Section 20: Graphics

CNC 88HS Graphics

Graphics Menu
The graphics menu of the page editor has been designed to allow the user to view the part path of the current program in memory. The graphics can be accessed by pressing the G Key from the page editor or by entering the command DR. A second menu will appear, allowing the user to choose from several options. All of these options can be pressed while plotting is taking place.

Plotting Options


```
VIEW AREA: X -20.0000 TO X  20.0000
           Y -12.8000 TO Y  12.8000

 A   AUTO DRAW (RESTART SCALED)
 C   CLEAR SCREEN
 F   FULL TABLE
 M   TOGGLE DISPLAY MODE
     (NC CODE, ABSOLUTE LOCATION & MODAL G-CODES)
 O   PLOTTING OPTIONS
 S   SINGLE STEP (START TO CANCEL)
 V   TOGGLE THE VIEW [TOP]
 X   EXIT
JOG ZOOM
ENTER SELECTION {
```

Figure 20-1 Plotting Options Menu

A = AUTO

Pressing the A key runs the current program completely through the part path showing interpolation moves only (movement programmed at a feedrate G1,G2,G3)

C = CLEAR

Pressing the C key clears the screen and continues auto part path draw at full table plotting.

F = FULL TABLE

Pressing the F key clears the screen and continues auto part path draw at full table plotting. This is used after the part path plot has been ZOOMED inward and the user wished to see the whole part path again on a full table display.

M = TOGGLE DISPLAY MODE

Pressing the M key will toggle the options differences displayed along with the graphics plot. Toggle display options are incremental moves, absolute positions, and modal codes. The M key can be pressed while plotting in order to view the various modes.

O = OPTIONS PLOTTING

Pressing the O key displays an additional menu allowing the user to choose from:

I   Ignore G41 G42 compensation

L   Plot only subroutines

O   Plot only subprogram

P   Plot total program

T   Plot tool

Once the option key has been pressed, the plotting continues.

S = SINGLE STEP

Pressing the S key, one program line will be plotted. Repeated pressing of the S key allows the user to step through the program in line by line execution. This can be canceled at any time by pressing the START button. During single step plot the current program line will also appear on the screen in G91 incremental value.

V= VIEW TOP OR ISOMETRIC

The V Key can be pressed at any time during plotting to change the view from top to simple isometric view. Plotting restarts from the beginning. This view may not be rotated.

JOG = ZOOM

During the plotting process, or after or during the plot, pressing the JOG button allows the user to ZOOM in or ZOOM out the display. The PULSE GENERATOR (the Jog Hand Wheel) now controls the position where the ZOOM BOX will be located on the screen (in this mode JOG does not Jog the machine). X and the Hand Wheel moves the box left to right. Y and the Hand Wheel moves the box up and down. Z and the Hand Wheel increases or decreases the size of the box. Locate the box and place it around the portion of functionthe part path the user wishes to see in a larger detail. Press the ENTER button and the part path contained in the ZOOM box will be redrawn larger.

After each successive ZOOM the pixel size representation is located to the right of the axis location of the displayed part path.

The Graphics screen will display a position located in the upper left hand portion. Located to the right of the position is a + (or -) and a value. This value is the Pixel resolution. The further the user ZOOMs into the graphically displayed part the smaller the Pixel resolution will become.

The ZOOM box may be decreased in the Z to show a cross hatch. The user may position this crosshatch using the X and Y. The position display will show a value and this value's tolerance depends on the Pixel amount displayed.

Function Menu

Using the Function Menus

The function menus are accessed through the Page Editor by pressing the F key. The screen will display 9 different function titles and function numbers. This menu consists of many independent functions that solve various geometric problems. Each is designed to help the user calculate items such as ANGLE, LINES, INTERSECTIONS, TANGENT, BLEND RADIUS, CIRCLE, and TRIANGLE. Also it is designed for creating TOOL CALL or END OF PROGRAM coding and for defining FIXED CYCLES or SUBROUTINES.

Cursor Movement

Once in the function menus, move the cursor up or down in the menu and describe the items by filling the values in. To move the cursor down press the ENTER button. To move the cursor UP press the **U** key.

If the value has been entered incorrectly, move the cursor to where the error is. Then press the backspace key until the incorrect data is removed. When all the data has been entered, press the **C** key to compute the geometry.

Getting Started

The user should always be aware of what position the cursor is at in the current program. The user should place the cursor on a line of the current program before entering the function menu. This line should be above the area where

the calculated information needs to be inserted. When the function menu inserts information into the Page Editor, a comment is also written to indicate which function was used.

The Menus Once in the function tile listing, select the number of the function titles until you arrive at the individual function menu. The cursor is used to locate a specific geometric question. Fill in the blank, and then press the ENTER button to move the cursor down to the next question. If the data has been entered incorrectly press the **U** key (UP) to move the cursor upward to the data then use the Backspace button to back over the information. Retype the data.

When all data has been successfully enter press the **C** key to compute. The geometry will automatically be computed and displayed at the bottom portion of the screen. Pressing the **D** key (DRAW) will enlarge the graphics to cover the entire screen.

To ZOOM in, press the **-** key; to reduce the view, press the **+** key. If the solution is not what the user wants, press the **S** key for same function and retype the information until the expected solution is found.

When the solution is accepted, the data may be entered and saved to the current program after the current cursor location. Pressing the **I** key will insert data into the editor. This will also return the display to the Page Editor. The current program will contain new code with appropriate comments from the function menu.

An entire G code program can be written by choosing from the other functions available on the menu. Repeat the above instruction until the program is complete. Be sure to insert the appropriate feeds, speed and Z milling values. View the program on the Graphics display before machining. Dry run the program before cutting the part.

Coordinate System   The function menu uses the X Y plane (G17) of the cartesian coordinate system. All point descriptions are in absolute mode(G90), where all points are described as their distance from HOME (X0,Y0).

```
                              Y+

        (X-1.,Y2.)  +       + (X1.,Y2.)
          (-2.,Y1.)   +       + (X2.,Y1.)


   X-                                      X+
        (X-2.,Y-1.)   +          + (X2.,Y-1.)
          (X-1.,Y-2)  +        + (X1.,Y-2)


                              Y-
```
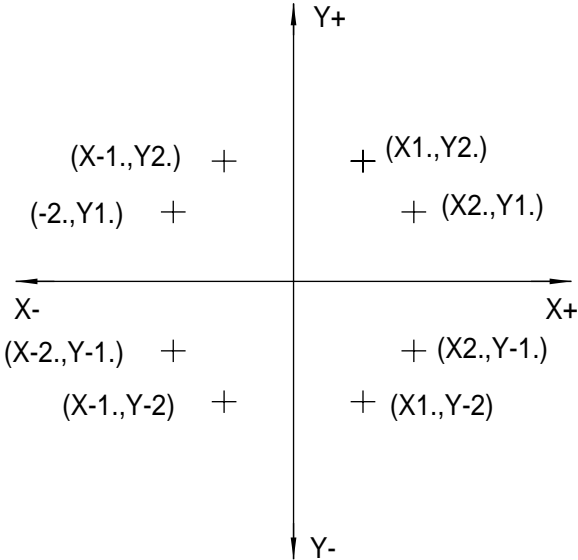
Figure 20-2 Coordinate System

Points   Describe a point by specifying its X and Y distance from home. The X is measured right (+) or left (-) from the X axis zero location. The Y is measured up (+) or down (-) from the Y axis zero location.

