Survey 4.0

Coordinate Geometry Solutions
For Land Surveyors

Produced by

Simplicity Systems, Inc.

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Section 1
The Survey 4.0 System

1.01 INTRODUCTION

The routines included in Survey 4.0 have been written to provide land surveyors with simplified methods for solving any commonly encountered coordinate geometry and construction surveying problems.

Survey 4.0 contains several menus and provides numerous monitor prompts and help screens to guide you. You will be capable of running the routines contained in this package without the aid of the manual in a very short time. As each routine runs, all data inputs will be requested by screen prompts. As you enter data, the computer checks the responses for obvious errors, refusing most improper entries. This results in a collection of routines which actually guides you from beginning to end.

The program package is basically structured into four fully interactive parts: The **COORDINATE GEOMETRY (COGO)** section, which contains the routines most commonly used in field traverse programs; the **UTILITY** section, which contains routines for the solution of curves and triangles, slope reductions and a variety of disk and file handling functions; the **S4-EDIT** program, which provides an integrated or stand-alone text editor; and the **S4-CALC** program, which provides an integrated or stand-alone trigonometric calculator, complete with memory and triangle functions.

While the program runs in the Coordinate Geometry mode, you are allowed to access the Utility routines without any coordinate data loss. In many cases, data computed by the Utility routines may be carried back into the Coordinate Geometry routines as a response to a data entry prompt.

1.02 WHAT VERSION DO YOU HAVE?

Your Survey 4.0 program may have arrived in any one of three forms: as a **Demo**, as **Survey Lite**, or as a full **Survey 4.0** version. Chances are, if you are holding the actual manual in your hands right now, your version is either **Survey Lite** or **Survey 4.0.**

It's Instantly Upgradable!

Unlike our other programs, the Survey 4.0 program disks are designed to allow you to copy and distribute them to anyone who might be interested in this program. Each and every disk copied, no matter what copy method is used, will be a **Demo** disk. If the user decides to purchase the program, they need only call the Simplicity Sales office at 1-800-777-7978 and we can upgrade their disk to either the **Survey Lite** or **Survey 4.0** versions over the telephone. *Instant software, with no delay for shipping!* Upgrade instructions are contained in Section 13.11. (Note: Even programs purchased directly from Simplicity Systems must be configured.)

The Survey 4.0 Demo

The **Survey 4.0 Demo** allows access to the entire program. You will be limited to 25 data points and you will not be able to save coordinate files or use your printer. Other restrictions may apply to the Utility programs.

Survey Lite

The **Survey Lite** program allows access to 2000 data points but does not allow access to a number of routines, such as macros, Inscribe Arc, Three Point Curve, Street Intersection and Cul-De-Sac Solutions, Section Breakdowns and RoadRunner. Routines that are not available in Survey Lite are clearly marked in the manual.

Survey 4.0

The **Survey 4.0** program allows access of the entire program with a point capacity of up to about 10,000 data points. Your actual capacity will vary according to the amount of free RAM available at program start-up time.

1.03 THE REFERENCE MANUAL

This Survey 4.0 manual is designed to provide information in a clear, convenient format. As you page through the manual sections you will notice that in most cases each routine is assigned its own page(s). The program's monitor prompts are shown in **Blue, Bold Style Helvetica** letters in the left column of the page and are followed by detailed instructions for each needed response. In cases where the manual indicates a specific response, the response is printed in **`Blue, Bold Style Courier`** letters. You will also occasionally see K E Y C A P responses which indicate that you should press the key or keys shown. When you see key-caps in combination, but not with an ↵Enter key such as Alt E, press the first key and hold it down while pressing the second key. When a combination includes an ↵Enter key, such as E ↵Enter, press and release the keys shown in succession. Please note that even though the responses may be shown in capital letters, lower case data entry is acceptable.

You might also notice that the instructions for many of the routines will look somewhat repetitious. Certain instruction sequences are repeated often to eliminate needless searches in the manual. Where supplementary instructions regarding data entry may be needed, the appropriate manual sections are referenced for fast access.

The manual's layout has been designed to match the menu structure of Survey 4.0.

SECTION 2 - INSTALLATION contains the hard disk installation and initial setup information for this program.

SECTION 3 - DATA ENTRY contains information regarding the basic and advanced types of data entry, including formats, angular entry, bearing and distance recalls, station entry, grade entry and point number entry.

SECTION 4 - GETTING AROUND contains information regarding entering and leaving routines, error recovery and using the pull down menus.

SECTION 5 - STARTUP AND CONFIGURATION contains information on personal customization of the program's configuration settings, as well as information regarding the use of data files.

SECTION 6 - THE LINE MENU contains the operating instructions for the following routines: Best Fit to Line, Measure an Angle, Inverse, Deflection Inverse, Field Data Inverse, Inverse Figure, Inverse Pair, Inverse with Stations, Radial Inverse, Slope Inverse, Radial Stake Out, Side Shot, Offset, Traverse, Traverse

Straight Line, Traverse with Offsets, Traverse Closure and Adjustment, Traverse Right of Way, and Traverse With Stationing.

SECTION 7 - THE CURVE MENU contains operating instructions for the following curve routines: Inverse Curve, Inverse Obtuse Curve, Inscribe an Arc, Inscribe an Arc with Offsets, Curve Offset, Three Point Curve, Traverse Arc, Traverse Arc with Offsets, Circular Curves, and Spiral Curves.

SECTION 8 - THE INTERSECTION MENU contains operating instructions for the following intersection routines: Arc-Arc, Arc-Bearing, Arc-Distance, Bearing-Arc, Bearing-Bearing, Bearing-Distance, Distance-Arc, Distance-Bearing, Distance-Distance, Offset Intersection, Perpendicular Line Station & Offset, Perpendicular Arc Station & Offset, Perpendicular Offset, Cul-De-Sac, Corner Cul-De-Sacs, Offset Cul-De-Sacs, Corners, Tee Intersections, 4 Way Intersections, and Section Breakdowns into Quarters and Sixteenths.

SECTION 9 - THE AREA MENU contains operating instructions for the following area routines: Area Printout, Point to Point Area, and three Predetermined Areas.

SECTION 10 - THE POINT MENU contains operating instructions for the following point handling routines: Start At, Go To Point, Enter Backsight Bearing, Automatic Point Numbering, Renumber Points, Overwrite Protection, Coordinate Transformation, Blank Point Scan, Clear Coordinates, Clear Point Names, Copy Block of Points, Define Figure, Enter and Assign, Enter Elevation, Identify Point, Offset Define, Point Name Define, List Coordinates, Store Coordinates, and Recover Coordinates.

SECTION 11 - THE MISCELLANEOUS MENU contains operating instructions for the following routines: Configuration Menu, Clear Work Space, Constant Factor, Pop-up Calculator, Form Feed, Keyboard Lock, New Page, Page Heading, Page Stamp, Printer On/Off, Names Output Toggle, Remarks, Print Input Data, View Coordinate Screen, and the DOS Shell.

SECTION 12 - THE FILE MENU contains the operating instructions for the following file handling routines: ASCII File Exchange, Edit/View File, Save Keystrokes, Run File, Run Macro

File, Write/Edit Macro File, Write Legal File, *LegalEase* Processor, and Write a *RoadRunner* File.

SECTION 13 - THE UTILITY MENU contains the operating instructions for the following routines: Circular Curves, Curve by Deflections, Curve by Tangent Offsets, Curve by Chord Offsets, EDM Slope Reduction, Stadia Reduction, Spiral Curve Solution, Vertical Alignment, Universal Triangle, File Manager, and Upgrades.

SECTION 14 - THE EXIT MENU contains operating instructions for Starting a New Job, or for Exiting to your Survey 4.0 Menu or DOS. Instructions are also given for constructing other exit paths through the use of batch files.

SECTION 15 - S4-CALC: USING THE POP-UP CALCULATOR contains information regarding the use of the integrated trigonometric calculator, ***S4-Calc***™.

SECTION 16 - S4-EDIT: USING THE EDITOR contains information regarding the use of Survey 4.0's integrated text editor, ***S4-Edit***™.

SECTION 17 - WRITING MACRO FILES contains information regarding the development and use of **SIMPLE**™, (**S**implicity's **I**ntegrated **M**acro **P**rogramming **L**anguage **E**xtensions), to develop your own COGO routines.

SECTION 18 - GETTING SUPPORT contains a listing of all of the information you must provide in the event that you need to call Simplicity Systems for support. Phone numbers as well as the support hours are also listed in this section.

SECTION 19 - EXAMPLES contains three keystroke by keystroke example solutions for: the development of a small subdivision; the balancing of a closed traverse; and the balancing of an open traverse. These examples illustrate the use of a large number of COGO routines, as well as the use of macro program solutions.

Additionally, this manual includes the following:

APPENDIX A - SURVEY 4.0 FILE STRUCTURES contains information which may be necessary for file type conversion to or from file types not supported by the onboard *File Manager*.

APPENDIX B - RUNNING IN WINDOWS contains information which may prove helpful when running Survey 4.0 inside *Microsoft's Windows*.

APPENDIX C - OPTIMIZING SURVEY 4.0 contains information which may prove helpful when running Survey 4.0 with a RAM drive and/or memory manager.

APPENDIX D - OPERATIONAL & ERROR MESSAGES contains a listing of messages that you may receive while running Survey 4.0.

APPENDIX E - UN-MENUED CODES contains a listing of routine codes that do not appear on Survey 4.0's menus. Some codes are simply substitutions for menued codes, while others are for new routines.

GLOSSARY - contains some of the terms used within this manual and also terms relating to your computer and DOS.

INDEX - contains a comprehensive listing of routines and terms, and where they can be found within this manual.

1.04 READ ME FILES

Quite often, software manufacturers will place a file on their disk(s) which contains information regarding software version updates and features not described in the manual. These files are typically named README.DOC or just READ.ME. It is a good idea to always directory your software to determine if the disk contains a read me type file.

The easiest way to read a read me file is to load the file into your word processing program. You may also view a read me file with the DOS **TYPE** command. In describing the use of the **TYPE** command, let's assume that the disk containing the file is in drive **A**, and the file name is **READ.ME**. Enter the command:

TYPE A:READ.ME Enter

If you want a printed copy, modify the command to look like:

TYPE A:READ.ME >PRN Enter

Be sure that your printer is ***ON*** and ***ON LINE*** or a **DEVICE TIMEOUT** error will occur.

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Survey 4.0
Simplicity Surveying Series

Section 2
Installation

2.01
MINIMUM SYSTEM CONFIGURATION

To effectively function, Survey 4.0 needs to run on an IBM PC, PC-XT, PC-AT, PS/2 or compatible computer with the following installed options:

1. 640Kb RAM;
2. One floppy drive;
3. A hard drive with at least 3Mb of free space.

Optional Hardware:

4. An EGA or VGA display;
5. A dot matrix or laser printer;
6. A math co-processor;
7. A mouse.

2.02
DO YOU NEED A SITE LICENSE?

Your purchase of Survey 4.0 is nothing more than a license to run the Survey 4.0 program on a single computer. You may need an additional site license if you plan to:

- Install Survey 4.0 on more than one computer at your place of business;
- Install Survey 4.0 on a home computer;
- Install Survey 4.0 on a field computer;
- Install Survey 4.0 on a network computer or server;
- Have Survey 4.0 available at temporary field office sites within your company.

The best rule to follow is: ***If there is any probability that a single copy of Survey 4.0 will be running on more than one computer at a time, an additional site license is required!***

The "Transportable" License

Realizing that we don't always perform our jobs entirely in the office, the Survey 4.0 license is a "Transportable" license which allows the licensee to copy the Survey 4.0 program to their home computer and use it there for no additional fee, provided that Survey 4.0 is used in accordance with the copyright. In other words, the licensee may use Survey 4.0 under the "Transportable" license only when they are certain that no other licensed copies of Survey 4.0 are running at the same time.

If the Survey 4.0 license was originally purchased by a Company, and the Company has multiple owners, the license extends to one owner only. The Company must purchase site licenses in order for additional owners and/or their employees to have a legal copy of Survey 4.0 on their home computers. The purchasing Company retains ownership of ALL licenses of the programs.

The "Transportable" license may also be used to allow Survey 4.0 to be loaded on a portable field computer instead of, *or in addition to*, a single home computer, *if the user can guarantee that only a single copy of Survey 4.0 is running at a time.*

Multiple Office Installations

The Survey 4.0 license covers only a single site, i.e. building or address. ***If you have multiple locations, each location is expected to purchase their first license at full cost,*** with subsequent purchases for each location in accordance with the established site licensing fees.

Network Installations

If Survey 4.0 is loaded on a *network* computer, either a server or a node, a site license may be needed. If the network administrator limits access to Survey 4.0 to a single user at any one time, a site license is not needed. However, if Survey 4.0 is available to more than one networked computer at a time, at least one additional site license is required. The number of site licenses required is based on the number of computers likely to be using Survey 4.0 *concurrently*, not necessarily the total number of computers on the network.

Site Licensing Fees

A site license granting you permission to make an additional copy(s) of this software and manual is available at a cost of 50% of the full version price, ***per computer licensed***. The license cost including a manual and disk furnished by Simplicity Systems is 65% of the full version price, ***per computer licensed***. (Costs are rounded up to the nearest dollar.) Prices are subject to change without notice. Call for verification.

2.03 INSTALLING SURVEY 4.0

Survey 4.0/Lite should be the ***first*** program installed if you have purchased any other programs from Simplicity. Survey 4.0 may only be installed to a hard disk containing 3Mb of free space. To install Survey 4.0, you must begin at a DOS prompt, such as **C:\>** or **A:\>**. To simplify the installation instructions, we will assume that you are logged to drive **C:\>** and your floppy disk is drive **A:\>**.

STEP 1. Place the ***original*** **Survey 4.0 Installation Disk** into your floppy drive and type **A:INSTALL** Enter.

STEP 2. Follow the installation instructions that appear on your display. We strongly recommend that you accept the default directory structure, (but not necessarily the disk drive), presented in the installation program.

STEP 3. After the installation is complete, store the original Survey 4.0 disks in a safe place.

STEP 4. After you have finished the installation procedure, the computer will automatically start the Survey 4.0 program to allow you to configure the program settings.

2.04 CHANGING YOUR CONFIG.SYS FILE

During the Survey 4.0 installation, the **CONFIG.SYS** file on your computer was examined for certain statements that set the environment space and the number of files. If either or both of these items are found to be deficient for running Survey 4.0, the installation program will create an alternate **CONFIG.SYS** file named **CONFIG.SS4**. Your previous **CONFIG.SYS** settings are all preserved in the new file. You will be given the opportunity to allow the installation program to automatically update your **CONFIG.SYS** file, or you may do so manually at a later date using the DOS **REN**ame command.

2.05 PRODUCT REGISTRATION

During the Survey 4.0 installation, you will be asked to provide or verify your name, company name, address and telephone number. This information, or at least portions of it, must be provided or the installation program will fail. The information provided is used in two places. Your name and/or company name will automatically appear on your job printouts, but more importantly, the information entered is used to prepare your product registration form for you.

Product registration is important for many reasons. It provides us with updated information so that we can contact you with upgrade information, etc. But perhaps most important is that we will not provide support for unregistered software.

When the installation program has finished running, it will produce a completed registration form for you to sign, fold, stamp and mail in. It's a quick and simple task that you are strongly urged to complete.

NOTE

The Registration Form will only print out on printers that are connected to parallel port LPT1. If your printer does not match this setup, select the option to save your Registration Form to a disk file, then print it out later using your word processing program.

Survey 4.0
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Section 3
Data Entry

3.01
GENERAL DATA ENTRY PROCEDURES

All of the Survey 4.0 routines have been standardized to accept data entries in a manner which is common throughout the program. This section deals with the nature of the data entry as it pertains to points, bearings, distances, stations, coordinates, and point names.

Also contained in this section is a discussion on the use of key-stroke recording and playback. Keystroke recording is a powerful tool when used to edit your input data and replay the resulting changes.

Safeguards

Survey 4.0 has the ability to save your data on the fly. As your data is computed, the coordinates are written to a disk file, there-by guarding against data loss due to power surges and failures, computer lock up, etc. Of course, if the data file specified is a ***RAM disk*** data file, power failures or fluctuations could cost you your data anyway.

You may also save your data file manually with the **Store Coordinates** command, (**SC** - Section 10.21). This particular command also provides an opportunity to save a backup file.

A very important habit to maintain involves taking the time to back up your data disk. The price of an extra disk is a small amount to pay to insure yourself against the loss of many hours of labor. Disks are also somewhat fragile and data loss can be caused in the blink of an eye by dust, moisture, fingerprints, bending, etc.

3.02
A MATTER OF TERMINOLOGY

Throughout this manual, you will see a variety of instructions for answering all of the various types of prompts. Some prompts will require a **YES** or **NO** answer, while others will be accompanied by instructions to **ENTER** your response. Still others will contain instructions for you to **PRESS** a key in response to a given prompt.

In an effort to simplify your operation of this program, the following guidelines shall apply to all of the prompt responses for all Survey 4.0 routines.

ENTER vs. PRESS

When you encounter an instruction which requires you to **ENTER** data, the program expects you to press [↵Enter] after the data has been entered. When you encounter the word **PRESS**, the program is indicating that it is expecting a single key press, or a series of key presses, in response. In these cases, do not press [↵Enter] after your response.

YES or NO

This type of prompt requires only that you **PRESS** [Y] to answer in the affirmative, or [N] to answer in the negative. To facilitate entry from the numeric key pad, all **YES** answers may be indicated by substituting [1] for [Y]. Likewise, all **NO** answers may be indicated by substituting [0] for [N].

Using Your Mouse

You may also use your mouse to answer any Yes or No question. To answer Yes, point at the word Yes in the prompt and press either mouse button. To answer No, point at the word No in the prompt and press either mouse button. You may also simply press a mouse button WITHOUT pointing at either Yes or No. Press the Left mouse button for Yes and the Right mouse button for No.

Function Key Entries

In many cases, your data entry may be completed by pressing a function key on your keyboard. These keys are numbered [F1] through [F12] across the top of an enhanced 101-key keyboard. When using a function key, the distinction between Enter and Press is built into the key. Do not press [↵Enter] after pressing a function key.

Some older keyboards do not have the [F11] or [F12] keys, and in a few rare instances, Survey 4.0's input line does not support them either. In these cases, it is possible to substitute [Alt] [F1] for [F11] and [Alt] [F2] for [F12]. And, for those times when the [Alt] key combination is not allowed, you may also substitute letters. For example, [E] [↵Enter] will generally exit a prompt and [H] [↵Enter] will call up the Help screen. Another combination, [?] [↵Enter], is often used to call up the calculator memory, but in a few instances, it may call up the Help Screen.

3.03 POINT IDENTIFIERS

Survey 4.0 has been designed to allow for point entry in a wide variety of convenient methods. While a point number is a required element for all points, you also have the option of referring to points by names or by station numbers, and to groups of points by figure names or figure numbers.

Point Numbers

Entering point numbers into Survey 4.0 is as easy as typing them on your keyboard. Any number is a valid number, from 0 up to the top limit that your computer will allow. This top limit is 25 for the Demo version, 2000 for the Survey Lite version and up to 10,000+ for Survey 4.0, depending upon your system configuration. You can view the allowable limit at any **Select Routine** prompt by pressing F10 to access the ***Information Menu***.

Survey 4.0 also includes semi-automatic and **Automatic Point Numbering**, (**AN** - Section 10.04). In most COGO routines that compute and set a data point, automatic point numbering may be employed to seek out the next available point number. To activate or deactivate automatic point numbering, type in **AN** at any **Select Routine** prompt.

Semi-automatic point numbering works at your command by requiring a - Enter (or F8) or a + Enter (or F9) keypress to search either backward or forward for your next available point.

Point Overwrite Protection

Survey 4.0 also includes **Point Overwrite Protection**, (**OP** - Section 10.06). This feature may be activated and deactivated when desired, or it may be employed on a point by point basis. To activate or deactivate the overwrite protection, type in **OP** at any **Select Routine** prompt. When overwrite protection is active, you can deactivate it on a point by point basis by placing an asterisk after the point number, such as **153***.

Point Names

Naming a point may be done at any request for a point number, or by using the **Identify Point** routine (Section 10.17). Call this routine by typing in **ID** at any **Select Routine** prompt. To name a point at the time of point number assignment, type the letter N (for name) immediately following the point number, before pressing Enter. Point names may be from 3 to 28 characters in length and should not contain any apostrophes (See section 10.19).

If you frequently use point names in COGO, you can instruct Survey 4.0 to automatically prompt for names and include them in all printouts by activating the **Names Output** toggle (**NO** - Section 11.11). This on/off switch is actuated by typing `NO` at any **Select Routine** prompt.

Survey 4.0 also contains a ***names table*** which allows you to store and retrieve up to 10 frequently used point names. Assign names to the table using the **Point Names Define** routine (**ND** - Section 10.19). Call the table by typing `ND` at any **Select Routine** prompt. The table automatically appears when you are prompted for a new point name, allowing you to pick a name from the table, enter a new name, re-use the last used name, or copy a name from an existing point.

Stations

When stations are computed in COGO, the station is formatted in either an ***English*** or ***metric*** format as specified in the program's Configuration Menu. Stationing precision matches the distance precision, from 0 to 6 decimal places, as specified in the Survey 4.0 Configuration Menu. The station number is retained as the beginning characters of a maximum 28 character point name. For this reason, you should try to avoid giving any particular point both a name and a station. If you must both name and station a point, the station should be first in the name string. For example, if a point has the name of ***Intersection with Smith Township Road*** and a station of ***5+07.25***, enter the point name as:

```
#5+07.25 INT SMITH TWP RD
```

The symbol # must precede all station values. Note that the above entry contains abbreviations for the words ***Intersection*** , ***Township*** and ***Road*** . Also note that the word ***with*** was left out of the point name. These actions are necessary to keep the total length of the point name within the maximum 28 character limit imposed by the program.

NOTE

*If you are using the **Inverse with Stations** (**IS** - Section 6.08) or the **Traverse with Stations** (**TS** - Section 6.19) routine, the stationing will precede any existing point names. Any stationing and name combination that exceeds 28 characters will be cut off after the 28th character.*

When entering stations, remember to fill any zero values with 0 digits. A station at 50 feet must be **#0+50**, 105.1 feet must be **#1+05.1**, etc. Likewise for METRIC formats, 50 meters would be **#0+050**, 1005.1 meters would be **#1+005.1**, etc.

Entering Stations in the Utility Programs

When computing Circular Curves (by deflections, tangent, or chord offset method), Vertical Curves and Alignment, Spiral Curves, and when Traversing with Stations, you will be required to enter station data. Enter the station in a format as shown in the following examples:

ENGLISH UNITS

Station Distance	Enter as Station
25.0 feet	**0.25** or **0+25**
600.0 feet	**6** or **6+00**
1675.0 feet	**16.75** or **16+75**
1550.4 feet	**15.504** or **15+50.4**
12535.3 feet	**125.353** or **125+35.3**

Care must be taken to avoid entering an erroneous station. For example, entering 1+50 as *150* results in a station of 150+00. The station should be entered as *1+50* or *1.50*.

METRIC UNITS

Station Distance	Enter as Station
25.0 meters	**0.025** or **0+025**
600.0 meters	**.6** or **0+600**
1675.0 meters	**1.675** or **1+675**
1550.4 meters	**1.5504** or **1+550.4**
12535.3 meters	**12.5353** or **12+535.3**

Care must be taken to avoid entering an erroneous station. For example, entering a station at 150 meters as *150* results in a station of 150+000. The station should be entered as *.150* or *0+150*.

3.04 SEARCHING FOR A POINT BY NAME

As previously stated, the COGO program requires the use, or at least the assignment, of point numbers. However, COGO is also capable of searching for a particular point if it has been given a name.

To search for a point by name, enter a ? or / character, or the point name itself at any point number request. If you enter a ? or / character, you will need to enter a point name before the search will begin. This type of entry results in a search for an exact point name match. If a name match is found, you are generally given the opportunity to either Exit the search, Use the located point, continue the Search, or enter a new Name. If you continue the search, the program searches for the next exact match. These options will vary depending upon the COGO routine in progress at the time of the search.

The point name search may also be conducted for a partial match. That is, even if you only have a portion of the name, or wish to see which points may share a common element of a name, the routine will still work. This partial search feature will seek all point matches and report on them, allowing you the same Exit, Use, Search or Name options as before. To call a partial search, place a < or > character before the point name in question.

3.05 POINT STRINGS AND DEFINED FIGURES

In "inverse" type coordinate geometry routines, (routines that *measure between* points, rather than routines that *compute* points), you may speed your data entry by entering a list of point numbers instead of a single point at a time. This list of points is referred to as a ***point string***.

Enter a point string by typing the point numbers separated by a comma, or a dash to indicate a range. For example, to inverse from point 1 to 2 to 7 to 9 to 10 to 11 to 12 to 13 and back to 1, enter the string:

```
1,2,7,9-13,1
```

Curves may also be included in a point string by the addition of a ***center point identifier character*** immediately preceding the number of the curve's center (or radius) point. Use the characters *****, **R**, or **<** to mark the center point of an ***acute*** curve (delta less than 180° or 200 grads). Use the characters (letter) **O**, or **>** to mark the center point of an ***obtuse*** curve (delta angle greater than or equal to 180° or 200 grads). For example, to inverse from point 1 to 2 to 7 (a PC) and then around an obtuse curve whose center point is 8 to 9 (the PT) to 10 to 11 and back to 1, enter the string:

`1,2,7>8,9-11,1` or `1,2,7O8,9-11,1`

Multiple consecutive curves, having the same center point, must be individually addressed. For example, to inverse from point 1 through 7 (a PC) and then around three acute curves whose center point is 8 and whose curve points are 10, 15 and 17, and then on a line back to 1, enter the string:

`1-7*8,10*8,15*8,17,1`

Defining Figures

Survey 4.0 also contains provisions for the storage of your point strings as ***defined figures***, thus saving you from having to enter a particular point string each time you want to access it. The **Define Figures** routine (**DF** - Section 10.14) may be called from any **Select Routine** prompt by typing `DF`. Storage and use of defined figures is discussed in Section 10.14.

