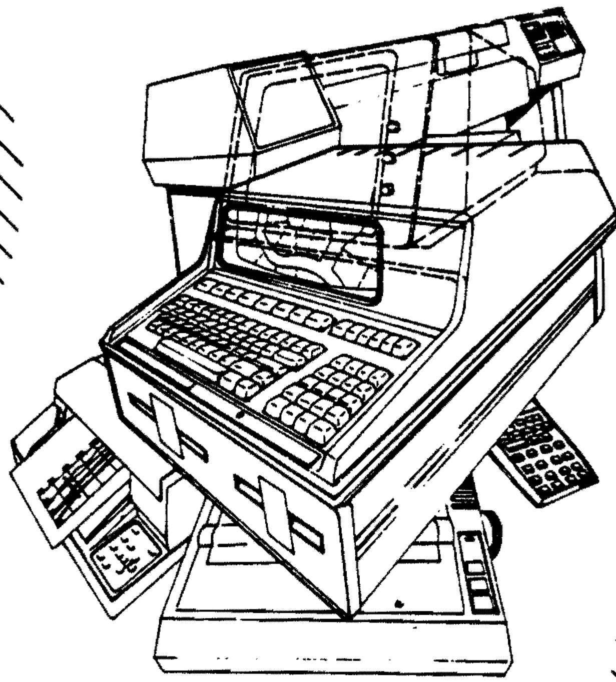
LAND
INNOVATION
CONCEPTS IN SITE DEVELOPMENT



HP-87/86
SITE COMPUTATION and DESIGN PACKAGE

HP PLUS
USER RATED
INDEPENDENT SOFTWARE
PRODUCTS

INTRODUCTION TO SET-UP PROCEDURES

This program must be used before any other program in this software package to notify all other software of the hardware used and user selection of point overwrite. The purpose of the set-up program is to let the user expand the hardware at any time without having to purchase additional software. Instructions are shown on the computer's display, and this documentation will serve to clarify details of the instructions.

NOTES ON COMPUTER MODEL

If you are using an HP-87 model with 32K internally, you will need an additional 128K (HP-82909A) and a 32k (HP-92907A) memory module to use this software. If you are using an HP-87 with 128K internally, you will need a 64K (HP-82908A) memory module to use this software. On an HP-86, you will need one 128K memory module. Add an additional 128K module and you will be able to hold an additional 6000 points internally along with an additional 1000 drawing instructions! The CRT size of the HP-86 is user selectable. It is suggested that you utilize an HP-82913A monitor for large view plotting on the CRT.

HP-IB (I-EEE 488) INTERFACE

If you are using an HP-87, the plotter address must be 705, and the printer address is user selectable, but should be 701 for the HP-82905 printer. If using an HP-86, you will need to add an HP-82937A HP-IB interface to communicate with a plotter. When communicating with a printer through the HP-IB, the program will not halt if executing a printing command with the printer off. If the printer is using the printer port on the HP-86 which is parallel, you must use the printer control functions of the software. The HP-IB interface must be switched from a select code of "7" to a select code of "6" when using an HP-86. See the users manual of the HP-IB interface for instructions on accessing the switch, then change switch 8 to the 0 position, switch 9 to the 1 position, and switch 10 to the 1 position. If you do not wish to take the device apart, a local computer shop can re-switch the interface in a few minutes.

PRINTER NOTES

All software is designed to be used with the HP-82905 series printers. The "A" model is not the same as the "B" model. The "A" model uses the same instructions as an EPSON printer, and the "B" model uses standard HP type coding. Using any other printer may result in errors when advançing paper and double driking characters. If you are using another printer other than an HP-82905 series or EPSON, then select the "A" printer instructions. Each program includes an option to select a Smith-Corona TP-1 type daisy wheel printer for low-cost (but low speed) letter quality printing.

User Instructions

LOADING THE PROGRAM

Turn on the disk drive (if not an HP-9130) and the monitor if using an HP-86. Then turn on the computer. Be sure all memory modules are inserted. After the cursor appears:

1) Insert the program disk into drive 0.

2) Type in CHAIN"SETUP".

3) Press the END LINE key.

The program will load off of the disk and the display will explain the purpose of the set-up program. Be sure that a WRITE PROTECT tab is not on the program disk.

4) Press the CONT key to continue.

5) Enter 87 if using an HP-87 or 86 if using an HP-86 (if using an 87, skip step 6).

6) Enter 9 if using a 9 inch monitor, or 12 if using a 12 inch monitor.

7) Press the CONT key to continue.

8) Enter A if using an HP-82905A or EPSON printer, or B if using an HP-82905B.

9) Enter the address code of the printer.

NOTE

If using an HP-87, use an address code of 701 with the printer, and if using an HP-86 with a parallel printer, also use an address code of 701. If using an HP-82905A or B printer with an HP-86 through I-EEE, use an address code of 601 for the printer.

10) The display shows the address and asks if it is correct.

    a. Enter Y if it is correct and go to step 11.
    b. Enter N if not correct and repeat step 9.

11) Specify the type plotter used; enter 7225, 7470, or 7580.

NOTE

The software will automatically know the scaling used after the commands you specify at this point. The HP-7580 will enable the user to use several routines that will not run on the smaller plotters.

If the HP-86 is used, the plotter address will automatically be changed to 605, and if the 87 is used, the plotter address will be 705.

12) Enter the code for the disk drive as shown on the computer display.

NOTES

If using an HP-82901M disk drive, then enter D for dual dusk. The address of the data disk will be :D701 on an HP-87, or :D601 on an HP-86.

If using a Winchester disk drive (HP-9135A only), the address of the data will be the same as above, which will store all points on volume 1 of the hard disk.

If using an HP-86 with a single disk drive, you must remove the program disk after a program is loaded and insert a data disk. This is not that much trouble, as the program can be loaded once. By selecting the S, the address code of the data disk will be :D700. By selecting the B, the address code will be using DRIVE 1 of the HP-86 to store data.

13) You are now asked if you want to bypass program halt on existing points.

NOTE

If you enter Y each time you encounter an existing point in traverse and intersection routines, the program will halt and ask if you want to overwrite that point. This can add hundreds of hours to computation time if you are revising major blocks of points. By entering N, you will not be stopped. Either way, the previous value of the point will be displayed and printed for your reference. It is suggested that you enter N at this point; you can always change it later.

14) Enter if you are using a single 128K or dual 128K modules - enter 1 or 2.

NOTE

On an HP-87 with 128K standard internal memory, enter 1 if you plan on the minimum memory of 64K additional, or 2 for the maximum of one 128K module and one 64K module. On and HP-87 with 32K standard internal memory, enter 1 for a minimum memory of one 128K and one 32K module, or 2 of maximum memory of two 128K and one 32K module. Entering 1 will set the limit for points at 4000 internally and figures at 999 internally. Entering 2 will set the limits at 9999 points internal and 2000 figures internally.

After the memory configuration is specified, the STATUS file will be set up on the program disk. If the file is existing such as in the case of a hardware or any other change in the status file, the display will give you instructions on how to purge the STATUS file, then press the CONT key to continue.

When the display appears:

STATUS FILE HAS BEEN SET UP - YOU CAN NOW USE ALL OTHER PROGRAMS

You can now use any of the other programs in this software package, and they will all automatically choose the correct routines based on the data you just entered using this program.

HARDWARE CHANGES

If you change any hardware, or want to change point overwrite status, or memory configuration, simply repeat the steps in the last 4 pages.

LAND INNOVATION
HP-87/86 SOFTWARE PACKAGE

June 1982

PLEASE NOTE;

Read the HP-87/86 operators manual for instructions on the general operation of the computer before using any features of this software package.

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INTRODUCTION TO LAND INNOVATION HP-87/86 PACKAGE

June 1982

This software package consists of 8 programs to be used for your calculations and general business operations. The MAIN program is a horizontal computation and plotting program, which is over 92,000 bytes in length. There is a vertical program, a text manager, planimeter program, HP-IL interface program, cost estimate program, set-up program, Spanish printout program and a HP-41CV section with programming on Bar-Code.

Before using this package, read the HP-87/86 operators manual to learn the general operation of the computer and key functions.

Refer to the serial number of the disk when calling for support if you did not buy direct from LAND INNOVATION.

LOADING THE MAIN PROGRAM

1) Set-up the status file - see pages A through D of this manual.

2) Insert program disk in drive 0 of your disk drive.

3) Turn the computer on, or type LOAD"Autost" or CHAIN"Autost".

If you simply turned the computer on, the program will automatically load off of the program disk, and read the STATUS file for hardware used.

Your data disk will always be in drive 1, unless you are using a single HP-9130 disk drive. It is suggested that you use a write protect tab on the program disk. The tab will have to be removed to store a temporary Crandall Rule file, or a display drawing.

CAUTION

Never press the RUN,INIT, or RESET keys while you have points in internal memory, or all the data will be lost. It is important that you store points and figures periodically, if you should press any of those keys in error.

FUNCTION - DISPLAY and CURSOR KEYS

The function keys in inverse video at the bottom of the computer display represent the keys at the top of the keyboard. The upper row must be shifted.

ERROR RECOVERY

The program is constantly running. It can be halted by pressing any alpha or numeric key when an input is not needed (a beep will sound). The blinking power light will stop blinking when the program is halted. You can then use the computer as a calculator for manual calculations. To continue program control, press the CONT key.

An input error with a question mark (?) afterwards will enable you to re-enter data (the program is still active).

An input error that does NOT have a question mark after will halt the program operation. To recover, type in CONT 36 and press the END LINE key, which will return you to the main menu in any program.

In all the routines, enter zero's (0's) to exit.

POINT CAPACITY EXAMPLE

After setting up the status file, and while in the main program press the PLOT key, then the FINE ADJ key, and then the RECALL key. A subdivision will load off of the program disk (it will look funny if recalling into a non-HP-87 display). This subdivision consists of 1700 points, which is less than 1/2 the capacity of the computer at its lowest size.

Press the CONT key and then the RETURN key to return control to the main menu.

PRINTER CONTROL FUNCTIONS

All the programs have printer control functions which are needed if communicating through a parallel interface, as standard on the HP-86. There is a TP-1 key which will let you print on a daisy wheel that is not at the same address of your HP-82905 printer.

In the main menu press the PRINTER key. You will have 3 keys for printer control - press the PRINT-ON key to return control to the main printer. Press the PRINT-OFF key to direct address to 720 (a non-existant printer). Press the TP-1 key to enter the address code of a daisy wheel printer (tab controls are set using Smith Corona TP-1 codes).

SUPPORT

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ASSIGNING POINTS

This section will explain how to enter coordinates into the system and assign them point numbers. First go to the main menu (the key labels that appear when the program is first initialized). On key #9 you will see ASSIGN.

User Instructions

1. Press the ASSIGN key and the display will appear:

```
ENTER North, East Coordinates, Point Number
?
```

2. Enter the NORTH coordinate (comma) the EAST coordinate (comma) and the POINT NUMBER. If the point had already existed in the computer memory, the display will then show the previous value of point, or if the point does not exist, the display will prompt for another point input.
   a. To exit the point assignment mode, simply enter 0,0,0 and press END LINE.

   If you entered a point greater than the capacity of the computer, the program will automatically return to the main menu.

E X A M P L E

Enter point number 125 as 1000 north and 1250 east;

Press the ASSIGN key (Key #9)

The display appears:

```
ENTER North, East Coordinates, Point Number
?
```

Enter 1000, 1250, 125

Press END LINE and the display will now appear:

```
ENTER North, East Coordinates, Point Number
?
1000,1025,125
ENTER North, East Coordinates, Point Number
?
```

Now, re-enter the same point number as 1000 North 1000 East and the display will appear:

```
ENTER North, East Coordinates, Point Number
?
1000,1025,125
ENTER North, East Coordinates, Point Number
?
1000,1000,125
PREVIOUS VALUE OF POINT # 125 N:   1000 E:   1250
ENTER North, East Coordinates, Point Number
?
```

To return to the main menu simply enter 0,0,0

If you pressed the ASSIGN key by mistake, simply enter zeros to exit. This routine has many safeguards for bad data, but if you should ever get an error that halts program operation, type in CONT 36 and press END LINE.

OCCUPYING STORED POINTS

To occupy a point to traverse from, or simply to review it, use the OCCUPY key (Key #1) which is located in the main menu, (the set of keys that appear when the program is first initialized). A point must exist in the computer memory before a point can be occupied (see previous page for point assignments.)