Angles   Angles are measured from the positive X axis using decimal degrees. A positive angle is measured counterclockwise from the X positive axis, and the negative angle is measures clockwise from the X positive axis.
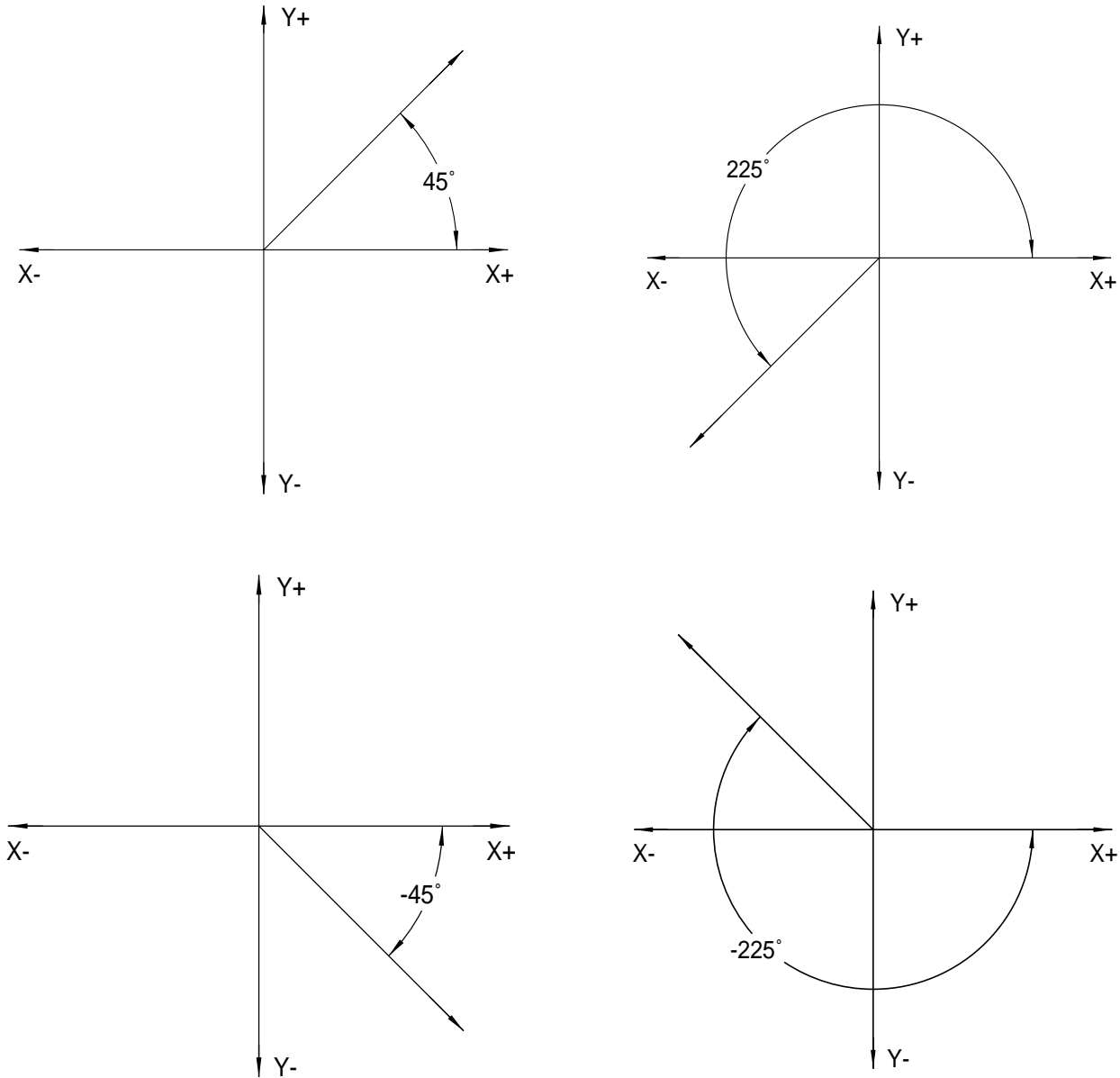

Figure 20-3 Angles

Angles describe direction of motion on a line. Moving on a line to the right describes the line to be at an angle of 0 deg. Moving on a line to the left describes the line to be at an angle of 180 deg.

Lines Lines are described by specifying a point on a line and the angle of the line. The point does not need to be on the part. It can be on an extended portion of the line. The angle defines the direction of the motion on the line (see Angles).

MOTION TO LEFT
GIVES ANGLE OF 180˚

MOTION TO RIGHT
GIVES ANGLE OF 0˚

Y+

(X0,Y2.)

X-

X+

(X0,Y0.)

Y-
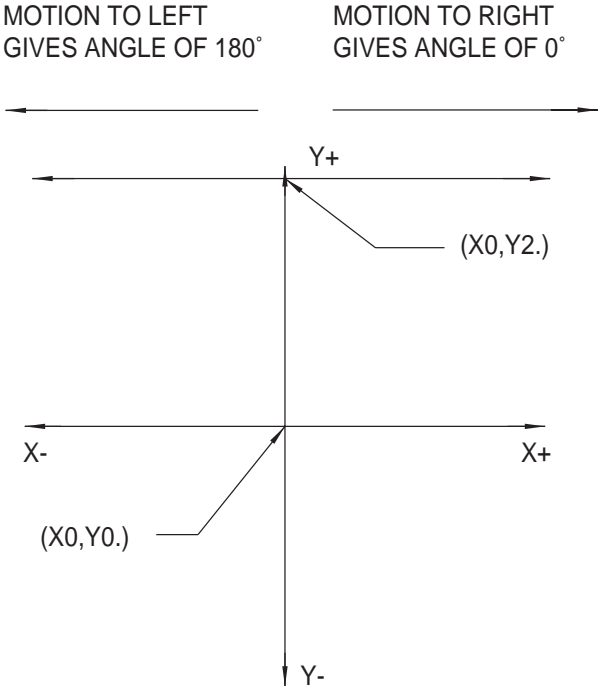
Figure 20-4 Lines

Circles A circle is defined by the X, Y location of its center, a Radius, and a direction of motion. The circle direction of motion is described by clockwise or counterclockwise. To define a circle as a point, describe the circle as having a zero radius. If the X, Y center location is not known, then it is to be considered a blend radius.

Y+

X-

X+

-225˚

Y-
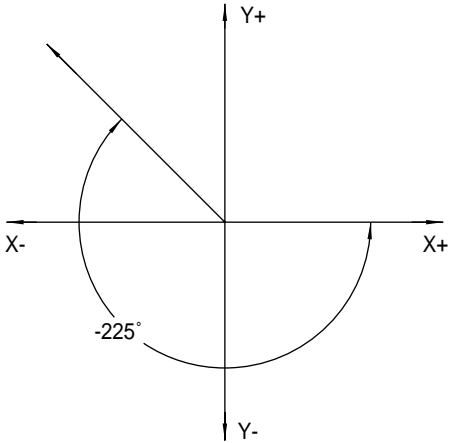
Figure 20-5 Circles

Blend Radius   A blend radius is a circle that is situated between two known geometric elements. It is defined by a radius value and a direction of motion. The blend radius direction of motion is described by clockwise or counterclockwise.
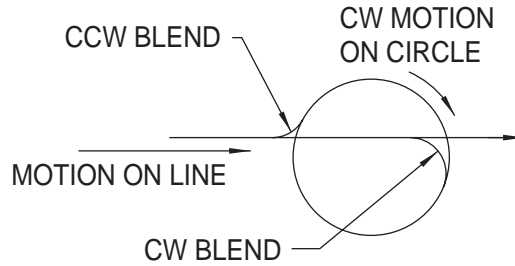
Figure 20-6 Blend Radius

The Function Menu Display

Function menus   The Function menu display and each of the graphics menus are shown as they appear on the monitor.