Defined figures may be identified by a figure name or a figure number. The identifier can be up to 60 characters in length, while the combined length of the figure identifier and the point string is limited to 125 characters. To overcome this potential limitation, figures are allowed to call other figures, effectively eliminating any restrictive length. For example, suppose the figure ***BLOCK 1*** contains points 1, 7, 9, 5*8, 6 and figure ***BLOCK 2*** contains additional points that you would like to append to ***BLOCK 1***. Simply define ***BLOCK 1*** as:

`1,7,9,5*8,6,F:BLOCK 2`

When figure ***BLOCK 1*** has been completed, figure ***BLOCK 2*** will be run automatically.

Another time saving feature allows you to place the code `AR` for **AR**ea after a defined figure point string, which sends the program to the Area routine to report the area enclosed by the figure.

Calling a Defined Figure

To call a defined figure from a point number prompt, enter the letter F and a colon before the figure name, for example:

`F:BLOCK 1`

If you are using the **Inverse Figure** routine (**IF** - Section 6.06), you do not need to place the `F:` in front of the figure name, although no error will result if you do.

3.06 DIRECTIONAL ENTRIES

When entering angular data, both horizontal and vertical, enter all angular data in one of two user-selected ***degrees*** formats (***D.MMSS*** or ***D-M-S***), or in the ***grads*** format. The format selection is made through the use of the initial Configuration Menu which is discussed in Section 5.02.

The D-M-S Format

Enter angular entries in the D-M-S format by separating the numeric values with a non-numeric character. For example; enter 45° 30' 50" as **45-30-50** or **45,30,50** or **45+30+50**. We suggest separating each of the values by a plus [+], minus [-] or comma [,] but any non-numeric character, **except spaces, periods, back slashes,** and **forward slashes** will do.

Trailing values are not needed if the values are zero. For instance, 45° 30' 00" may be entered as **45-30**. Likewise, an even 55° should be entered simply as **55**.

The D.MMSS Format

Enter angular entries in the D.MMSS format by separating the degrees value from the remainder of the entry with a decimal. For example; enter 45° 30' 50" as **45.3050**. There is no need to enter any trailing values if the values are zero. For instance, 45° 30' 00" may be entered as **45.30** (but not as **45.3**). Likewise, an even 55° should be entered simply as **55**.

In the D.MMSS format, you must not use decimal points on fractional seconds entries. Simply omit the decimal point. An angle entry of 45° 25' 35.65" should be entered as **45.253565** and not as **45.2535.65** or the .65 seconds will be dropped and or flagged as an illegal Quad Code entry.

The Grads Format

The grad is a unit of measure equivalent to 1/400th of a circle. Grads are expressed as decimal values and may be formatted in Survey 4.0 with up to 6 decimal places.

Angle Codes & Function Keys

In any degrees format, directional entries may be in the form of bearings, angles left or right, deflection angles left or right, or as North or South referenced azimuths. In the grads format, while entries may be made as bearings, they will always be output as North or South referenced azimuths.

The information that identifies the directional type is referred to as the ***angle code***. Angle codes may be entered by number, by two letter alpha codes, or by pressing function keys. Survey 4.0 provides angle codes in two flavors, largely as a result of keyboard changes over the years, and also as an attempt to provide you with compatibility to other COGO programs you may also be using. These ***Angle Code Sets*** are shown below. The desired Angle Code Set is selected in the Configuration Menu.

The Simplicity Systems, Inc. (SSI) Angle Code Set

Angle Code	Alpha Code	Numeric Code	Function Key
Northeast	**NE**	1	F1
Southeast	**SE**	2	F2
Southwest	**SW**	3	F3
Northwest	**NW**	4	F4
Azimuth	**AZ**	5	F5
Angle Right	**AR**	6	F6
Angle Left	**AL**	7	F7
Deflect Right	**DR**	8	*none*
Deflect Left	**DL**	9	*none*
90° Right	**90AR**	*none*	F8
90° Left	**90AL**	*none*	F9

The Hewlett Packard (HP) Angle Code Set

Angle Code	Alpha Code	Numeric Code	Function Key
Northeast	**NE**	1	F1
Southeast	**SE**	2	F2
Southwest	**SW**	3	F3
Northwest	**NW**	4	F4
Azimuth	**AZ**	5	F5
Angle Left	**AL**	6	F6
Angle Right	**AR**	7	F7
Deflect Left	**DL**	8	*none*
Deflect Right	**DR**	9	*none*
90° Left	**90AL**	*none*	F8
90° Right	**90AR**	*none*	F9

The Hewlett Packard code set is so named to recognize the numeric codes used by HP and some other manufacturers.

NOTE
If you are using grads, 90°AR and 90°AL will be renamed to 100g AR and 100g AL.

Combining Angle Entries and Codes

In Survey 4.0, all directional data may be incorporated into a single entry by simply adding an **alphabetic** or **numeric** angle code immediately following the angular data, before pressing Enter, or by completing your entry by pressing a function key.

For example, in the **D-M-S** entry mode a bearing may be input as `37-8-45NW`, or as `N37-8-45W`, or as `37-8-45-4`, or finally as `37-8-45` F4. In the **D.MMSS** or **Grads** entry modes, the same entry may be input as `37.0845NW`, or as `N37.0845W`, or as `37.0845-4`, or finally as `37.0845` F4.

In any mode, a space between the numeric entry and an angle code will not cause a problem; however, you cannot place any spaces *following* an alpha code. A space following an alphabetic code will cause the code to be ignored and will trigger a request to re-enter the proper angle code. Any improperly entered code will be similarly treated.

IMPORTANT!
If you are using a ***numeric*** *code attached to the end of a bearing entry in the D-M-S mode, you must use a non-numeric character between the Seconds entry and the Code entry as shown above. You must also include a Minutes and Seconds entry even if the values of one or both are null. For example, North 45 degrees East cannot be entered as 45-1, but must be entered as 45-0-0-1 (D-M-S).* ***An entry of 45-1 is permissible in the D.MMSS mode.***

Measuring Angles

At **Bearing** or **Angle** requests in Survey 4.0, you can respond with the code **`MA`** to ask the program to **Measure an Angle** (**MA** - Section 6.02). After entering an instrument point, backsight and foresight point, Survey 4.0 will compute the angle formed by the three points and then incorporate that angle as the numeric portion of your entry. You will then be asked to supply an angle code. The points used in this routine may be any valid points, i.e. the instrument point does not have to be the currently occupied point.

Recalling Bearings

Survey 4.0 contains the ability to recall a bearing between any two points residing in the memory for use in the forthcoming calculation. To recall any bearing, enter an asterisk ***** or the letter **R** followed by a beginning and ending point (separated by a comma or a hyphen) at any **Bearing** or **Angle** prompt. For example:

***15-21** (or ***15,21**, or **R15-21**, or **R15,21**)

will input the bearing as it lies from point 15 to point 21. If you omit one or both of the point numbers and simply enter [*] [Enter] or [R] [Enter] at a bearing request, the program will prompt you for the point numbers. Enter them one at a time pressing [Enter] after each number, or enter them together, separated by a comma or a hyphen. The recalled bearing will travel in a direction from the first point to the second point.

Survey 4.0 also allows you to enter a recalled bearing with an addition or subtraction operator. For example, suppose the bearing from point 1 to point 5 is N 45° W. To enter the recalled bearing from point 1 to point 5 plus 10° 15' 25", (in a D.MMSS format) enter:

R1,5+10.1525

which results in a bearing entry of N 34° 44' 35" W.

IMPORTANT!
The angular entry is treated as a ***deflection*** *from the recalled course, with positive entries deflecting to the right, and negative entries deflecting to the left.*

Recalling the Last Used Bearing

A second method of recalling a bearing is to recall the value last used. At any prompt for a bearing you may enter the letter **L** (or simply press [Enter]) to reuse the last used bearing. Such a response to a bearing prompt will cause the bearing of the next course to be the same as that of the last course. (This will be displayed in the prompt area as a **0 D**eflect **R**ight)

Recalling a Calculator Memory Value

Survey 4.0 contains an integrated surveying calculator, ***S4-Calc***, which may be used at any time within COGO, or as a stand-alone product. The calculator includes a host of conversion and trigonometric functions as well as five triangle solutions and a 16 register memory. The calculator is discussed in detail in Section 15.

The S4-Calc calculator contains 10 user-assignable memory registers, and six automatically assigned triangle memory registers. Values stored in any of the 16 registers are available inside COGO at any **Angle** or **Distance** request by pressing ? ↵Enter or function key F11. You may then select the desired value by pressing its corresponding alphanumeric identifier. Note that the entries 0-9 hold values from memory registers 0-9, while entries A-F hold the three sides and angles of the last performed triangle solution. The triangle solution angles, entries D-F, are formatted (after your selection) to match your selected angle entry format.

3.07 THE REFERENCE BEARING

After the first traverse or inverse procedure in the COGO program, a bearing will be retained in the memory as a ***reference*** (or acksight) ***bearing***. The reference bearing is simply the reverse of the bearing which you traveled on to get to the point which is now occupied. The reference bearing is the bearing referenced every time you enter an angle or deflection to the right or left. You may change this bearing through the use of the **Enter Backsight** routine (**EB** - Section 10.03)

3.08 VERTICAL AND ZENITH ANGLES

All ***vertical angles*** and ***zenith angles*** must be entered in the same format as horizontal angles. The routines contained in Survey 4.0 are set up to accept either vertical or zenith entries, with the program determining your intent by using break points set at every 45 degree (50 grad) point from the horizontal plane. The illustrations that follow indicate how the data entries will be treated.

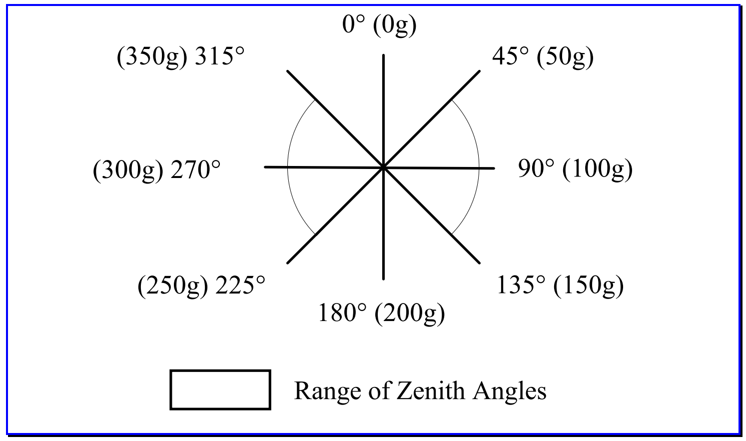

Figure 3-1: Zenith Angles

Zenith Angles: All values between 45 and 135 degrees (50 and 150 grads), and all values between 225 and 315 degrees (250 and 350 grads).

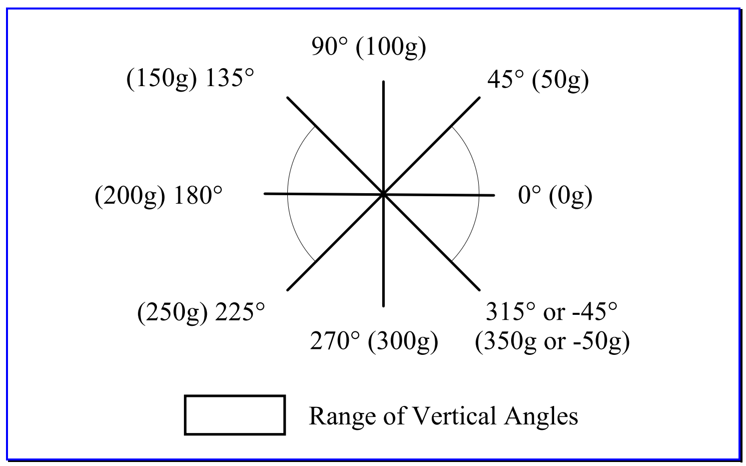

Figure 3-2: Vertical Angles

Vertical Angles: Any value lying between 0 and 45 degrees (0 and 50 grads), between -45 and 0 degrees (-50 and 0 grads), between 315 and 360 degrees (350 and 400 grads), and between 135 and 225 degrees (150 and 250 grads).

3.09 HORIZONTAL DISTANCE ENTRY

In all Survey 4.0 routines, horizontal distances are entered just as if you were keying data into a calculator. Trailing zeros need not be entered.

Recalling Distances

Survey 4.0 allows you to recall a distance between any two points residing in the memory for use in the forthcoming calculation. To recall any distance, enter an asterisk **`*`** or the letter **`R`** followed by a beginning and ending point (separated by a comma or hyphen) at any **Distance** prompt. For example:

`*15-21` (or **`*15,21`**, or **`R15-21`**, or **`R15,21`**)

will input the distance between points 15 and 21. If you omit one or both of the point numbers and simply enter [*] [↵Enter] or [R] [↵Enter] at a distance request, the program will prompt you for the point numbers. Enter them one at a time pressing [↵Enter] after each number, or enter them together separated by a comma or a hyphen.

Survey 4.0 also allows you to enter a recalled distance with an addition, subtraction, multiplication or division operator (**`+`**, **`-`**, **`*`**, **`/`**). For example, to enter the distance from point 1 to point 5 less 150.25 feet, enter **`R1,5-150.25`**.

Recalling the Last Used Distance

A second method of distance recall involves recalling the value last used. At any prompt for a distance you may enter the letter [L] [↵Enter] or simply press [↵Enter] to introduce a distance value equal to the last distance value used.

IMPORTANT!

If the last distance was entered as a slope distance, the distance that will be recalled and used as the last distanced entered will be the reduced horizontal distance.

You may also reuse the last distance entry, **`L`**, in the form of an expression. For example, **`L*2`**, **`L/3`**, **`L+50`** and **`L-35.20`** are all valid entries. This procedure allows for easy, error free entries of multiples or fractions of many distances.

Additionally, whenever you are prompted for a distance entry within COGO, the function keys [F1] through [F9] will be predefined to the following values:

F1	=	**L**	Enter	F6	=	**L*2**	Enter
F2	=	**L/2**	Enter	F7	=	**L*3**	Enter
F3	=	**L/3**	Enter	F8	=	**L*4**	Enter
F4	=	**L/4**	Enter	F9	=	**S**	Enter
F5	=	**L/8**	Enter			*(slope distance)*	

(To use F9, type in the slope distance and then press F9.)

Recalling a Calculator Memory Value

Survey 4.0 contains an integrated surveying calculator, ***S4-Calc***, which may be used at any time within COGO, or as a stand-alone product. The calculator includes a host of conversion and trigonometric functions as well as five triangle solutions and a 16 register memory. The calculator is discussed in detail in Section 15.

The S4-Calc calculator contains 10 user-assignable memory registers, and six automatically assigned triangle memory registers. Values stored in any of the 16 registers are available inside COGO at any **Angle** or **Distance** request by pressing ? Enter or function key F11. You may then select the desired value by pressing its corresponding alphanumeric identifier. Note that the entries 0-9 hold values from memory registers 0-9, while entries A-F hold the three sides and angles of the last performed triangle solution. The triangle solution angles, entries D-F, are formatted (after your selection) to match your chosen angle entry format.

3.10 THE COMMAND LINE CALCULATOR

Survey 4.0 contains a second type of calculator in addition to the surveying calculator, S4-Calc. This second calculator is the ***command line calculator***.

The command line calculator is a one-line entry calculator. In other words, you may enter an expression at a bearing or distance prompt and Survey 4.0 will calculate and use your result as the entry to the prompt. Expressions are keyed in preceded by the word **CALC**.

For example, suppose that you are traversing to a point and you do not know the polar distance, but you do know the X and Y components (75 and 382 respectively) of the distance in question. Knowing that the polar distance is equal to the square root of the quantity (X squared + Y squared), enter the expression **CALC SQR((75^2)+(382^2))**. Survey 4.0 will calculate the result and enter 389.293 into the program as your response.

IMPORTANT!
Note the extra parenthesis in the equation above. It is important that you enclose each term in parenthesis or the command line calculator may not function correctly. Follow this procedure when writing your own macro programs as well.

Survey 4.0 includes a wide assortment of trigonometric and conversion functions that are available to the command line calculator. These functions are the same as those available in the ***Macro Programming Language***, discussed in detail in Section 17.

IMPORTANT!
*The programming language used to develop Survey 4.0 computes all angles in **radians**, although the command line calculator allows you to enter data in D.MMSS, D-M-S or Grads format. However, you must use a conversion function to convert TO and FROM the radian values. See Section 17 for a discussion of these conversion functions.*

3.11
SLOPE ENTRIES AND SLOPE TYPES

When entering distances in the COGO routines, (except within the Intersection routines), you may be prompted for a **Slope Angle**. This may either be a ***zenith*** or a ***vertical*** angle as discussed in Section 3.08. The angle entry rules found in Section 3.06 also apply to slope angle entries. If you are entering a horizontal distance with no slope distance, simply press the ↵Enter key at the prompt for the slope angle.

On Survey 4.0's Configuration Menu you will be given the opportunity to select whether or not you want to be prompted for the slope angle after every distance entry. If the majority of your distances were taken without the use of a slope angle, you might wish to disable the automatic prompt. If the prompt is disabled, a slope angle may still be entered by placing a letter **S** (or pressing F9) immediately after the distance, for example, **1250.44S**. The **S** ***must not*** be separated from the numeric value by a space or any other character, nor should a space or other character be placed after the **S**.

In Survey 4.0, there are five available methods for entering elevations and slope distances and reducing the entered data to horizontal and vertical distances. Two additional methods exist for those instances when you are using horizontal distance data along with plus/minus readings or elevations. The methods are:

1. by Assigned Elevations;
2. by EDM Slope distances;
3. by EDM Slope distances - Mining Option;
4. by Levels (plus and minus shots);
5. by Simple Slope Angles;
6. by Stadia distances;
7. by Total Station.

The desired method is selected from the Configuration Menu. A discussion of each method follows, including complete data entry instructions. Refer to these instructions whenever you see the **Slope Angle** prompt.

Assigned Elevations

The Assigned Elevations method is actually not a slope reduction method at all, but rather just a convenient way for you to enter the known elevation at each target point. Type in the elevation and press ↵Enter. If you do not know the elevation for a particular point, just press **0** ↵Enter. Pressing ↵Enter without first typing in an elevation value will cause Survey 4.0 to use the "last used" elevation.

EDM Slope Reductions

Upon entering the EDM reduction routine, you will be asked to provide certain information regarding your instrument and target setups. Listed below, and also shown graphically in Figure 13-5, these are:

Height of the Theodolite - Type in the actual height of the scope of the theodolite above the ground surface and press ↵Enter. ***This is not an elevation!***

Height of the Distance Meter - Type in the actual height of the EDM above the ground surface and press ↵Enter. ***This is not an elevation!***

Height of the Target - Type in the actual height of the target (sighted by the theodolite) above the ground surface and press ↵Enter. ***This is not an elevation!***

Height of the Prism Assembly - Type in the actual height of the prism center above the ground surface and press [Enter]. ***This is not an elevation!***

After entering the required data, Survey 4.0 computes horizontal distance solutions for four elevations. You select from horizontal distances at:

- The EDM elevation;
- The Average (EDM/Target) Elevation;
- The Target Elevation;
- Sea Level.

After the first time you enter all of this data, the program will retain the difference between the H.I.'s of the EDM and theodolite and also the difference between the H.I.'s of the prism and target. Each subsequent access of the EDM reduction from within COGO will ask only for a H.I. of the theodolite and the target. The H.I. of the EDM and the prism assembly will then be calculated from the retained information and presented for your approval. If the setup information has not changed, simply press [Enter] to accept the EDM height and prism height. If the setup has changed, type in the correct values before pressing [Enter].

OPTION

If you have activated the Curvature and Refraction correction on the Configuration menu, all EDM computations are corrected for curvature and refraction through the use of the formula C+R= (0.574)(K2) where K is the distance measured in miles.[1]

EDM Slope Reductions - Mining Option

The EDM - Mining Options reduction routine, is functionally equivalent to the regular EDM routine. The only difference being that the heights are measured down from the roof of the mine instead of up from the floor. Refer to the EDM Slope Reductions section for a discussion of the prompts.

Leveling

The Leveling method is not actually a valid method for handling slope distances. Instead, this routine is only to be used for setting the elevations of points by using plus and minus shots. Upon en-

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[1]. BOUCHARD, H. and MOFFITT, F. H. *Surveying*.: International Textbook Company, Scranton, PA, 1965.

tering the levels routine, you will be asked to provide certain information regarding your instrument and target setups. These are:

Height of the Instrument - Type in the actual height of the scope of the instrument above the ground surface and press ↵Enter. ***This is not an elevation!***

Rod Reading at Foresight - Type in the actual rod reading at the foresight point and press ↵Enter. ***This is not an elevation!***

Survey 4.0 assumes that the original distance entered is not a slope distance at all, but rather it is a horizontal distance. The only effect that the H.I. and rod readings have on the leg in question, is in the setting of the elevation at the foresight point.

NOTE
When you are computing the locations and elevations of several points using the Side Shot routine, after your initial height of the instrument entry, the program will present the HI for your confirmation. Simply press ↵Enter to bypass the prompt and proceed to the Rod Reading prompt.

Simple Slope Angles

The slope angle is the only entry required for this method. Basically, the program assumes that the H.I.'s of your EDM, theodolite, target and prism assembly are relatively equal and any differences lying therein do not adversely affect the distance reduction.

Stadia Reductions

Upon entering the stadia reduction routine, you will be asked to provide certain information regarding your instrument and target setups. These are:

Stadia Interval Constant (K) - Type in the stadia interval constant and press ↵Enter. After your initial entry, this value is retained and you will not be prompted for it again during the same COGO session.

Distance from Center of Instrument to Principal Focus (C) - Type in the value for C and press ↵Enter. After your initial entry, this value is retained and you will not be prompted for it again during the same COGO session.

Height of the Instrument - Type in the actual height of the scope of the instrument above the ground surface and press ↵Enter. ***This is not an elevation!***

Reading - Type in the actual rod reading (middle stadia hair) at the foresight point and press ↵Enter. ***This is not an elevation!***

After your initial use of the stadia routine, subsequent accesses will require only the entry of the instrument height and rod reading.

IMPORTANT!

To utilize STADIA reductions, the program assumes that you have entered the STADIA INTERVAL (the difference between the top and bottom stadia hairs) as the actual distance entry. Entering an actual distance instead of the Stadia Interval at the Distance prompt will result in a warning message. The program will require verification of any interval value greater than 9.

Total Station

The Total Station option is another routine that does not actually reduce a slope distance. Instead, Survey 4.0 assumes that the distance entered is a horizontal distance. You are then asked to supply additional information regarding your setup, after which an elevation is computed.

Height of the Instrument - Type in the actual height of the scope of the Total Station above the ground surface and press ↵Enter. ***This is not an elevation!***

Vertical Distance - Type in the actual measured vertical distance and press ↵Enter. Enter this value as a negative if you are shooting downhill. ***This is not an elevation!***

Height of the Prism Assembly - Type in the actual height of the prism center above the ground surface and press ↵Enter. ***This is not an elevation!***

After the first time you enter all of this data, the program will retain the H.I.'s of the total station and also the prism. In each subsequent access this information is presented for your approval. If the setup information has not changed, simply press ↵Enter to accept each entry. Otherwise, type in the correct values before pressing Enter.

3.12 ENTERING COORDINATE VALUES

When entering coordinate values into the Survey 4.0 routines, you will use the coordinate entry dialog box. Whenever the dialog box appears, it may or may not have coordinate values shown in the entry fields. This of course, depends upon whether or not the point number you entered already has coordinates.

If the dialog box's entry fields show coordinates, you can clear each field by placing the cursor in the field and pressing Alt C. Then type in the correct value and press Enter or Tab until you have corrected and/or completed all of the entries. In Survey 4.0 you will have three entries to complete, these being the Northing, the Easting and the elevation. In Survey Lite, you will not be able to assign an elevation.

3.13 CORRECTING YOUR ENTERED DATA

During data entry, it is inevitable that mistakes will be made. Survey 4.0 contains features and routines to help you correct errors. Often, errors may be corrected using the **Coordinate Transformation** routine (**CT** - Sections 10.07 through 10.09), but sometimes you will need more power. Just remember, power comes with a price.

As a by-product of **SIMPLE**, Simplicity's macro programming language, Survey 4.0 contains ***keystroke recording***, ***keystroke editing***, and ***keystroke playback*** to make correcting errors easier. Unfortunately, these features also make it considerably easier for you to trash your data.

The keystroke recording, editing, and playback features are designed for internal use in the traverse adjustment routines, and in macro programming. While these features are not necessarily intended for use in correcting your entry errors, we realize that many users will attempt to utilize them for that purpose.