User Instructions

1. Press the OCCUPY key and the display will appear:

   NOTE: Turn the ON LINE key on the printer off if you do not wish to have the point printed.

```
ENTER Point Number of the Point to be Occupied
?
```

   For example, use the point described on the previous page. (point 125).

2. Enter 125 and Press END LINE; The display will appear:

```
ENTER Point Number of the Point to be Occupied
?
125
Point #    125      +1000.0000000      +1000.0000000
```

   The Printer will print:

```
Point #    125      +1000.0000000      +1000.0000000
```

   a. If the point is not an existing number the display will show:

```
POINT #    125 DOES NOT EXIST AT THIS TIME
```

   b. If you entered a point that is greater than the capacity of the computer, or entered 0 for the point number, you will return to the main menu. After the point is displayed, the key labels will still appear. The program is still running, so pressing any of the keys will execute to their functions.

   c. It is highly unlikely that the program will be halted during this process, but should anything happen, type in CONT 36 and press END LINE to recover.

All traverse data is entered using a single line of input, which includes sideshots, vertical angles, angles, deflections, duplication of bearings between 2 known points, entering distances in feet and inches, repeating bearings and distances. The TRAVERSE key appears in the INTERSECTION menu and the INVERSE menu, as well as the Main menu.

First occupy a point before using the traverse function (see occupy and assign points on the previous pages). After assigning a point using the ASSIGN key, you will be at that last point, and can then press the TRAVERSE key to traverse from that point.

Before using the traverse function, read the below features of the traverse section.

QUADRANT 1

Quadrant 1 is the Northeast quadrant and is standard on most calculators that have surveying programming. If you are entering azimuths that have 0 degrees at Due North, use quadrant No. 1 to enter north azimuths.

QUADRANT 2

Quadrant 2 is the Southeast quadrant, as standard on most calculators that have surveying programming.

QUADRANT 3

Quadrant 3 is the Southwest quadrant and is standard on most calculators that have surveying programming. If you are entering azimuths that have 0 degrees at Due South, use quadrant No. 3 to enter south azimuths.

QUADRANT 4

Quadrant 4 is the Southwest quadrant and is standard on most calculators that have surveying programming.

QUADRANT 5

Quadrant 5 will duplicate the bearing between two points that are existing in computer memory. You do not have to be occupying one of the points to use this quadrant.

For example, if you were occupying point 1254 and wanted to traverse a bearing that was exactly the same as the bearing between points 12 and point 125, enter the bearing as 12.0125 and the quadrant as 5. Notice how the bearing was entered as 12.0125, the number to the left of the decimal place is the point that the bearing will come from, and the point to the right of the decimal place is the point the bearing is going to.

Notice how the point to the right of the decimal was entered as .0125, all points to the right of the decimal MUST be entered as a four digit number. For example, point 145 to point 1 will be entered as 145.0001 and point 1 to point 3254 will be entered 1.3254.

Quadrant 5 can also be used to re-establish a backsight by entering the distance as zero (0).

If you make any kind of an input error such as entering points that do not exist, the display will appear: YOU MADE A QUADRANT 5 ERROR. Check data entry. You will then be able to re-enter your data. Quadrant 5 errors will include entering a point that exceeds computer memory, entering 0 as a point, or using a point that does not exist in computer memory at that time. You will probably make many quadrant 5 errors until you get used to entering the points with 4 places to the right of the decimal place.

QUADRANT 6

Quadrant 6 is the deflection quadrant. This will give the angle entered as a deflection off of the foresight, and if the angle was entered negative, the deflection will be to the left; if the angle is entered positive, the deflection will be to the right.

Entering the angle as 0 and quadrant 6, will duplicate the previously entered bearing, and by entering 90 (or -90) as the angle, the quadrant 6, you will turn a right angle, which you will use often when laying out curves.

QUADRANT 7

Quadrant 7 is the angle quadrant. This will give the angle entered as an angle off of the backsight, and if the angle was entered negative, the angle will be to the left; if the angle is entered positive, the angle to the right.

Entering the angle as 0 and quadrant 7, will go opposite to the previously entered bearing, and by entering 90 (or -90) as the angle, and quadrant 7, you will turn a right angle, which you will use often when laying out curves.

Use quadrant 7 as the delta when at the center point of a curve to go to the PT point as you will see in the following examples within this manual.

ENTERING BEARINGS (ANGLES WITH QUADRANT 6 & 7)

The entering of bearings and angles is the same for all sections and functions of this program. Quadrant 5 will only work in the traverse mode and quadrants 6 and 7 will only work with the traverse and Crandall Rule sections. All bearings and angles are entered in the same format, that is first the bearing (angle), then a comma (,) then the quadrant code.

The bearing is always entered in degrees minutes and seconds, and in no case will you enter a decimal angle. Input of bearings (angles) is the same as a small calculator such as a Hewlett-Packard or Texas Instruments; DEG.MMSS. For example:

To enter 45 deg 32 min 23 sec:
Enter 45.3223

To enter 45 deg 00 min 12 sec
Enter 45.0012

To enter 45 deg 00 min 00 sec
Enter 45

To enter 45 deg 23 min 12.56 sec
Enter 45.231256

The computer will automatically separate minutes and seconds. If more than 60 seconds or more than 60 minutes is entered the printer will print BEARING ERROR, such as if you had entered 45.6523 as the bearing (45 deg. 65 min. 23 sec); the bearing will not be used and you will return to the main menu. If a QUADRANT over 7 is entered, the printer will print QUADRANT ERROR and return to the main menu. Be aware of this, because much of the time you will have the printer off to conserve paper.

HORIZONTAL DISTANCES

Enter the distance after the quadrant. Trailing zeros in the decimal is not necessary for data entry; for example, you do not have to enter 200.00 to enter 200 feet; just enter the number 200.

SLOPE DISTANCES

To enter a slope distance just enter the distance as a negative; you will then be asked to enter the vertical angle. See Example 1 on Page 11 for details.

ENTERING DISTANCES AS FEET AND INCHES

To enter a distance as feet and inches, enter the Quadrant as a negative.

For example: enter 200 feet and 4 inches as 200.04, or 12 feet and 11 inches as 12.11, and the quadrant as negative.

SIDESHOTS

You can enter a sideshot with all bearing codes except code 5. A sideshot will not change the traverse bearing and you will be able to enter many sideshots without re-entering the base bearing.

To enter a sideshot, enter the point number as a negative.

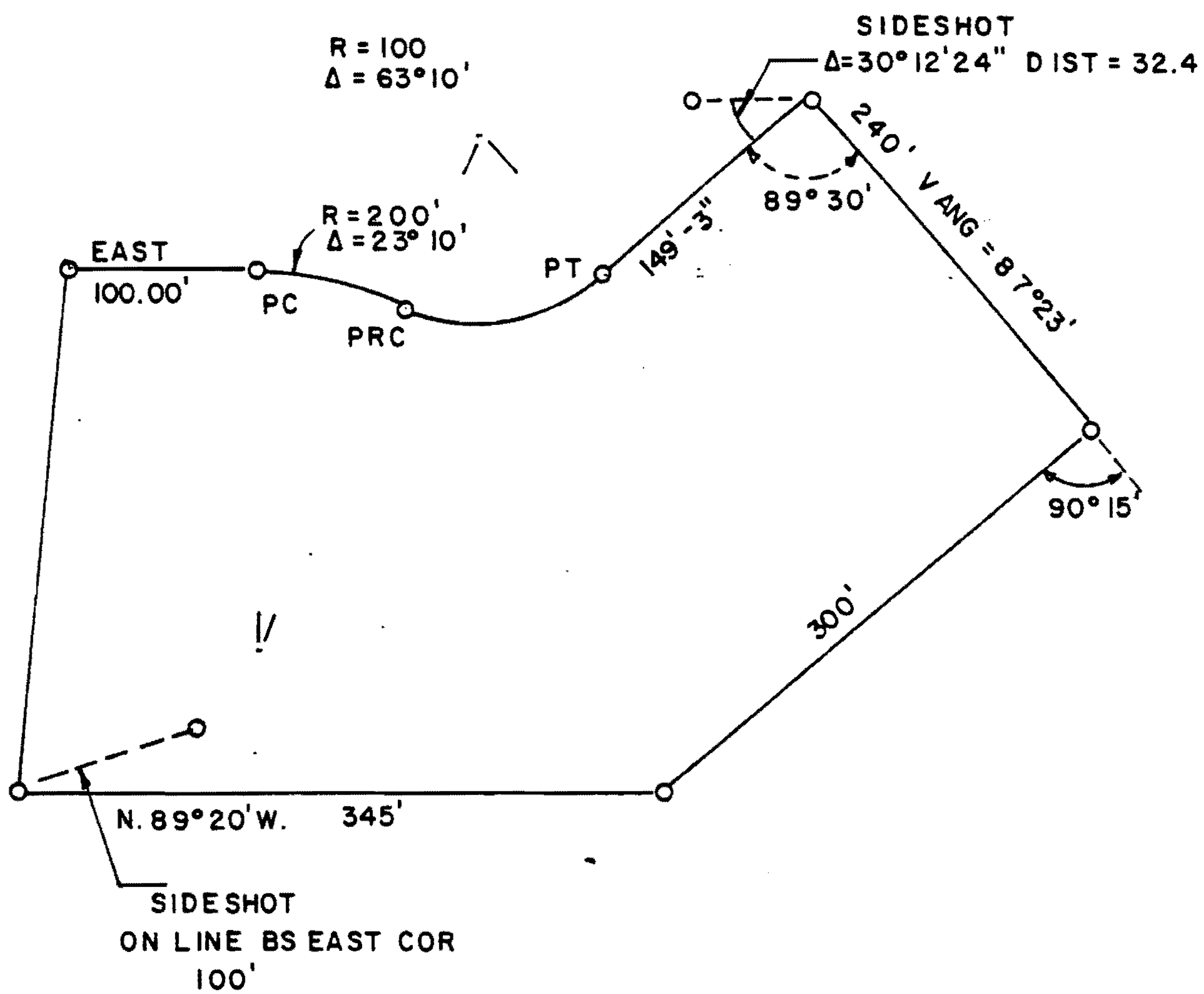
DUPLICATING DISTANCES

Entering the distance as D3 will duplicate a previously traversed (or inversed) distance.

EXITING TRAVERSE MODE

To exit traverse mode, simply enter 0,0,0,0 and press END LINE.

IF THE PROGRAM HALTS EXECUTION PRESS THE CONT KEY. IF THAT DOES NOT WORK, type in CONT 36 and press END LINE. IF THAT DOES NOT WORK, type in CHAIN "Autost".



EXAMPLE NO. 1

EXAMPLE

Using the example on the previous page, you will see how to enter traverse data.

1. First assign the beginning point (in this case the northwest corner). See the ASSIGN section of this manual for instructions and enter 1000 for the North coordinate and 1000 for the East coordinate, and assign it to point number 1.

2. Now press the TRAVERSE key (it is in the inverse and intersection menu also). This display will now appear:

```
If Vert Angle, Enter Dist as Neg    Enter Quad as Neg If Dist is in feet & in.
If a Sideshot, Enter Point as Neg   Enter 0,0,0,0 to EXIT

ENTER Deg.mmss, Quadrant, Distance, Point #
?
```

The above display is what appears every time the TRAVERSE key is pressed. You can always enter 0,0,0,0 to exit the traverse mode.

3. Now enter 90,1,100,2 to traverse East 100 feet to point #2. The first time the computer computes a traverse, it may take a few seconds, but the speed increases to only about a second to compute a leg for each additional leg.

   If you press any key while the computer is calculating, it will pause the program; just press the CONT key to continue program operation.

   The display should now appear:

```
If a Vert Angle, Enter Dist as Neg. ENTER Quad as Neg if dist is in feet & in.
If a Sideshot, Enter Point as Neg.  ENTER 0,0,0,0 to EXIT

ENTER Deg,mmss, Quadrant, Distance, Point #
?
90,1,100,2
TRAVERSE         DUE EAST                100.000 feet to point 2
ENTER Deg,mmss, Quadrant, Distance, Point #
?
```

Notice how the display (and printout if the printer was on), appeared DUE EAST instead of N 90 00 00 E, as most other software would have provided.