MAIN MENU
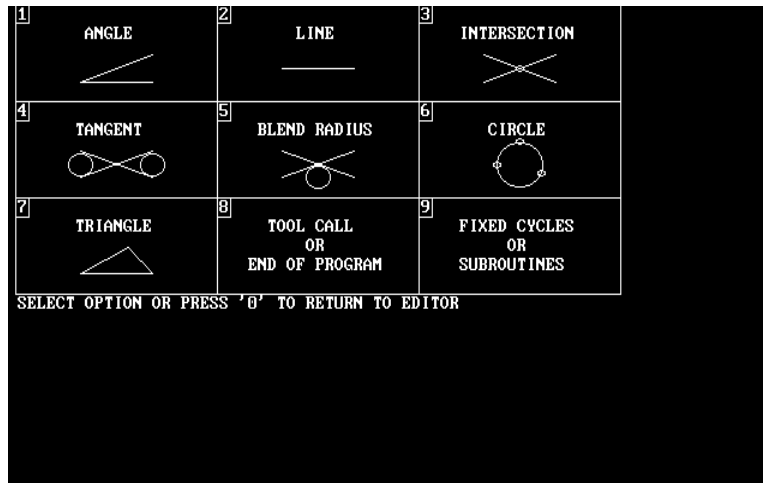
Figure 20-7 Main Menu

ANGLE OF A LINE
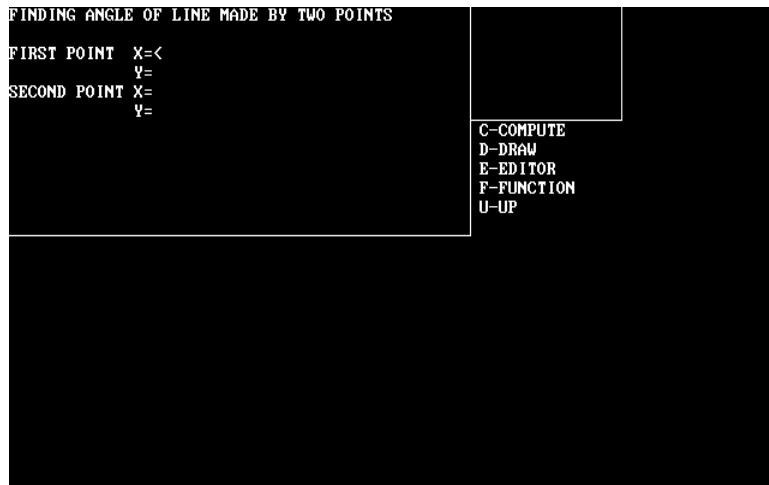
Figure 20-8 Angle of a Line

TWO LINE FUNCTIONS
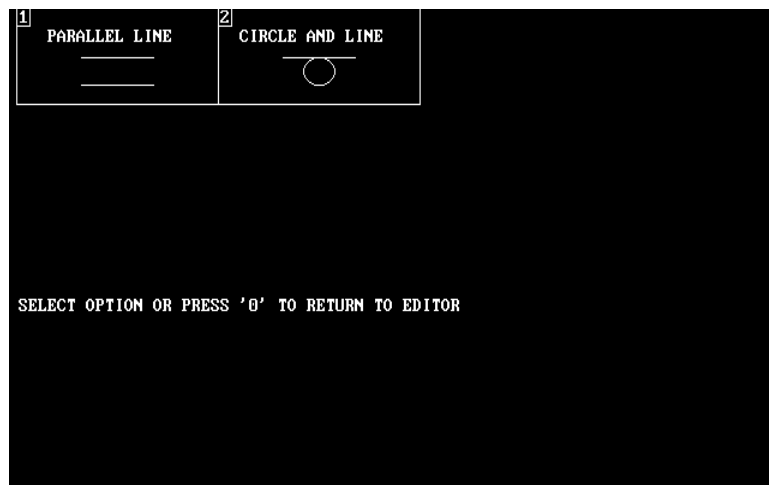
Figure 20-9 Two Line Functions

**FINDING A PARALLEL
LINE USING A LINE
OR CIRCLE**

```
FINDING A PARALLEL LINE

POINT OR CENTER OF CIRCLE X=<
                          Y=
        ANGLE OF UNKNOWN LINE=
DISTANCE BETWEEN LINES=
IN THE DIRECTION OF MOTION, IS THE        C-COMPUTE
NEW LINE RIGHT(1) OR LEFT(2) OF KNOWN POINT?   D-DRAW
                                          E-EDITOR
                                          F-FUNCTION
                                          U-UP
```
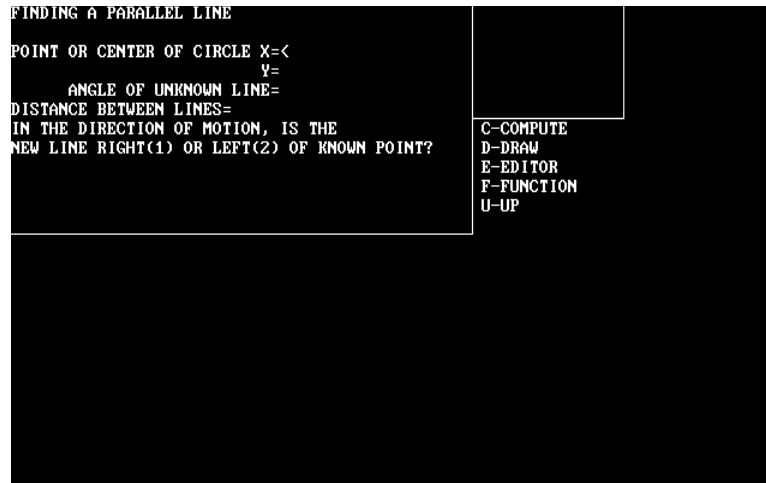
Figure 20-10 Finding a Paralell Line

**THREE
INTERSECTION
FUNCTIONS**

```
1   2 LINES       2   2 CIRCLES      3   LINE AND CIRCLE




SELECT OPTION OR PRESS '0' TO RETURN TO EDITOR
```
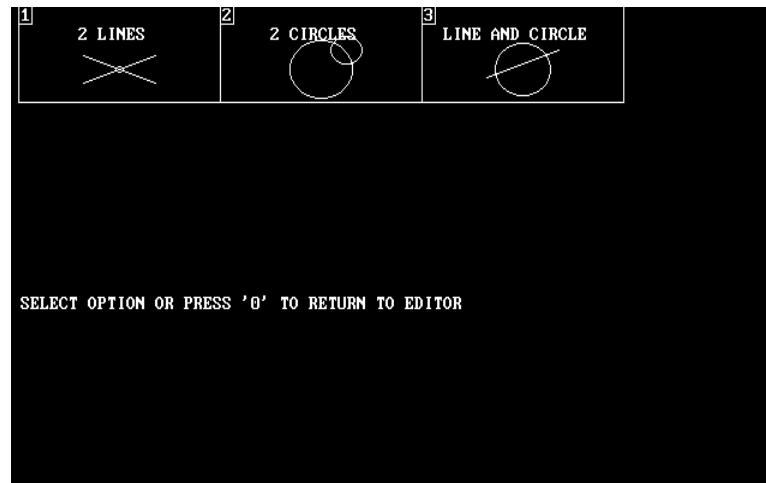
Figure 20-11 Three Intersection Functions

INTERSECTION OF 2 LINES

```
FINDING THE INTERSECTION OF 2 LINES

FIRST LINE  X=<
            Y=
        ANGLE=
SECOND LINE X=
            Y=
        ANGLE=              C-COMPUTE
                            D-DRAW
                            E-EDITOR
                            F-FUNCTION
                            U-UP
```
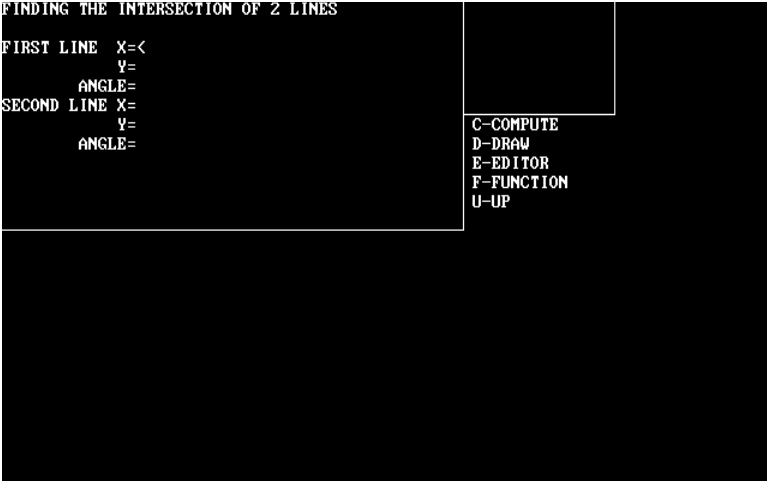
Figure 20-12 Intersection of 2 Lines