☠☠☠☠☠ *WARNING!* ☠☠☠☠☠

Serious irreparable damage to your data files ***WILL*** *result from the misuse of the keystroke recording, editing, and playback features! Simplicity Systems, Inc. will not be responsible for any data loss you may experience.*

If you are not 100% certain that you know what you are doing with these routines, DO NOT USE THEM!

If we still haven't convinced you that you could experience trouble, make sure you have backup copies of all pertinent files stored in some location other than your designated data directory, ***before*** *using the* **Run File** *routine (**RF** - Section 12.04).*

What Can Go Wrong?

Suppose you are working in a job where the base point coordinates ***already exist*** in a data file. You start the job, enter the data file name, and turn the keystroke recording on to save your work. You start at point 1 which is already in memory. As your work progresses, you set several hundred points based in part on the location of base point 1, as well as several other points that were previously computed and loaded from the data file. So far, no problem.

Now, using Coordinate Transformation, you rotate, translate and scale the data to match a different coordinate system. It is only after that operation that you realize that you made an error early on in your work. No problem, you think...You'll just correct the keystroke file and rerun it. Right?

WRONG! You see, the keystroke file recorded calculations that were based on coordinate point values existing in your data file at that particular moment in time. But the translation routine re-wrote those points with new values, so your original basis has been changed. And, when the basic components are changed, so is the outcome. ***BE WARNED, BE CAREFUL!***

When *Can* It Work?

Keystroke recording, editing and playback will work *with the fewest problems* when you are just starting a new job, and you have yet to place any coordinate values into a data file. If you use it any other time, be prepared to manually review and edit the keystroke file (using the ***S4-Edit*** program) before re-running it. *Remember to make backup data files before re-running any keystroke file!*

Keystroke Recording

When keystroke recording is **On**, Survey 4.0 records your keystrokes into a disk file. To activate keystroke recording type **SK** (**Save Keystrokes** - Section 12.03) at any **Select Routine** prompt. If no keystroke file exists, one will be opened at that time. If a file already exists for the job you are working on, you will be asked if you want to [A]ppend or [O]verwrite the file, or [T]urn the recorder off. If you choose to append a file, your new work is added to the end of the existing file. If you elect to overwrite the old file, a backup file will be created, and a new keystroke file will be started.

Keystroke files are located in your data directory and they share your data file's root name. The filename extension is **KEY**. A backup keystroke filename extension is **BKY**. If you ever need to reuse a backup keystroke file, use the DOS **REN**ame command to change the filename extension to **KEY**. If you see a file with a **KE-** extension, that is a backup file of a key file that was edited using the **Edit File** routine (**EF** - Section 12.02) or the ***S4-Edit*** program (Section 16).

Keystroke Editing

Keystroke editing allows you to view your keystroke file and make corrections to any data that was omitted or incorrectly entered. The editing routine, accessible from within Survey 4.0, uses the program ***S4-Edit***, which is discussed in detail in Section 16.

To edit your keystroke file, type **EF** at any **Select Routine** prompt and then press [F1] when you are prompted for a file name.

Keystroke Playback

When you have finished editing your keystroke file, you can replay it to correct your data by typing **RF** (**Run File** - Section 12.04) at any **Select Routine** prompt. Survey 4.0 will replay your entire session.

Prior to pressing **RF**, you may want to use the editor to change your printer output settings within your keystroke file. Look for a group of **SET** statements, and within this group, a statement that reads **SET Printer =** *value*. Changing the value changes your output device as follows: **0** = Display Only; **1** = Display and

Printer; **2** = Display, Printer & Disk File; and **3** = Display & Disk File.

Trouble Guaranteed If You...

There are a couple of actions that can guarantee you trouble during a keystroke file playback. They are: manually inserting certain routine codes into a keystroke file; and using an *indirect* **Enter and Assign** (**EA** - Section 10.15) in COGO.

The following routines are ***never*** recorded into a keystroke file. (Section numbers are in parenthesis)

`An` **Advance Printer (App. E)**	`OP` **Overwrite Protection (10.06)**
`AN` **Auto Numbering (10.04)**	`PB` **Previous Backup (App. E)**
`AX` **ASCII File Exchange (12.01)**	`PC` **Pop-up Calculator (11.04)**
`CB` **Copy Block (10.13)**	`PD` **Print Input Data (11.13)**
`CJ` **Clear Junk (App. E)**	`QU` **Quit to Menu (14.01)**
`CM` **Configuration Menu (11.01)**	`RC` **Recover Coordinates (10.22)**
`CW` **Clear Work Space (11.02)**	`RE` **Remarks (11.12)**
`DF` **Define Figure (10.14)**	`RF` **Run File (12.04)**
`DS` **DOS Shell (11.15)**	`RM` **Run Macro File (12.05)**
`EF` **Edit/View File (12.02)**	`RP` **Renumber Points (10.05)**
`FM` **File Manager (13.10)**	`RR` **Write RoadRunner File (12.09)**
`FR` **Free RAM Report (App. E)**	`SC` **Store Coordinates (10.21)**
`KL` **Keyboard Lock (11.06)**	`SK` **Save Keystrokes (12.03)**
`KS` **Keystroke Save (App. E)**	`SY` **Exit to System (14.02)**
`LE` **LegalEase Processor (12.08)**	`TF` **Traverse Fix (App. E)**
`LF` **Write Legal File (12.07)**	`U1-U9` **Utility Programs (13.01-09)**
`ND` **Name Define (10.19)**	`UP` **Upgrade (13.11)**
`NJ` **Start a New Job (14.03)**	`VS` **View Coordinate Screen (11.14)**
`OD` **Offset Define (10.18)**	`WM` **Write/Edit Macro File (12.06)**

Just remember that anytime you manually edit any routine into a keystroke file, you run the risk of crashing. ***If you manually edit any of the above routines into your keystroke file, it will crash during playback, and destroy your data file!***

An ***indirect*** **Enter & Assign** occurs any time you are asked to furnish point coordinates, when you are not actually in the **Enter & Assign** routine. For example, an indirect assignment occurs when you inverse to a point that has not been assigned coordinates, and Survey 4.0 prompts you for them. What happens during playback is this: Survey 4.0 finds the coordinates in the data file so the indirect assignment is no longer needed, but the commands are still there. Unless you edit the indirect assignment out of the keystroke file, the file will contain commands it is not expecting, causing it to crash.

3.14 ROUNDING ERRORS

Survey 4.0 uses up to 16 significant digits for internal calculations. However, despite this high degree of accuracy, there may be times when you experience rounding errors. Generally these errors manifest themselves somewhere in the second or third decimal place, or beyond. But in almost every case except accumulated stationing, ***these are not errors generated by the program's handling of data. They are user-introduced errors.***

Introduced Errors

We are often asked what data items will produce the best solution. For example, in terms of curve solutions (including the macro programs), it seems that many users believe that a curve solution based on certain parameters may be more accurate than that same solution based on a different set of parameters. ***Actually, the parameter type makes no difference at all. The accuracy of any solution is based on the precision of the data entered.*** Once this fact is understood, you will have an easier time of selecting the best data to be entered.

For example, suppose that you have the following curve data:

Delta	35°00'00"
Radius	750.00
Arc Length	458.15
Tangent	236.47
Chord	451.06

Depending upon which two parameters you use to compute the other values, you will generate slightly different curve data every time as seen in the table below:

Parameters Used	Delta & Radius	Radius & Chord	Tangent & Chord	Arc & Radius
Delta	35°00'00"	35°00'00.4"	34°59'33.6"	35°00'00.3"
Radius	750.00	750.00	750.1545061	750.00
Arc	458.1489287	458.1502926	458.1472447	458.15
Tangent	236.4740917	236.4748415	236.47	236.4746807
Chord	451.0586992	451.06	451.06	451.0597212

As can be easily seen from the above table, the precision data directly affects the accuracy of the solution. Only the first solution based on the delta and radius is exact, as every other solution failed to produce the exact same delta and radius. ***Remember: For the most accurate solution, use the most precise data that you have.***

Accumulating Errors

From time to time, you may notice slight errors creeping into your stationing values. These are ***accumulating*** errors. When you generate stationing, Survey 4.0 accumulates the stationing in a 16 significant digit value. You may however, be reporting stationing to only two or three places, and therein lies the problem. For example, assume that you have three points to which you wish to assign stations. The actual inversed distances between these points, the inversed distance to two places and the stationing to two places is shown below.

Actual Distance	Accumulated Actual Dist.	Reported Distance	Accumulated Reported Dist.	Reported Station
0.00000	0.00000	0.00	0.000	0+00.00
100.07451	100.07451	100.07	100.07	1+00.07
100.27138	200.34589	100.27	200.34	2+00.35
100.64483	300.99072	100.64	300.98	3+00.99

As you can see, the final difference between the **Accumulated Reported Distance** and the **Reported Station** is 0.01. This is the accumulated error. Internally however, the actual stationing value is 300.99072, which is right where it should be.

Generally, accumulating errors will correct themselves somewhere down the line. The only time they can actually affect data is if you start stationing at a point that has been already assigned a station. For example, if you ***started*** another stationing run from the last point as shown above, the starting internal station value would be 3+00.99. Since the internal stationing value was 300.99072 when that station was established, subsequent stations will be in error by 0.00072.

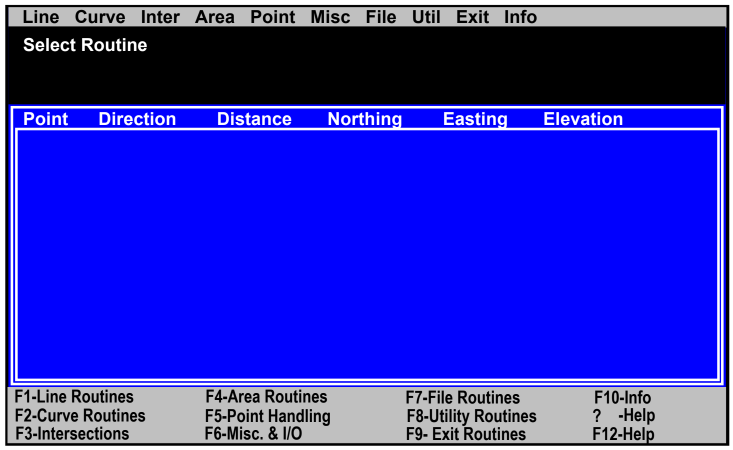
The Survey 4.0 Examples

When you work through the example solutions presented in this manual, you may experience slight deviations from the printed results. This is not uncommon, and can be traced to the methods used to establish the given data. Generally, if you use the **Enter and Assign** routine (**EA** - Section 10.15) to assign the given points, you will have greater success in matching the printouts.

Section 4
Getting Around

4.01
THE SURVEY 4.0 SCREEN LAYOUT

The Survey 4.0 working screen is divided into four regions: the ***Menu Bar***; the ***Prompt Area***; the ***Work Space***; and the ***Key & Message*** Area.



The Survey 4.0 Working Screen: Figure 4-1

The Menu Bar

The first region is the ***Menu Bar*** which consists of a single line of menu names at the top of the display. It is from this bar that the pull down menus appear.

The Prompt Area

The second region consists of the next seven lines and is referred to as the ***Prompt Area***. This is the area of the screen that will display all of the program prompts, message boxes and option selection boxes. The prompt you will see when first opening this screen is the **Select Routine** prompt.

The Work Space

The third region consists of everything from the prompt area, down to the bottom three lines of the screen. If you are using a CGA display or an EGA display with a non-enhanced monitor, this region is about 13 lines long. An EGA with an enhanced color monitor will yield about 31 lines, while a VGA screen will produce about 38 lines. This is the ***Work Space***, the area that will contain the results of your calculations.

The Key & Message Area

The fourth and final area of the screen is the ***Key & Message*** area which consists of the bottom three lines of the display. In this area you will see a listing of the function keys that are active at any given time. Occasionally, this area will also contain a message which will serve to clarify a procedure in progress.

4.02 SELECTING ROUTINES

Routines are generally selected from the **Select Routine** prompt in coordinate geometry by one of two methods: selecting routines from the pull down menus; or entering a two letter code.

Pull Down Menus

The menu method consists of a series of nine pull down menus which correspond to Section 6 through Section 14 within this manual. A 10th menu is an informational menu that reports on disk space, point capacity, program version and serial number, and registration information. The technical support hours and telephone number are also included on this screen.

To pull down any menu, press the function key for the desired menu at the **Select Routine** prompt, or press [Alt] and the key corresponding to the menu's ***hot key***, highlighted by a different color on the menu bar. For example, pressing [F1] or [Alt] [L] will access the **Line Routines** pull down menu.

The function key assignments for each menu are shown on the bottom of your display whenever you are at the **Select Routine** prompt.

Once you are inside a menu, use the [↑] and [↓] arrow keys, or your [Space Bar] to move the highlight bar inside the menu to the chosen routine, or press the routine's highlighted ***hot key*** to move the highlight bar directly to the routine. Note that the menus incorporate a wrap around function. In other words, to go from the bottom item of a menu to the top item of the same menu, you need not press [↑] you reach the item. Instead, press [↓] one time and the highlight will wrap around to the top menu item. This function works equally well in a reverse fashion. Other keys that function inside a menu include: [Home] to go to the top of the menu; [End] to go to the bottom of the menu; and Alt ***hot key*** to run a particular routine.

Once you have chosen and pulled down a menu, you may select any other menu by using the ← and → keys, or by pressing the assigned function key. Changing menus via the use of the arrow keys also incorporates a wrap around feature similar to that described above.

When you reach the desired routine, you must press ↵Enter to activate it. You may also access the help screen at this time by pressing F11 or ?, after which you will be asked if you would like to run the routine.

Depending upon program exit option availability and also upon your program version, Survey 4.0 or Survey Lite, some menu options will appear dimmed. These items are disabled, except for the help screens. Also, no selections may be made from the Information Menu.

Mouse Users

To pull down any menu from a **Select Routine** prompt, point to the menu and click the left mouse button. To select an item inside a menu, point to the item and click the left mouse button. To view the help screen for an item inside a menu, point to the item and click the right mouse button.

NOTE

*The mouse works only when the **Mouse Capable** setting on the Configuration Menus is set to **On**.*

Two-Letter Codes

Using the two-letter code method simply involves the entry of the two-letter codes that are shown on the pull down menus. Two-letter codes may be entered at the **Select Routine** prompt or at any request for a point number, but not while any pull down menu is being displayed.

When entering a two letter code at the **Select Routine** prompt, ***do not*** follow the code with an ↵Enter keypress. However, when entering a two letter code at any other time, you ***must*** follow the code letter with an ↵Enter keypress.

4.03
HELP SCREENS

Survey 4.0 contains many help screens designed to assist you without getting in your way. Help screens accessed from the pull down menus describe the various Survey 4.0 routines and list the data required to run them. To access a help screen for a pull down menu item, place the highlight bar on the item and press ? or F11. Mouse users may view the help screen for an item by pointing to the item and clicking the right mouse button.

Help screens are also available for nearly every prompt in the COGO program. If a help screen is available, the Key and Message area of your display will indicate that help is available by pressing key F12. If you do not have an F12 key, you can still access the help by pressing H ↵Enter.

4.04
THE IMPORTANCE OF A GOOD START

The COGO **Start At** command (**ST**, Section 10.01), is indeed a very important way to begin, for two reasons. First, several of the COGO routines cannot begin without a data point in the memory. **Start At** is used to identify such a data point.

As you proceed through the routines, the last point you use becomes the currently occupied point, or in effect, the point from which the next computation will begin. Use **Start At** if you wish to start from a different point.

The second reason to use **Start At** lies in the fact that the **Start At** routine clears the ***traverse length*** and ***area*** accumulators. In order to produce an accurate area calculation of a traverse, you must begin by using the **Start At** routine.

The GoTo Option

Survey 4.0 also includes a **GoTo Point** option (**GT**, Section 10.02). The **GoTo Point** option should be used when you want to jump to a particular point without resetting the ***traverse length*** and ***area*** accumulators.

4.05
EXITING A ROUTINE

While using the coordinate geometry routines, responding to any prompt with E ↵Enter or Q ↵Enter will allow you to select a new routine within COGO. Often, you will find that key F10 has also been assigned to the exit function. The Esc key will also exit most menu items where a single keypress entry is expected.

The exit key presses, (E ↵Enter, Q ↵Enter or F10), may also be used to re-start a routine to correct an erroneous data entry. At any prompt, you may use an exit keypress to exit the prompt. Then re-enter the routine code and resume your operation with the correct data.

While in COGO, an alternate method for changing routines also exists. At most requests for a point number, type in a routine code and press ↵Enter. The program will switch to the selected routine. Due to the modular nature of Survey 4.0, a few routines do not allow for switching routines in this manner. In those instances, you will be returned to a **Select Routine** prompt, where you may re-enter the routine code.

4.06 RECOVERING FROM AN ERROR

Survey 4.0 contains error handling routines to guard against data loss caused by a bad response to a request for data. In most cases, if the error is user-correctable, the program will allow you to correct the condition and continue. In all other cases, the program will route you back to a **Select Routine** prompt after reporting the error or allow you to return to DOS.

If your error is simply a bad point number or a typo in your bearing entry, remember that the exit key presses, (E ↵Enter, Q ↵Enter or F10), may also be used to re-start a routine to correct an erroneous data entry. At any prompt, you may use an exit keypress to exit the prompt. Then re-enter the routine code and resume your operation with the correct data.

Computational errors may be corrected through the use of keystroke files, as discussed in Section 3.13.

4.07 THROWN FOR A LOOP

As discussed in Section 3.05, Survey 4.0 allows you to create defined figures that can contain a call to another figure. This feature may produce an ***endless loop*** if you are not careful. For example, suppose you have a figure that calls a second figure, and the second figure contains a call to a third figure. No problem so far. But suppose the third figure contains a call to the first figure. If that happens, Survey 4.0 will continue to cycle through endless reams of paper as it travels from figure 1 to 2 to 3 to 1... and so on. This is an endless loop.

The Great Escape

If you ever find yourself locked in an endless loop, escape is possible. All you have to do is press Esc and you will return to a **Select Routine** prompt.

Survey 4.0
Simplicity Surveying Series

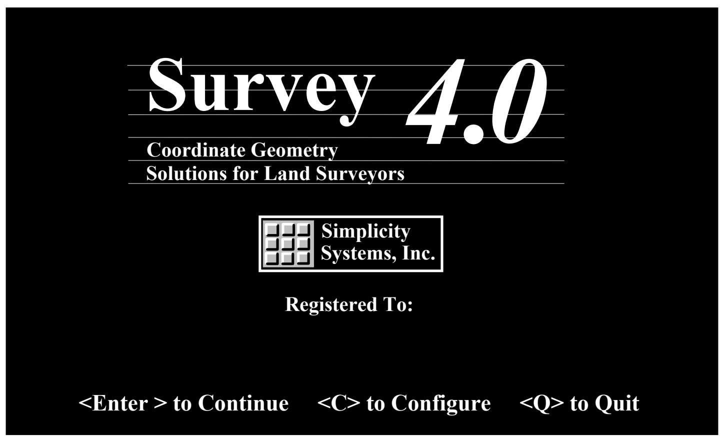
Section 5
Startup and Configuration

5.01
STARTUP

You may begin Survey 4.0 by either: typing **SSI** Enter to start the Simplicity Systems Menu and then selecting Survey 4.0; or by changing to the Survey 4.0 directory and typing **CGStart** Enter.

When you start Survey 4.0, the first screen you see is the title screen. If you have an EGA or VGA graphics adapter installed in your computer, the screen should look similar to the screen below, otherwise, you will receive a text screen. The bottom line of either screen contains the prompt line:

<Enter> to Continue <C> to Configure <Q> to Quit

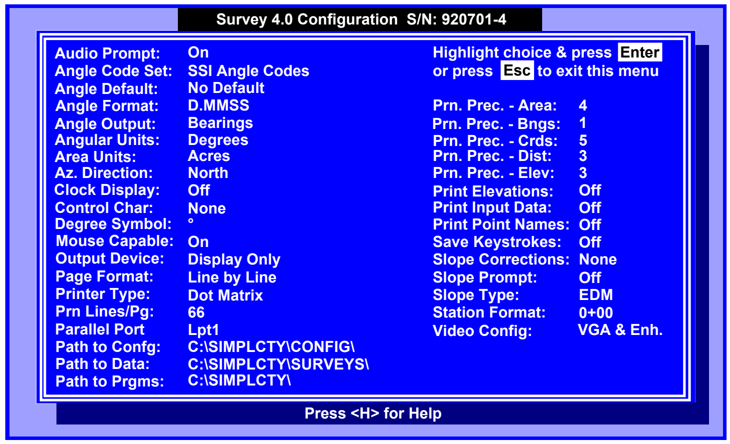


The Title Screen: Figure 5-1

Make your selection by pressing the appropriate key, but be aware of the fact that some items on the ***Configuration Menu*** are only available when the menu is accessed from the title screen. This is done to maintain data integrity, and these items are identified in Section 5.04.

5.02 THE CONFIGURATION MENU

The ***Configuration Menu*** is used to define operating parameters, either on a semi-permanent or temporary basis. Generally, most of the Survey 4.0 operating parameters will be set only once. Some however, will be adjusted from time to time. The Configuration Menu is available from the title screen by pressing C. You may also call the Configuration Menu from inside COGO by typing **CM** at a **Select Routine** prompt.



The Configuration Menu: Figure 5-2

5.03 THE MENU ITEMS

The next several pages contain a listing of the Configuration Menu items. Each item is accompanied by a brief description of its function and available settings. To select any item, use the cursor control keys to highlight the item and press ↵Enter. Press H for **Help** on any highlighted item. Mouse users may select an item by clicking the left mouse button on the item, and can access **Help** by pointing to an item and clicking the right mouse button. Keyboard cursor control is handled by the following keys:

← or →	moves from one column to the next.
↑	moves up one item in the current column
↓ or Space Bar	moves down one item in the current column
Page Up	moves to the top of the current column
Page Dn	moves to the bottom of the current column
Home	moves to the top of the left side column
End	moves to the bottom of the right side column

In many cases, the selected item is a toggle switch, changing from one condition to another and then back again. Other items will present a selection box of choices. To choose from the selection box, move the highlight bar using your ↑ or ↓ arrow keys or your Space Bar and press ↵Enter, or use your mouse to point to your desired choice and double-click the left button. A third type of item is an input item, which requires you to type in a response and press ↵Enter.

When you have finished making changes, exit the Configuration Menu by pressing (or clicking your left mouse button on) Esc and your changes will be saved for use in future work sessions.

Audio Prompt

When the **Audio Prompt** is `On`, Survey 4.0 alerts you to entry errors and certain other messages with an audible beep. Sometimes the audio signal conflicts with the operating BIOS on certain computers causing the program to lock up. Should this occur, turn this option to `Off`. This item is a toggle setting.

Angle Code Set

The **Angle Code Set** assigns the angle code numbers. Sets included are the Hewlett-Packard (HP) code set and the Simplicity Systems, Inc. (SSI) code set. This item is a toggle setting. The code sets are shown below:

SSI Code Set		**Common to Both**		**HP Code Set**	
Numeric Code	Function Key	Quadrant or Direction	Alpha Code	Numeric Code	Function Key
1	F1	Northeast	**NE**	**1**	F1
2	F2	Southeast	**SE**	**2**	F2
3	F3	Southwest	**SW**	**3**	F3
4	F4	Northwest	**NW**	**4**	F4
5	F5	Azimuth	**AZ**	**5**	F5
6	F6	Angle Right	**AR**	**7**	F7
7	F7	Angle Left	**AL**	**6**	F6
8	*none*	Deflect Right	**DR**	**9**	*none*
9	*none*	Deflect Left	**DL**	**8**	*none*
none	F8	90° Angle Right	**90AR**	*none*	F9
none	F9	90° Angle Left	**90AL**	*none*	F8

(If you are working in grads, the 90° values become 100 grads.)

Angle Default

The **Angle Default** establishes the directional data type of any angle entry that does not include a ***Quadrant Code***. If set to `No`

Default, all angular entries will require a quadrant code to establish the correct direction. If an Angle Default mode is set, any quadrant code entered with an angle entry will override the Angle Default setting. This item produces a selection box containing these choices: **None**; **Azimuths**; **Angle Right**; and **Deflect Right**.

Angle Format

The **Angle Format** option sets the entry format for your angular data. If you are working in degrees, select the **D-M-S** format or the calculator style **D.MMSS** format. If you are working in ***grads***, this item is automatically set to a decimal format and is controlled by the Angular Units setting. This item is a toggle setting.

Angle Output

The **Angle Output** option specifies the output format of your directional data, either as **Bearings** or **Azimuths**. If azimuth output is chosen, the azimuth orientation is set by the **Azimuth Direction** setting. If you are working in ***grads***, this item is automatically locked as **Azimuths**. This item is a toggle setting.

Angular Units

The **Angular Units** option sets the angular units as either **Degrees** or **Grads**. If set as degrees, the actual entry format is set by the **Angle Format** option. If set to ***grads***, the entry format is set to decimal, and the precision is set to six places. The **Degree Symbol** also changes to '**g**' and **Angle Output** is set to **Azimuths**. This item is a toggle setting.

Area Units

The **Area Units** option specifies area output values as English or metric units. This item produces a selection box containing these choices: **Acres & Square Feet**; **Cuerdas & Square Meters**; or **Square Meters & Hectares**. (Conversions used: 1 acre = 43,560 sq. ft; 1 hectare = 10,000 sq. m.; 1 cuerda = 3,930.3956 sq. m.)