4. Now enter the curve as shown. First Deflect to the right 90 degrees and traverse 200 feet; to do this use quadrant 6 (the deflection quadrant).

   a. Enter 90,6,200,3 - the display will appear:

```
If a Vert Angle, Enter Dist as Neg. ENTER Quad as Neg if dist is in feet & in
If a Sideshot, Enter Point as Neg.  ENTER 0,0,0,0 to EXIT

ENTER Deg,mmss, Quadrant, Distance, Point #
?
90,1,100,1
TRAVERSE                DUE EAST                100.000 feet to point 2
ENTER Deg,mmss, Quadrant, Distance, Point #
?
90,6,200,3
TRAVERSE                DUE SOUTH               200.000 feet to point 3
```

You have just traversed to the center of the curve.

5. Now use quadrant 7 to go to the PRC point.

   a. Enter 23.1,7,200,4 and the display will appear:

```
ENTER Deg,mmss, Quadrant, Distance, Point #
?
90,6,200,3
TRAVERSE                DUE SOUTH               200.000 feet to point 3
ENTER Deg,mmss, Quadrant, Distance, Point #
?
23.1,7,200,4
TRAVERSE                North 23 10 00 East     200.000 feet to point 4
ENTER Deg,mmss, Quadrant, Distance, Point #
?
```

6. Now repeat the previous bearing by entering 0 for the angle and the deflection quadrant 6.

   a. Enter the next curve by entering 0,6,100,5 and the display will appear:

```
ENTER Deg,mmss, Quadrant, Distance, Point #
?
23.1,7,200,4
TRAVERSE                North 23 10 00 East     200.000 feet to point 4
ENTER Deg,mmss, Quadrant, Distance, Point #
?
0,6,100,5
TRAVERSE                North 23 10 00 East     100.000 feet to point 5
```

7. Traverse to the PT point of the curve.

   a. Enter -63.1,7,100,6 and the display will appear:

```
ENTER Deg.mmss, Quadrant, Distance, Point #
?
0,6,100,5
TRAVERSE                North 23 10 00 East     100.000 feet to point 5
ENTER Deg.mmss, Quadrant, Distance, Point #
?
-63.1,7,100,6
TRAVERSE                South 40 00 00 East     100.000 feet to point 6
```

8. Now you are at the PT of the curve, so turn a 90 degree right angle a distance of 149 feet and 3 inches to point 7; to do this, enter the quadrant as a negative and the distance will be converted from feet and inches to decimal feet.

   a. Enter 90,-7,149.03,7 and the display will appear:

```
ENTER Deg.mmss, Quadrant, Distance Point #
?
-63.1,7,100,6
TRAVERSE                South 40 00 00 East     100.000 feet to point 6
ENTER Deg.mmss, Quadrant, Distance Point #
?
90,-7,149.03,7
TRAVERSE                North 50 00 00 East     149.250 feet to point 7
```

9. Enter a sideshot from point 7 using quadrant 7 to turn an angle off of the backsite of 30 deg 12 min 24 sec, a distance of 32.4 feet. Enter the point as a negative to go to a sideshot.

   a. Enter 30.1224,7,32.4,-8 and the display will appear:

```
ENTER Deg.mmss, Quadrant, Distance Point #
?
90,-7,149.03,7
TRAVERSE                North 50 00 00 East     149.250 feet to point 7
ENTER Deg.mmss, Quadrant, Distance Point #
?
30.1224,7,32.4,-8
SIDESHOT                South 80 12 24 West     32.400 feet to point 8
ENTER Deg.mmss, Quadrant, Distance Point #
?
```

Notice how the word "TRAVERSE" was replaced by the word "SIDESHOT".

10. Now turn an angle left of 89 deg 30 min, a slope distance of 240 feet with a vertical angle of 87 deg 23 min. To enter a slope distance simply enter the distance as negative.

   a. Enter -89.3,7,-240,9 and the display will appear:

```
ENTER Deg.mmss, Quadrant, Distance Point #
?
30.1224,7,32.4,-8
SIDESHOT                South 80 12 24 West     32.400 feet to point 8
ENTER Deg.mmss, Quadrant, Distance Point #
?
-89.3,7,-240,9
 Zenith Angle (D.MS) - add 90 to Vertical Angle
?
```

b. Now enter 87.23 as the vertical angle and the display will appear:

```
TRAVERSE                 South 39 30 00 East     239.750 feet to point 9
ENTER Deg.mmss, Quadrant, Distance Point #
?
```

11. Now deflect to the right 90 deg 15 min, a distance of 300 feet.

a. Enter 90.15,6,300,10 and the display will appear:

```
ENTER Deg.mmss, Quadrant, Distance Point #
?
-89.3,7,-240,9
 Zenith Angle (D.MS) - add 90 to Vertical Angle
87.23
TRAVERSE                 South 39 30 00 East     239.750 feet to point 9
ENTER Deg.mmss, Quadrant, Distance Point #
?
90.15,6,300,10
TRAVERSE                 South 50 45 00 West     300.000 feet to point 10

ENTER Deg.mmss, Quadrant, Distance Point #
?
```

12. Now traverse North 89 deg 20 min West a distance of 345 feet.

a. Enter 89.2,4,345,11 and the display will appear:

```
ENTER Deg.mmss, Quadrant, Distance Point #
?
90.15,6,300,10
TRAVERSE                 South 50 45 00 West     300.000 feet to point 10
ENTER Deg.mmss, Quadrant Distance Point #
?
89.2,4,345,11
TRAVERSE                 North 89 20 00 West     345.000 feet to point 11
ENTER Deg.mmss, Quadrant, Distance Point #
?
```

13. Now you are at point 11 and want to traverse a distance of 100 feet on a line that is exactly in line between points 11 and 9. To duplicate this bearing use quadrant 5.

a. Enter 11.0009,5,100,12 and the display will appear:

```
ENTER Deg.mmss, Quadrant, Distance Point #
?
89.2,3,345,11
TRAVERSE                 North 89 20 00 West     345.000 feet to point 11
ENTER Deg.mmss, Quadrant, Distance Point #
?
11.0009,5,100,12
TRAVERSE                 North 72 09 35 East     100.000 feet to point 12
ENTER Deg.mmss, Quadrant, Distance Point #
?
```

Now you have just entered the tract.

14. Simply enter 0,0,0,0 to exit the traverse mode and return to the original menu.

    You can now inverse around the site to find the area , (see the INVERSE section of this manual) or obtain a plot of the tract (see the HORIZONTAL PLOTTING section of this manual), or store the drawing in a disk file (see the FILE section in this manual).

    It is suggested that you store these points away in a file as you will be returning to this EXAMPLE 1 throughout this manual.

TRAVERSING WITH SEQUENTIAL POINT ASSIGNMENTS

To traverse with points that are assigned automatically, press the SEQ TRAV key instead of the TRAVERSE key, but there are some slight differences:

User Instructions

1. Press the SEQ TRAV key; the display will appear:

```
ENTER BEGINNING POINT #
?
```

   a. Now enter the beginning point number that will be at the next traverse point. Be sure that it is not the same number of the point that you are traversing from, or you will overwrite that point.

   b. The other difference is that you will be entering the bearing (angle) (comma) quadrant (comma) distance (comma).

      Enter a comma after the distance, or you will get an input error, and have to either re-enter the line or move the cursor to the incorrect line and add the comma.

   c. All the features are the same except for a sideshot. There is no point number to enter as a negative, so enter an S after the last comma to indicate a sideshot.

NOTES

1. IF YOU OVERWRITE A PREVIOUS POINT, THE DISPLAY AND THE PRINTER WILL INDICATE IT BY PRINTING AND DISPLAYING THE POINT AND ITS FORMER COORDINATES.

2. IF AT ANY TIME THE PROGRAM HALTS OPERATION, FIRST PRESS THE CONT KEY, AND IF THAT FAILS, PRESS THE PAUSE KEY AND type in CONT 36 and press END LINE; IF THAT FAILS, type in: CHAIN "Autost".

3. If you attempt to enter a slope distance in the sequential traverse mode, the display will appear:

```
ENTER HORIZONTAL DIST ONLY
```

INVERSE FEATURES

The inverse mode can only be used with established points, and will NOT work with direct coordinate input as on some small programmable calculators. When first setting up your coordinates, it is important to try to set them in a sequential order, as it will save time by using the PtThruPt function of this program.

There are 4 types of inversing:

Key 1	PtThruPt	Inverse sequentially between points.
Key 2	PtToPt	Inverse between 2 points.
Key 3	ToPt	Inverse to a point from a previously occupied point.
Key 4	Curve	Inverse a curve given the PC, CENTER and PT points.

The last point inversed to is the one being occupied, so press the TRAV key to traverse from that point.

NOTES

1. EACH TIME THE INVERSE KEY IS PRESSED THE AREA MEMORY IS CLEARED AND YOU ARE READY TO COMPUTE THE AREA OF A TRACT.
2. If you enter a point that exceeds the capacity of the computer memory you will return to the main menu.
3. If you pressed the wrong inverse key just enter 0's for the input and you will then be able to press the correct inverse function key.
4. All data is displayed to the nearest second, but the exact bearing is used internally. The distances are all rounded to 3 decimal places.

User Instructions

Inverse EXAMPLE 1:

1. Press the INVERSE key in the main menu (it is also available in the intersection menu). The inverse function keys will appear. They are keys 1 through 4 and key 8. Inverse beginning at point #1 and go clockwise.

   a. Press the PtToPt key and the display will appear:

```
FROM Point, TO Point
?
```

   b. Now enter 1,2 and the display will show (and printer will print if it was turned on):

```
FROM Point, TO Point
?
1,2
Pt#1 to Pt#2                     DUE EAST          100.000 feet
```

This first inverse will take longer than others. If you inverse due north, east, south, west directly from initializing the program the display may show some warnings, just ignore these.

2. Now inverse the curve, press the CURVE key and the display will appear:

```
ENTER
PC Pt#,CTR Pt (- if delete),PT Pt
?
```

a. Enter the curve as 2,3,4 and the display will show (and the printer will print, if it is turned on):

```
PC Pt#,CTR Pt (- if delete),PT Pt
?
2,3,4
Radius =     200.000 Delta=023 10 00       Arc = 80.867      Tan = 40.993
PC to CENTER              DUE SOUTH                         200.000 Feet
CENTER to Pt              NORTH 23 10 00 EAST               200.000 Feet
CHORD BRG & DIST          SOUTH 78 25 00 EAST                80.317 Feet
```

If the printer was on, it would have printed:

CURVE 2 to 3 to 4

```
Radius =     200.000 Delta=023 10 00       Arc = 80.867      Tan = 40.993
PC to CENTER              DUE SOUTH                         200.000 Feet
CENTER to Pt              NORTH 23 10 00 EAST               200.000 Feet
CHORD BRG & DIST          SOUTH 78 25 00 EAST                80.317 Feet
```

3. Enter the next curve. Notice how the curve arc's into the site. The area of this curve must be DELETED from the total area of the tract. To do this, just enter the center point number of the curve as a negative; this will delete the curve area.

a. Press the CURVE key.

b. Enter 4,-5,6 to inverse the next curve, the display will show:

```
ENTER
PC Pt#,CTR Pt (-if delete), PT Pt
?
4,-5,6
Radius=      100.000      Delta=063 10 00   Arc=  110.247      Tan=  61.480
PC TO CENTER              NORTH 23 10 00 EAST               100.000 Feet
CENTER to Pt              SOUTH 40 00 00 EAST               100.000 Feet
CHORD BRG & DIST          NORTH 81 35 00 EAST               104.748 Feet
```

The printer will have a printout similar to the previous example.

4. You are now occupying point 6 and need to inverse to point 7.

a. Press the ToPt key and the display will appear:

```
Number of Point you are inversing to ?
?
```

b. Enter point 7 and the display will appear (and the printer will print, if turned on):

```
Number of Point you are inversing to ?
?
INVERSE TO POINT # 7    NORTH 50 00 00 EAST     149.250 Feet
```

5. You are now at point 7 and need to inverse to point 9.

a. Press the ToPt key again.

b. Enter 9 and the display will appear:

```
Number of Point you are inversing to ?
?
9
INVERSE TO POINT# 9     SOUTH 39 30 00 EAST     239.750 Feet
```

6. You are now at point 9. Now to inverse from point 9 to 10 to 11 in a sequential order, you can use the sequential key: PtThruPt

You can use this key to go sequentially from a lower point number to a higher point number, or to go sequentially from a higher point number through a lower point number.

a. Now press the PtThruPt key, and the display will appear:

```
FROM Point, Through Point
?
```

b. Enter 9,11 and the display will appear (and the printer will print, if turned on):

```
FROM Point, Through Point
?
FROM Pt# 9 TO Pt# 10     SOUTH 50 46 00 WEST     300.000 Feet
FROM Pt# 10 TO Pt# 11    NORTH 89 20 00 WEST     345.000 Feet
```

7. You are at point 11 and have to inverse back to point 1 to close the site.

a. Press the ToPt key.

b. Enter 1 and the display will appear:

```
Number of the Point you are inversing to ?
?
1
INVERSE TO POINT# 1     NORTH 05 50 00 EAST     277.088 Feet
```

You have just inversed the site.