INTERSECTION OF 2 CIRCLES

```
FINDING THE INTERSECTION POINT OF 2 CIRCLES

FIRST CIRCLE X=<
             Y=
        RADIUS=
DIRECTION ON FIRST CIRCLE(2=CW, 3=CCW)=
SECOND CIRCLE X=
              Y=
        RADIUS=                 C-COMPUTE
DIRECTION ON SECOND CIRCLE(2=CW, 3=CCW)=  D-DRAW
                                E-EDITOR
                                F-FUNCTION
                                U-UP
```
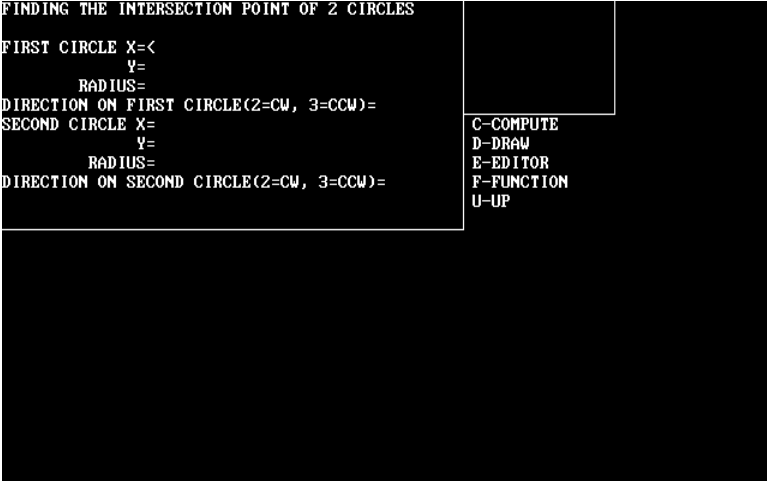
Figure 20-13 Intersection of 2 Circles

INTERSECTION OF A LINE AND CIRCLE

```
INTERSECTION POINTS OF A LINE AND A CIRCLE

LINE   X=<
       Y=
   ANGLE=
CIRCLE X=
       Y=                        C-COMPUTE
   RADIUS=                       D-DRAW
                                 E-EDITOR
                                 F-FUNCTION
                                 U-UP
```
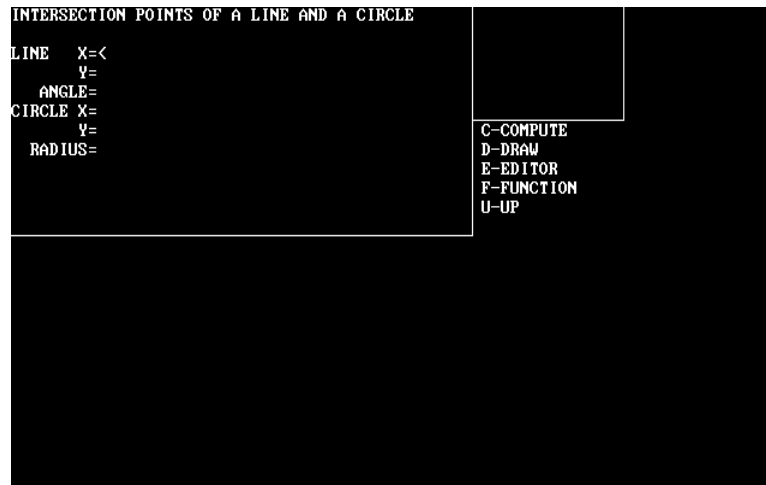
Figure 20-14 Intersection of a Line and Circle

TWO TANGENT FUNCTIONS

```
1 LINE AND CIRCLE      2  TWO CIRCLES




SELECT OPTION OR PRESS '0' TO RETURN TO EDITOR
```
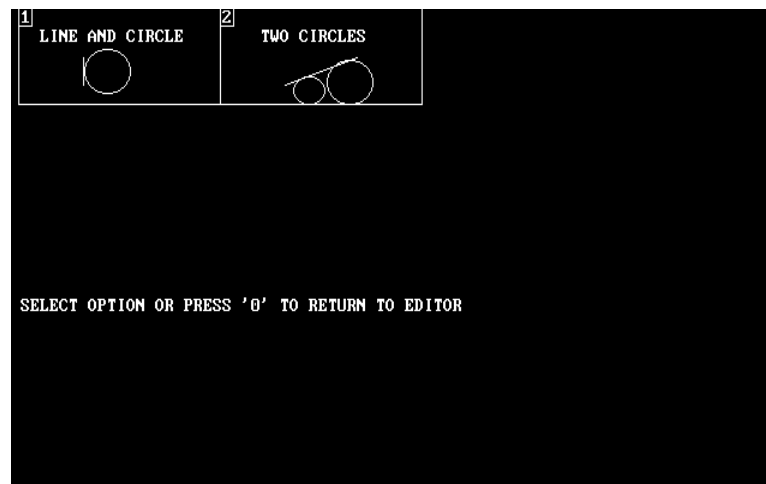
Figure 20-15 Two Tangent Functions

TANGENT POINT OF
A LINE AND CIRCLE

```
TANGENT POINT OF A LINE AND A CIRCLE

LINE   X=<
       Y=
   ANGLE=
CIRCLE X=
       Y=
                                    C-COMPUTE
                                    D-DRAW
                                    E-EDITOR
                                    F-FUNCTION
                                    U-UP
```
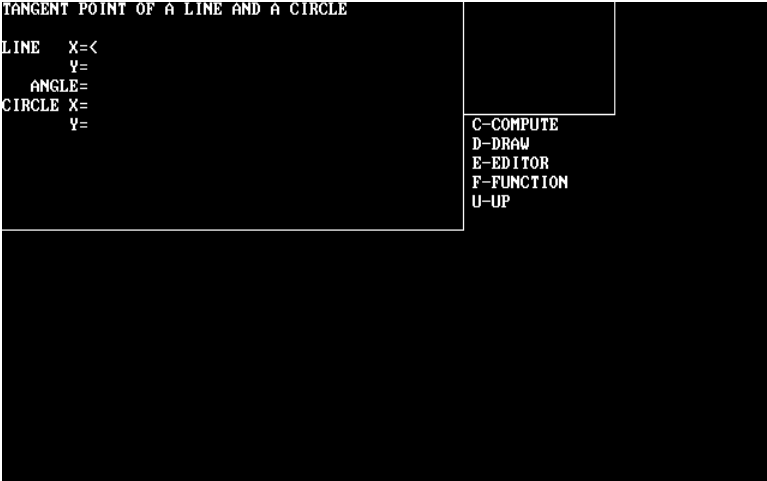
Figure 20-16 Tangent Point of a Line and Circle

TANGENT POINTS OF
TWO CIRCLES

```
FINDING THE TANGENT POINTS OF 2 CIRCLES

FIRST CIRCLE X=<
             Y=
        RADIUS=
DIRECTION ON FIRST CIRCLE(2=CW, 3=CCW)=
SECOND CIRCLE X=
              Y=
         RADIUS=                       C-COMPUTE
DIRECTION ON SECOND CIRCLE(2=CW, 3=CCW)=   D-DRAW
                                       E-EDITOR
                                       F-FUNCTION
                                       U-UP
```
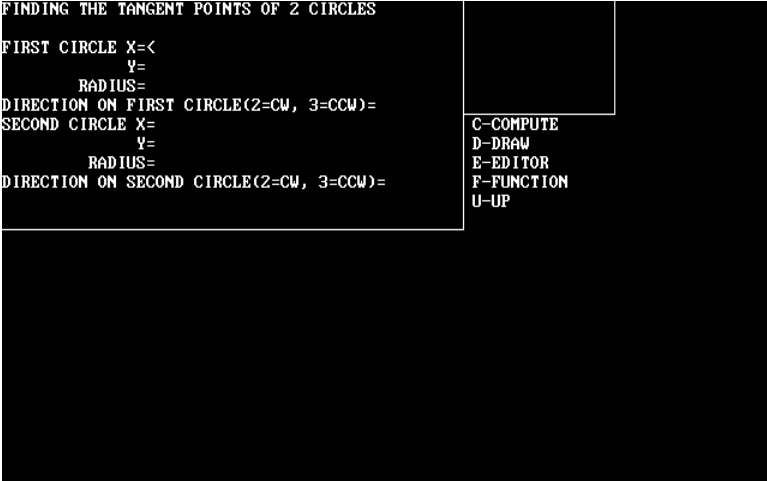
Figure 20-17 Tangent Points of Two Circles