Azimuth Direction

The **Azimuth Direction** option sets the default azimuth reference as **North** or **South**. Once set, all references to any azimuth in Survey 4.0 assumes the chosen directional basis. This item is a toggle setting.

Clock Display

When the **Clock Display** is `On`, Survey 4.0 displays a real-time clock in the upper right corner of the main work screen. This clock is incompatible with some computers, causing Survey 4.0 to lock up. Should this occur, turn this option to `Off`. This item is a toggle setting.

Control Characters

The **Control Characters** option sends control codes to a printer to enable font selection and forms control. Up to three numeric control codes may be entered. For example, on some Epson printers, the codes 27 & 15 will set the printer to print in a condensed font. Check your printer manual for specific codes. Entering *any* control codes also triggers the program to insert a left margin on your printouts, to permit binding the printouts in a notebook.

WARNING !

Avoid entering printer codes which will change the printer spacing to less than 12 characters per inch. Entering printer codes for pitch settings of less than 12 characters per inch, (such as 10 cpi Pica), results in text lines wrapping around to the next printed line and disables any effective forms control such as skip over perforations, form feeds, etc. If you intend to use a 10 character per inch font, DO NOT introduce any printer control codes at the Configuration Menu level. Instead, use your printer's control panel to select fonts.

The **Control Characters** option is an input item. You will be presented with a three line entry window showing the current code settings. Either type in new setting numbers over the old data or clear the line first by pressing Alt C. Use your ↑ or ↓ arrow keys or ↵Enter to navigate between the lines. Alt R restores the old settings. Remember to enter zeros or clear any lines you do not want to use. To exit the input screen, press Esc after any entry, or ↵Enter after the third entry.

HINTS

1. To insert a left margin on printers that require more than three control codes, enter the codes 32 (space) and 8 (backspace), and then set the desired printer font from the printer control panel.
2. After exiting Survey 4.0, remember to reset your printer to cancel the control codes. This can be accomplished by turning your printer off and back on.

Degree Symbol

The **Degree Symbol** option defines the character that follows angular data. This item produces a selection box containing these choices: a degree symbol **°**; a **space**; a lower case **d**; or a lower case **g** if you are working in ***grads***. Some printers (particularly Epson) cannot print the **°** symbol.

Mouse Capable

The **Mouse Capable** option enables and disables mouse operation. When **On**, you may use a mouse to pull down the routine menus and to select menu items and options in any dialog box. This item is a toggle setting.

Output Device

The **Output Device** option directs your computational output to the monitor and/or printer and/or to a disk file. Disk files are in an ASCII format for later printing via a word processor or DOS, and may also be viewed in the Edit/View File routine. This is a menu item that provides a selection box containing the following choices: **Display Only**; **Display/Printer**; **Display/Printer/File**; and **Display/File**. (If you are using Survey Lite, the disk file options will not be visible. If you are running a demo version, you may only use the display.)

If you select a printer option, two additional selection boxes are presented. The **Printer Check** selection box contains two choices: **Use Printer Check**; and **No Printer Check**. Printer Check is used to eliminate ***device timeout*** errors caused when your printer is not ready to print. Your computer may not be compatible with this routine. If Survey 4.0 locks up while attempting to print, select the **No Printer Check** option.

The **Carriage Return/Line Feed** selection box also contains two choices: **CR & No Line Feed**; and **CR with Line Feed**. Some printers automatically add a line feed whenever a carriage return is issued, and some do not. Survey 4.0's printing routine normally adds a line feed to the carriage return command. If you find that your printouts are double spaced, select **CR & No Line Feed**. If your printout does not advance after each line, select **CR with Line Feed**.

Page Format

The **Page Format** option sets printer output to be in a **`Line by Line`** format for dot matrix printers, or in a **`Whole Page`** format common to laser printers. In the Line by Line format, each line is sent to the printer as it is composed. In the Whole Page format, output is stored until an entire page is composed. ***While you can use the `Whole Page` setting on any printer, do not attempt to use the `Line by Line` setting on a laser printer.*** This item is a toggle setting.

Printer Type

The **Printer Type** option establishes the proper command for a form feed. Unless you use an **`HP Laserjet`** printer, select **`Dot Matrix`** as your printer type. If your printer fails to issue form feed commands, change this setting. This item is a toggle setting.

Printer Lines/Page

The **Printer Lines/Page** option establishes the number of lines that the program prints before issuing a form feed command. The value is established by subtracting 6 from the number entered. The result governs all forms control such as form feeds, page numbering and headings. This is a modified input item that accepts a maximum of two keystrokes, thus limiting your entry to a maximum of 99 lines. Do not press ↵Enter after entering a two digit number.

The default value for an 11" long page at 6 lines per inch is 66 lines. You may reduce the amount of "white space" at the bottom of your form by increasing this value to **`69`** or **`70`**.

Parallel Port

The **Parallel Port** setting tells Survey 4.0 where it can find your printer, either on **`Lpt1`** or **`Lpt2`**. If you have a serial printer on a COM port, set this option to **`Lpt2`** and include the following command in your **CGStart.BAT** file:

```
MODE LPT2:=COMn:
```

where **`n`** is the designation number of the serial port that your printer is actually connected to. In the CGStart.Bat file, the mode command must come before the command **S4-Title**.

Path to Config
Path to Data
Path to Programs

The **Path to Config**, **Path to Data** and **Path to Programs** settings let Survey 4.0 know where to find the configuration, data, and program files if Survey 4.0 is running on a network or multi-user system. See Section 5.05 for more information on pathname rules.

NOTE

*A **Site License** is required for network and multi-user systems! (See Section 2.02)*

When you call a path item, Survey 4.0 presents you with a one line input field containing the current path setting. Press Alt C to clear the setting and then enter a new one, or simply type over the old setting, making sure to erase all remnants with the Space Bar. If you need to make minor changes to the existing setting, use your ← and → arrow keys to position the cursor and make your changes. Press ↵Enter when you are finished.

Printed Precision
Area
Bearings
Coordinates
Distances
Elevations

The **Printed Precision** options set the decimal formats for printed data. ***This is printed precision only***. Internal values are computed with 17 digit precision on all values except elevations, which are computed to 8 places. Remember: An elevation field is is only 8 places. For example, set 6 decimal places and only 2 will remain to the left of the decimal point. These items present a selection box containing values ranging from **0** to **8** places, depending upon the item being set.

Print Elevations

The **Print Elevations** option enables and disables the printing of elevations with your output data. The **Printed Precision - Elevation** option actually controls the output format. When **On**, Survey 4.0 prints an elevation for each computed point. This item is a toggle setting. ***This item is not accessible in Survey Lite.***

Print Input Data

The **Print Input Data** option enables and disables the printing of your entered data on your data printout. Including input data provides a convenient log of the data and procedures you used to complete your work. When **On**, input data is printed. This is the only method available to print out your input data.

Print Point Names

The **Print Point Names** option activates and deactivates a continuous output of point names or descriptors. When **On**, Survey 4.0 includes point names on the printout and prompts for point names at each new point. Including point names reduces the speed of the program since point names are stored in a disk file and not in RAM. A ***RAM disk*** minimizes this speed reduction. See Appendix C for details on optimum system configuration. This is a toggle item.

Save Keystrokes

The **Save Keystrokes** option activates and deactivates the recording of all data entry and keystrokes to a disk file. The resulting file may be edited and rerun to correct errors in your original computations. Set this option to **`On`** for data recording. Recording keystrokes significantly reduces the speed of the program since almost every keystroke is stored in a disk file and not in RAM. A ***RAM disk*** minimizes this speed reduction. See Appendix C for details on optimum system configuration. This is a toggle item.

Slope Corrections

The **Slope Corrections** option allows corrections for curvature & refraction and reductions to sea level in EDM reductions within Survey 4.0. When activated, these corrections will be made to the computed reductions. Some EDM's automatically perform one or both adjustments. Activate this item accordingly. This item produces a selection box containing the following choices: **`Curvature & Refraction`**; **`Sea Level Correction`**; **`Both Curvature & Refraction and Sea Level`**; and **`No Correction`**.

Slope Prompt

The **Slope Prompt** option activates and deactivates automatic prompting for slope reductions. When **`On`**, Survey 4.0 assumes that entered distances are slope distances, (except when using reductions for leveling, total station, stadia and assigned elevations), and asks you to provide the appropriate slope data for reduction to horizontal datum. The nature of the slope data is determined by the **Slope Type** option. This item is a toggle setting.

Slope Type

The **Slope Type** option indicates the nature of the incoming slope distance data. When you enter a slope distance, Survey 4.0 prompts you for the reduction data necessary to reduce the slope distance to a horizontal distance. Prompts for slope reduction are only activated when the **Slope Prompt** option is set to **`On`**. This item produces a selection box containing the following choices: **`EDM`**; **`Stadia`**; **`Simple Slope Angles`**; **`Leveling`**; **`Total Station`**; **`EDM (Mining Option)`**; and **`Assigned Elevation`**. These options are discussed in Section 3.11.

Station Format

The **Station Format** option specifies stationing in the US format of **`0+00`**, or in the metric format of **`0+000`**. In either format, the number of decimal places in the station number corresponds to the distance precision number. This item is a toggle setting.

Video Configuration

The **Video Configuration** option properly configures Survey 4.0 for your equipment. If Survey 4.0 is having difficulty displaying the View Screen, and/or the text screen, your video configuration is probably incorrect and you should try a different setting. This item produces a selection box containing the following choices: **MDA & Monochrome Monitor**; **MGA & Monochrome Monitor**; **CGA & Monochrome Monitor**; **CGA & Color Monitor**; **MCGA & Monochrome Monitor**; **MCGA & Color Monitor**; **MCGA & Enhanced Color Monitor**; **EGA & Monochrome Monitor**; **EGA & Color Monitor**; **EGA & Enhanced Color Monitor**; **VGA & Monochrome Monitor**; and **VGA & Enhanced Color Monitor**.

In the monochrome and CGA modes, the program will utilize a screen display of 80 columns by 25 lines. With an EGA video adapter and an enhanced color monitor, the program will utilize a screen display of 80 columns by 43 lines. With a VGA video adapter and an enhanced color monitor, the program will utilize a screen display of 80 columns by 50 lines.

5.04 CHANGING YOUR CONFIGURATION FROM INSIDE SURVEY 4.0

In most cases, you will set your Survey 4.0 configuration at the beginning of your computing session, however there may be times when you want to change a setting from within COGO. This option is available by typing **CM** (for **Configuration Menu**) at any **Select Routine** prompt.

When Items Are Not Available

When calling the configuration menu from inside COGO, not all items are available for editing. The number of unavailable items depends upon whether or not you are recording keystrokes at the time that the configuration menu is called.

At the very least, the following items are not available for changing from within COGO: **Azimuth Direction**; **Control Characters**; **Output Device**; **Page Format**; **Printed Lines/Page**; **Parallel Port**; **Path to Config**; **Path to Data**; **Path to Programs**; **Save Keystrokes**; and **Video Configuration**.

If you are recording keystrokes when the Configuration Menu is called, the following items will also be unavailable: **Angle Code Set**; **Angle Default**; **Angle Format**; **Angular Units**; **Print Point Names**; **Slope Prompt**; and **Slope Type**.

Four items which are inaccessible from the Configuration Menu, may be accessed directly within COGO. These are: **Printer On/Off** (**PR**: Section 11.10); **Save Keystrokes** (**SK -** Section 12.03); **Names Output** (**NO** - Section 11.11); and **Slope Angle Prompting** (**SA** - Appendix E).

5.05
LOADING A DATA FILE

One last item remains before the work session can begin. You have reached the point where you must now specify the name of the data file.

Filename Rules

Naming a data file can be an exasperating experience when you are forced into using the DOS file name constraints. DOS implements some rigid filename rules, forcing you to use your imagination when you name files.

DOS file names consist of a ***drive*** designation, optional ***directory*** designations (max. 8 characters with a three character extension), the actual ***filename*** (max. 8 characters), and a ***filename extension*** (max. 3 characters). A typical file name looks like:

```
C:\Simplcty\Surveys\Jones.Dat
```

where `C:` is the drive, `Simplcty` is a directory, `Surveys` is a subdirectory of the `Simplcty` directory, `Jones` is the actual job name and `.Dat` is an extension indicating that the file contains point data.

Generally, floppy disks are not organized into directories, so a typical floppy disk filename looks like:

```
A:Jones.Dat
```

where `A:` is the drive, `Jones` is the job name and `.Dat` is the filename extension.

Names and directories are limited to a maximum of eight characters with a three character extension. They ***must not*** contain spaces or any of the following characters

/ [ ] : | < > + = ; , * ?

Follow all drive designations with **:** and place a **** after each directory name.

Reserved Extensions and Filenames

As if the DOS filename rules aren't enough, Survey 4.0 has a few filename rules of its own. Survey 4.0 uses the filename extension (the three characters following the period at the end of a filename) to identify the specific types of files required by the program.

The reserved filename extensions are:

.DAT	-	The actual coordinate data files
.JOB	-	The files containing descriptive job data
.OFF	-	The files containing offset data
.FIG	-	The files containing stored, predefined figures
.KEY	-	The files containing recorded keystroke data
.DOC	-	The files containing your data printouts
.MAC	-	The files containing macro routines
.S4D	-	The files containing drawing image parameters
.CGA	-	The files containing CGA video images
.GRN	-	The files containing EGA and VGA video images

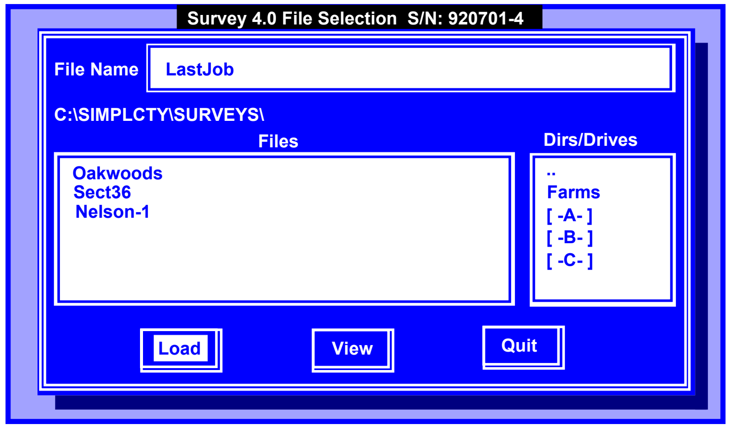
The reserved filenames are:

ASCII.FMT	-	The file containing ASCII exchange formats
Memory.CLC	-	The file containing the calculator memory
Survey-4.NME	-	The file containing the point name table
Survey-4.CFG	-	The file containing configuration information

When you directory your data disk you may not see all of these file types. This is because Survey 4.0 eliminates any file with a zero byte size at the end of each session.

The Selection Menu

Fortunately, Survey 4.0 contains a file selection routine to speed up the file loading process. This menu allows you to specify the drive, directory path and filename of the data file you want to load. The file selection screen is shown in Figure 5-3.



The File Selection Menu: Figure 5-3

The file selection screen consists of seven elements: three windows, a directory information line and three instruction keys. The windows are: the **File Name** bar; the **Files** selection window; and the **Directory/Drives** window. The three instruction keys are: **Load**; **View** and **Quit**. The directory information line is located just below the filename and is the only element of the file selection menu that is not user accessible. Use your mouse or [Tab] key to move thru the windows and keys.

Navigate inside the **Files** window by using your mouse, or the following keys:

[↑]	to move up one item
[↓] or [Space Bar]	to move down one item
[←]	to move left one column
[→]	to move right one column
[Page Up] or [Alt] [U]	to move up eight items
[Page Dn] or [Alt] [P]	to move down eight items
[Home] or [Alt] [H]	to move to the beginning of the list
[End] or [Alt] [E]	to move to the end of the list

Navigate inside the **Directory/Drives** window by using the following keys:

[↑]	to move up one item
[↓] or [Space Bar]	to move down one item
[Page Up] or [Alt] [U]	to move up eight items

Page Dn or Alt D	to move down eight items
Home or Alt H	to move to the beginning of the list
End or Alt E	to move to the end of the list

The File Name Window

The **File Name** window is a one line entry field that accepts the name of the job you wish to open. To open a data file, type in the name of the file, with or without the **JOB** extension and press ↵Enter. The cursor will highlight the **Load** key. Press ↵Enter again to load the job.

Notice that the window shows only **JOB** files and not **DAT** files. Generally, you cannot have a **DAT** file, (the actual coordinate data file) without a **JOB** file, but it is possible. In those cases, proceed with the file loading as if it were a new job, which will provide the opportunity for the reconstruction of a proper **JOB** file.

You may jump to the **File Name** window from any other window by pressing Alt N.

The Files Window

If the job in the file name window is not the job you want, but you are in the correct directory, press Tab until the cursor is located in the **Files** window. Move the highlight bar to the file you want to select and press ↵Enter. The **Load** button will become highlighted.

If you are using a mouse, simply point to the desired job and click the left button twice to load the job. If you want to view the job first, click the left button once and the **Load** button will become highlighted. Then click the left mouse button on the **View** button.

You may jump to the **Files** window from any other window by pressing Alt F.

The Dir./Drives Window

If you need to change disk drives or directories in order to find your data file, press the tab key until the cursor is located in the **Directory/Drives** window. Using your ↑, ↓ or Space Bar, move the highlight bar to the drive or directory you want to select and press ↵Enter. The new drive and directory will be displayed on the directory information line and the cursor will move to the **File Name** window.

If you are using a mouse, simply point to the desired drive or directory and click the left button twice. The new drive and directory will be displayed on the directory information line and the cursor will move to the File Name window.

Selecting the double dot entry, **. .**, at the top of the list, will allow you to back out of your current directory path, one level at a time. For example, if you are in the **C:\Simplcty\Surveys\Farms** directory, selecting **. .** takes you to **C:\Simplcty\Surveys**. Another **. .** takes you to **C:\Simplcty** and a third **. .** to **C:**.

You may jump to the **Directory/Drives** window from any other window by pressing Alt D.

The Load Button

Pressing ↵Enter whenever the **Load** button is highlighted will load the job shown in the **File Name** window. If you do not want to load the file, use your mouse or Tab key to move the cursor to a new location. You can execute this button at any time by pressing Alt L.

The View Button

Pressing ↵Enter whenever the **View** button is highlighted will load the **JOB** file into the **Files** window for viewing. The **JOB** file contains information about the **DAT** file such as a date, time and description of the job. You can use this information to determine if you indeed have the file you want. When you are done viewing the information, you will be given the opportunity to load that job or select another. You can execute this button at any time by pressing Alt V.

The Quit Button

Pressing ↵Enter whenever the **Quit** button is highlighted will exit the Survey 4.0 program, but only after you confirm your decision to do so. Pressing Esc at any time will also exit the program. You can execute this button at any time by pressing Alt Q.

5.06 OTHER PROMPTS FROM THE FILE SELECTION MENU

When using the Survey 4.0 File Selection Menu , you will likely see some additional prompts, some quite regularly, and some only occasionally. The prompts will be in the form of dialog boxes, offering you a choice. Select your choices by pressing the appropriate letter, or by clicking on your choice with the mouse.

< L > Load Job Shown
< S > Select New Job

Survey 4.0 generally begins by showing you the name of the last loaded job in the File Name window. Press L to load the job shown or S to select a new job. If you respond by pressing L, Survey 4.0 loads the data file and begins the actual coordinate geometry session. If you choose to select a new job, the Files window will be loaded with a listing of jobs found in the currently logged data directory path.

Cannot locate the file.
Is this a new job?
< Yes > < No >

If you are starting a new job, simply press Y and Survey 4.0 will continue. If you have entered a name in error, or if you are in the wrong directory, press N to restart the file selection process.

Generally, you cannot have a DAT file, (the actual coordinate data file) without a JOB file, but it is possible. In those cases, proceed with the file loading as if it were a new job, which will provide the opportunity for the reconstruction of a proper JOB file. Your DAT file, if it does exist, will be loaded into Survey 4.0. If the specified file does not exist, a new file of that name will be created.

Change data files
to Survey 4 format?
< Yes > < No >

If you are attempting to load a Survey 3 data file, the file format must be changed. Simply press Y and Survey 4.0 will convert your data file to the proper format. When Survey 4.0 converts a Survey 3 data file, it actually builds new files without destroying the old ones. Your Survey 3 files all get renamed with a 3 as the last character of the filename extension. For example: **`MYFILE.DAT`** becomes **`MYFILE.DA3`**; **`MYFILE.JOB`** becomes **`MYFILE.JO3`**; **`MYFILE.FIG`** becomes **`MYFILE.FI3`**; and **`MYFILE.NME`** becomes **`MYFILE.NM3`**. If you need to access these jobs in their old Survey 3 format, use the DOS **REN**ame command to change the filename extensions back to their original names.

5.07
THE JOB FILE

If you are beginning a new Survey 4.0 job, you will be asked to enter data for a ***Page Stamp***. This information makes up the ***Job File***, and unless changed by you, it will also be the information that prints as a header on your printed output.

The Job File entry screen consists of a series of one line text entry fields. An instruction box is provided to assist you in moving about the fields.

You are given the opportunity to provide your name, along with up to four 75 character long lines of descriptive information, such as job descriptions, etc. You can exit the page stamp input screen at any time by pressing Esc.

Page stamp input is completely optional. You can bypass the page stamp entirely by pressing Esc at the first prompt. Page stamps may also be edited from within COGO through the use of the **Page Stamp** routine (**PS** - Section 11.09).

5.08 WHEN YOUR DATA FILE LOADS

When your existing data file begins loading, at least one, and possibly two additional events will occur. These events are: the production of a backup data file; and the construction of an ADD file.

Automatic Backup Files

At the completion of the actual data file loading process, you will be asked if you want to create a backup data file. Simply answer Y or N. The backup file is nothing more than a copy of the file you just loaded, but it serves two important purposes. First, it is stored in a location that is different from the regular data file location, to safely provide a copy of your data. Second, it stands ready to be restored on command if you decide that you have erred in your work and want to get back to where you started from.

Throughout Survey 4.0, you will be given other opportunities to save a backup file. Restoring a file is done through the use of the **Recover Coordinates** command (Section 10.22), **RC**, at any **Select Routine** prompt. *Be aware however, that the **Recover Coordinates** command only restores the most recently stored backup file, and it completely replaces the file that you are currently working in. Any changes completed since the backup file was created will be lost.*

The ADD File

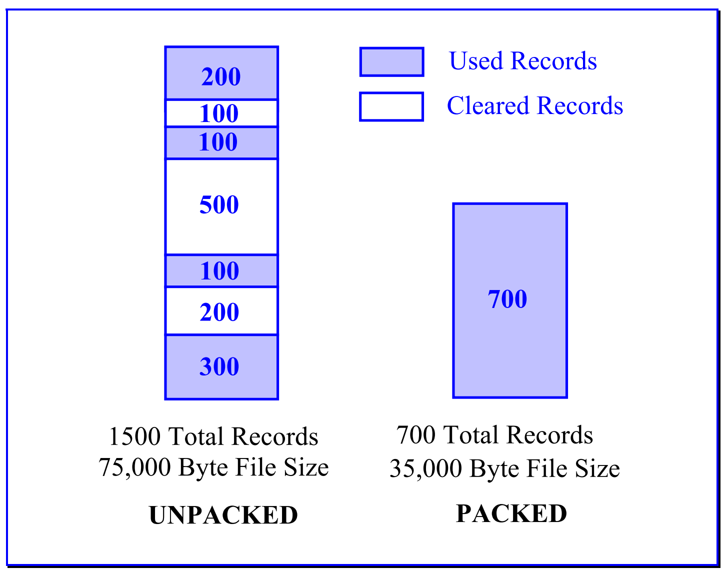
There may be times when your computer configuration has been slightly altered, or you want to run a particular Survey 4.0 job on another computer. What happens to your data if your current computer's capacity is less than the computer that originally ran the job? Where do the points that don't get loaded go, and how do you retrieve them?

When you load a Survey 4.0 file into a computer and the file is too large for the computer to handle, the unloaded points go automatically to an ***ADD file***. The ADD file will hold those points until you complete your session, then merge the points back into the data file. Unfortunately, you cannot use the points contained in an ADD file during your session.

Survey 4.0 data files are stored in a random access indexed file. Points are stored as records, and it is the record number, not the point number, that the program uses to get a point. In short, the point number and the actual record number will rarely correspond. All you really need to know is that all records containing points numbered in excess of the highest allowed point number will be sent to the ADD file.

Packing Data Files

When a data file is packed, each unused record is discarded and the record stack drops down by one, not unlike a stack of records on a turntable. Since each record contains 50 bytes of information, a packed file may be significantly smaller than the original size. Packed files load and save faster because they contain fewer records. They also access point names faster for the same reason.



The Effect of File Packing: Figure 5-4

To pack a data file, save the file using the **Store Coordinates** command (Section 10.21) by typing **SC** at any **Select Routine** prompt. File packing is automatically done when you use this command, and you will receive a report on the number of bytes saved. You will also have the opportunity to save a backup file at the same time.