8. Now press the AREA key to find the area of the tract. The area will be printed and shown on the display (along with the main menu) as shown below:

```
Total area of tract is:     138,281.340 SQ FT or    3.174503 Acres
```

ADDITIONAL NOTES THAT YOU SHOULD BE AWARE OF:

If a curve is entered that does not have radial lines equal to within .0005 feet, the display will appear:

```
ENTER
PC Pt#,CTR Pt (-if delete),PT Pt
?
1,2,3
You Blew It!  RADIAL LINES ARE NOT EQUAL PLEASE CHECK AND RE-ENTER DATA
```

Press the CURVE key again and enter the correct data.

FORMATTING & LABELING FUNCTIONS

Advancing Paper

1. Press the ADVANCE key; the paper will advance without affecting current area memory or disturbing the occupied point.

Labeling

1. By pressing the LABEL key, the display will appear:

```
ENTER LABEL
?
```

2. You can now enter what you want to label. If the entry is less than 40 characters long, the printout will be with double wide characters, and if the entry exceeds 40 characters, the label will be of normal character width. Do not exceed 80 characters.

REPEATING A PREVIOUSLY INVERSED DISTANCE IN A TRAVERSE

To repeat a distance that was inversed, first inverse between two points, then press the traverse key and enter the distance as D3.

RADIAL INVERSES

This routine is available in the inverse menu. With this feature you can get the bearing and distance or angle and distance inverses from a reference point to a series of points. To begin with, press the RADIAL key in the inverse menu and you will see the radial function keys:

KEY #1	BEARING	To obtain a bearing and distance printout.
KEY #2	ANGLES	To obtain an angle and distance printout.
KEY #3	BASE PT	Enter your point of reference.
KEY #4	BACKST	Enter your backsight reference for angle output.
KEY #7	RETURN	Returns you to the inverse menu.

User Instructions

Use point from EXAMPLE 1 for the following examples:

OBTAINING A BEARING OUTPUT:

1. To get a bearing and distance listing, you must first occupy a reference point; in this example use point 12 as a reference point.

   a. Press the BASE PT key and the display will appear:

```
ENTER Reference Point
?
```

   Enter the reference point. If you enter 0 or a number greater than the capacity of the computer, control returns to the radial keys.

   b. Enter 12 and the display will appear (and the printer will print, if turned on):

```
ENTER Reference Point
?
12
TIES ARE FROM POINT No. 12
```

2. Now to get a listing from points 1 through point 5, press the BEARING key and the display will appear:

```
FROM POINT, THROUGH POINT
?
```

   a. Enter the beginning point and the ending points of the lines you want listed. For this example, list from point 1 through point 5; enter 1,5 and the display will show (and the printer will print, if turned on):

```
FROM POINT , THRU POINT
?
1,5
   POINT 12 to POINT 1  NORTH 15 18 00 EAST     254.020 Feet
   POINT 12 to POINT 2  NORTH 07 39 50 EAST     247.225 Feet
   POINT 12 to POINT 3  NORTH 36 13 09 EAST      55.799 Feet
   POINT 12 to POINT 4  NORTH 26 00 11 EAST     254.670 Feet
   POINT 12 to POINT 5  NORTH 25 12 12 EAST     354.582 Feet
```

b. Control will now resume to the radial function keys.

OBTAINING AN ANGLE OUTPUT

1. To get an angle and distance listing, you must first occupy a reference point. In this example, use point 12 as a reference point.

   a. Press the BASE PT key and the display will appear:

```
ENTER Reference Point
?
```

2. Now enter your reference point. If you enter 0 or a number greater than the capacity of the computer, control returns to the radial keys.

   a. Enter 12 and the display will appear (and the printer will print, if turned on):

```
ENTER Reference Point
?
12
TIES ARE FROM POINT No. 12
```

Now you must enter the backsight reference. The following will give examples of both methods:

ENTERING A BEARING AS A BACKSIGHT:

3. To enter a bearing as a backsight, press the BACKST key and the display will appear:

```
TO BACKSIGHT FROM AN EXISTING POINT -- ENTER Point No. , 0

TO BACKSIGHT A BEARING ENTER DD.MMSS , QUAD
(Quad must not exceed 4, and bearing is from base point)
?
```

Now you can enter a bearing backsight; for this example use N 10 E.

   a. Enter 10,1 and the display will appear (and the printer will print, if turned on):

```
TO BACKSIGHT FROM AN EXISTING POINT -- ENTER Point No. , 0
TO BACKSIGHT A BEARING  ENTER DD.MMSS . Quad
(Quad must not exceed 4, and bearing is from base point)
?
10,1
REFERENCE BACKSIGHT
NORTH 10 0 0 EAST
```

ENTERING A POINT AS A BACKSIGHT

4. To enter a point as a backsight, press the BACKST key and the display will appear:

```
TO BACKSIGHT FROM AN EXISTING POINT -- ENTER Point No. , 0
TO BACKSIGHT A BEARING  ENTER DD.MMSS . Quad
(Quad must not exceed 4, and bearing is from base point)
?
```

a. Now enter a point number as a backsight. If you enter 0,0 control will resume to the radial function keys. For this example, use point 5 as a reference backsight.

b. Enter 5,0 and the display will appear (and the printer will print, if turned on):

```
TO BACKSIGHT FROM AN EXISTING POINT -- ENTER Point No. , 0
TO BACKSIGHT A BEARING  ENTER DD.MMSS , Quad
(Quad must not exceed 4, and bearing is from base point)
?
5,0
REFERENCE BACKSIGHT
NORTH 25 12 12 EAST
```

5. To get a listing from points 1 through point 5, press the ANGLE key and the display will appear:

```
FROM POINT , THROUGH POINT
?
```

a. Enter the beginning point and the ending points of the lines you want listed. For this example, list from point 1 through point 5; enter 1,5 and the display will show (and the printer will print, if turned on):

```
FROM POINT , THRU POINT
?
1,5
FROM POINT 12 to POINT 1
Angle Left=040 30 13 Angle Right=319 29 47 Distance=  254.020
FROM POINT 12 to POINT 2
Angle Left=017 32 22 Angle Right=342 27 38 Distance=  247.225
FROM POINT 12 to POINT 3
Angle Left=348 59 03 Angle Right=011 00 57 Distance=   55.799
FROM POINT 12 to POINT 4
Angle Left=359 12 01 Angle Right=000 47 59 Distance=  254.670
FROM POINT 12 to POINT 5
Angle Left=000 00 00 Angle Right=360 00 00 Distance=  354.582
```

b. Control will resume to the radial menu. If the reference backsight is either Due East, West, North or South, and error condition may be present, but you may never encounter it, but be aware of the possibility.

LISTING POINTS

User Instructions

1. To list the points that you have computed, press the LIST key in the main menu, and the display will appear:

```
ENTER STARTING POINT, ENDING POINT
?
```

Now enter the beginning point and the ending points of the points to be listed. The paper will advance automatically for each 100 sets of coordinates listed.

a. For example, list the points in EXAMPLE 1.

b. Enter 1,12 and the printer will print:

POINT	NORTH	EAST	POINT	NORTH	EAST
1	+1000.00000	+10000.00000	2	+10000.00000	+1100.00000
3	+800.000000	+1100.000000	4	+983.872874	+1178.681422
5	+1075.809311	+1218.022133	6	+999.204867	+1282.300894
7	+1095.140917	+1396.633028	8	+1089.697882	+1365.099341
9	+910.144109	+1549.132628	10	+720.332510	+1316.814838
11	+724.346677	+971.838189	13	+754.983238	+1067.029581

The display will show the points and coordinates as they are printed.

NOTE

If you entered a starting or ending point that exceeded computer memory, the li-ting will not operate and control will be returned to the main menu.

POINT FILES ON DISK

Points should be filed away on disk whenever you compute a group of 50 to 100 points, so that you do not lose them if you press the RUN key, or RESET the computer by mistake.

Data disks are ALWAYS inserted in DRIVE 1 of your 82901M disk drive.

If the points that you are storing away are NULL points, a warning message will appear when recording them onto disk. The NULL points will be assigned 0 to its north and east coordinates, and when you overwrite these points, they will display and print: PREVIOUS VALUE POINT X 0 0.

User Instructions

1. Press the FILE key (key #8) in the main menu and the file keys will appear in the display; these are the OLD FILE (key #1), the NEW FILE (key #2), and the CHK-DATA (key #9) key. For example of how to set up a file you must first have the points that you want to file away in computer memory. Use the 12 points that you set up in EXAMPLE 1 and store them away in a file named EXAMPLE1. (The data disk must be initialized before data can be stored on it; make sure the program disk is not residing in the disk drive when you initialize any other disk).

   a. Press the NEW FILE key and the display will appear:

```
ENTER File Name , Maximum Number of Points that will be used in the FILE
?
```

   b. Enter the name of the file you are going to use (this can be any combination of digits and/or characters with a limit of 10 characters). The number of points is the projected number of points that you will use on that job, not the present number of points. For example, EXAMPLE 1 has 12 points, but you feel that the client will want to add onto the site in the future, so you will want to provide a file large enough to store all of the future projected points. The maximum file size is 3200 points with a 128K module, or 9999 points with two 128k modules.

   c. In this example, enter EXAMPLE1,50 and the file will be set up for 50 points, and the display will not appear:

```
ENTER File Name , Maximum Number of Points that will be used in the FILE
?
EXAMPLE1,50
ENTER Beginning Point No.   Ending Point   No. of points to be used
?
```

d. Enter the beginning point of the points that you want to file (comma) and the ending point of the points that you want to file. The beginning point does not have to be point 1; for example, you filed away points 1 through 12, then computed points 13 through 45 at a later date; you would not have to enter 1,45 to file those points, just 13,45. As your files grow bigger and bigger, this will save much time.

Now Enter 1,12 and after the points are recorded, the display will clear and the original menu will appear.

RECALLING POINTS FROM A DATA FILE

User Instructions

1. To recall points from a data file, press the FILE key and then the OLD FILE key and the display will appear:

```
ENTER FILE NAME   (enter EXIT to ESCAPE)
?
```

a. The file name must be an existing file. If the file did not exist on the disk, the display would read: FILE NOT FOUND ON DISK, Check Name and Re-Enter. You can now enter the correct name, or enter EXIT to return control to the menu.

Enter the name of the file of the points that you either want to read or write. For this example, recall the EXAMPLE1 file that was previously recorded. Enter EXAMPLE1 and the display will appear:

```
ENTER FILE NAME  (enter EXIT to ESCAPE)
?
EXAMPLE1
To READ Points FROM DISK    ENTER R
To WRITE Points ONTO DISK   ENTER W
?
```

b. Enter W to write points onto the disk from internal computer memory or R to read points from the disk and put them into computer memory. In this example, enter R and the display will appear:

```
ENTER FILE NAME  (enter EXIT to ESCAPE)
?
EXAMPLE1
To READ Points FROM DISK      ENTER R
To WRITE Points ONTO DISK     ENTER W
?
R
ENTER Beginning Point NO. Ending Point NO. of points to be used
?
```

c. Enter the beginning point and the ending point of the points to be read from the disk. In this case you forgot how many points the file had in it, so you will guess 14 points. Enter 1,14 for the points. If you had entered 1,12 the points would have been read off of the file and the display cleared and returned to the main menu. In this case, the display will appear:

```
ENTER FILE NAME  (enter EXIT to ESCAPE)
?
EXAMPLE1
To READ Points FROM DISK  ENTER R
To WRITE Points ONTO DISK  ENTER W
?
R
ENTER Beginning Point NO. Ending Point NO. of points to be used
?
1,14
YOU HAVE REACHED THE END OF THE LAST POINTS YOU FILED (Pt# 12)
```

The main menu keys are now active and you can use other features of the program. One thing to note is that the last point indicated is the last point encountered at an error which may or may not be the last point in the file. The majority of the time you can use it as the last existing point, but do not rely on it.