NINE BLEND RADIUS FUNCTIONS
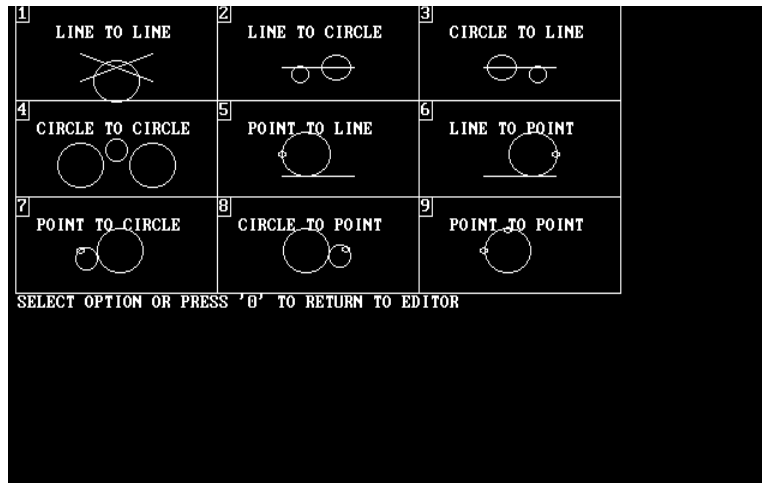
Figure 20-18 Nine Blend Radius Functions

BLEND RADIUS FROM A LINE TO A LINE
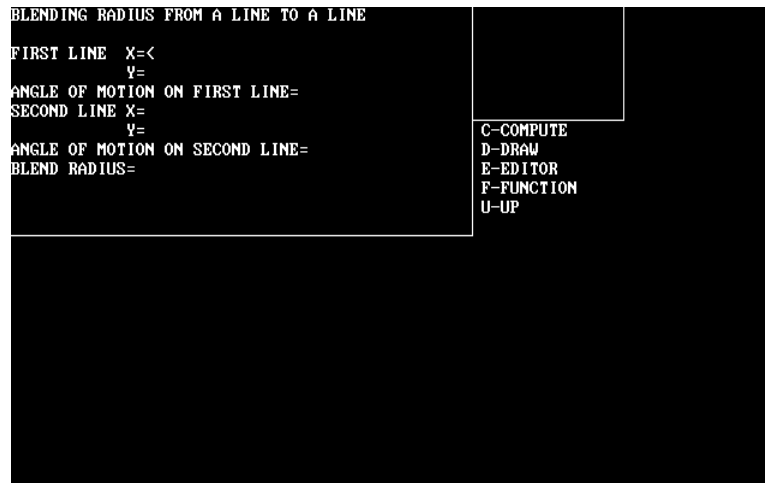
Figure 20-19 Blend Radius from a Line to a Line

BLEND RADIUS FROM A LINE TO A CIRCLE

```
BLENDING RADIUS FROM A LINE TO A CIRCLE

LINE   X=<
       Y=
    ANGLE=
CIRCLE X=
       Y=
   RADIUS=
DIRECTION ON CIRCLE(2=CW, 3=CCW)=          C-COMPUTE
BLEND RADIUS=                              D-DRAW
DIRECTION ON BLEND RADIUS(2=CW, 3=CCW)=    E-EDITOR
                                           F-FUNCTION
                                           U-UP
```
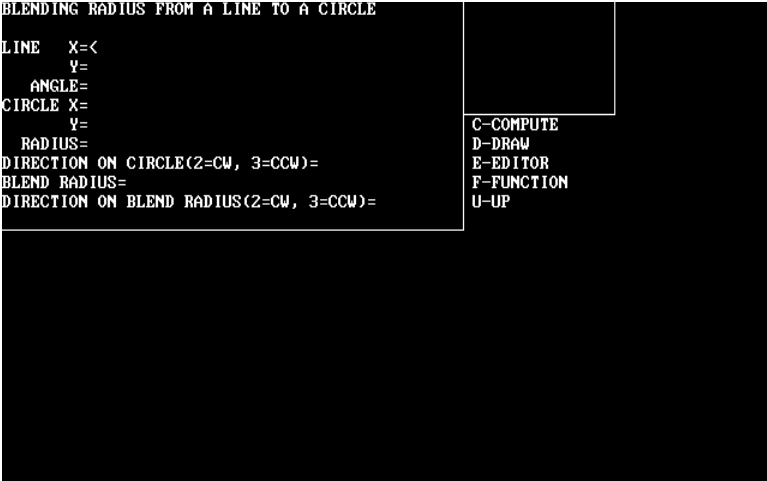
Figure 20-20 Blend Radius from a Line to a Circle

BLEND RADIUS FROM A CIRCLE TO A LINE

```
BLENDING RADIUS FROM A CIRCLE TO A LINE

LINE   X=<
       Y=
    ANGLE=
CIRCLE X=
       Y=
   RADIUS=
DIRECTION ON CIRCLE(2=CW, 3=CCW)=          C-COMPUTE
BLEND RADIUS=                              D-DRAW
DIRECTION ON BLEND RADIUS(2=CW, 3=CCW)=    E-EDITOR
                                           F-FUNCTION
                                           U-UP
```
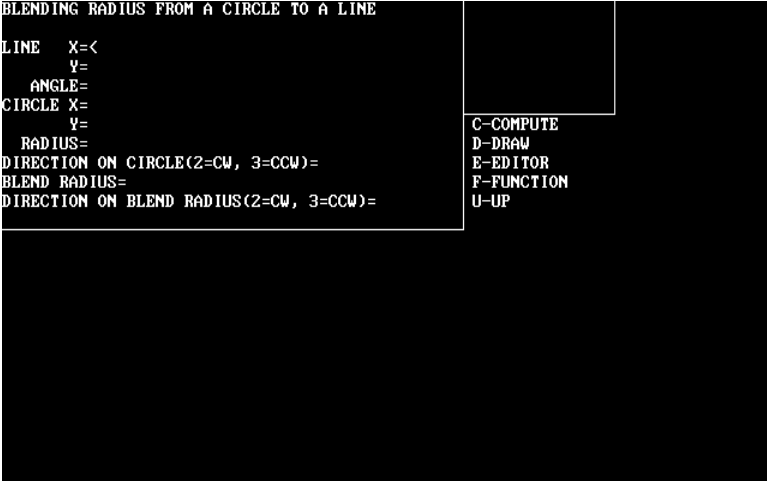
Figure 20-21 Blend Radius from a Circle to a Line

**BLEND RADIUS
FROM A CIRCLE TO A
CIRCLE**

```
BLENDING RADIUS FROM A CIRCLE TO A CIRCLE

FIRST CIRCLE X=<
              Y=
         RADIUS=
DIRECTION ON FIRST CIRCLE(2=CW, 3=CCW)=
SECOND CIRCLE X=
              Y=
         RADIUS=
DIRECTION ON SECOND CIRCLE(2=CW, 3=CCW)=
BLEND RADIUS=
DIRECTION ON BLEND RADIUS(2=CW, 3=CCW)=_____

                                          C-COMPUTE
                                          D-DRAW
                                          E-EDITOR
                                          F-FUNCTION
                                          U-UP
```
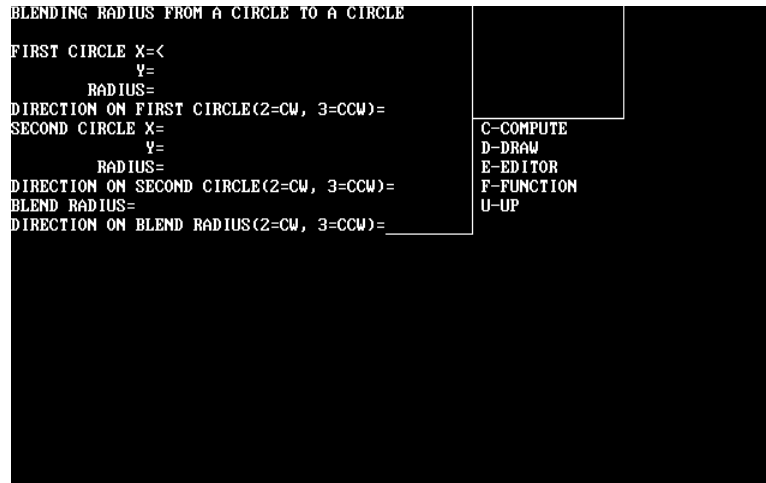
Figure 20-22 Blend Radius from a Circle to a Circle