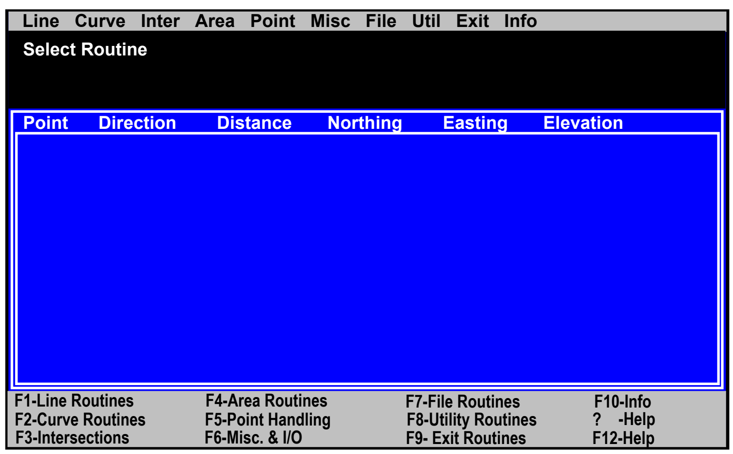
5.09 SURVEY 4.0'S MAIN WORK SCREEN

After your data file has loaded, you may be presented with one last prompt before the appearance of the Survey 4.0 main work screen. If the specified data file actually exists, i.e. it is not a new job, you are given the opportunity to save a ***backup data file***.

Save a backup coordinate file? (Yes/No)

Save a backup file by pressing Y, 1, or clicking your mouse on the word **Yes**. Otherwise, press N, 0, or click your mouse on the word **No**. Remember, anytime you save a backup file, any previously saved backup file is overwritten. It is also at this prompt that you have your last opportunity to quit the program before your COGO session begins. To do so, press Esc.

You should now see Survey 4.0's main work screen, a representation of which is shown below in Figure 5-5. The layout and navigation of the four areas of the work screen is covered in Section 4.01.



The Survey 4.0 Work Screen: Figure 5-5

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Survey 4.0
Simplicity Surveying Series

6.01 BEST FIT TO A LINE

Code: BF

Lite

Not available in Survey Lite

FUNCTION: The BEST FIT TO A LINE routine is used to compute the bearing and end point coordinates of a line which best fits the coordinates of any three or more known points.

Select Routine

To perform a best fit to a line, type **BF** at **Select Routine** or type **BF** at any point number prompt.

Point(s) for Best Fit

Type in individual point numbers or a point string(s) and press Enter after each entry.

Survey 4.0 will prompt for points until you press Enter without entering any additional points. Survey 4.0 will then print the point numbers entered, along with two additional, automatically numbered points which designate the end points of the "best fit" line. To print out the bearing and distance of the line, use the **Inverse** (**IN** - Section 6.03) or **Inverse Pair** (**IP** - Section 6.07) routine. You may view the points using the **View Coordinate Screen** routine (**VS** - Section 11.14)

USE CAUTION WHEN USING THIS ROUTINE!
This routine employs standard ***linear regression*** *formulas, and as such, the coordinates are computed with respect to your "**x**" values (Eastings).* **Best Fit** *works fine when your target line runs East-West,* ***but special provisions must be made for all other lines.*** *Data sets, other than East-West, should be rotated to an East-West line before solving.*

For example, when your target line runs North-South, this routine will not produce the desired result. However, if you rotate your coordinates 90° (or 100g) to the right, solve for the best fit, and then rotate your coordinates left 90° (or 100g), you will achieve the results you desire. Example 6.1 and Figure 6-1 illustrate the effect of rotation on a North-South target line.

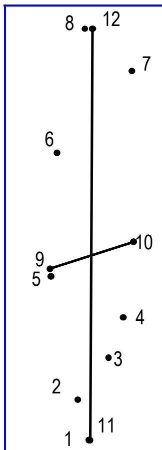
Given:

Point	Northing	Easting
Assign		
1	1000.0000	2000.0000
2	1100.0000	1975.0000
3	1200.0000	2045.0000
4	1300.0000	2080.0000
5	1400.0000	1910.0000
6	1700.0000	1925.0000
7	1900.0000	2100.0000
8	2000.0000	1990.0000

Compute a best fit line for points 1-8. The target line is assumed to run North-South. To illustrate the effects of rotation upon the data points, first compute an un-rotated solution defined by points 9 and 10. Now, using the Coordinate Translation routine, rotate points 1-8 to the right 90° and re-compute the solution defined by points 11 and 12, then rotate points 1-8, 11 and 12 back to the left 90°. Use the View Screen routine to see the final results for both solutions.

Point			Northing	Easting
Un-Rotated Solution				
9	1st Un-Rotated End Point		1419.4759	1910.0000
IN	N 71°51'07.7" E	199.946		
10	2nd Un-Rotated End Point		1481.7532	2100.0000
Rotated Solution				
11	1st Rotated End Point		1000.0000	1998.1888
IN	N 0°37'42.5" E	1000.060		
12	2nd Rotated End Point		2000.0000	2009.1582

Example 6.1



The effects of rotation become more and more evident as the target line approaches true North. Using the data from Example 6.1, the un-rotated solution produces the line from point 9 to point 10, clearly not the desired result. However, if we rotate points 1-8 to the right 90°, solve for the best fit, (defined by points 11 and 12), then rotate points 1-8, 11 and 12 back to the left 90°, our solution is more accurate.

Best Fit to Line: Figure 6-1

Survey 4.0
Simplicity Surveying Series

6.02 MEASURE AN ANGLE

Code: MA

Not available in Survey Lite

FUNCTION: The MEASURE AN ANGLE routine is used to compute and report the value of an angle defined by any three points of known coordinates. This routine may be called as a stand-alone routine, or as a computational tool when prompted for an angle or bearing.

OPTIONS

This routine may be used in two ways. ***Option 1*** *uses the routine to measure and report angles.* ***Option 2*** *uses this routine as a response to a* **Bearing** *prompt to measure an angle and use that angle as a response to the prompt.*

Option 1

Select Routine

To measure an angle, type **MA** at **Select Routine** or type **MA** Enter at any point number prompt.

Instrument at

Type in the number of the point occupied by the instrument and press Enter. This is the point at which you are measuring the angle.

Backsight to

Type in the backsight point and press Enter.

Sight Points

Type in each individual foresight point number and press Enter, or type in a point number string or a figure name, and press Enter. Survey 4.0 will respond to each accepted foresight point by printing the computed angle as turned to the right along with the distance between the occupied point and the foresight.

Option 2

Bearing

To measure an angle as a response to a **Bearing** prompt, type **MA** Enter.

Instrument at

Type in the number of the point theoretically occupied by the instrument and press Enter. This is the point at which you are measuring the angle.

Backsight to

Type in the theoretical backsight point and press Enter.

Sight Point

Type in the theoretical foresight point number and press Enter. If you enter a point string or defined figure, only the first point will be used. Survey 4.0 will respond to an accepted foresight point by using the computed angle (as turned to the right) as the response to the angle prompt.

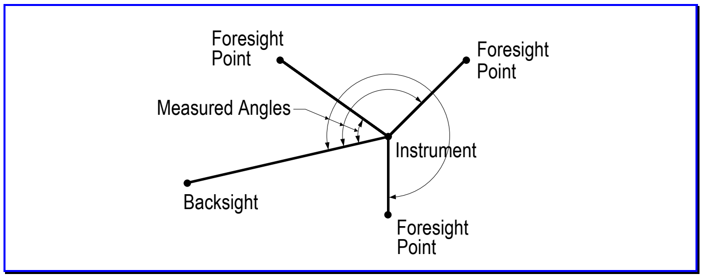
Given:

Point		Northing	Easting
Assign			
1	Instrument Point	1000.0000	2000.0000
2	Backsight Point	1100.0000	1975.0000
3	Foresight Point	1200.0000	2045.0000
4	Foresight Point	1300.0000	2080.0000
5	Foresight Point	1400.0000	1910.0000

With the instrument at point 1 and the backsight at point 2, measure the angles to points 3, 4 and 5.

Point		Northing	Easting
Measure Angle at point 1, backsighting point 2			
MA	AR 26°42'59.9"	205.000	Foresighting point 3
MA	AR 28°58'03.6"	310.483	Foresighting point 4
MA	AR 1°21'21.1"	410.000	Foresighting point 5

Example 6.2



Measure an Angle: Figure 6-2

Survey 4.0
Simplicity Surveying Series

6.03 INVERSE

Code: IN

FUNCTION: The INVERSE routine is used to compute and report the bearing, horizontal distance and difference in elevation between any two points of known coordinates.

Select Routine

To inverse between points, type **IN** at **Select Routine** or type **IN** [Enter] at any point number prompt.

Inverse from (P1) to

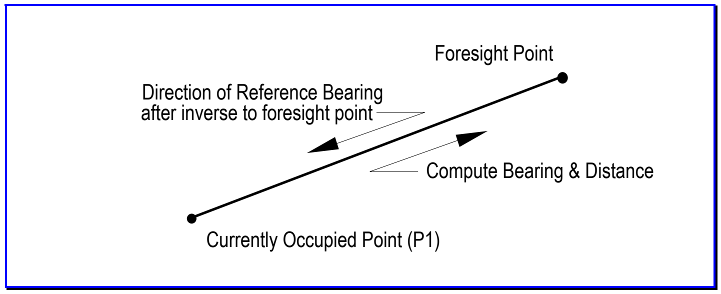
The variable **P1** represents the currently occupied point, which will be given in the prompt. This point may be the last point accessed by a previous calculation, or it may be set using the **Start At** (**ST** - Section 10.01) or the **Go To Point** (**GT** - Section 10.02) routines. Type in individual foresight point number(s), a point number string, or a defined figure name and press [Enter].

Survey 4.0 will respond to an accepted foresight point by printing the computed bearing and the horizontal and vertical distances from the currently occupied point to the foresight point, the foresight point number, ID, and coordinates. The foresight point becomes the currently occupied point **P1** and the reference bearing becomes the reverse of the bearing just inversed.

NOTES

1. To inverse all of your points consecutively, start at your lowest numbered point and inverse to [A] [Enter] *for All.*

2. To inverse from your point through a series of consecutive points, enter your ***Inverse To*** *point as the negative value of the last point number in the series. For example, you are at point 3 and you want to inverse to 4, 5, 6, 7, 8, 9, and 10. Respond to the prompt* ***Inverse from P1 to*** *with* **-10** [Enter].



Inverse: Figure 6-3

Given:

Point	Northing	Easting
Assign		
1	1000.0000	2000.0000
2	1100.0000	1975.0000
3	1200.0000	2045.0000
4	1300.0000	2080.0000
5	1400.0000	1910.0000

Inverse from point 1 through point 5.

Point			Northing	Easting
Start				
1			1000.0000	2000.0000
IN	N 14°02'10.5" W	103.078		
2			1100.0000	1975.0000
IN	N 34°59'31.3" E	122.066		
3			1200.0000	2045.0000
IN	N 19°17'24.2" E	105.948		
4			1300.0000	2080.0000
IN	N 59°32'04.0" W	197.231		
5			1400.0000	1910.0000

Example 6.3

Survey 4.0
Simplicity Surveying Series

6.04 DEFLECTION INVERSE

Code: DI

Not available in Survey Lite

FUNCTION: The DEFLECTION INVERSE routine is used to compute and report the deflection angle (from the forward extension of the previous bearing), horizontal distance and the difference in elevation between any two points of known coordinates.

Select Routine

To perform a deflection inverse, type `DI` at **Select Routine** or type `DI` Enter at any point number prompt.

Deflection Angle Inverse from (P1) to

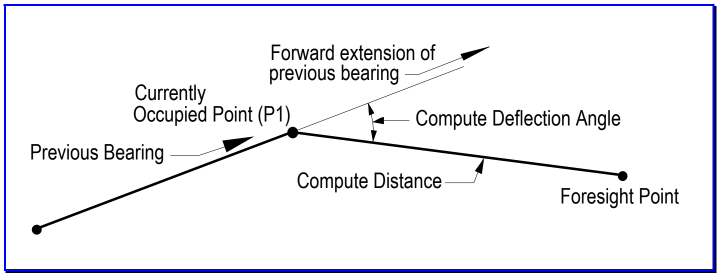
The variable **P1** represents the currently occupied point, which will be given in the prompt. This point may be the last point accessed by a previous calculation, or it may be set using the **Start At** (**ST** - Section 10.01) or the **Go To Point** (**GT** - Section 10.02) routines. Type in individual foresight point number(s), a point number string, or a defined figure name and press Enter.

Survey 4.0 will respond to an accepted foresight point by printing the deflection angle (from the forward extension of the previous bearing), and the horizontal and vertical distances from the currently occupied point to the foresight point, the foresight point number, ID, and coordinates. The foresight point becomes the currently occupied point **P1** and the reference bearing becomes the reverse of the bearing just inversed.

NOTES

1. To inverse all of your points consecutively, start at your lowest numbered point and inverse to A Enter *for All.*

2. To inverse from your point through a series of consecutive points, enter your ***Inverse To*** *point as the negative value of the last point number in the series. For example, you are at point 3 and you want to inverse to 4, 5, 6, 7, 8, 9, and 10. Respond to the prompt* ***Inverse from P1 to*** *with* `-10` Enter.



Deflection Inverse: Figure 6-4

Given:

Point	Northing	Easting
Assign		
1	1000.0000	2000.0000
2	1100.0000	1975.0000
3	1200.0000	2045.0000
4	1300.0000	2080.0000
5	1400.0000	1910.0000

Starting at 2 and backsighting point 1, perform a deflection inverse to points 3, 4 and 5.

Point			Northing	Easting
Start				
1			1000.0000	2000.0000
IN	N 14°02'10.5" W	103.078		
2			1100.0000	1975.0000
DI	DR 49°01'41.7"	122.066		
3			1200.0000	2045.0000
DI	DL 15°42'07.1"	105.948		
4			1300.0000	2080.0000
DI	DL 78°49'28.2"	197.231		
5			1400.0000	1910.0000

Example 6.4

Survey 4.0
Simplicity Surveying Series

6.05 FIELD DATA INVERSE

Code: FI

Lite

Not available in Survey Lite

FUNCTION: The FIELD DATA INVERSE routine is used to compute and report the field angle (as turned to the right from the previous backsight), horizontal distance and the difference in elevation between any two points of known coordinates.

Select Routine

To perform a field data inverse, type **FI** at **Select Routine** or type **FI** [Enter] at any point number prompt.

Inverse from (P1) to

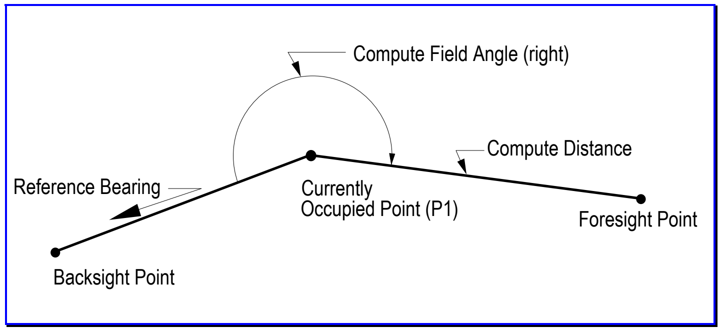
The variable **P1** represents the currently occupied point, which will be given in the prompt. This point may be the last point accessed by a previous calculation, or it may be set using the **Start At** (**ST** - Section 10.01) or the **Go To Point** (**GT** - Section 10.02) routines. Type in individual foresight point number(s), a point number string, or a defined figure name and press [Enter].

Survey 4.0 will respond to an accepted foresight point by printing the field angle (turned to the right from the previous backsight), and the horizontal and vertical distances from the currently occupied point to the foresight point, the foresight point number, ID, and coordinates. The foresight point becomes the currently occupied point **P1** and the reference bearing becomes the reverse of the bearing just inversed.

NOTES

1. To inverse all of your points consecutively, start at your lowest numbered point and inverse to [A] [Enter] *for All.*

2. To inverse from your point through a series of consecutive points, enter your ***Inverse To*** *point as the negative value of the last point number in the series. For example, you are at point 3 and you want to inverse to 4, 5, 6, 7, 8, 9, and 10. Respond to the prompt* ***Inverse from P1 to*** *with* `-10` [Enter].



Field Data Inverse: Figure 6-5

Given:

Point			Northing	Easting
Assign				
1			1000.0000	2000.0000
2			1100.0000	1975.0000
3			1200.0000	2045.0000
4			1300.0000	2080.0000
5			1400.0000	1910.0000

Starting at 2 and backsighting point 1, perform a field data inverse to points 3, 4 and 5.

Point			Northing	Easting
Start				
1			1000.0000	2000.0000
IN	N 14°02'10.5" W	103.078		
2			1100.0000	1975.0000
FI	AR 229°01'41.7"	122.066		
3			1200.0000	2045.0000
FI	AR 164°17'52.9"	105.948		
4			1300.0000	2080.0000
FI	AR 101°10'31.8"	197.231		
5			1400.0000	1910.0000

Example 6.5

Survey 4.0
Simplicity Surveying Series

6.06 Code: IF

INVERSE FIGURE

Not available in Survey Lite

FUNCTION: The INVERSE FIGURE routine is used to measure and report the bearings, horizontal distances and the difference in elevation between the points contained in a user-defined figure.

NOTE
This routine works with figures that are defined by the **Define Figure** *routine, (**DF** - Section 10.14).*

Select Routine

To inverse a defined figure, type **IF** at **Select Routine** or type **IF** Enter at any point number prompt.

Inverse Figure

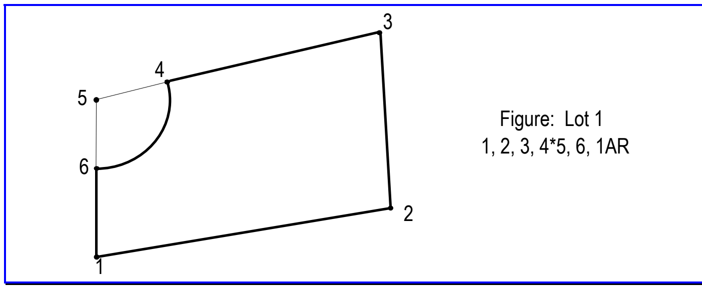
Type in the name of a defined figure and press Enter. You do not need to place an **F:** in front of the figure name, although there is no harm done if you do so.

Survey 4.0 will respond to an accepted name by inversing through the figure.

NOTES
1. If your figure is a closed figure, i.e. the first and last points are the same, and you have included provisions for printing the area, it will be printed at the conclusion of the figure inverse.

2. Figures can contain curves. See Section 10.14.

3. Figures can call other figures. Unfortunately, this feature also allows you to send your system into an endless loop as your first figure calls a second figure that calls a third figure that calls the first figure, and so on. Around and around and around you go, but how can you stop? The Shadow knows! (Just press Esc.)



Inverse Figure: Figure 6-6

Given:

Point			Northing	Easting
Assign				
1			1000.0000	2000.0000
2			1026.0899	2308.9002
3			1275.6040	2293.3211
4			1201.5654	2061.9086
5			1181.7582	2000.0000
6			1116.7582	2000.0000

Inverse the figure "Lot 1" as shown in Figure 6-6. Assign the coordinates using the point listing shown above. Use Define Figure (DF - Section 10.14) to assign the points to a figure name.

Point			Northing	Easting
Start				
1			1000.0000	2000.0000
IF	N 85°10'20.0" E	310.000		
2			1026.0899	2308.9002
IF	N 3°34'22.0" W	250.000		
3			1275.6040	2293.3211
IF	S 72°15'30.0" W	242.968		
4			1201.5654	2061.9086
IF				
5			1181.7582	2000.0000
	Central Angle	107° 44' 30.1"		
	Radius	65.000		
	Arc	122.229		
	Tangent	89.042		
	Chord	105.000		
	Chord Bearing	S 36° 07' 45.0" W		
6			1116.7582	2000.0000
IF	S 0°00'00.0" E	116.758		
1			1000.0000	2000.0000

Area = 61425.0229 Sq. Feet or 1.4101 Acres

Example 6.6

Survey 4.0

Simplicity Surveying Series

6.07 Code: IP

INVERSE PAIR

Not available in Survey Lite

FUNCTION: The INVERSE PAIR routine is used to compute and report the bearing, horizontal distance and the difference in elevation between any two random points of known coordinates.

Select Routine

To inverse a coordinate pair, type `IP` at **Select Routine** or type `IP` ↵Enter at any point number prompt.

Inverse Pair From

Type in an individual point number and press ↵Enter, or type in a pair of point numbers, separated by a comma or dash, and press ↵Enter.

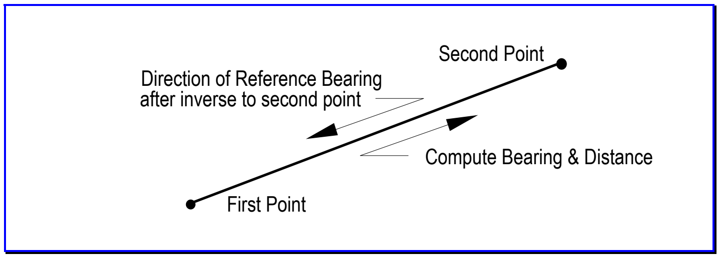
To

If you type in a single point number in response to the **From** prompt, you must now enter a **To** point. Type in an individual point number and press ↵Enter.

Survey 4.0 will respond to an accepted pair of points by printing the point number, ID and coordinates of the first point; the bearing, and the horizontal and vertical distances from the first point to the second point; and the point number, ID, and coordinates of the second point.

NOTE

*Upon leaving an **Inverse Pair** calculation, the second point becomes the currently occupied point and the reference bearing becomes the reverse of the bearing just inversed.*



Inverse Pair: Figure 6-7

Given:

Point			Northing	Easting
Assign				
1			1000.0000	2000.0000
2			1100.0000	1975.0000
4			1300.0000	2080.0000
5			1400.0000	1910.0000

Use Inverse Pair to find the bearings and distances between points 1 and 2, and points 4 and 5.

Point			Northing	Easting
Start Pair				
1			1000.0000	2000.0000
IP	N 14°02'10.5" W	103.078		
2			1100.0000	1975.0000
Start Pair				
4			1300.0000	2080.0000
IP	N 59°32'04.0" W	197.231		
5			1400.0000	1910.0000

Example 6.7

Survey 4.0 Simplicity Surveying Series

6.08 INVERSE WITH STATIONS

Code: IS

FUNCTION: The INVERSE WITH STATIONS routine is used to toggle a stationing mode on and off. When active, the stationing mode computes horizontal stationing data along your inversed course. Stationing always proceeds in an increasing fashion.

NOTE
Existing stations ***will not*** *be recomputed by this routine unless the station is first cleared using the* ***Clear Point Names*** *routine (CN - Section 10.12)*

Select Routine

To inverse with stations, type `IS` at **Select Routine** or type `IS` Enter at any point number prompt.

Inverse Stationing is On (Off)
Names Output is On (Off)

The `IS` command is actually a toggle switch. If the current status of the inverse with stations routine is **Off**, it will be turned **On** and vice versa.

After turning the stationing feature **On**, each straight leg (and/or arc) inversed will also have a station computed. This station will be carried along with the point as the ID for the point. Consequently, to begin with a particular station, you must assign a station value to your starting point by using the **Identify Point** routine (**ID** - Section 10.17), or use the **Start At** (**ST** - Section 10.01) or **Go To Point** (**GT** - Section 10.02) routine to place an existing station value into the computer's memory. Rules governing the entry of stationing are discussed in Section 3.03.

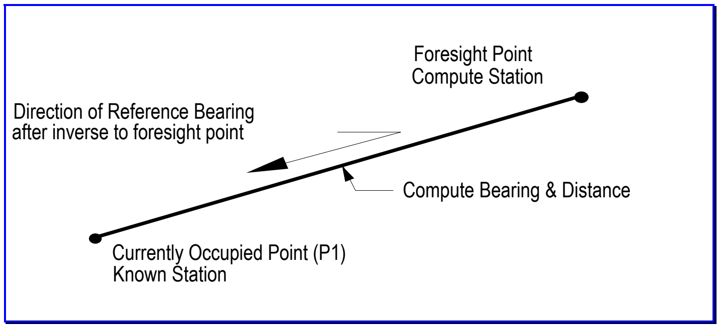
As is also the case with the **Traverse with Stations** mode (**TS** - Section 6.19), you should follow these steps to successfully begin your stationing:

1. Use the **Identify Point** routine (**ID** - Section 10.17) to set a station at your beginning point, if the point has not yet been stationed.

2. Turn on the stationing mode using the `IS` (`TS`, if traversing) command.

3. Use the **Start At** (**ST** - Section 10.01) or **Go To Point** (**GT** - Section 10.02) routine to set the initial point.

4. Use **Inverse** (**IN** - Section 6.03) or **Traverse** (**TR** - Section 6.14) to begin inversing or traversing.



Inverse with Stations: Figure 6-8

Given:

Point			Northing	Easting
Assign				
1	#0+00.000		1000.0000	2000.0000
2			1100.0000	1975.0000
3			1200.0000	2045.0000
4			1300.0000	2080.0000
5			1400.0000	1910.0000

Inverse with Stations from point 1 through point 5.

Point			Northing	Easting
Start				
1	#0+00.000		1000.0000	2000.0000
IN	N 14°02'10.5" W	103.078		
2	#1+03.078		1100.0000	1975.0000
IN	N 34°59'31.3" E	122.066		
3	#2+25.143		1200.0000	2045.0000
IN	N 19°17'24.2" E	105.948		
4	#3+31.091		1300.0000	2080.0000
IN	N 59°32'04.0" W	197.231		
5	#5+28.322		1400.0000	1910.0000

Example 6.8

Survey 4.0
Simplicity Surveying Series

6.09 RADIAL INVERSE

Code: RI

FUNCTION: The RADIAL INVERSE routine is functionally similar to the INVERSE routine (IN - Section 6.03), except the Currently Occupied Point is held constant throughout the routine. This routine computes and reports the bearing, horizontal distance and difference in elevation between the currently occupied point and a series or range of foresight points of known coordinates.