REVIEWING EXISTING DATA FILES

Now suppose you have had the computer for a few months and want to review just exactly what you have stored on all the data disks to find an old job; but you forgot just what disk it was stored on, or you weren't sure of the file name or the size.

User Instructions

1. Insert the data disk in DRIVE 1.

   a. Press the FILE key and then the CHK-DATA key and the catalog of that disk will appear on the display. You will probably have to use the ROLL key to scroll the display to review the files. Control is returned to the main menu.

CRANDALL RULE ADJUSTMENT

This program will adjust by Crandall's Rule. You have the option of adjusting angles, distances and/or both. You can review courses and error at different stages of adjustment.

This program will automatically assign points beginning with point #1, and uses both point and figure variables for data storage. The amount of courses that you can enter (including sideshots) is 398, which will overwrite points and figures up to point and figure #799. Be sure to file away any points and figures in internal computer memory before using the Crandall Adjustment program. After all points are adjusted, use the RE-ASN function to re-number the points if you do not want the points to begin at point #1.

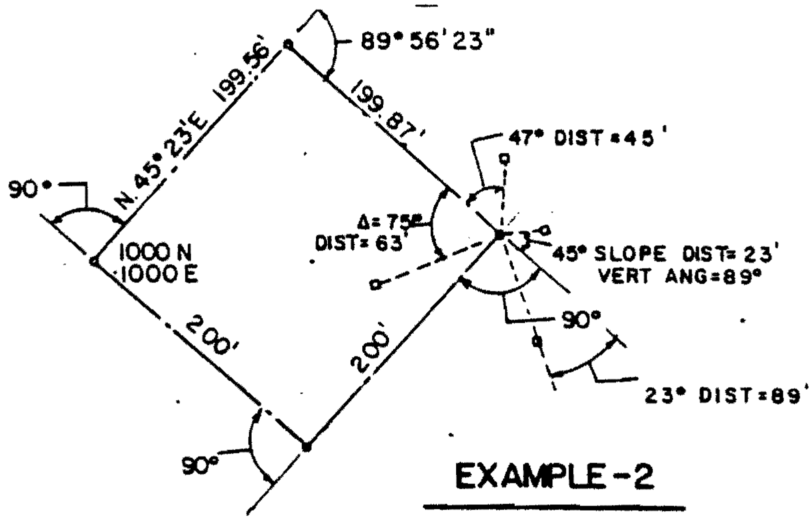
USES FOR CRANDALL ADJUSTMENT

This program is generally used for survey traverse adjustment, as it only adjusts distances and will leave all bearings intact. Because it does not adjust bearings, it is an excellent way of adjusting errors when checking boundaries for area; for example: A client brings in a parcel of land 100 feet wide and 3000 feet long and wants an exact area, but when you traverse the site the closure is off by 0.01 foot. Since the error is 0.01 foot and the site is 3000 feet long, the most accurate area that you can give the client is within 30 square feet (30 x 1000). You can use this Crandall Rule routine to distribute the error on the distances, then use the inverse routing to find the exact area.

User Instructions

1. While in the MAIN MENU press the ADJUST key.
2. Press Key #1 (CRANDALL key) in the adjust menu. If you want to return at this point, press the RETURN key to get back to the MAIN MENU.
   a. The printer at this point prints: CRANDALL RULE ADJUSTMENT

USE EXAMPLE 2 ON PAGE 29 FOR REFERENCE ON THE EXAMPLE PROBLEM.



EXAMPLE-2

b. The Computer display will now appear:

```
        CRANDALL RULE ADJUSTMENT
   ENTER Traverse (after last course enter Ø,Ø,Ø)
   ** ON A SIDESHOT ENTER THE QUADRANT AS NEGATIVE
   ENTER Deg.mmss , Quadrant , Distance
   ?
```

3. This is the beginning prompt for Crandall adjustment. Enter the traverse similar to traverse using the normal traverse key in the main menu. Since there are no provisions for point entry, enter the QUADRANT as NEGATIVE for a sideshot. As the other traverse routines, the prompt is repeating until Ø,Ø,Ø is entered which signals the end of data entry and bring control to the MANIPULATION keys. If you make a mistake during data entry, just continue, as you will be able to revise the point after the MANIPULATION keys appear. NOTE: DO NOT ENTER QUADRANT #5 or any quadrant over 7, or the display will appear: Quadrant Error - please re-enter.
   a. Enter the distance as negative, and you will be asked to enter the Zenith angle, just as in normal traverse mode.
   b. This does not review data entry as it is being entered as in the traverse mode, because errors can be easily changed after data entry and entry time is much quicker without waiting for routines that display data entered.

USE THE ABOVE TRAVERSE FOR EXAMPLE IN FURTHER INSTRUCTIONS

4. Enter the first course.
   a. If the first course is a reference bearing, enter the bearing and quadrant (use quadrants 1 through 4) and the distance as Ø. The display will then show: REFERENCE BEARING ENTERED
   b. Using EXAMPLE 2, enter the first course: N 45-23 E 199.56
   ENTER 45.23,1,199.56 and the display will appear:

```
ENTER Deg.mmss , Quadrant , Distance
?
45.23,1,199.56
ENTER Deg.mmss , Quadrant , Distance
?
```

5. Enter the next course. In EXAMPLE 2, it is a deflection to the right of 89 deg. 56 min. 23 sec. and a distance of 199.87 feet. ENTER 89.5623,6,199.87 and the display will appear:

```
ENTER Deg.mmss , Quadrant , Distance
?
89.5623,6,199.87
ENTER Deg.mmss , Quadrant , Distance
?
```

6. EXAMPLE 2 shows 4 sideshots to be entered at this point, the first being an angle to the right of 47 degrees, a distance of 45 feet. ENTER 47,-7,45 (the quadrant negative for sideshot) and the display will appear:

```
ENTER Deg.mmss , Quadrant , Distance
?
47,-7,45
ENTER Deg.mmss , Quadrant , Distance
?
```

7. The next sideshot in EXAMPLE 2 is a deflection to the right of 23 degrees, a distance of 89 feet. ENTER 23,-6,89 (the quadrant negative for a sideshot) and the display will appear:

```
ENTER Deg.mmss , Quadrant , Distance
?
23,-6,89
ENTER Deg.mmss , Quadrant , Distance
?
```

8. The next sideshot in EXAMPLE 2 is an angle to the left of 75 degrees and a distance of 63 feet. ENTER -75,-7,63 (the angle as negative for an angle LEFT, and the quadrant as negative for a sideshot), and the display will appear:

```
ENTER Deg.mmss , Quadrant , Distance
?
-75,-7,63
ENTER Deg.mmss , Quadrant , Distance
?
```

9. The next sideshot in EXAMPLE 2 is a deflection to the left of 45 degrees, and a slope distance of 23 feet. ENTER -45,-6,-23 (the angle as negative for a deflection LEFT, the quadrant as negative for a sideshot, and the distance as a negative to signal a slope distance), the display will now appear:

```
ENTER Zenith Angle (add 90 if vertical angle)
?
```

a. Enter the zenith angle. If you are working with vertical angles, simply add 90 to the angle; for example: a vertical angle of 5 degrees 23 minutes will be entered as 95.23. The zenith angle in EXAMPLE 2 was 89 degrees, so enter 89 and the display will appear:

```
ENTER Zenith Angle (add 90 if vertical angle)
?
89
ENTER Deg.mmss , Quadrant , Distance
?
```

10. Enter the next course in EXAMPLE 2: a deflection of 90 degrees to the right, a distance of 200 feet, ENTER 90,6,200 and the display will appear:

```
ENTER Deg.mmss , Quadrant , Distance
?
90,6,200
ENTER Deg.mmss , Quadrant , Distance
?
```

11. Enter the next course in EXAMPLE 2: a deflection of 90 degrees to the right, a distance of 200 feet. ENTER 90,6,200 and the display will appear:

```
ENTER Deg.mmss , Quadrant , Distance
?
90,6,200
ENTER Deg.mmss , Quadrant , Distance
?
```

12. Now you are at the beginning point of the traverse on EXAMPLE 2. If you are not going to adjust angles, this will be the last course. If you are going to adjust angles and the reference bearing was not entered at the beginning of the traverse, you must enter the closing angle (or deflection).

a. If you are not adjusting angles - go to step 13.

b. If you entered a reference bearing at the beginning of the traverse, go to step 13.

c. Enter the closing angle. Enter the distance as Ø (zero) to signal that it is a closing angle (use quadrants 6 or 7 only). In EXAMPLE 2, the closing angle was a 90 degree deflection to the right. ENTER 90,6,0 and the display will appear:

```
ENTER Deg.mmss , Quadrant , Distance
?
90,6,0
CLOSING ANGLE ENTERED
ENTER Deg.mmss , Quadrant , Distance
?
```

13. You have just entered all the traverse data. To exit this mode, enter 0,0,0 and the display will appear:

```
ENTER Beginning North , East Coordinates
?
```

a. Enter the beginning North coordinate (comma) and the beginning East coordinate of the traverse. In EXAMPLE 2 the beginning coordinates are 1000 North and 1000 East. Enter 1000, 1000 and the display will appear:

```
Is Traverse Open or Closed?  ENTER O or C
?
```

b. If the traverse is closed as in EXAMPLE 2, enter C for a closed traverse and go to step 14.

c. If the traverse is open enter O (for open) and the display will appear:

```
ENTER Closing North , East Coordinates
?
```

d. ENTER the closing coordinates.

14. The MANIPULATION control keys will now appear:

KEY	LOCATION	DESCRIPTION
Adj.Ang.	Key #1	Adjusts angles of traverse entry - only adjusts traverse angles and not sideshot angles.
REVIEW	Key #2	Displays and prints contents of traverse information.
REVISE	Key #3	Revises a point without changing other traverse data.
ERROR	Key #4	Displays current error of traverse. Must be used before pressing the adjust key.
ADJUST	Key #5	Adjusts by Crandall Rule current traverse.
NO ADJ	Key #6	Assigns coordinates to current traverse without any adjustment, then returns to the main menu.
RETURN	Key #7	Returns control to the MAIN MENU.

15. At this point review the traverse entry. You should turn the printer on to record the data on a hard copy, as it will run-off the display if over 4 courses. Press the REVIEW key and the display will appear:

```
POINT NUMBER 2
TRAVERSE
                   NORTH 45 23 00 EAST   199.560 Feet
POINT NUMBER 3
TRAVERSE DEFLECTION RIGHT
ANGLE; 90  0  0  DISTANCE= 199.87

POINT NUMBER 4
SIDESHOT ANGLE RIGHT
ANGLE; 47  0  0  DISTANCE= 45

POINT NUMBER 5
SIDESHOT DEFLECTION RIGHT
ANGLE; 23  0  0  DISTANCE= 89

POINT NUMBER 6
SIDESHOT ANGLE LEFT
ANGLE; 75  0  0  DISTANCE= 63

POINT NUMBER 7
SIDESHOT ANGLE LEFT
ANGLE; 45  0  0  DISTANCE= 23
ZENITH ANGLE= 89  0  0

POINT NUMBER 8
TRAVERSE DEFLECTION RIGHT
ANGLE; 90  0  0  DISTANCE= 200

POINT NUMBER 9
TRAVERSE DEFLECTION RIGHT
ANGLE; 90  0  0  DISTANCE= 200

POINT NUMBER 10
TRAVERSE DEFLECTION RIGHT
ANGLE; 90  0  0  DISTANCE= 0
```

Continued on Page 34

Continued from Page 33...

Control is returned to the manipulation menu. Review the data printed, and if there are any changes, use the REVISE key to change the course. See revision instructions on Page 35.

16. If you are not adjusting angles - go to step 17. To adjust angles, you must have used angle entry for the traverse (sideshots can be bearing-distance entry). The closing angle must be the same direction as the reference bearing or you will be at least 180 degrees off. The computer remembers if the traverse was open or closed, so on an open traverse, you will be asked to enter the closing bearing, quad.

    a. Press the Adj.Ang key to adjust the angles in EXAMPLE 2, and the display will appear:

    ```
    TOTAL ANGLE ERROR= 0 -3 -37
    ERROR AT EACH CORNER= 0 0 -54
    DO YOU WANT TO ADJUST THE ANGLES? ENTER Y or N
    ?
    ```

    b. If the traverse was open you would be able to enter the closing bearing and quadrant before the error was shown. If the angle error is within your tolerance, enter Y, and if not, enter N and review for entry error, or send field crew to correct error. Enter Y to adjust the angles in EXAMPLE 2 and return to the manipulation menu.