**BLEND RADIUS
FROM A POINT TO A
LINE**

```
BLENDING RADIUS FROM A POINT TO A LINE

POINT  X=<
       Y=
LINE   X=
       Y=
   ANGLE=
BLEND RADIUS=

                                          C-COMPUTE
                                          D-DRAW
                                          E-EDITOR
                                          F-FUNCTION
                                          U-UP
```

Figure 20-23 Blend Radius from a Point to a Line

**BLEND RADIUS
FROM A LINE TO A
POINT**


```
BLENDING RADIUS FROM A LINE TO A POINT

POINT   X=<
        Y=
LINE    X=
        Y=
   ANGLE=                                    C-COMPUTE
BLEND RADIUS=                                D-DRAW
                                             E-EDITOR
                                             F-FUNCTION
                                             U-UP
```
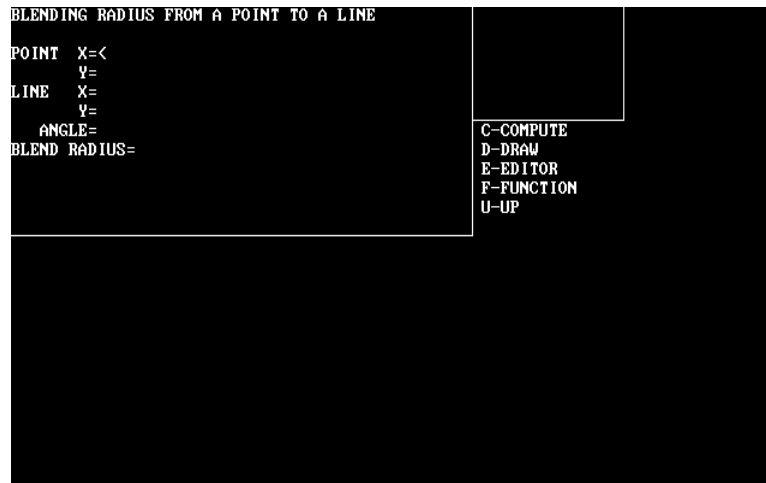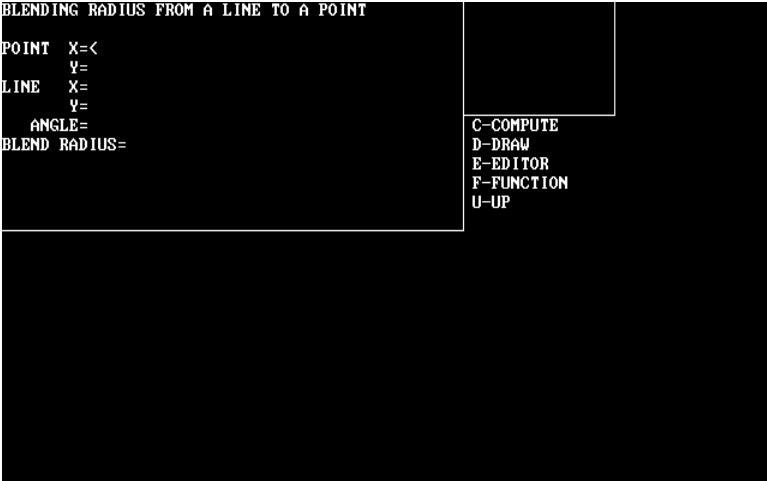
Figure 20-24 Blend Radius from a Line to a Point

**BLEND RADIUS
FROM A POINT TO A
CIRCLE**


```
BLENDING RADIUS FROM A POINT TO A CIRCLE

POINT   X=<
        Y=
CIRCLE  X=
        Y=
   RADIUS=                                   C-COMPUTE
DIRECTION ON CIRCLE(2=CW, 3=CCW)=            D-DRAW
BLEND RADIUS=                                E-EDITOR
DIRECTION ON BLEND RADIUS(2=CW, 3=CCW)=      F-FUNCTION
                                             U-UP
```

Figure 20-25 Blend Radius from a Point to a Circle

BLEND RADIUS FROM A CIRCLE TO A POINT

```
BLENDING RADIUS FROM A CIRCLE TO A POINT

POINT  X=<
        Y=
CIRCLE X=
        Y=
  RADIUS=                          C-COMPUTE
DIRECTION ON CIRCLE(2=CW, 3=CCW)=  D-DRAW
BLEND RADIUS=                      E-EDITOR
DIRECTION ON BLEND RADIUS(2=CW, 3=CCW)=  F-FUNCTION
                                   U-UP
```
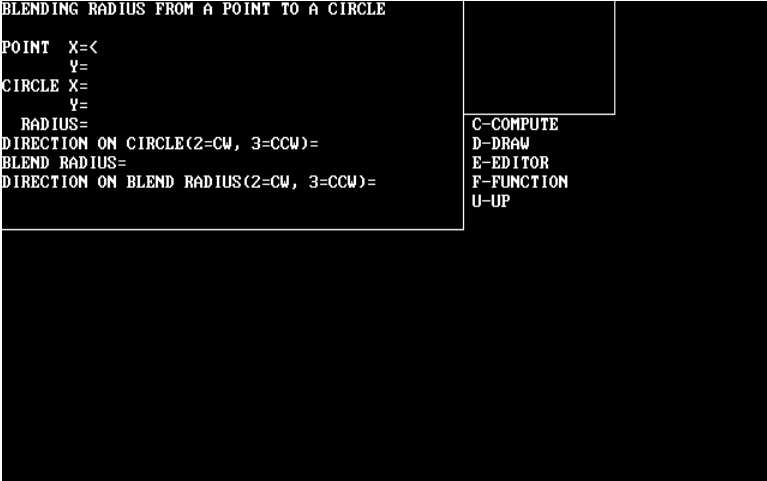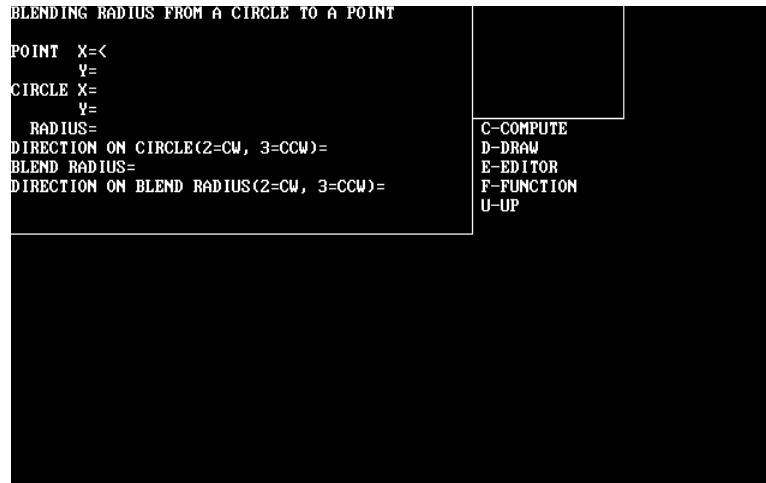
Figure 20-26 Blend Radius from a Circle to a Point