Select Routine

To perform a radial inverse, type **RI** at **Select Routine** or type **RI** ↵Enter at any point number prompt.

Radial Inverse from (P1) to

Type in the individual foresight point number(s), a point number string, the letter A (for all points), or a defined figure name and press ↵Enter. The variable **P1** represents the currently occupied point as shown in Figure 6-9. The actual point number will be given in the prompt.

Survey 4.0 will respond to an accepted foresight point by printing the computed bearing and the horizontal and vertical distances from the currently occupied point to the foresight point, the foresight point number, ID, and coordinates. The currently occupied point **P1** and the reference bearing are left unchanged.

This routine repeats until exited. Exit to **Select Routine** by pressing E ↵Enter at the above prompt.

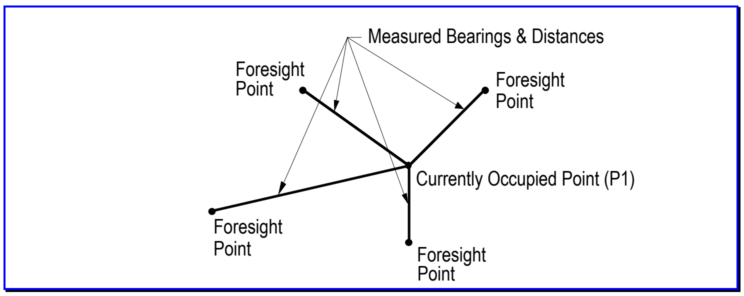
Given:

Point		Northing	Easting
Assign			
1	Foresight Point	1000.0000	2000.0000
2	Foresight Point	1100.0000	1975.0000
3	Instrument Point	1200.0000	2045.0000
4	Foresight Point	1300.0000	2080.0000
5	Foresight Point	1400.0000	1910.0000

With the instrument at point 3, perform a radial inverse to points 1, 2, 4 and 5.

Point			Northing	Easting
Start				
3	Instrument Point		1200.0000	2045.0000
RI	S 12°40'49.4" W	205.000	from Base Point 3	
1	Foresight Point		1000.0000	2000.0000
RI	S 34°59'31.3" W	122.066	from Base Point 3	
2	Foresight Point		1100.0000	1975.0000
RI	N 19°17'24.2" E	105.948	from Base Point 3	
4	Foresight Point		1300.0000	2080.0000
RI	N 34°01'09.7" W	241.299	from Base Point 3	
5	Foresight Point		1400.0000	1910.0000

Example 6.9



Radial Inverse: Figure 6-9

Survey 4.0
Simplicity Surveying Series

6.10 SLOPE INVERSE

Code: SI

Lite

Not available in Survey Lite

FUNCTION: The SLOPE INVERSE routine is used to compute and report the bearing, slope distance and the difference in elevation between any two random points of known coordinates.

Select Routine

To perform a slope inverse, type `SI` at **Select Routine** or type `SI` Enter at any point number prompt.

Slope Inverse from (P1) to

The variable **P1** represents the currently occupied point, which will be given in the prompt. This point may be the last point accessed by a previous calculation, or it may be set using the **Start At** (**ST** - Section 10.01) or the **Go To Point** (**GT** - Section 10.02) routine. Type in individual foresight point number(s), a point number string, or a defined figure name and press Enter.

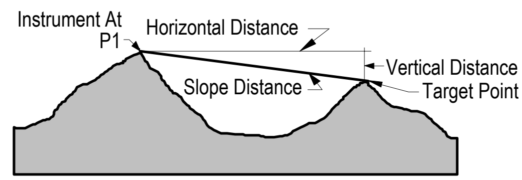
Survey 4.0 will respond to an accepted foresight point by printing the computed bearing and the slope and vertical distances from the currently occupied point to the foresight point, the foresight point number, ID, and coordinates. The foresight point becomes the currently occupied point **P1** and the reference bearing becomes the reverse of the bearing just inversed.

This routine repeats until exited. Exit to **Select Routine** by pressing E Enter at the above prompt.

NOTES

1. To inverse all of your points consecutively, start at your lowest numbered point and inverse to A Enter *for All.*

2. To inverse from your point through a series of consecutive points, enter your ***Inverse To*** *point as the negative value of the last point number in the series. For example, you are at point 3 and you want to inverse to 4, 5, 6, 7, 8, 9, and 10. Respond to the prompt* ***Inverse from P1 to*** *with* `-10` Enter.



Slope Inverse: Figure 6-10

Given:

Point	Northing	Easting	Elevation
Assign			
1	1000.0000	2000.0000	810.000
2	1100.0000	1975.0000	512.000
3	1200.0000	2045.0000	377.000
4	1300.0000	2080.0000	751.000
5	1400.0000	1910.0000	853.000

Inverse from point 1 through point 5, then slope inverse from points 1-5.

Point	Direction	Dist	Northing	Easting	Elevation
Start					
1			1000.0000	2000.0000	810.000
IN	N 14°02'10.5" W	103.078			-298.000
2			1100.0000	1975.0000	512.000
IN	N 34°59'31.3" E	122.066			-135.000
3			1200.0000	2045.0000	377.000
IN	N 19°17'24.2" E	105.948			374.000
4			1300.0000	2080.0000	751.000
IN	N 59°32'04.0" W	197.231			102.000
5			1400.0000	1910.0000	853.000
Start					
1			1000.0000	2000.0000	810.000
SI	N 14°02'10.5" W	315.324	Slope Distance		-298.000
2			1100.0000	1975.0000	512.000
SI	N 34°59'31.3" E	182.003	Slope Distance		-135.000
3			1200.0000	2045.0000	377.000
SI	N 19°17'24.2" E	388.717	Slope Distance		374.000
4			1300.0000	2080.0000	751.000
SI	N 59°32'04.0" W	222.045	Slope Distance		102.000
5			1400.0000	1910.0000	853.000

Example 6.10

Survey 4.0 Simplicity Surveying Series

6.11 RADIAL STAKE OUT

Code: RS

FUNCTION: The RADIAL STAKE OUT routine is used to compute and report an angle (as turned to the right, from a known backsight point), the horizontal distance and difference in elevation between the currently occupied point and a series or range of foresight points of known coordinates. The currently occupied point and backsight bearing are held constant throughout this routine.

Select Routine

To perform a radial stake out, type **RS** at **Select Routine** or type **RS** [Enter] at any point number prompt.

Instrument at

Type in the instrument point location and press [Enter].

Backsight to

Type in the number of the backsight point and press [Enter]. Survey 4.0 will respond to an accepted backsight location by printing the instrument and backsight points and their respective coordinates and the backsight bearing.

Max. Foresight Distance (<Enter> for none)

Type in the maximum foresight distance desired from this set up and press [Enter]. If you want all of the points in the data file to be included, press [Enter] without typing in any distance value.

Sight Points

Type in the individual foresight point number(s), a point number string, the letter [A] (for all points), or a defined figure name and press [Enter].

The program will respond to accepted foresight points by printing the angle right (as turned from the backsight) and the horizontal and vertical distances from the currently occupied point to the foresight point, the foresight point number, ID, and coordinates.

The **Sight Points** prompt will continue until you enter [E] or a valid routine code.

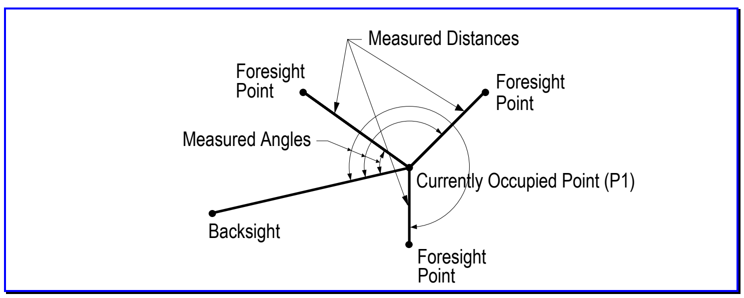
Given:

Point			Northing	Easting
Assign				
1	Instrument Point		1000.0000	2000.0000
2	Backsight Point		1100.0000	1975.0000
3	Foresight Point		1200.0000	2045.0000
4	Foresight Point		1300.0000	2080.0000
5	Foresight Point		1400.0000	1910.0000

With the instrument at point 1 and the backsight at point 2, perform a radial stake out to points 3, 4 and 5, with no maximum foresight distance.

Point			Northing	Easting
Radial Stake Out				
1	Instrument Point		1000.0000	2000.0000
2	Backsight Point		1100.0000	1975.0000
BS	N 14°02'10.5" W			
Sight Points				
3	Foresight Point		1200.0000	2045.0000
RS	AR 26°42'59.9"	205.000		
4	Foresight Point		1300.0000	2080.0000
RS	AR 28°58'03.6"	310.483		
5	Foresight Point		1400.0000	1910.0000
RS	AR 1°21'21.1"	410.000		

Example 6.11



Radial Stake Out: Figure 6-11

Survey 4.0
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6.12 SIDE SHOT

Code: SS

FUNCTION: The SIDE SHOT routine is similar to a Traverse routine in that it is used to compute the coordinates for a point(s) when given a bearing (or angle from a backsight) and a distance from the currently occupied point. Both the currently occupied point and the backsight bearing are held constant throughout the computation of all side shot points relative to a particular occupied point.

TRAVERSE ADJUSTMENT NOTE

Side shots are not handled within the traverse balancing routines, therefore you should balance your traverse data before entering any side shot information.

Select Routine

To set side shot points, type **SS** at **Select Routine** or type **SS** Enter at any point number prompt.

Side Shot from (P1) to

Type in the number for the foresight point you are shooting to and press Enter. The variable **P1** represents the currently occupied point as shown in Figure 6-12. The point number will be given in the prompt.

Enter a point ID up to 28 characters

If **Names Output** is on, or if you have manually indicated a name assignment (by including an **N** after the point number), you may enter a point name. Type in the name and press Enter, or select a predefined name by pressing one of the function keys. You may also press Alt L (or click your mouse on the **Last** button) to use the last point name, or press Alt P (or click your mouse on the **Point** button) to recall a name from another point. If you do not want to assign a name at this time, just press Enter.

Bearing

Type in a bearing, angle, deflection or azimuth in your pre-specified format, or recall a bearing between any two points in memory.

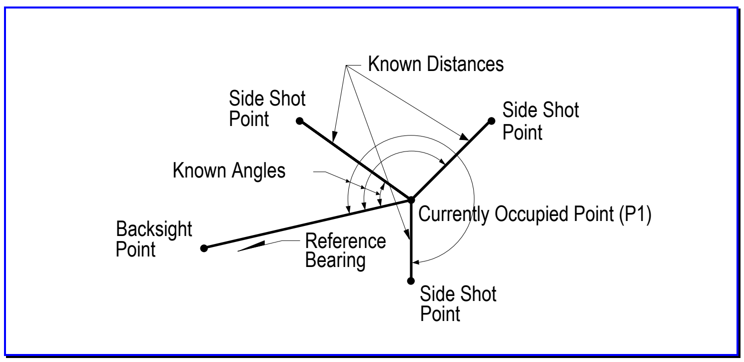
Distance

Type in the horizontal or slope distance from the currently occupied point to the foresight point and press Enter, or recall a distance between two existing points. If you are entering a slope distance and the automatic **Slope Angle** prompt is **Off**, place the letter S immediately after your distance entry, before you press Enter.

If the **Slope Angle** prompt is active, or if you have manually specified the entry of a slope distance, you will be prompted for data that is necessary for slope reduction according to the method you have specified on the Configuration Menu. See Section 3.11 for slope reduction instructions.

Following a correct distance entry, Survey 4.0 will print the bearing, horizontal and vertical distances from the currently occupied point to the side shot point, and also the point number, ID, and coordinates of the side shot point. The currently occupied point, **P1**, and the reference bearing remain unchanged.

This routine repeats until exited. Exit to **Select Routine** by pressing E Enter at the above prompt.



Side Shot: Figure 6-12

Given:

Point			Northing	Easting
Assign				
1	Backsight Point		1000.0000	2000.0000
2	Occupied Point		1100.0000	2250.0000
	1st Point	45°00'00" AR	75.00	
	2nd Point	125°00'00" AR	88.00	
	3rd Point	37°00'00" AR	125.00	

With the instrument at point 2 and the backsight at point 1, set the three side shots from the information given above.

Point			Northing	Easting
Start				
1	Backsight Point		1000.0000	2000.0000
IN	N 68°11'54.9" E	269.258		
2	Occupied Point		1100.0000	2250.0000
SS	N 66°48'05.1" W	75.000	from Base Point 2	
3			1129.5439	2181.0641
SS	N 13°11'54.9" E	88.000	from Base Point 2	
4			1185.6754	2270.0928
SS	N 74°48'05.1" W	125.000	from Base Point 2	
5			1132.7707	2129.3721

Example 6.12

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6.13 OFFSET

Code: OS

FUNCTION: The OFFSET routine is similar to a Side Shot routine in that it is used to compute the coordinates for a point(s) while holding both the currently occupied point and the backsight bearing. Offsets are set perpendicular to the current bearing.

TRAVERSE ADJUSTMENT NOTE
Offsets are not handled within the traverse balancing routines, therefore you should balance your traverse data before entering any offset information.

Select Routine

To set offset points, type **OS** at **Select Routine** or type **OS** Enter at any point number prompt.

Offset from (P1) to

Type in the number for the offset point you are shooting to and press Enter. The variable **P1** represents the currently occupied point as shown in Figure 6-13. The point number will be given in the prompt.

Offset Distance (- if offset left)

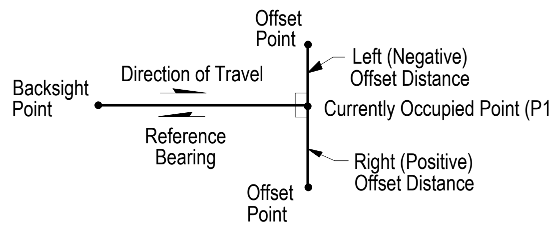
Type in the **HORIZONTAL** offset distance from the currently occupied point to the offset point and press Enter, or recall a distance between two existing points. If the offset point lies to the left of the occupied point, relative to a forward direction of travel, enter the offset distance as a negative value.

DEFINED OFFSET DISTANCES
If the ***Offset Define*** *routine (****OD*** *- Section 10.18) has been used to build an offset table, this routine will first automatically use the table values before allowing you to manually enter an offset distance. When this occurs, you* ***will not*** *receive the* ***Offset Distance*** *prompt.*

Following a correct offset entry, Survey 4.0 will print the bearing and distance to the offset point, the offset point number, ID and the coordinates.

SLOPE DISTANCES

Offsets cannot perform slope reductions. Use the **Side Shot** *routine (***SS** *- Section 6.12) for slope entries.*



Offset: Figure 6-13

Given:

Point			Northing	Easting
Assign				
1	Backsight Point		1000.0000	2000.0000
2	Occupied Point		1100.0000	2250.0000
	1st Offset	Left 40.00		
	2nd Offset	Right 60.00		

With the instrument at point 2 and the backsight at point 1, set the two offset points from the information given above.

Point			Northing	Easting
Start				
1	Backsight Point		1000.0000	2000.0000
IN	N 68°11'54.9" E	269.258		
2	Occupied Point		1100.0000	2250.0000
OS	N 21°48'05.1" W	40.000	from Base Point 2	
3	OS 40.000 L. @ Pt. 2		1137.1391	2235.1444
OS	N 21°48'05.1" E	60.000	from Base Point 2	
4	OS 60.000 R. @ Pt. 2		1044.2914	2272.2834

Example 6.13

Survey 4.0
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6.14 TRAVERSE

Code: TR

FUNCTION: The TRAVERSE routine is used to compute the coordinates of a new point along a line of known bearing and distance from the currently occupied point.

Select Routine

To traverse to a new point, type **TR** at **Select Routine** or type **TR** [Enter] at any point number prompt.

Traverse from (P1) to

Type in the number for the foresight point you are shooting to and press [Enter]. The variable **P1** represents the currently occupied point as shown in Figure 6-14. The point number will be given in the prompt.

Enter a point ID up to 28 characters

If **Names Output** is on, or if you have manually indicated a name assignment (by including an **N** after the point number), you may enter a point name. Type in the name and press [Enter], or select a predefined name by pressing one of the function keys. You may also press [Alt] [L] (or click your mouse on the **Last** button) to use the last point name, or press [Alt] [P] (or click your mouse on the **Point** button) to recall a name from another point. If you do not want to assign a name at this time, just press [Enter].

Bearing

Type in a bearing, angle, deflection or azimuth in your pre-specified format, or recall a bearing between any two points in memory.

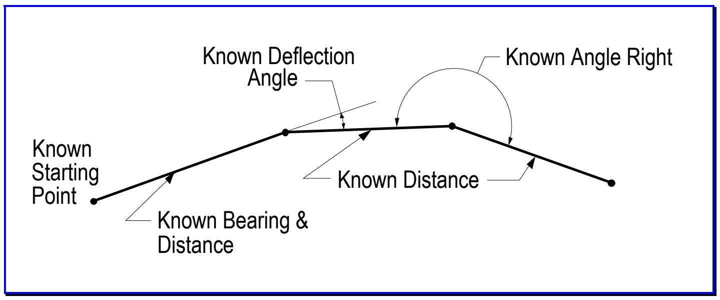
Distance

Type in the horizontal or slope distance from the currently occupied point to the foresight point and press [Enter], or recall a distance between two existing points. If you are entering a slope distance and the automatic **Slope Angle** prompt is **Off**, place the letter [S] immediately after your distance entry, before you press [Enter].

If the **Slope Angle** prompt is active, or if you have manually specified the entry of a slope distance, you will be prompted for data that is necessary for slope reduction according to the method you have specified on the Configuration Menu. See Section 3.11 for slope reduction instructions.

Following a correct distance entry, Survey 4.0 will print the bearing, horizontal and vertical distances from the currently occupied point to the foresight point, and also the point number, ID, and coordinates of the foresight point. The foresight point becomes the currently occupied point, and the reference bearing becomes the reverse of the bearing just traversed.

This routine repeats until exited. Exit to **Select Routine** by pressing E ↵Enter at the above prompt, or exit to another routine by entering a valid routine code.



Traverse: Figure 6-14

Given:

Point			Northing	Easting
Assign				
1	Occupied Point		1000.0000	2000.0000
	1st Point	N 68°00'00" E	270.000	
	2nd Point	13°24'00" DR	200.000	
	3rd Point	192°27'15" AR	145.000	

With the instrument at point 1 traverse to points 2, 3 and 4 from the information given above.

Point			Northing	Easting
Start				
1	Occupied Point		1000.0000	2000.0000
TR	N 68°00'00.0" E	270.000		
2			1101.1438	2250.3396
TR	N 81°24'00.0" E	200.000		
3			1131.0508	2448.0909
TR	S 86°08'45.0" E	145.000		
4			1121.3044	2592.7630

Example 6.14

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6.15 TRAVERSE STRAIGHT LINE

Code: SL

FUNCTION: The TRAVERSE STRAIGHT LINE routine is used to compute the coordinates of several points lying along the same bearing. While similar to the Traverse routine, the use of the TRAVERSE STRAIGHT LINE routine does not require the entry of additional bearings after the first bearing entry.

Select Routine

To traverse a straight line, type **SL** at **Select Routine** or type **SL** [Enter] at any point number prompt.

Traverse from (P1) to

Type in the number for the foresight point you are shooting to and press [Enter]. The variable **P1** represents the currently occupied point as shown in Figure 6-15. The point number will be given in the prompt.

Enter a point ID up to 28 characters

If **Names Output** is on, or if you have manually indicated a name assignment (by including an **N** after the point number), you may enter a point name. Type in the name and press [Enter], or select a predefined name by pressing one of the function keys. You may also press [Alt] [L] (or click your mouse on the **Last** button) to use the last point name, or press [Alt] [P] (or click your mouse on the **Point** button) to recall a name from another point. If you do not want to assign a name at this time, just press [Enter].

Bearing

Type in a bearing, angle, deflection or azimuth in your pre-specified format, or recall a bearing between any two points in memory.

Distance

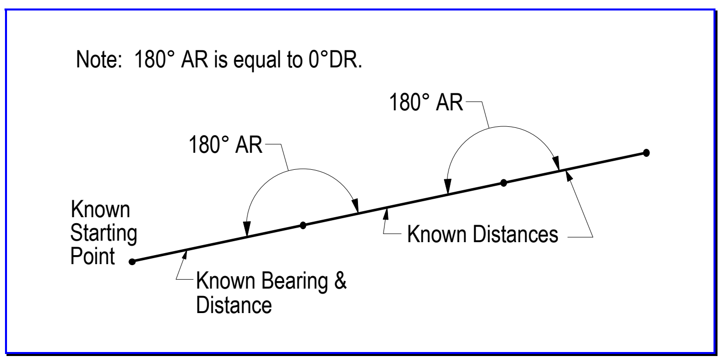
Type in the horizontal or slope distance from the currently occupied point to the foresight point and press [Enter], or recall a distance between two existing points. If you are entering a slope distance and the automatic **Slope Angle** prompt is **Off**, place the letter [S] immediately after your distance entry, before you press [Enter].

If the **Slope Angle** prompt is active, or if you have manually specified the entry of a slope distance, you will be prompted for data that is necessary for slope reduction according to the method you have specified on the Configuration Menu. See Section 3.11 for slope reduction instructions.

Following a correct distance entry, Survey 4.0 will print the bearing, horizontal and vertical distances from the currently occupied point to the foresight point, and also the point number, ID, and coordinates of the foresight point. The foresight point becomes the currently occupied point, and the reference bearing becomes the reverse of the bearing just traversed.

To continue traversing along the same bearing, type in the next point number and press Enter. Survey 4.0 will respond to an accepted point number by displaying the **Bearing** prompt with a response of a 0° deflection to the right (or left, if using the HP Code Set). The program will then continue with a **Distance** prompt. This sequence will continue until you exit the routine.

Exit to **Select Routine** by pressing E Enter, or exit to another routine by entering a valid routine code.



Traverse Straight Line: Figure 6-15

Given:

Point			Northing	Easting
Assign				
1	Occupied Point		1000.0000	2000.0000
	1st Point	N 68°00'00" E	270.000	
	2nd Point	0" DR	200.000	
	3rd Point	0" DR	145.000	

With the instrument at point 1 traverse a straight line to points 2, 3 and 4 from the information given above.

Point			Northing	Easting
Start				
1	Occupied Point		1000.0000	2000.0000
SL	N 68°00'00.0" E	270.000		
2			1101.1438	2250.3396
SL	N 68°00'00.0" E	200.000		
3			1176.0651	2435.7764
SL	N 68°00'00.0" E	145.000		
4			1230.3831	2570.2181

Example 6.15

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6.16 Code: TO

TRAVERSE WITH OFFSETS

FUNCTION: The TRAVERSE WITH OFFSETS routine is used to compute the coordinates of a new point along a line of known bearing and distance from the currently occupied point, and then set perpendicular offset points at the foresight point.

TRAVERSE ADJUSTMENT NOTE
Offsets are not handled within the traverse balancing routines, therefore you should balance your traverse data before entering any offset information.

Select Routine

To traverse with offsets, type TO at **Select Routine** or type TO [Enter] at any point number prompt.

Traverse with Offsets from (P1) to

Type in the number for the foresight point you are shooting to and press [Enter]. The variable **P1** represents the currently occupied point as shown in Figure 6-16. The point number will be given in the prompt.

Enter a point ID up to 28 characters

If **Names Output** is on, or if you have manually indicated a name assignment (by including an N after the point number), you may enter a point name. Type in the name and press [Enter], or select a predefined name by pressing one of the function keys. You may also press [Alt] [L] (or click your mouse on the **Last** button) to use the last point name, or press [Alt] [P] (or click your mouse on the **Point** button) to recall a name from another point. If you do not want to assign a name at this time, just press [Enter].

Bearing

Type in a bearing, angle, deflection or azimuth in your pre-specified format, or recall a bearing between any two points in memory.

Distance

Type in the horizontal or slope distance from the currently occupied point to the foresight point and press [Enter], or recall a distance between two existing points. If you are entering a slope distance and the automatic **Slope Angle** prompt is **Off**, place the letter S immediately after your distance entry, before you press Enter.

If the **Slope Angle** prompt is active, or if you have manually specified the entry of a slope distance, you will be prompted for data that is necessary for slope reduction according to the method you have specified on the Configuration Menu. See Section 3.11 for slope reduction instructions.

Following a correct distance entry, Survey 4.0 will print the bearing, horizontal and vertical distances from the currently occupied point to the foresight point, and also the point number, ID, and coordinates of the foresight point. The foresight point becomes the currently occupied point, and the reference bearing becomes the reverse of the bearing just traversed.

Offset from (P2) to

Type in the number for the offset point you are shooting to and press Enter. The variable **P2** represents the new currently occupied point (the old foresight point). The point number will be given in the prompt.