17. Find the traverse error by pressing the ERROR key. The error will be displayed and printed. Using EXAMPLE 2 the error will appear:

    ```
    ERROR= N:-.21812889  E:-.255883802
    TOTAL TRAVERSE DISTANCE= 799.43
    ERROR RATIO = 1 foot in 2377.56424458 feet.
    ```

    a. If the error was not within your tolerance, review data again for input errors, or send crew out to correct data.

18. If you do not want the traverse adjusted, and want to utilize the data "as is" without adjustment, press the NO ADJ key and the points will have coordinates assigned to them and return to the main menu.

19. Press the ADJUST key to adjust current traverse; the display will appear after a few seconds:

```
TRAVERSE ADJUSTED - LIST FOR ADJUSTED COURSES - return to main menu to list
points and utilize other routines.
```

a. You can now press the REVIEW key again to review adjusted data, or press the RETURN key to return to the main menu to use normal functions.

REVISING DATA

You can use the REVISE key to change points before adjustment if an entry error was made.

1. Press the REVISE key and the display will appear:

```
ENTER Point Number you wish to revise
?
```

2. Enter the point number of the point that you wish to revise, and the display will appear:

```
THIS IS HOW THE POINT EXISTS:
Deg.mmss= 89.5717
Quadrant= 6
Distance= 199.88226727
DO YOU WISH TO REVISE THIS POINT? ENTER Y or N
?
```

3. If you want to revise the point, enter Y and if the point was not the point that you wanted to revise, enter N to return to the manipulation menu. If you enter Y, you will be able to enter the correct data.

TRAVERSE DATA STORAGE

You can store the raw traverse data after you get into the manipulation menu with the STORE key and recall the data with the READ key. This will store the unadjusted traverse if you find that a mistake was made and have to wait for field work to complete the adjustment. Store the data simply by pressing the STORE key, and all the information will transfer to a special file on the program disk. After you get the correct information, you can get back into the manipulation menu by typing in CONT"18049" and pressing the END LINE key. Then press the READ key to read the data from the special file on the program disk and revise the bad data using the REVISE key.

NOTES ON TRAVERSE ADJUSTMENT

1. On an angle adjustment the closing bearing and reference bearing can cross quadrants, except NE and NW quadrants; for example: the last bearing computed was North 00-02-01 West, and the reference bearing was N-00-02 E, the program will have an error condition and not compute.

2. If the program should halt for any reason:

   Type in CONT 36 to return to the main menu.

   Type in CONT 18049 to return to the manipulation menu.

3. Points will not have coordinates assigned to them until the ADJUST or NO ADJ key is depressed.

COMPASS RULE ADJUSTMENT

This routine works completely different than the Crandall Rule program. You must not have sideshots included with this routine; they will be added later by occupying the traverse points and re-establishing your backsights by using quadrant 5 and traversing 0 feet.

User Instructions

1. First enter the EXAMPLE 3 as shown on Page 37 by using the traverse function.

2. Now press the ADJUST key in the main menu.

3. Press the COMPASS key in the adjust menu and the display will appear:

```
ENTER Beginning Point, Ending Pt, Closing Pt
?
```

a. Enter the beginning point of the traverse and the ending point of the traverse. All the points in-between MUST be in a sequential order with the beginning point being the lowest number, and the ending point being the higher number.

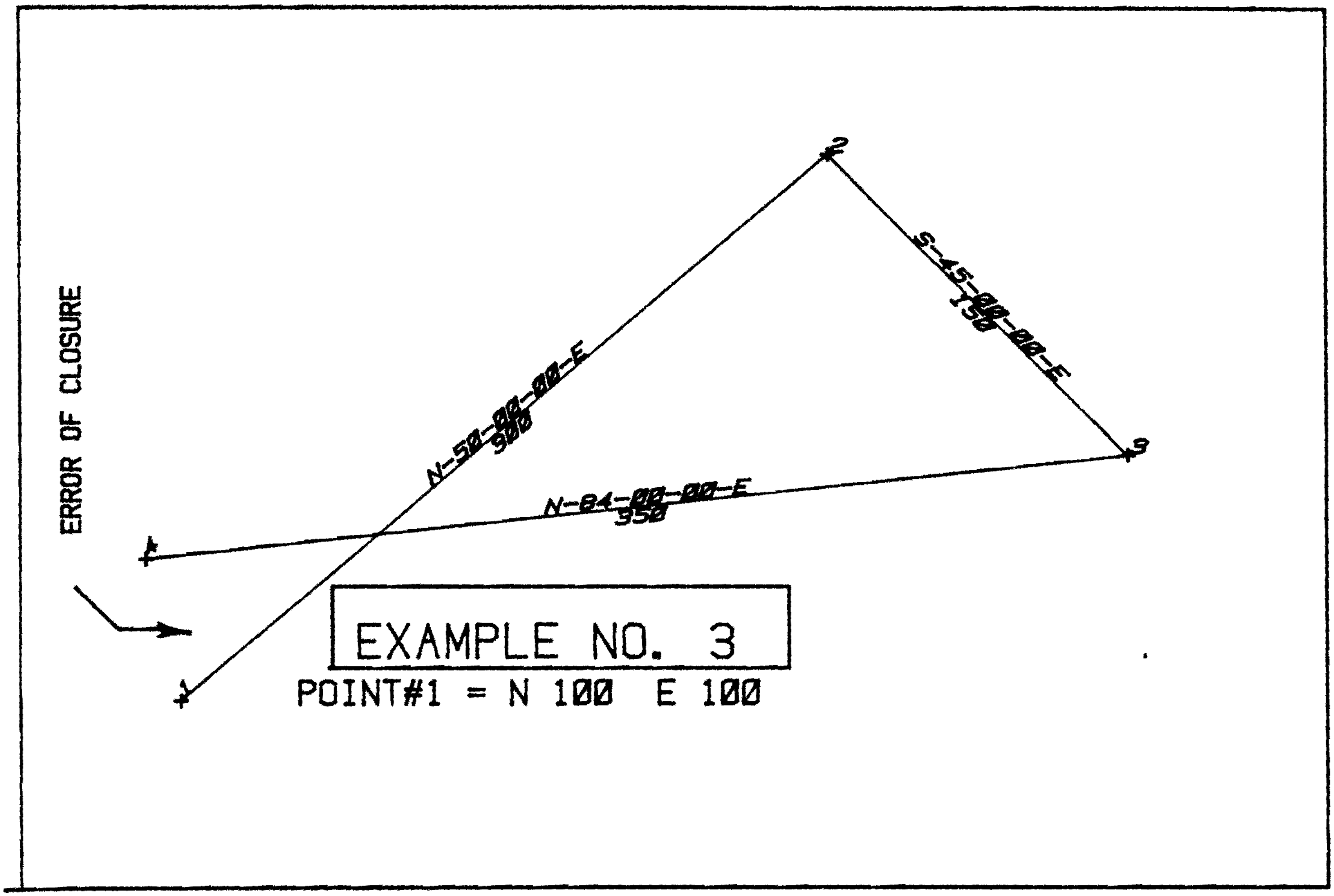
   The closing point will be the same as the beginning point on a closed traverse, or a different point number on an open traverse. The closing point has to be existing in computer memory, and can be any point number.

b. For the example below, enter 1,4,1 for the closed traverse, and the display will appear:

```
ERROR=50.18530359 North
    -12.203313259 East
Or 1 foot in 15.4895552889 feet
TRAVERSE ADJUSTED
```

Control resumes to the original menu. If you want to try the adjustment and have the option of not using the points, re-number the original points, then re-number the points back again if you do not want to use the adjusted points.

A few NULL DATA warnings may appear on the display; they can be ignored.



ERROR OF CLOSURE
N-50-00-00-E
900
S-45-00-00-E
150
N-84-00-00-E
350
EXAMPLE NO. 3
POINT#1 = N 100 E 100

SINGLE POINT INTERSECTIONS

Introduction

This program is designed to perform bearing-bearing, bearing-distance, and distance-distance intersections using the same basic format on all three. This method will eliminate confusion when using the different types together without having to think through different entry process for each one.

The points used in this section will be taken off of EXAMPLE 1 as shown in the TRAVERSE section of this manual (page 7).

If an intersection point is entered that exceeds the capacity of the computer, original menu will appear.

If you press the wrong type of intersection, exit that function by entering 0,0 or exit the intersection function at the point of which you are going to enter the intersection point number; enter 0 and you will return to the main menu, or abort the intersection routine on the last line of entry; enter 0's to exit the mode.

USE ONLY QUADRANTS 1 THROUGH 4 WHEN PERFORMING AN INTERSECTION

After an intersection is performed, you will be occupying the first point, so press the INVERSE key and then the ToPt key to inverse the intersection point. Also, after you enter the intersection point, the previous value of that point will be displayed (and printed if the printer was turned on), and can abort on the next line by entering 0's if you do not wish to overwrite that point.

ADDITIONAL NOTES ON INTERSECTION ROUTINES

If the intersection was not performed, it is because of bad data input; for example, if you were to perform a distance-distance intersection between points 1 and 2 which are 100 feet apart, and the distances that you entered to the intersection point was 20 feet and 30 feet, it will be impossible to perform the intersection, so the computer will not perform it.

After the intersection is performed, all data remains on the display; this is so that you can enter more similar intersections and change only the data that differed from the previous intersection.

There are many routines within the program to prevent halting the program because of bad data entry; if the program does halt, type in CONT 36 and press END LINE to return control to the main menu.

BEARING - BEARING INTERSECTION

To begin with you need to have the end points existing in computer memory. In this example, use the points 1 and 2 of EXAMPLE 1 as the end points.

User Instructions

1. Press the INTERSECT key which is in the main menu and the inverse menu. The 3 intersection keys are keys 1 thru 3.

2. Press the Brg-Brg key and the display will appear:

```
ENTER 1st Point , 2nd Point
?
```

3. Enter the first end point and the second end point. In this example, enter 1,2 and the display will appear:

```
ENTER 1st Point , 2nd Point
?
1,2
ENTER Intersection Pt Number
?
```

4. Enter the point number of the intersection point. In this case, enter 20 and the display will appear:

```
ENTER 1st Point , 2nd Point
?
1,2
ENTER Intersection Pt Number
?
20
ENTER 1st Brg,Q, 2nd Brg,Q
?
```

5. Enter the bearing and quadrant from the first point towards the intersection point and the bearing and quadrant from the second point towards the intersection point. In this example, enter 45,1,45,4 and the display will then appear:

```
ENTER 1st Point , 2nd Point
?
1,2
ENTER Intersection Pt Number
?
20
ENTER 1st Brg,Q, 2nd Brg,Q
?
45,1,45,4
INTERSECTION POINT  20 = 1050 1050
```

Control is returned to the intersection menu.

BEARING - DISTANCE INTERSECTION

To begin with, you need to have the end points existing in computer memory. In this example, use the points 1 and 2 of EXAMPLE 1 as the end points.

User Instructions

1. Press the INTERSECT key which is in the main menu and the inverse menu. The 3 intersection keys are keys 1 thru 3.

2. Press the Brg-Dist key and the display will appear:

```
ENTER 1st Point , 2nd Point
?
```

3. Enter the first end point and the second end point. In this example, enter 1,2 and the display will appear:

```
ENTER 1st Point , 2nd Point
?
1,2
ENTER Intersection Pt Number
?
21
ENTER Bearing, Quadrant, Distance (BEARING TWARDS POINT FOR CLOSER INTERST)
?
```

5. Enter the bearing and quadrant from the first point (away from the first point for the further answer and towards the first point for the closer answer and the distance from the second point. Enter 45,1,200 and the display appears:

```
ENTER 1st Point , 2nd Point
?
1,2
ENTER Intersection Pt Number
?
21
ENTER Bearing, Quadrant, Distance (BEARING TWARDS POINT FOR CLOSER INTERST)
?
45,1,200
INTERSECTION POINT  21 = 1182.28756555   1182.28756555
```

Control is returned to the intersection menu.

DISTANCE - DISTANCE INTERSECTIONS

To begin with, you need to have the end points existing in computer memory. In this example, use the points 1 and 2 of EXAMPLE 1 as the end points.