BLEND RADIUS FROM A POINT TO A POINT

```
BLENDING RADIUS FROM A POINT TO A POINT

FIRST POINT  X=<
             Y=
SECOND POINT X=
             Y=
BLEND RADIUS=                      C-COMPUTE
DIRECTION ON BLEND RADIUS(2=CW, 3=CCW)=  D-DRAW
                                   E-EDITOR
                                   F-FUNCTION
                                   U-UP
```
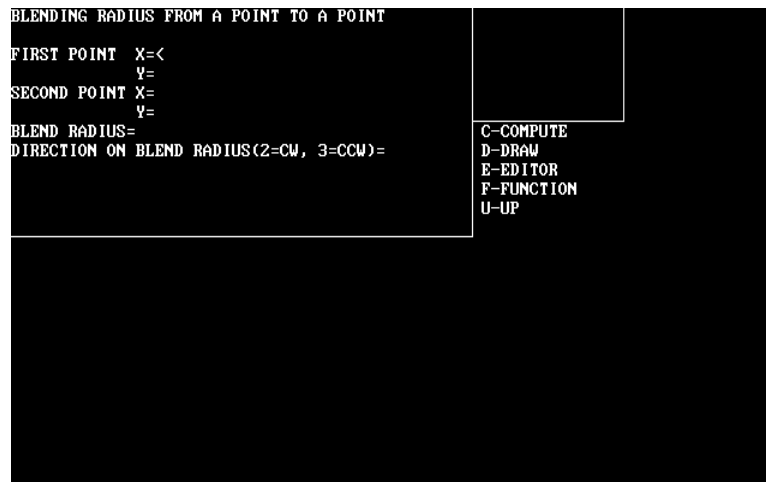
Figure 20-27 Blend Radius from a Point to a Point

CIRCLE FUNCTION

```
FINDING A CIRCLE WITH 3 POINTS

FIRST POINT  X=<
             Y=
SECOND POINT X=
             Y=
THIRD POINT  X=                    C-COMPUTE
             Y=                    D-DRAW
                                   E-EDITOR
                                   F-FUNCTION
                                   U-UP
```
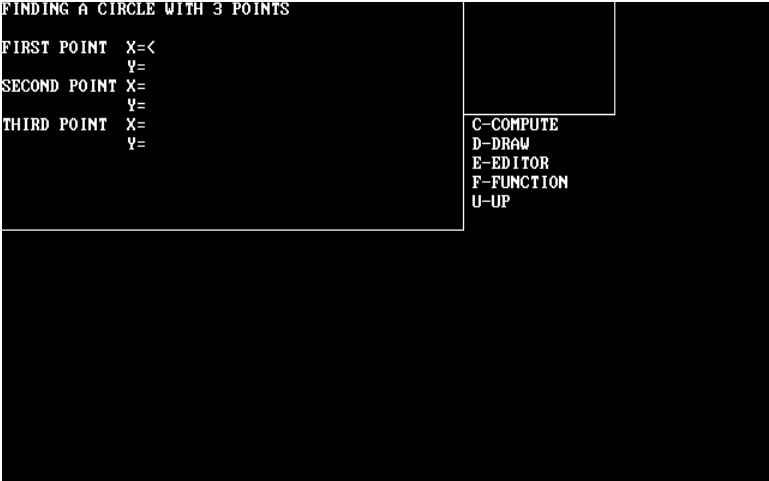
Figure 20-28 Circle Function

TRIANGLE SOLVER

```
TRIANGLE SOLVER

SIDE  A=<
SIDE  B=
SIDE  C=
ANGLE A=
ANGLE B=                    E-EDITOR
ANGLE C= 90                 F-FUNCTION
DIA. OF CIRCUMSCRIBED CIRCLE=   U-UP
```
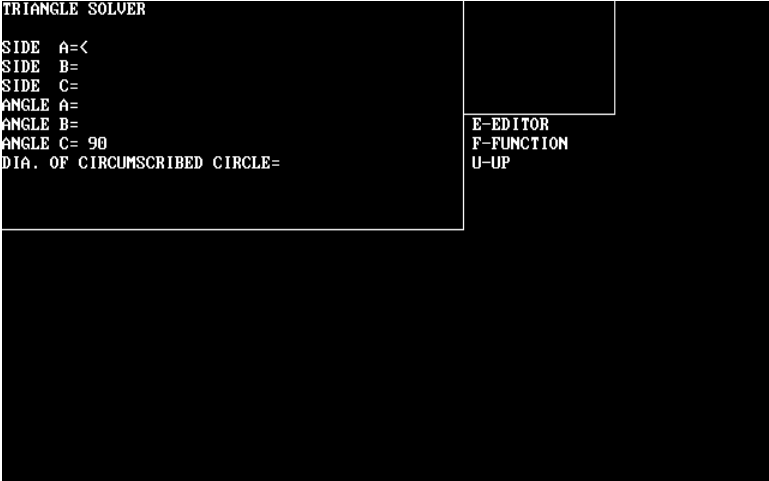
Figure 20-29 Triangle Solver

TOOL CALL AND END OF PROGRAM

```
1  TOOL CALL        2  END OF PROGRAM




SELECT OPTION OR PRESS '0' TO RETURN TO EDITOR
```
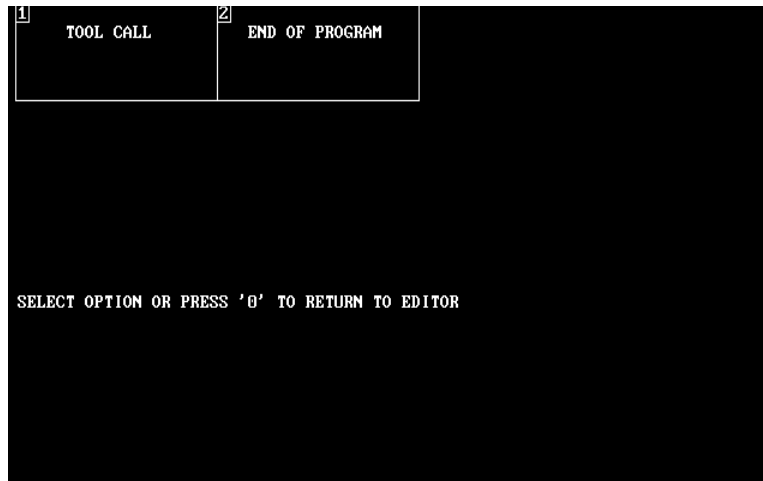
Figure 20-30 Tool Call and End of Program

TOOL CALL

```
TOOL CALL                                      E-EDITOR
                                               F-FUNCTION
TOOL #=<                                        I-INSERT CODE
COMMENT=                                        U-UP
SPINDLE RPM=
SPINDLE DIRECTION (3=CW, 4=CCW, 5=OFF)=
FIXTURE OFFSET (0-24)=
RAPID TO X=
        Y=
        Z=
        A=
        B=
COOLANT (1 OR 2)=
CUTTER COMP. (41=LEFT, 42=RIGHT, 40=OFF)=
```
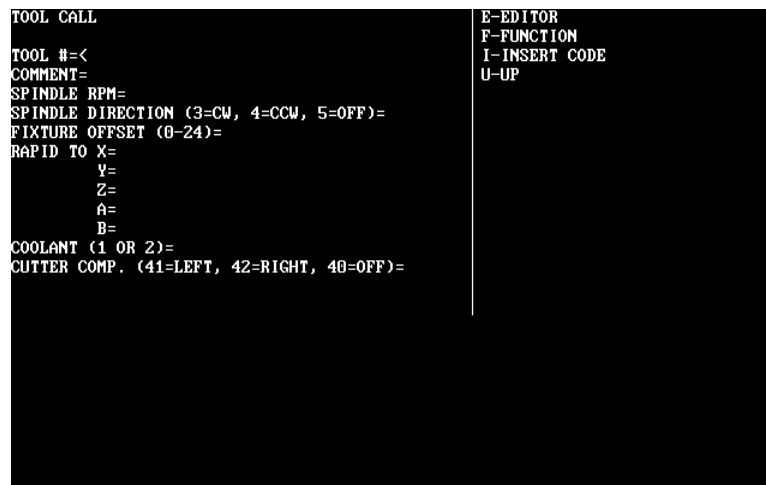
Figure 20-31 Tool Call

END OF PROGRAM

WARNING: End of program will insert at cursor!