Offset Distance (- if offset left)

Type in the **HORIZONTAL** offset distance from the currently occupied point to the offset point and press Enter, or recall a distance between two existing points. If the offset point lies to the left of the occupied point, relative to a forward direction of travel, enter the offset distance as a negative value. *CAUTION: Recalled distances are always entered as positive values.*

DEFINED OFFSET DISTANCES

*If the **Offset Define** routine (**OD** - Section 10.18) has been used to build an offset table, this routine will automatically use the table values to set the offset points and you will not be able to manually enter an offset distance.*

If you are not using an offset table, the offset sequence of this routine allows only a single offset point to be set.

SLOPE DISTANCES

*Offsets cannot perform slope reductions. Use the **Side Shot** routine (**SS** - Section 6.12) for slope entries.*

Following a correct offset entry, Survey 4.0 will print the bearing and distance to the offset point, the offset point number, ID and the coordinates.

NAMING YOUR OFFSET POINTS

*Offsets points are automatically assigned a name, relative to the offset's base point. If you want to change the assigned name, use the **Identify Point** routine (**ID** - Section 10.17)*

Given:

Point				Northing	Easting
Assign					
1	Occupied Point			1000.0000	2000.0000
	Foresight at	N 68°11'54.9" E		269.258	
	1st Offset		Left 40.00		
	2nd Offset		Right 60.00		

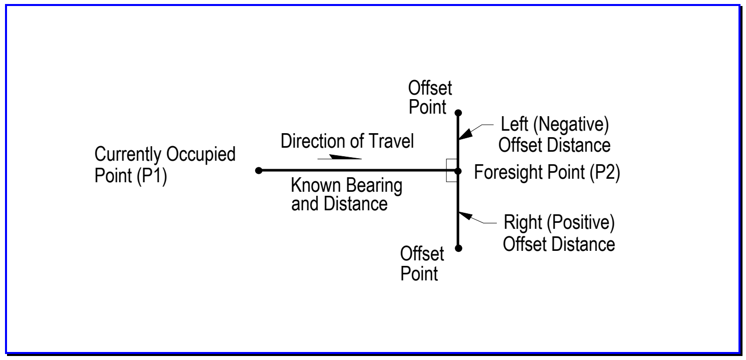
With the instrument at point 2 and the backsight at point 1, set the two offset points from the information given above. Use the Offset Define routine (OD - Section 10.18) to place the offset distances into a table.

Point			Northing	Easting
Start				
1	Occupied Point		1000.0000	2000.0000
TR	N 68°11'54.9" E	269.258		
2			1099.9999	2249.9998
OS	N 21°48'05.1" W	40.000	from Base Point 2	
3	OS 40.000 L. @ Pt. 2		1137.1390	2235.1441
OS	S 21°48'05.1" E	60.000	from Base Point 2	
4	OS 60.000 R. @ Pt. 2		1044.2913	2272.2832

Exit Offsets, resume at point

2		1099.9999	2249.9998

Example 6.16



Offset: Figure 6-16

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6.17 Code: TC

TRAVERSE CLOSE

FUNCTION: The TRAVERSE CLOSE routine is used to determine the length and direction of the linear error and the amount of angular error in a traverse. This routine must be used prior to traverse adjustment routines.

PROCEDURE FOR CLOSING TRAVERSES

1. Use the **Start At** *routine (**ST** - Section 10.01) to establish the known starting point.*

2. If the reference bearing into the starting point has not been set, use the **Enter Backsight Bearing** *routine (**EB** - Section 10.03).*

3. Use the **Traverse** *routine (**TR** - Section 6.14) to set points along the traverse path.*

4. Use the **Inverse** *routine (**IN** - Section 6.03) to move along the traverse path between established points.*

*5. When you reach the point **IMMEDIATELY BEFORE** the last leg (or closing leg) is to be entered, continue with the instructions below. For example, on a closed traverse from point* **1** *to* **2** *to* **3** *to* **4** *and back to point* **1***, when you reach point* **4***, you must call the* **Traverse Close** *routine.*

Select Routine or **Traverse from (P1) to**

To close a traverse, type **TC** at **Select Routine** or type **TC** [Enter] at any point number prompt. The variable **P1** represents the currently occupied point. The point number will be given in the prompt.

Close To Point

Type in the number of the closing point you are shooting to and press [Enter].

Bearing

Type in a bearing, angle, deflection or azimuth in your pre-specified format, or recall a bearing between any two points in memory.

Distance

Type in the horizontal or slope distance from the currently occupied point to the closing point and press Enter, or recall a distance between two existing points. If you are entering a slope distance and the automatic **Slope Angle** prompt is **Off**, place the letter S immediately after your distance entry, before you press Enter.

If the **Slope Angle** prompt is active, or if you have manually specified the entry of a slope distance, you will be prompted for data that is necessary for slope reduction according to the method you have specified on the Configuration Menu. See Section 3.11 for slope reduction instructions.

Following a correct distance entry, Survey 4.0 will print the bearing, horizontal and vertical distances from the currently occupied point to the calculated closing point, and also the coordinates of the calculated closing point. The program will then inverse the closing bearing and distance from the calculated closing point to the actual closing point. The **Precision Ratio**, **Length Traversed**, **Length To Close**, **Error in Latitude**, **Error in Departure**, **Error in Elevation** and the **Area**, in a closed traverse, are also reported.

If your traverse is a ***closed*** traverse (the starting and ending point numbers are the same), continue with the next prompt. If your traverse is an ***open*** traverse (the starting point and the ending point numbers are different), skip the next prompt and paragraph and continue at the **Enter the Closing Foresight Pt** prompt.

Enter angle RIGHT at Pt. (P1)
Backsighting Pt. (P4)
Foresighting Pt. (P2)
Press <Enter> if unknown

With the theodolite at point **P1**, type in the angle (as turned to the right) from the backsight point **P4** to the foresight point **P2**, and press Enter. The actual point numbers will be given in the prompt. If you do not know this angle, simply press Enter, ***however, in a closed traverse you must enter this angle for accurate angle balancing.*** Refer to Figure 6-17 for a visual representation of this angle.

Enter the Closing Foresight Pt
Press <Enter> if unknown

Type in a closing foresight point number (P5) and press ↵Enter. The foresight point may or may not be a point on the traverse, but it must be a known point if you choose to enter a number. If you did not turn an angle to a closing foresight point, simply press ↵Enter, ***however, in an open traverse you must enter this angle for accurate angle balancing.*** Refer to Figure 6-17 for a visual representation of the closing foresight point.

Enter Closing angle
RIGHT at Pt. (P1)
Backsighting Pt. (P4)
To the fixed Foresight
Press <Enter> if unknown

With the theodolite at point **P1**, type in the angle (as turned to the right) from the backsight point **P4** to the closing foresight point (P5), and press ↵Enter. The actual point numbers will be given in the prompt. If you do not know this angle, simply press ↵Enter. Refer to Figure 6-17 for a visual representation of this angle.

Adjust this traverse? (Yes/No)

Press Y, 1 or click your mouse on the word **Yes** to balance the traverse. Press N, 0 or click your mouse on the word **No** to return to **Select Routine**. If you continue the balancing procedure, you will be presented with the **Total Angular Error** and the **Error per Station**. You may also briefly see the message **Building Traverse Key File** flash on your screen. The length of time the message appears is directly related to the length of your traverse and the speed of your computer. If you see an unrecognizable flash of a prompt, do not be alarmed, you haven't missed anything. The message is replaced with the **Adjustment Option Selection Box**.

< 1 >	**Balance Angles**
< 2 >	**Adjust by Compass Rule**
< 3 >	**Adjust by Crandall Rule**
< 4 >	**Adjust by Transit Rule**
< 5 >	**Edit Traverse File**
< 6 >	**Restore Unadjusted Coordinates**
< E >	**EXIT to Select Routine**

Select an Adjustment Option

On your first pass through the traverse adjustment options, Option 6, **Restore Unadjusted Coordinates**, will be dimmed. This simply means that the option is unavailable at this time because a backup file of unadjusted coordinates does not exist.

Option $\boxed{1}$
Balance Angles

To balance the traverse angles, press $\boxed{1}$ or click your mouse on the **< 1 >** in the **Adjustment Option Selection Box**.

NOTE
If there is no angular error, this option will be dimmed and inaccessible.

< 1 > Save a backup coordinate file
< 2 > Continue without a backup file
< 3 > EXIT this Routine

Survey 4.0 now provides you with an opportunity to create a backup file. The backup file is useful if you later find that you have made an error in traverse adjustment and wish to restore your original coordinate file. ***If you intend to try more than one adjustment method on your traverse, you must create a backup file now!*** To create a backup file, press $\boxed{1}$. Press $\boxed{2}$ to continue the angle balancing routine without a backup file. ***Remember, whenever you create a backup file, you overwrite any previous backup file.***

After you have made your choice regarding a backup file, Survey 4.0 will balance the angles and recompute the traverse. The new **Precision Ratio**, **Length Traversed**, **Length To Close**, **Error in Latitude**, **Error in Departure**, **Error in Elevation**, **Area**, and the **Total Angular Error** will be reported.

NOTE
Survey 4.0 balances angles equally per station. If you need to make weighted adjustments, or if you need to correct a particular station, select Option 5, ***Edit Traverse File****, from the* ***Adjustment Option Selection Box*** *prior to balancing angles. This option will allow you to edit and re-run the traverse file. See* ***Option*** $\boxed{5}$*,* ***Edit Traverse File****, for more information.*

Select an Adjustment Option

Once again, you will be presented with the **Adjustment Option Selection Box**. This time however, Option 1, **Balance Angles**, and Option 5, **Edit Traverse File**, will be unavailable. If you did not save a backup file before balancing angles, Option 6, **Restore Unadjusted Coordinates**, will also be unavailable.

Option 2

Adjust by Compass Rule

To balance the traverse using the **Compass Rule** (or ***Bowditch method***), press 2 or click your mouse on the **< 2 >** in the **Adjustment Option Selection Box**.

Option 3

Adjust by Crandall Rule

To balance the traverse using the **Crandall Rule**, press 3 or click your mouse on the **< 3 >** in the **Adjustment Option Selection Box**.

Option 4

Adjust by Transit Rule

To balance the traverse using the **Transit Rule**, press 4 or click your mouse on the **< 4 >** in the **Adjustment Option Selection Box**.

All Adjustment Options

Balance Elevations (Yes/No)

If your traverse contains a closing error in elevation, you will be given the opportunity to balance the elevations at the same time as the horizontal legs of the traverse are balanced. Press Y, 1, or click your mouse on the word **Yes** to balance the elevations, otherwise press N, 0, or click your mouse on the word **No**. If your traverse does not contain an elevation error, you will not receive this prompt.

NOTE

Survey 4.0 balances elevations proportionally. The correction per foresight station is proportional to the length of the incoming leg divided by the length of the total traverse. If you do not want proportional balancing, you will have to manually balance your elevations at a later time.

Select an Adjustment Option

After selecting your adjustment method, Survey 4.0 will compute the balanced traverse and print out the results. Once again, you will be presented with the **Adjustment Option Selection Box**. This time however, only Option 6, **Restore Unadjusted Coordinates**, and Option 7, **EXIT to Select Routine** are available. Remember, Option 6 will only be available if you have previously elected to save a backup file.

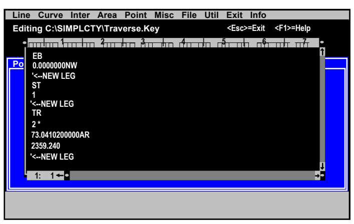
If you are satisfied with the results of the traverse balancing, select Option 7 by pressing [7] or by clicking your mouse on the **< 7 >** in the **Adjustment Option Selection Box**. If you want to try a different adjustment method, and Option 6 is available, press [6] or click your mouse on the **< 6 >** in the **Adjustment Option Selection Box**.

Restore Backup File from *date* at *time* (Yes/No)

If you are recomputing your traverse adjustment, press [Y], [1], or click your mouse on the word **Yes**. To return to **Select Routine**, press [N], [0], or click your mouse on the word **No**. The ***date*** and ***time*** of your last back up operation will be given in the prompt. If you elect to continue, your original traverse will be restored and you will be returned to the **Enter angle RIGHT at Pt. (P1)** prompt as shown on page 106.

Option [5]
Edit Traverse File

If your initial closure indicates a large error, you may need to edit and re-run your traverse. Select Option 5 by pressing [5], or by clicking your mouse on the **< 5 >** in the **Adjustment Option Selection Box**. The **Editor** window will open.



Following the ***S4-Edit*** instructions presented in Section 16, edit your traverse entries in the editor window. For help with editor key presses, press [F1]. When you have finished entering your traverse, press (or click your mouse on) [Esc] to exit the editor.

To avoid errors caused by not including enough information, or by including too much information, we strongly suggest that you limit your traverse editing to the correction of existing entries. If you need to insert and/or delete a leg, you must be sure to include all of the necessary information. Use the checklist below and also the other entries in your traverse file as a guide. Remember to include:

- ❒ Routine codes;
- ❒ Point numbers (each followed by an asterisk);
- ❒ Angles or deflections left or right, or a bearing or azimuth;
- ❒ Angle codes (either with the angle or on their own line);

- ❒ Distances (either slope or horizontal);
- ❒ Point names (if you are using them);
- ❒ `'<-- NEW LEG` separator (not required, but useful to distinguish between your traversal legs.

NOTE
The Traverse.Key file does not contain any slope information. All distances in the file are, and must be horizontal distances. Any attempt to force feed slope data into this file will cause Survey 4.0 to suffer from massive indigestion. It just won't work. If you have a keystroke file, edit it and re-run it. Of course, you did read the keystroke file warnings in Section 3.13, right???

Save Changes?
< Y > Yes
< N > No
< A > Abandon Changes & Restart

To exit the editor and re-run your traverse file, press Y or click your mouse on the **< Y >**. To ignore your changes, press N or click your mouse on the **< N >**. If you have made a mistake in your editing and wish to re-edit the file, press A or click your mouse on **< A >**. Choosing to abandon and restart will cause the editing window to clear, close and then re-open.

After you have edited your traverse file and closed the editor, Survey 4.0 will re-run your traverse file and leave you at the **Enter angle RIGHT at Pt. (P1)** prompt as shown on page 106.

Option 6
Restore Unadjusted Coordinates

Restore Backup File from *date* at *time* (Yes/No)

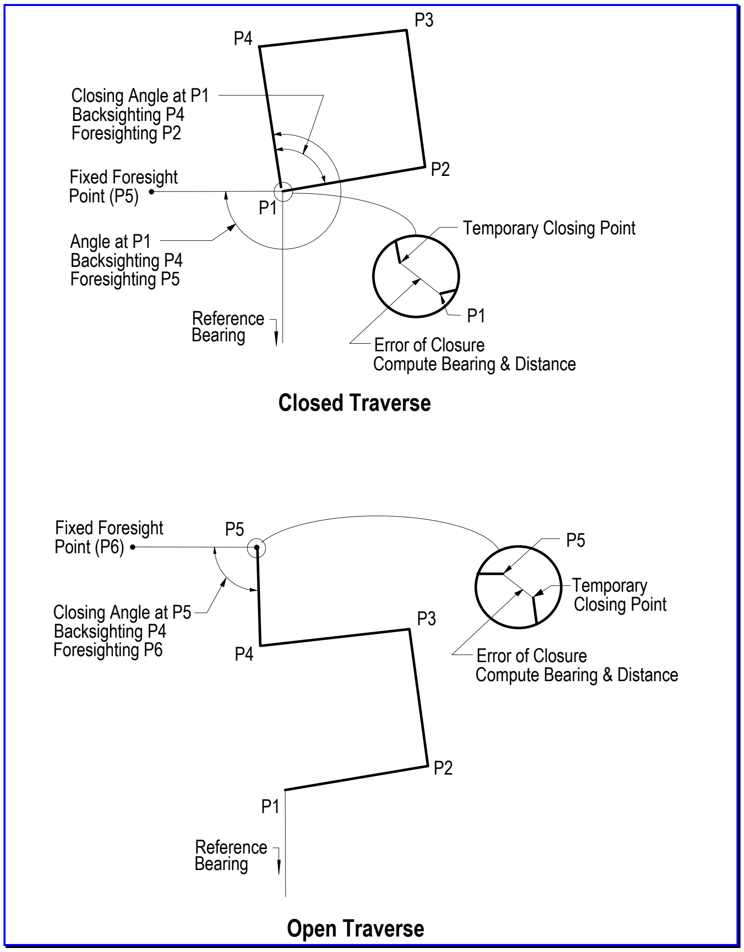
If, at any **Adjustment Option Selection Box**, you wish to restore your original traverse, press 6, or click your mouse on the **< 6 >**. Now press Y, 1, or click your mouse on the word **Yes** to restore your original file. To return to **Select Routine**, press N, 0, or click your mouse on the word **No**. The actual ***date*** and ***time*** of your last back up operation will be given in the prompt. If you elect to continue, your original traverse will be restored and you will be returned to the **Enter angle RIGHT at Pt. (P1)** prompt as shown on page 106.

Select Routine

If you choose **No** because you just wanted to continue without restoring your original coordinates, you may be wondering how you can continue. Simply press **TF** and you will return to the **Adjustment Option Selection Box**.

Keystroke examples for Open and Closed traverse closure and adjustment are contained in Section 19 - Examples.

Example 6.17



Traverse Closure: Figure 6-17

Survey 4.0
Simplicity Surveying Series

6.18 TRAVERSE RIGHT OF WAY

Code: RW

Lite
Not available in Survey Lite

FUNCTION: The TRAVERSE RIGHT OF WAY routine functions as a multiple offset intersection routine to lay out one or two lines parallel to a centerline.

BEFORE USING THIS ROUTINE
The **Traverse Right of Way** *routine requires an incoming bearing for the correct placement of the first pair of offset points. Unless changed, the bearing used is the last reference bearing. However, if you want the first pair of offset points set perpendicular to the bearing between your 1st and 2nd right-of-way points, use the* **Enter Backsight Bearing** *routine (**EB** - Section 10.03) to establish the reference bearing as the bearing from right-of-way point 1 to right-of-way point 2.*

Select Routine

To traverse a right of way, type **RW** at **Select Routine** or type **RW** [Enter] at any point number prompt.

Left Offset distance

Type in the left offset distance and press [Enter]. If you do not want to set a right-of-way line on the left side, just press [Enter]. The direction **Left**, refers to the position of the line with respect to the forward direction of travel.

Right Offset distance

Type in the right offset distance and press [Enter]. If you do not want to set a right-of-way line on the right side, just press [Enter]. The direction **Right**, refers to the position of the line with respect to the forward direction of travel.

Define R/W Centerline from (P1) to

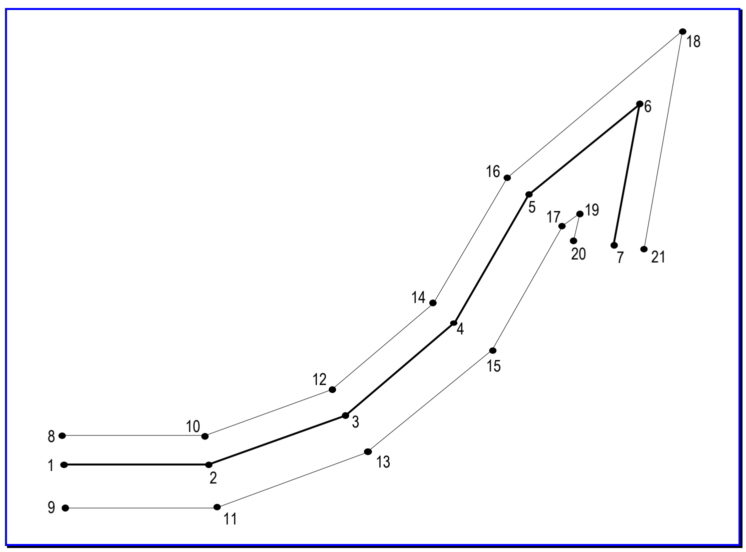
Type in individual point numbers, pressing [Enter] after each number. You may also type in a point string or a figure name and press [Enter]. The point **P1** represents the currently occupied point and the point number will be given in the prompt.

CAUTION - POINT RANGES

If you enter a point string or a figure name, you may experience some difficulty if the point string contains a point range. A point range is allowed, provided that the points are in ascending order. In other words, a range of **`1-8`** *will work, whereas a range of* **`8-1`** *will not work, because the points are in descending order. This ascending order requirement affects only point ranges. A point string of* **`6,5,4,3,2,1`** *works just as well as* **`1,2,3,4,5,6`**.

Survey 4.0 will respond to each accepted right-of-way point by computing and printing the offset point coordinates and a point name. Offset point numbers are automatically assigned.

Exit this routine at the **Define R/W Centerline** prompt by pressing Enter without entering a point number, or by entering a valid routine code. A final pair of offset points will be computed and printed before the routine ends. To set this final pair perpendicular to the last bearing, Survey 4.0 assumes a foresight to the previous backsight point. For example, in Figure 6-18, the point pair at point 7 is set by assuming that the final foresight lies from point 7 back to point 6.



Traverse Right of Way: Figure 6-18

Given:

Point	Northing	Easting
Assign		
1	1000.0000	2000.0000
2	1000.0000	2200.0000
3	1068.4040	2387.9385
4	1196.9616	2541.1474
5	1370.1666	2641.1474
6	1498.7242	2794.3563
7	1301.7626	2759.6267

Given a left offset of 40 and a right offset of 60, compute the right-of-way lines for points 1-7.

Point		Northing	Easting
Start			
1		1000.0000	2000.0000
Set parallel offset line(s)			
	Left offset = 40.000		
	Right offset = 60.000		
Right of Way offsets at point 1			
8	OS 40.000 L. @ Pt. 1	1040.0000	2000.0000
9	OS 60.000 R. @ Pt. 1	940.0000	2000.0000
Right of Way offsets at point 2			
10	OS 40.000 L. @ Pt. 2	1040.0000	2192.9469
11	OS 60.000 R. @ Pt. 2	940.0000	2210.5796
Right of Way offsets at point 3			
12	OS 40.000 L. @ Pt. 3	1103.5794	2367.6300
13	OS 60.000 R. @ Pt. 3	1015.6409	2418.4013
Right of Way offsets at point 4			
14	OS 40.000 L. @ Pt. 4	1223.0697	2510.0329
15	OS 60.000 R. @ Pt. 4	1157.7994	2587.8191
Right of Way offsets at point 5			
16	OS 40.000 L. @ Pt. 5	1396.2748	2610.0329
17	OS 60.000 R. @ Pt. 5	1331.0044	2687.8191
Right of Way offsets at point 6			
18	OS 40.000 L. @ Pt. 6	1600.0078	2852.8324
19	OS 60.000 R. @ Pt. 6	1346.7988	2706.6422
Right of Way offsets at point 7			
20	OS 60.000 L. @ Pt. 7	1312.1815	2700.5382
21	OS 40.000 R. @ Pt. 7	1294.8167	2799.0190

Example 6.18

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Survey 4.0
Simplicity Surveying Series

6.19 Code: TS

TRAVERSE WITH STATIONS

FUNCTION: The TRAVERSE WITH STATIONS routine is used to toggle a stationing mode on and off. When active, the stationing mode reports horizontal stationing data along your traversed course. Stationing always proceeds in an increasing fashion.

Select Routine

To traverse with stations, type `TS` at **Select Routine** or type `TS` Enter at any point number prompt.

Traverse Stationing is On (Off)
Names Output is On (Off)

The `TS` command is actually a toggle switch. If the current status of traverse stationing is **Off**, it will be turned **On** and vice versa.

After turning the stationing feature **On**, each straight leg (and/or arc) traverse will also have a station computed. This station will be carried along with the point as the ID for the point. Consequently, to begin with a particular station, you must assign a station value to your starting point by using the **Identify Point** routine (**ID** - Section 10.17), or use the **Start At** (**ST** - Section 10.01) or **Go To Point** (**GT** - Section 10.02) routine to place an existing station value into the computer's memory. Rules governing the entry of stationing are discussed in Section 3.03.

As is also the case with the **Inverse with Stations** mode (**IS** - Section 6.08), you should follow these steps to successfully begin your stationing:

1. Use the **Identify Point** routine (**ID** - Section 10.17) to set a station at your beginning point, if the point has not yet been stationed.

2. Turn on the stationing mode using the `TS` (`IS`, if inversing) command.

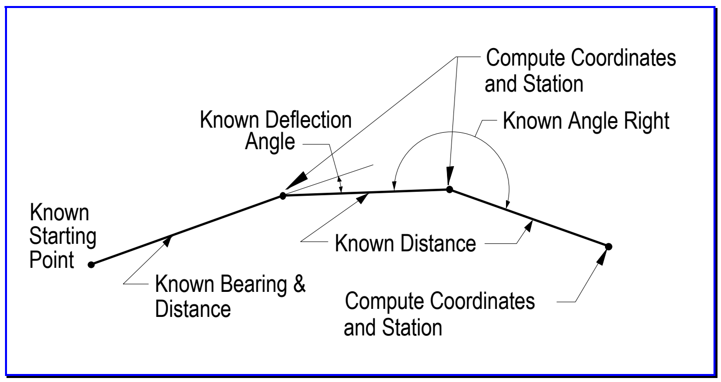
3. Use the **Start At** (**ST** - Section 10.01) or **Go To Point** (**GT** - Section 10.02) routine to set the initial point.