User Instructions

1. Press the INTERSECT key which is in the main menu and the inverse menu. The 3 intersection keys are keys 1 thru 3.

2. Press the Dist-Dist key; the display will appear:

```
ENTER 1st Point , 2nd Point
?
```

3. Enter the first end point and the second end point. In this example, enter 1,2 and the display will appear:

```
ENTER 1st Point , 2nd Point
?
1,2
ENTER Intersection Pt Number
?
```

4. Enter the point number of the intersection point. In this case, enter 22 and the display will appear:

```
ENTER 1st Point , 2nd Point
?
1,2
ENTER Intersection Pt Number
?
22
ENTER Distance , Distance (IN A CLOCK WISE MANNER)
?
```

5. Enter the distance from point the first point and the distance from the second point; remember that the intersection is done in a clockwise manner. In this example, enter 200,500 and the display will appear:

```
ENTER 1st Point , 2nd Point
?
1,2
ENTER Intersection Pt Number
?
22
ENTER Distance , Distance (IN A CLOCKWISE MANNER)
?
200,500
INTERSECTION POINT   22 = 1189.98355192   937.500000001
```

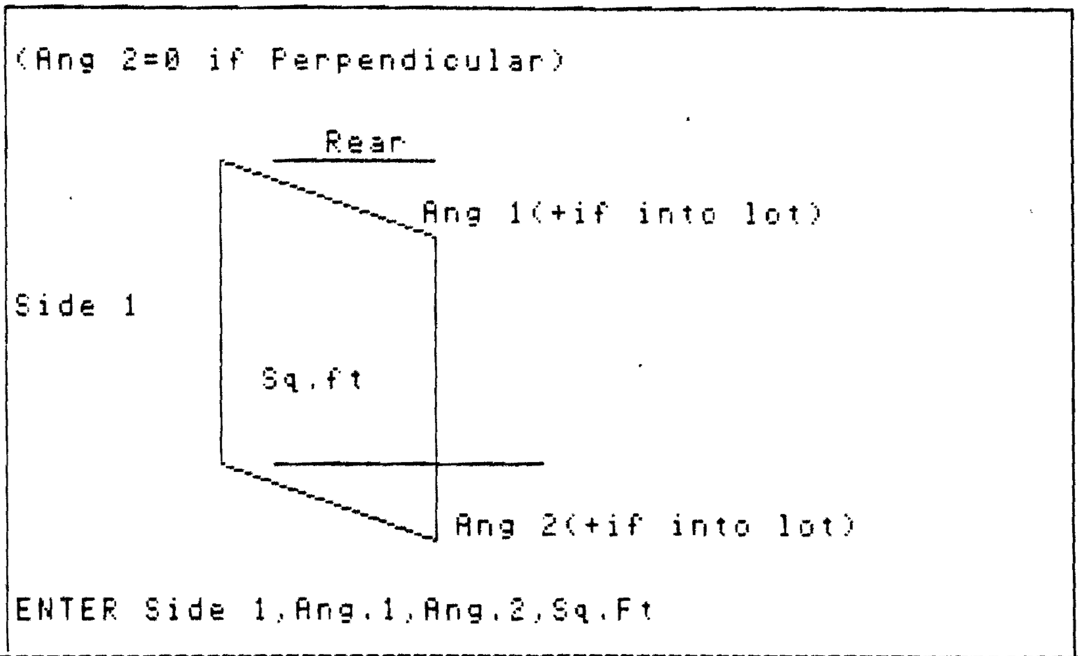
Control is returned to the intersection menu.

PREDETERMINED AREA

This feature can be performed from the intersection menu only.

User Instructions

1. Press the INTERSECT key and then the P-AREA key (the predetermined area key) and the display will appear as shown below:



Enter the data as it is asked for exactly on the display. If the front and rear lines are parallel, the site will not be computed, and if the lot line crosses, the program will stall, so press the CLEAR key, the PAUSE key and type in CONT 36 and press END LINE and control will return to the main menu.

a. Enter the distance of side 1, angle 1 (deg.mmss), angle 2 (deg.mmss), and the square footage. The next side, front distance, rear distance, and square footages will be displayed (and printed, if printer was on).

NOTE

If the above picture is not displayed, it is because the external plotter was specified before pressing the P-AREA key; you have 2 options:

1. Enter data at question mark (?) using drawing on this page.

2. Press PAUSE, type in CONT 36 and press END LINE; press PLOT, press CRT, press RETURN, and press the P-AREA key again.

COORDINATE TRANSFORMATION

You can transform any number (or group) of coordinates on a single command to a different coordinate system, by using the transformation function of this program. All the points should be existing in computer memory when they are transformed, or you will get beeps and a NULL DATA warning on the display when non-existing points are encountered. Any non-existing points will be transformed and the coordinates will change from a N 0, E 0 location.

User Instructions

For example, transform the coordinates from EXAMPLE 1. Transform the points using point 1 as the reference point, and transform the points so that point 1 will be located at N 5000 and E 5000.

1. First press the INTERSECT key in the main menu.

2. Press the TRANSFORM key and the display will appear:

```
Enter Reference Point
?
```

3. Enter the reference point. The reference point will move all of the other specified points to the new location. The reference point does not have to be in the same group as the points being transformed. For example, you can transform points 6 through 12 and use 1 as the reference point with a new coordinate of N 5000 and E 5000; the points 6 through 12 will then be on a new coordinate system, but points 1 through 5 will be on the old system. In this example, enter 1 and the display will appear:

```
Enter Reference Point
?
1
ENTER New North,East Coords
?
```

4. Enter the North coordinate (comma) and the East coordinate of the reference point in the new coordinate system. In this example, enter 5000,5000 and the display will appear:

```
Enter Reference Point
?
1
ENTER New North,East Coords
?
5000,5000
ENTER points to be Transformed
(Beginning,End)
?
```

5. Enter the beginning and ending points of the points that you want transformed. In this example, transform the entire tract by entering 1,12 and the points will be transformed and control will be returned to the intersection menu. If you return to the original menu, it means you entered a point that was greater than the capacity of the computer. It will only take a fraction of a second to transform a small number of points, but can take several seconds to transform very large amounts of points.

Should any error happen that causes the program to halt operation, type in CONT 36 and press END LINE, and control will resume to the main menu.

COORDINATE ROTATION

This routine will rotate a group of points to a new bearing system. The points must be in computer memory before they can be rotated, and points that are encountered that do not exist will be treated as null points and the computer will beep and a NULL DATA warning will appear on the display.

The points that are rotated will be around a reference point, and as the transformation routine, the rotation point does not have to be in the group of points that are being rotated. You can specify any group of points, no matter how small, or large, as long as the points do not exceed computer memory.

User Instructions

For example, rotate the points in EXAMPLE 1 by 10 degrees clockwise.

1. First press the ROTATE key in the intersection menu, and the display will appear:

```
ENTER Rotation Point
?
```

2. Enter the point that the other points will rotate around. If you enter 0, to escape to the intersection menu, or if the point was greater than the capacity of the computer, the main menu will appear. Now enter point 1 for this example; the display will appear:

```
ENTER Rotation Point
?
1
ENTER Clockwise Rotation
?
```

3. Enter the clockwise rotation of the points that will be rotated. If the rotation is counter-clockwise, then enter the angle as negative. For this example, enter 10 and the display will appear:

```
ENTER Rotation Point
?
1
ENTER Clockwise Rotation
?
10
CLOCKWISE ROTATION is
 10 Deg 0 Min 0 Sec
ENTER Beginning , Ending Points
?
```

4. Enter the beginning and ending points of the group of points that you want to rotate. For this example, use points 1 through 12.

Enter 1,12 and the display will indicate. This may take a while. The points are then listed on the display as they are being rotated; that way you can visually see how long the rotation will take. To rotate a few points, it takes very little time, but to rotate several hundred points, it could take several minutes.

After the rotation is performed, control will be returned to the intersection menu. If any error should occur that halts program operation, type in CONT 36 and press END LINE and control will resume to the main menu.

POINT RE-NUMBERING

You can re-number a point individually or a group of points sequentially using this routine.

User Instructions

1. To re-number a point (or group of points), press the RE-ASSIGN key in the intersection menu, and the display will appear:

```
ENTER Old POINT,New POINT  (1,1 to sequential assignments)
?
```

2. Now to re-number point 1 to point 1000, enter 1,100 and the display will appear:

```
ENTER Old Point,New POINT  (1,1 to sequential assignments)
?
1,100
ENTER Old POINT,New POINT  (1,1 to sequential assignments)
?
```

   This will repeat for all the points entered until you enter 0,0 which will return control to the intersection menu, or enter 1,1 which will let you re-number a group of coordinates on a single command.

3. For example, you want to re-number points 1 through 12 of EXAMPLE 1 to points that begin with 50, first enter 1,1 and the display will appear:

```
ENTER THE BEGINNING POINT AND ENDING POINT OF POINTS TO BE RE-ASSIGN
?
```

4. Enter the beginning point (comma) and the ending point of the points that will be re-numbered; in this example, enter 1,12 and the display will appear:

```
ENTER THE BEGINNING POINT AND ENDING POINT OF POINTS TO BE RE-ASSIGN
?
1,12
ENTER BEGINNING POINT NUMBER OF RE-ASSIGNED POINTS
?
```

5. Enter 50 and the display will show (and printer will print, if turned on):

```
ENTER THE BEGINNING POINT AND ENDING POINT OF POINTS TO BE RE-ASSIGN
?
1,12
ENTER BEGINNING POINT NUMBER OF RE-ASSIGNED POINTS
?
50
POINTS 1 to 12 are re-assigned to 50 to 61
ENTER THE BEGINNING POINT AND ENDING POINT OF POINTS TO BE RE-ASSIGN
?
```

You can now repeat the above steps for more group of point re-assignments or enter 0,0 to return control to the intersection menu.

NOTES ON POINT RE-NUMBERING:

1. Re-assigned points will not affect base points if the points do not overlap. After the points are re-numbered, you will have two sets of the same points.

2. If an error should occur that halts program operation, type in CONT 36 and press END LINE, and control will resume to the main menu.

LAYING OUT TRACTS BY BUILDING DUPLICATION

By using the sequential re-numbering routine, the transformation and rotation routines, you can easily layout and revise apartment type developments that have repeated use of floor plans.

This method can also easily locate houses on their lots, or move structures around easily.

First compute the boundary of the structure by using the traverse program and set up your points in a sequential order.

Then use the re-number routine and set up many of the same buildings of the same floor plan.

Then use your plotter and plot up however many buildings you are going to put on your tract, locate them on your boundary, and tape them down.

Scale the coordinates of some of the key building corners or locate them by other methods in relationship to the boundary points, (a drafting machine comes in handy).

Then transform and rotate the buildings individually to their locations and check the offsets and distances by other routines in this program.

Then fine-adjust the buildings if any errors occurred. You can now obtain a plot of your finished development.

You may find the feet and inches entry option on the traverse mode very valuable when setting up control on buildings.

COMPARING POINTS

You can compare the north/south and east/west relationships of stored points by using this routine. When determining survey boundaries, this is quite useful, and for other things, as you will probably find.

User Instructions

1. First press the COMPARE key in the inverse menu. The display will appear:

```
ENTER Base Point, Point
?
```

2. For this example, use points that are from EXAMPLE 1. Compare points 1 and 2. Enter 1,2 and the display will appear (and the printer will print, if turned on):

```
ENTER Base Point, Point
?
1,2
Pt 2 is 0 South and 100 East of Pt 1
```

Control is then returned to the inverse menu. If you enter 0 or a point that is greater than the capacity of the computer, the program will halt with a SUBSCRIPT ERROR, type in CONT 36 and press END LINE, to resume control to the main menu.

OFFSETS (and Stationing)

This program will find the perpendicular offset and its distance (station) from a reference point on a line, or an offset and distance (station) from a reference point on a curve.

You can use this feature for a multitude of things; to find the location of objects in relationship to a boundary line, to set up your stationing on plan and profiles, to find overlaps and encroachments, to set up control for a draftsman to plot or a field crew to layout. You will probably find other ways to use this feature.

User Instructions

1. First press the OFFSETS key which is in the main menu.

   Ths offset key functions will be displayed:

KEY NO.	FUNCTION	DESCRIPTION
1	LINE	Line function will give you the perpendicular offset from a line
2	C-STA	Curve station function will give you the radial offset along a curve.
3	RETURN	This key will return control to the main menu.

   For this program, use points from EXAMPLE 1.