The following will be inserted at the cursor for an "end of program":

(ENDING PROGRAM
G0 G80 G90 M5 M9
Z0 G53
X0 Y0 Z0 E0 H0
M30

FIXED CYCLES AND SUBROUTINE FUNCTIONS

```
1  ENGRAVING      2  BOLT CIRCLE    3  MILL BORING

4  RECTANGULAR    5  CIRCULAR       6  DRILLING
   POCKET            POCKET            CYCLES

7  TAPPING        8  BORING
   CYCLES            CYCLES

SELECT OPTION OR PRESS '0' TO RETURN TO EDITOR
```
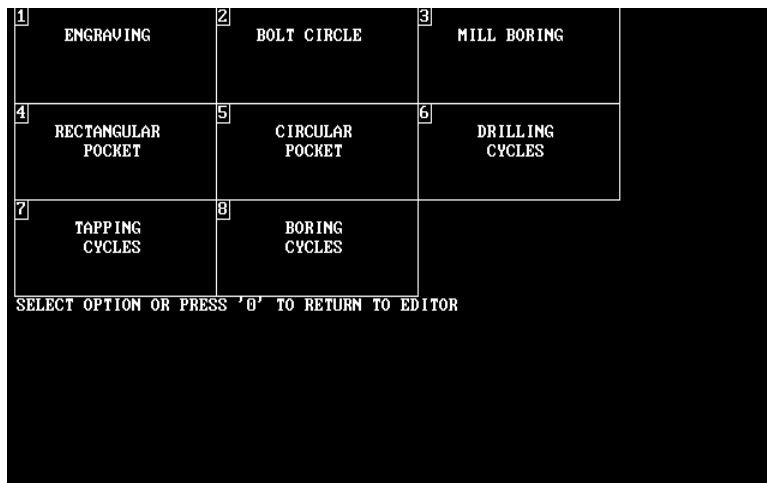
Figure 20-32 Fixed Cycles and Subroutine Functions

ENGRAVING

```
ENGRAVING                                      E-EDITOR
                                               F-FUNCTION
TEXT=<                                          I-INSERT CODE
FEED RATE=                                      U-UP
Z MINIMUM CLEARANCE (R) PLANE=
FINAL Z DEPTH=
CHARACTER HEIGHT=
FONT (0=STANDARD, 1=STENCIL)=
ANGULAR DIRECTION (0=X+, 90=Y+, 180=X-)=

OPTIONS:
RAPID TO X=
         Y=
         Z=
SERIALIZATION (0=OFF, 1=ON)=
SERIAL INCREMENT (1-9)=
```

Figure 20-33 Engraving

BOLT CIRCLE

```
BOLT CIRCLE                                     E-EDITOR
                                                F-FUNCTION
FIRST HOLE X=<                                  I-INSERT CODE
FIRST HOLE Y=                                   U-UP
CIRCLE CENTER X=
             Y=
NUMBER OF HOLES=
ANGULAR STEPS BETWEEN HOLES=
```

Figure 20-34 Bolt Circle

MILL BORING

```
MILL BORING                                     E-EDITOR
                                                F-FUNCTION
NUMBER OF PASSES=<                              I-INSERT CODE
DIAMETER OF BORE=                              U-UP
MILLING FEED RATE=
CUTTING DIRECTION (2=CW, 3=CCW)=

OPTIONS:
RAPID TO CENTER X=
                 Y=

RAPID TO Z=
FEED TO Z=
Z PLUNGE FEED RATE=
```

Figure 20-35 Mill Boring

RECTANGULAR POCKET

```
RECTANGULAR POCKET                              E-EDITOR
                                                F-FUNCTION
X LENGTH DIMENSION=<                            I-INSERT CODE
Y WIDTH DIMENSION=                             U-UP
MILLING FEED RATE=
CUTTING DIRECTION (2=CW, 3=CCW)=

OPTIONS:
RAPID TO CENTER X=
                 Y=
RAPID TO Z=
FEED TO Z=
Z PLUNGE FEED RATE=
BOTTOM CORNER RADIUS OF TOOL=
```

Figure 20-36 Rectangular Pocket

CIRCULAR POCKET


```
CIRCULAR POCKET                              E-EDITOR
                                             F-FUNCTION
DIAMETER OF BORE=<                           I-INSERT CODE
MILLING FEED RATE=                           U-UP
CUTTING DIRECTION (2=CW, 3=CCW)=

OPTIONS:
RAPID TO CENTER X=
              Y=
RAPID TO Z=
FEED TO Z=
Z PLUNGE FEED RATE=
BOTTOM CORNER RADIUS OF TOOL=
```
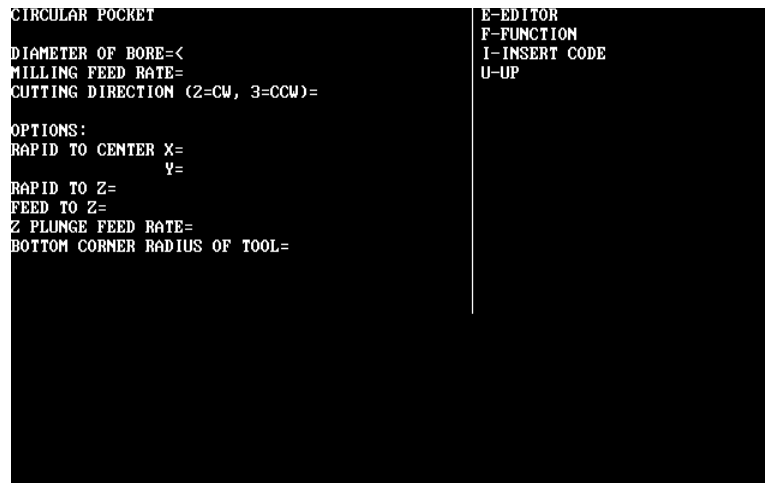
Figure 20-37 Circular Pocket

DRILLING CYCLES


```
1      PECK         2      DRILL      3    DEEP HOLE
                             OR
                         SPOT DRILL

4  CENTER DRILL
        OR
   COUNTER SINK



SELECT OPTION OR PRESS '0' TO RETURN TO EDITOR
```
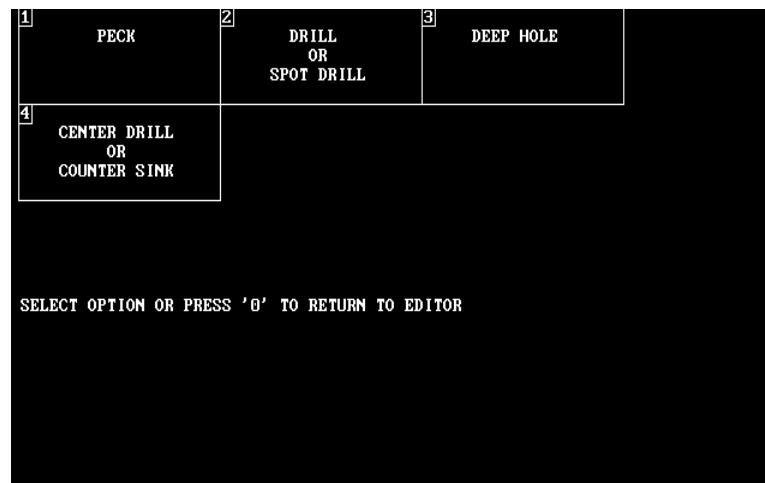
Figure 20-38 Drilling Cycles

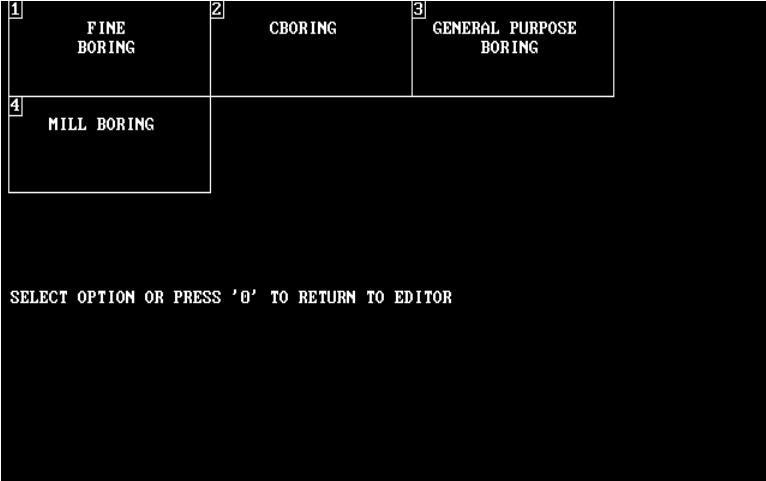## TAPPING CYCLES

Figure 20-39 Tapping Cycles

BORING CYCLES

Figure 20-40 Boring Cycles

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