OFFSETS OFF OF A LINE:

1. This feature works with points that are existing in computer memory. To start, press the LINE key and the display will appear:

```
ENTER Point for Reference
?
```

2. Now you can enter the reference point. This point is the point on the line for control to find distance (stationing) and offsets from. Enter 0 to return control to the offsets menu. If you enter a number greater than the capacity of the computer, you will get a SUBSCRIPT ERROR; to recover, type in CONT 36 and press END LINE, to return control to the main menu. For this example, find the offsets from point 1 on EXAMPLE 1 using a reference bearing of due east (N 90 E). Enter 1 and the display will show:

```
ENTER Point for Reference
?
ENTER Reference Brg.Quad
?
```

3. Enter the reference bearing and quadrant of the line off of the reference point. For this example, enter 90,1 and the display will show:

```
ENTER Point for Reference
?
1
ENTER Reference Brg.Quad
?
90,1
ENTER Station of Reference Point
?
```

4. Enter the station of the reference point. If you were stationing plan & profiles, you can enter a station (plus) along the line for reference, but in other cases you will want to find a distance from the reference point, as in this case, so enter 0 for this example, and the display will appear:

```
ENTER Point for Reference
?
1
ENTER Reference Brg,Quad
?
90,1
ENTER Station of Reference Point
?
 0
ENTER Offset Point No.
?
```

The printer will at this time print (if the printer was turned on):

```
From Reference Pt#  1 on Brg 90 00 00 Quad=1 At Station 0.000
```

5. Enter the points that you want to find the distance and offset to. For this example, find the distance and offsets to points 2,4, and 6 of EXAMPLE 1. Enter 2 and the display will appear (and the printer will print, if turned on):

```
  At Station       100.000      Point#    2 is ON LINE     0.000 Feet
ENTER Offset Point No.
?
```

a. Enter 4 and the display will appear (and the printer will print, if turned on):

```
  At Station    178.681   Point#   4 is RIGHT    16.127 Feet
ENTER Offset Point No.
?
```

b. Enter 6 and the display will appear (and the printer will print, if turned on):

```
  At Station   282.301   Point#   6 is RIGHT    .795 Feet
ENTER Offset Point No.
?
```

c. Enter 0 and control will resume to the offset menu.

FINDING OFFSETS AND DISTANCES (Stationing) ALONG CURVES:

This feature works like the offsets from a line, except it uses the arc of a curve to generate a radial offset. If the offset is negative, it means that the Offset is between the arc and the center point (on the inside of the curve), and if the offset is positive, it means it is on the outside of the curve. This feature cannot sense direction as the line offset can, so if you are going to use it for stationing, and the offsets are at a lesser station, you must enter the reference station as a negative.

User Instructions

For an example of how this program works, use the points from EXAMPLE 1, and get the offsets from the west curve to points 4 and 6.

1. Press the C-STA key, and the display will appear:

```
ENTER PC Pt,Ctr Pt,PC Sta
?
```

2. Enter the Point of curve (reference point on the curve), the center point number of the curve and the station of the curve. For this example, find the distance along the arc, to the offset points, so enter 0 for the station of the PC (the reference point on the curve). The PC point for this example will be point No. 2 and the center point is point No. 3. Enter 2,3,0 and the display will appear:

```
ENTER PC Pt,Ctr Pt,PC Sta
?
2,3,0
FROM PC Sta 0 Point 2 On radius of 200 Feet
ENTER New Point
?
```

The display shows the radius based on the PC point and the center point that you entered; if the radius is wrong, enter 0 to recume control to the offsets menu.

3. Now find the offset to point 4. Enter 4 and the display will appear:

```
Point 4 is at Sta 80.867 and is Offset   0 feet
ENTER New Point
?
```

If the printer was turned on, it will print the above data. Point 4 is offset 0 feet, which means that it is on the curve.

a. Now find the offset to point 6, enter 6 and the display will appear:

```
Point 6 is at Sta 148.224 and is Offset 70.03 feet
ENTER New Point
?
```

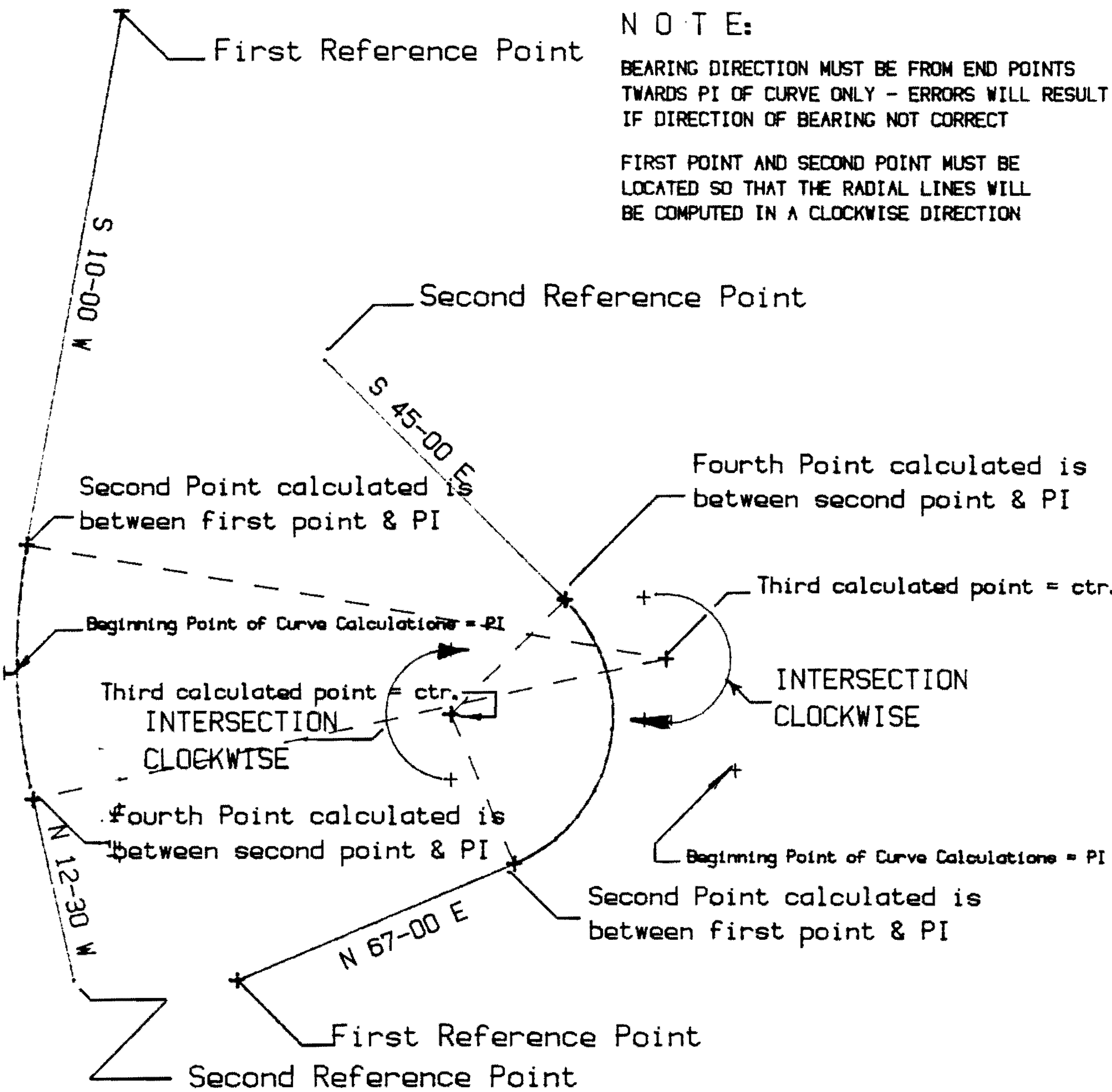
Enter 0 to resume control to the offsets menu.

Press RETURN to return control to the main menu.

N O T E:

BEARING DIRECTION MUST BE FROM END POINTS TWARDS PI OF CURVE ONLY - ERRORS WILL RESULT IF DIRECTION OF BEARING NOT CORRECT

FIRST POINT AND SECOND POINT MUST BE LOCATED SO THAT THE RADIAL LINES WILL BE COMPUTED IN A CLOCKWISE DIRECTION



EXAMPLE OF CURVE SET-UP

DRAWINGS AND LABELLING ON THIS PAGE DIRECTLY FROM SET-UP PROGRAM ON THIS PACKAGE AND PLOTTING ROUTINES. DRAWING FROM HP-7470 PLOTTER

CURVE SET-UP ROUTINE

This routine will lay out a curve, given only two points (see drawing on opposite page). All that is needed is those points, the bearings and curve radius. If the data input was wrong and the curve cannot compute, the display will appear

IMPOSSIBLE TO COMPUTE CURVE ON DATA ENTERED - PLEASE CHECK ENTRY PROCEEDURE

To use this routine, you must get into the MATH menu, which is the same menu that contain the angle addition,division and curve solution keys.

User Instructions

1) Press the SET-CURVE key and the display will appear;

ENTER First Point , Second point
?

a. Enter the first point and the second point for reference (see sketch)

NOTE

Place the first point so that the radial lines of the curve according to the order of point assignments is in a CLOCKWISE direction. If you do not do this, the curve will be wrong and may not even compute.

2) Enter first point, second point EXAMPLE: 1,2 and the display will appear;

ENTER Beginning Point number (4 points will be computed that will overwrite any existing points
?

3) Enter the beginning point of the 4 points that will be computed;
The first point will be the curve PI
The second point will be the curve PC (from the first reference point)
The third point will be the curve center
The fourth point will be the curve PT

The points will overwrite any existing points and will be in sequential order starting with the beginning point number

4) After the beginning point is entered, the display will appear;

ENTER RADIUS OF CURVE
?

Enter the radius of the curve, the PI point and its coordinates will be displayed and printed, the curve will be printed and displayed as if it was inversed.

Control is returned to the intersection menu.
If an error should occur that halts program operation, type in CONT 36 and press END LINE.

CURVE STAKING

This routine will stake curves using chord lengths. The final chord length is rounded and may be larger or smaller than the increment.

If you stake curves based on arc length, use the curve solution feature to find the corresponding chord length.

User Instructions

For this example, set up a curve that has a radius of 400 feet, a delta that is 45 degrees, and a chord increment of 50 feet.

1. Press the C-STAKE key in the intersection menu and the display will appear:

```
ENTER Radius, Delta,Chord
?
```

2. Turn the printer on and enter the radius, the total curve delta, and the chord increment; in this case, enter 400,45,50 and the printer will print:

```
CHORD INCREMENT= 50 RADIUS= 400

DEFLECTION ANGLE EQUALS 3 35 0
ARC DISTANCE FROM PC IS 50.033

DEFLECTION ANGLE EQUALS  7 10 0
ARC DISTANCE FROM PC IS 100.065

DEFLECTION ANGLE EQUALS  14 20 0
ARC DISTANCE FROM PC IS 200.131

DEFLECTION TO END OF CURVE IS 22 30 0
TOTAL ARC DISTANCE IS
314.159265359
FINAL CHORD LENGTH IS 113.643
```

CURVE TABLES

This program will automatically set up a curve table with the numbering of the curves in a sequential order, given only the radius and the delta. The printer must be turned on for this feature to work.

User Instructions

1. First press the C-TABLE key in the inverse menu, and the printer will print:

   ```
   CURVE No.   Radius      Delta       Length            Tangent
   ---------------------------------------------------------------
   ```

   The display will appear:

   ```
   ENTER BEGINNING CURVE NUMBER
   ?
   ```

2. Now enter the beginning curve number of the curve table. In this example, enter 1 and the display will appear:

   ```
   ENTER BEGINNING CURVE NUMBER
   ?
   1
   After Last Curve ENTER 0,0
   ENTER Radius, Delta
   ?
   ```

3. Now enter the radius and the delta of the curves that you want listed. For this example, enter 250,47.35 and 100,46.4356 and 78,101.0354 then enter 0,0 to exit and return control to the main menu. The printout will look like this:

CURVE No.	Radius	Delta	Length	Tangent
1	250.00	047 35 00	207.62	110.22
2	100.00	046 43 56	81.56	43.20
3	78.00	101 03 54	137.59	94.73

   If you made an error that halts the program, type in CONT 36 and press END LINE and control will return to the main menu.

NOTE

The plotting program has a routine that automatically sets up the curve table while the plotter is assigning curves.