4. Use **Traverse** (**TR** - Section 6.14) or **Inverse** (**IN** - Section 6.03) to begin traversing or inversing.

Save the P.I. as a COGO point (Yes/No)

CURVES

The stationing routine handles horizontal curves in the Traverse Arc routine by assuming that the currently occupied point is the P.C. point. The P.I. point will be computed and printed, and you will be given the opportunity to save the P.I. point data. Press Y*,* 1 *or click your mouse on the word* **Yes** *to save the P.I. point. Otherwise, press* N*,* 0*, or click your mouse on the word* **No***. If saved, the P.I. point number will be the first available point number following the P.T. point number. Stationing of the P.T. will be computed by adding the length of curve to the P.C. station.*



Traverse with Stationing: Figure 6-19

MACROS

Macros cannot be used to set stationing. If you need to use a macro routine to set points, use the **Inverse with Stations** *routine (**IS** - Section 6.08) to set your stations.*

Given:

Point			Northing	Easting
Assign				
1	#0+00.000		1000.0000	2000.0000
	1st Point	N 68°00'00" E	270.000	
	2nd Point	13°24'00" DR	200.000	
	3rd Point	192°27'15" AR	145.000	

With the instrument at point 1, traverse with stationing to points 2, 3 and 4 from the information given above.

Point			Northing	Easting
Start				
1	#0+00.000		1000.0000	2000.0000
TR	N 68°00'00.0" E	270.000		
2	#2+70.000		1101.1438	2250.3396
TR	N 81°24'00.0" E	200.000		
3	#4+70.000		1131.0508	2448.0909
TR	S 86°08'45.0" E	145.000		
4	#6+15.000		1121.3044	2592.7630

Example 6.19

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Survey 4.0 Simplicity Surveying Series

7.01 Code: IC

INVERSE CURVE

FUNCTION: The INVERSE CURVE routine is used to calculate and report the measurement data along an acute circular arc, having a delta angle of less than 180° (or 200 grads). This routine calculates the central angle, arc length, chord, chord bearing, tangent and radius of a curve when given the coordinates of the point of curvature (P.C.), the circle's center point and the curve's end point. Be aware that all distances reported by this routine are horizontal distances, not slope distances.

NOTE

*This routine is for **acute** curves, those having a delta angle of less than 180° (or 200 grads). If you have an **obtuse** curve, those having a delta of greater than or equal to 180° (or 200 grads), use the **Inverse Obtuse Curve** routine (**OC** - Section 7.02).*

Select Routine

To inverse along an acute curve, type `IC` at **Select Routine** or type `IC` [Enter] at any point number prompt.

Inverse Curve from PC point (P1) thru Center point

The variable **P1** represents the currently occupied point. In this routine, **P1** is also the **PC** of the curve to be inversed, as shown in Figure 7-1. The actual **PC** point number will be given in the prompt. Type in the circle's center point number and press [Enter].

Inverse Curve from PC point (P1) thru Center point (P2) to point

Type in the point number of the curve end point and press [Enter]. Survey 4.0 will respond to an accepted end point by first checking for a radii match. If the measured difference in radii is greater than 0.01 feet, the message **Radii do not match**, will be briefly displayed and you will regain control at a **Select Routine** prompt.

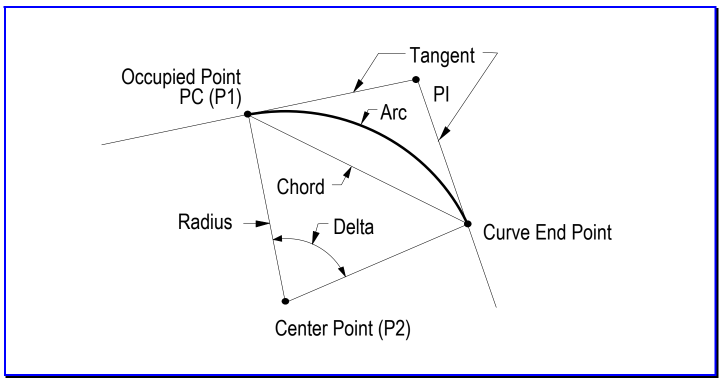
If the radii match successfully, the program will compute and print the Central Angle, Radius, Arc Length, Tangent, Chord and Chord Bearing from the PC to the end point. The end point will become the currently occupied point and the bearing from the end point to the center point becomes the reference bearing for use in the next calculation.

Point			Northing	Easting
Assign				
1	PC Point		1000.0000	2000.0000
2	Arc Center Point		1101.1438	2250.3396
3	Arc End Point		1307.9758	2076.7870

Inverse the acute curve formed by the three points given above.

Point			Northing	Easting
Start				
1	PC Point		1000.0000	2000.0000
IC				
2	Arc Center Point		1101.1438	2250.3396
	Central Angle	72°00'00.1"		
	Radius	270.000		
	Arc	339.292		
	Tangent	196.167		
	Chord	317.404		
	Chord Bearing	N 14°00'00.0" E		
3	Arc End Point		1307.9758	2076.7870

Example 7.1



Inverse Curve: Figure 7-1

Survey 4.0
Simplicity Surveying Series

7.02 Code: OC

INVERSE OBTUSE CURVE

FUNCTION: The INVERSE OBTUSE CURVE routine is used to calculate and report the measurement data along a circular arc having a delta of greater than or equal to 180° (or 200 grads). This routine calculates the central angle, arc length, chord, chord bearing, and radius of a curve when given the coordinates of the point of curvature (P.C.), the circle's center point and the circle's end point. Be aware that all distances reported by this routine are horizontal distances, not slope distances.

NOTE

*This routine is for **obtuse** curves, those having a delta of greater than or equal to 180° (or 200 grads). If you have an **acute** curve, those having a delta of less than 180° (or 200 grads), use the **Inverse Curve** routine (**IC** - Section 7.01).*

Select Routine

To inverse along an obtuse curve, type **OC** at **Select Routine** or type **OC** [Enter] at any point number prompt.

Inverse Obtuse Curve from PC point (P1) thru Center point

The variable **P1** represents the currently occupied point. In this routine, **P1** is also the **PC** of the curve to be inversed, as shown in Figure 7-2. The actual **PC** point number will be given in the prompt. Type in the circle's center point number and press [Enter].

Inverse Obtuse Curve from PC point (P1) thru Center point (P2) to point

Type in the point number of the curve end point and press [Enter]. Survey 4.0 will respond to an accepted end point by first checking for a radii match. If the measured difference in radii is greater than 0.01 feet, the message **Radii do not match**, will be briefly displayed and you will regain control at a **Select Routine** prompt.

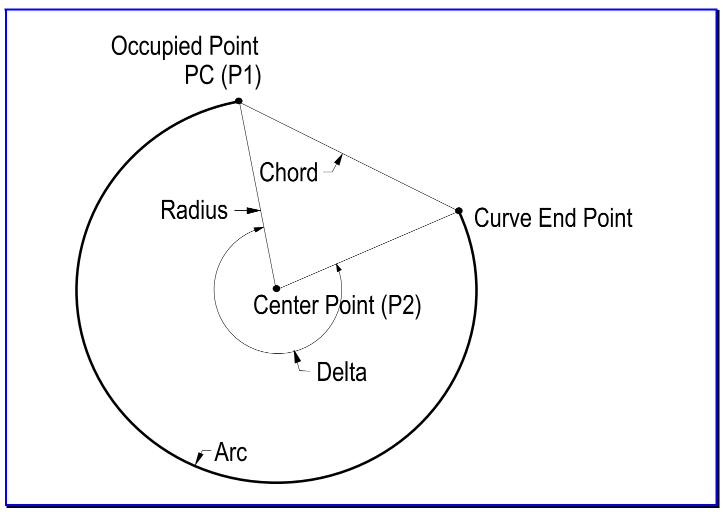
If the radii match successfully, the program will compute and print the Central Angle, Radius, Arc Length, (short) Chord and Chord Bearing from the PC to the end point. The end point will become the currently occupied point and the bearing from the end point to the center point becomes the reference bearing for use in the next calculation.

Point		Northing	Easting
Assign			
1	PC Point	1000.0000	2000.0000
2	Arc Center Point	1101.1438	2250.3396
3	Arc End Point	1307.9758	2076.7870

Inverse the obtuse curve formed by the three points given above.

Point		Northing	Easting
Start			
1	PC Point	1000.0000	2000.0000
OC			
2	Arc Center Point	1101.1438	2250.3396
	Central Angle 287°59'59.9"		
	Radius 270.000		
	Arc 1357.168		
	Chord 317.404		
	Chord Bearing N 14°00'00.0" E		
3	Arc End Point	1307.9758	2076.7870

Example 7.2



Inverse Obtuse Curve: Figure 7-2

Survey 4.0
Simplicity Surveying Series

7.03 INSCRIBE A TANGENT ARC FROM THE PC

Code: IA

FUNCTION: The INSCRIBE A TANGENT ARC FROM THE PC routine is used to compute the center point and end point of a tangent arc from a known PC.

NOTES

1. This routine is a macro program and is subject to the special data entry rules below:

- ***a. Point Overwrite Protection DOES NOT EXIST in macros.***
- *b. Use only point numbers, not names or the + or − keys. c. Required points must have been previously assigned coordinates.*
- *d. You can exit a macro routine at any prompt by entering E.*

2. The information prompted for in this routine is shown in Figure 7-3. This routine may be solved by any of the following criteria:

***Delta & Chord** known;*	***Chord & Tangent** known;*
***Delta & Arc** known;*	***Chord & Radius** known;*
***Delta & Tangent** known;*	***Arc & Radius** known;*
***Delta & Radius** known;*	***Tangent & Radius** known.*

Enter data for at least two of these known items. If you have additional data, you may enter it but it is not necessary to do so. Insufficient data will result in an incorrect solution.

*3. This routine assumes that the PC point is the currently occupied point. To establish a different point as the PC, use the **Start At** (**ST** - Section 10.01) or **Go To Point** (**GT** - Section 10.02) routine. **Remember, Start At clears the Traverse Length and Area Sum accumulators, and this routine will increment those values.***

Select Routine

To inscribe a tangent arc from the PC, type **IA** at **Select Routine** or type **IA** Enter at any point number prompt. Since this routine code is shared by other inscribe arc routines, a selection box will appear.

Select the type of arc to Inscribe
< 1 > Tangent from the P.C.
< 2 > Tangent from the P.I.
< 3 > Non-Tangent from the P.C.
< E > Exit Inscribe Arc

Select the first option, **Tangent from the PC**, by pressing 1 or by clicking your mouse on the **< 1 >** in the selection box.

Enter the Arc Center Point

Type in the desired point number and press Enter.

Enter the Arc End Point

Type in the desired point number and press Enter.

Enter the Delta Angle
(D.MMSS, <Enter> if unknown)

Type in the delta angle in a D.MMSS format and press Enter. If you do not know this value, just press Enter.

Enter the Chord Length
(<Enter> if unknown)

Type in the chord length and press Enter. If you do not know this value, just press Enter.

Enter the Arc Length
(<Enter> if unknown)

Type in the arc length and press Enter. If you do not know this value, just press Enter.

Enter the Tangent Length
(<Enter> if unknown)

Type in the tangent length and press Enter. If you do not know this value, just press Enter.

Enter the Radius Length
(<Enter> if unknown)

Type in the radius length and press Enter. If you do not know this value, just press Enter.

Enter Curve Direction
(0=Left 1=Right)

Press `0` Enter if the curve proceeds to the left, otherwise press `1` Enter. The direction of the curve is relative to the forward direction of travel.

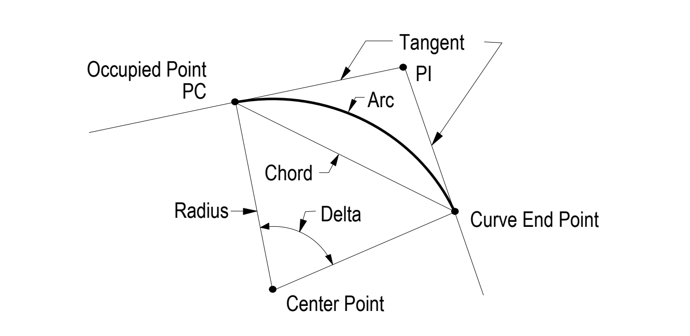
Survey 4.0 will respond to correct and sufficient data by computing the arc's center point and end point, and then printing the center point number and coordinates, the central angle, arc, radius, tangent, chord length and chord bearing; and the arc end point number and coordinates. You will be returned to **Select Routine**.

Point			Northing	Easting
Assign				
1	PC Point		1000.0000	2000.0000
10	Point on Tangent		814.5632	2074.9213
	Central Angle	72°00'00.0"		
	Radius	270.000		
	Direction of Curvature	Right		

Given the information above, Start At 10, Inverse to 1 (to set the tangent bearing), and then Inscribe a Tangent Arc from the PC to set points 2 and 3.

Point			Northing	Easting
Start				
10	Point on Tangent		814.5632	2074.9213
IN	N 22°00'00.0" W	200.000		
1	PC Point		1000.0000	2000.0000
Running Macro: TanPC				
Exit Side Shots, resume at point				
1	PC Point		1000.0000	2000.0000
IC				
2	Arc Center Point		1101.1437	2250.3397
	Central Angle	72°00'00.0"		
	Radius	270.000		
	Arc	339.292		
	Tangent	196.166		
	Chord	317.404		
	Chord Bearing	N 14°00'00.0" E		
3	Arc End Point		1307.9758	2076.7870

Example 7.3



Inscribe a Tangent Arc from the PC: Figure 7-3

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Survey 4.0 Simplicity Surveying Series

7.04 INSCRIBE A TANGENT ARC FROM THE PI

Code: IA

FUNCTION: The INSCRIBE A TANGENT ARC FROM THE PI routine is used to compute the PC, center point, and end point of a tangent arc from a known PI.

NOTES

1. This routine is a macro program and is subject to the special data entry rules below:

- ***a. Point Overwrite Protection DOES NOT EXIST in macros.***
- *b. Use only point numbers, not names or the + or − keys. c. Required points must have been previously assigned coordinates.*
- *d. You can exit a macro routine at any prompt by entering E.*

2. The information prompted for in this routine is shown in Figure 7-4. This routine may be solved by any of the following criteria:

***Delta & Chord** known;*	***Chord & Tangent** known;*
***Delta & Arc** known;*	***Chord & Radius** known;*
***Delta & Tangent** known;*	***Arc & Radius** known;*
***Delta & Radius** known;*	***Tangent & Radius** known.*

Enter data for at least two of these known items. If you have additional data, you may enter it but it is not necessary to do so. Insufficient data will result in an incorrect solution.

*3. This routine assumes that the PI point is the currently occupied point. To establish a different point as the PI, use the **Start At** (**ST** - Section 10.01) or **Go To Point** (**GT** - Section 10.02) routine. **Remember, Start At clears the Traverse Length and Area Sum accumulators, and this routine will increment those values.***

Select Routine

To inscribe a tangent arc from the PI, type **IA** at **Select Routine** or type **IA** Enter at any point number prompt. Since this routine code is shared by other inscribe arc routines, a selection box will appear.

Select the type of arc to Inscribe
< 1 > Tangent from the P.C.
< 2 > Tangent from the P.I.
< 3 > Non-Tangent from the P.C.
< E > Exit Inscribe Arc

Select the second option, **Tangent from the PI**, by pressing [2] or by clicking your mouse on the **< 2 >** in the selection box.

Enter the Arc PC Point

Type in the desired point number and press [Enter].

Enter the Arc Center Point

Type in the desired point number and press [Enter].

Enter the Arc End Point

Type in the desired point number and press [Enter].

Enter the Delta Angle
(D.MMSS, <Enter> if unknown)

Type in the delta angle in a D.MMSS format and press [Enter]. If you do not know this value, just press [Enter].

Enter the Chord Length
(<Enter> if unknown)

Type in the chord length and press [Enter]. If you do not know this value, just press [Enter].

Enter the Arc Length
(<Enter> if unknown)

Type in the arc length and press [Enter]. If you do not know this value, just press [Enter].

Enter the Tangent Length
(<Enter> if unknown)

Type in the tangent length and press [Enter]. If you do not know this value, just press [Enter].

Enter the Radius Length
(<Enter> if unknown)

Type in the radius length and press [Enter]. If you do not know this value, just press [Enter].

Enter Curve Direction
(0=Left 1=Right)

Press **0** [Enter] if the curve proceeds to the left, otherwise press **1** [Enter]. The direction of the curve is relative to the forward direction of travel.

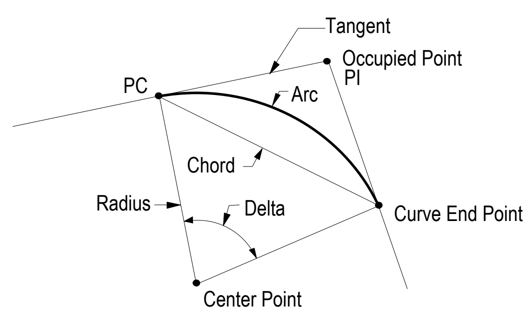
Survey 4.0 will respond to correct and sufficient data by computing the arc's P.C., center point, and end point; and then printing the P.C. point number and coordinates; the center point number and coordinates; the central angle, arc, radius, tangent, chord length and chord bearing; and the arc end point number and coordinates. You will be returned to **Select Routine**.

Point			Northing	Easting
Assign				
10	Point on Tangent		814.5632	2074.9213
11	PI of Arc		1181.8819	1926.5149
	Central Angle	72°00'00.0"		
	Chord	317.404		
	Direction of Curvature	Right		

Given the information above, Start At 10, Inverse to 11 (to set the tangent bearing), and then Inscribe a Tangent Arc from the PI to set points 1, 2 and 3.

Point			Northing	Easting
Start				
10	Point on Tangent		814.5632	2074.9213
IN	N 22°00'00.0" W	396.166		
11	PI of Arc		1181.8819	1926.5149
Running Macro: TanPI				
TR	S 22°00'00.0" E	196.166		
1	Arc PC		999.9995	2000.0002
Exit Side Shots, resume at point				
1	Arc PC		999.9995	2000.0002
IC				
2	Arc Center Point		1101.1433	2250.3398
	Central Angle	72°00'00.0"		
	Radius	270.000		
	Arc	339.292		
	Tangent	196.166		
	Chord	317.404		
	Chord Bearing	N 14°00'00.0" E		
3	Arc End Point		1307.9753	2076.7871

Example 7.4



Inscribe a Tangent Arc from the PI: Figure 7-4

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Survey 4.0
Simplicity Surveying Series

7.05 INSCRIBE A NON-TANGENT ARC FROM THE PC

Code: IA

FUNCTION: The INSCRIBE A NON-TANGENT ARC FROM THE PC routine is used to compute the center point and end point of a non-tangent arc from a known PC.

NOTES

1. This routine is a macro program and is subject to the special data entry rules below:

- ***a. Point Overwrite Protection DOES NOT EXIST in macros.***
- *b. Use only point numbers, not names or the + or − keys.*
- *c. Required points must have been previously assigned coordinates.*
- *d. You can exit a macro routine at any prompt by entering E.*

2. The information prompted for in this routine is shown in Figure 7-5. This routine may be solved by any of the following criteria:

***Delta & Chord** known;*	***Chord & Tangent** known;*
***Delta & Arc** known;*	***Chord & Radius** known;*
***Delta & Tangent** known;*	***Arc & Radius** known;*
***Delta & Radius** known;*	***Tangent & Radius** known.*

Enter data for at least two of these known items. If you have additional data, you may enter it but it is not necessary to do so. Insufficient data will result in an incorrect solution.

*3. This routine assumes that the PC point is the currently occupied point. To establish a different point as the PC, use the **Start At** (**ST** - Section 10.01) or **Go To Point** (**GT** - Section 10.02) routine. **Remember, Start At clears the Traverse Length and Area Sum accumulators, and this routine will increment those values.***

Select Routine

To inscribe a non-tangent arc from the PC, type `IA` at **Select Routine** or type `IA` Enter at any point number prompt. Since this routine code is shared by other inscribe arc routines, a selection box will appear.

Select the type of arc to Inscribe
< 1 > Tangent from the P.C.
< 2 > Tangent from the P.I.
< 3 > Non-Tangent from the P.C.
< E > Exit Inscribe Arc

Select the third option, **Non-Tangent from the PI**, by pressing [3] or by clicking your mouse on the **< 3 >** in the selection box.

Enter the Arc Center Point

Type in the desired point number and press [↵Enter].

Enter the Arc End Point

Type in the desired point number and press [↵Enter].

Enter the Delta Angle
(D.MMSS, <Enter> if unknown)

Type in the delta angle in a D.MMSS format and press [↵Enter]. If you do not know this value, just press [↵Enter].

Enter the Chord Length
(<Enter> if unknown)

Type in the chord length and press [↵Enter]. If you do not know this value, just press [↵Enter].

Enter the Arc Length
(<Enter> if unknown)

Type in the arc length and press [↵Enter]. If you do not know this value, just press [↵Enter].

Enter the Tangent Length
(<Enter> if unknown)

Type in the tangent length and press [↵Enter]. If you do not know this value, just press [↵Enter].

Enter the Radius Length
(<Enter> if unknown)

Type in the radius length and press [↵Enter]. If you do not know this value, just press [↵Enter].

Enter Curve Direction
(0=Left 1=Right)

Press `0` [↵Enter] if the curve proceeds to the left, otherwise press `1` [↵Enter]. The direction of the curve is relative to the forward direction of travel.

Enter the Chord Bearing
(D.MMSS w/No Quad Code)

Type in the chord bearing in a **D.MMSS** format (***without a quad code***) and press [↵Enter]. ***You cannot recall a bearing for this entry.***

Enter the Chord Bearing Quad
(1=NE, 2=SE, 3=SW, 4=NW, 5=AZ)

Type in the quad code number and press [↵Enter].

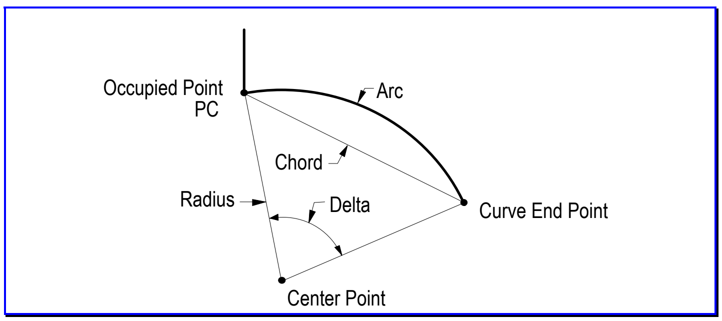
Survey 4.0 will respond to correct and sufficient data by computing the arc's center point and end point; and then printing the center point number and coordinates; the central angle, arc, radius, tangent, chord length and chord bearing; and the arc end point number and coordinates. You will be returned to **Select Routine**.

Point			Northing	Easting
Assign				
1	Arc PC		1000.0000	2000.0000
	Radius	270.000		
	Tangent	196.166		
	Chord Bearing	N 14°00'00.0" E		
	Direction of Curvature	Right		

Given the information above, Start At 1, and then Inscribe a Non-Tangent Arc from the PC to set points 2 and 3.

Point			Northing	Easting
Start				
1	Arc PC		1000.0000	2000.0000
Running Macro: NonTanPC				
TR	N 14°00'00.0" E	317.403		
3	Arc End Point		1307.9750	2076.7868
IN	S 14°00'00.0" W	317.403		
1	Arc PC		1000.0000	2000.0000
SS	N 68°00'00.0" E	269.999		
2	Arc Center Point		1101.1435	2250.3390
Exit Side Shots, resume at point				
1	Arc PC		1000.0000	2000.0000
IC				
2	Arc Center Point		1101.1435	2250.3390
	Central Angle	72°00'00.0"		
	Radius	269.999		
	Arc	339.291		
	Tangent	196.166		
	Chord	317.403		
	Chord Bearing	N 14°00'00.0" E		
3	Arc End Point		1307.9750	2076.7868

Example 7.5



Inscribe a Non-Tangent Arc from the PC: Figure 7-5

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Survey 4.0
Simplicity Surveying Series

7.06 INSCRIBE A TANGENT ARC FROM THE PC WITH OFFSETS

Code: IO

FUNCTION: The INSCRIBE A TANGENT ARC FROM THE PC WITH OFFSETS routine is used to compute the center point and end point of a tangent arc from a known PC, and then set radial offsets to the curve end point.

NOTES

1. This routine is a macro program and is subject to the special data entry rules below:

- ***a. Point Overwrite Protection DOES NOT EXIST in macros.***
- *b. Use only point numbers, not names or the + or − keys. c. Required points must have been previously assigned coordinates.*
- *d. You can exit a macro routine at any prompt by entering E.*

2. The information prompted for in this routine is shown in Figure 7-6. This routine may be solved by any of the following criteria:

***Delta & Chord** known;*	***Chord & Tangent** known;*
***Delta & Arc** known;*	***Chord & Radius** known;*
***Delta & Tangent** known;*	***Arc & Radius** known;*
***Delta & Radius** known;*	***Tangent & Radius** known.*

Enter data for at least two of these known items. If you have additional data, you may enter it but it is not necessary to do so. Insufficient data will result in an incorrect solution.

3. This routine assumes that the PC point is the currently occupied point. To establish a different point as the PC, use the **Start At** *(**ST** - Section 10.01) or* **Go To Point** *(**GT** - Section 10.02) routine.* ***Remember, Start At clears the Traverse Length and Area Sum accumulators, and this routine will increment those values.***

Select Routine

To inscribe a tangent arc from the PC and set offsets to the end point, type `IO` at **Select Routine** or type `IO` Enter at any point number prompt. Since this routine code is shared by other inscribe arc routines, a selection box will appear.

Select the type of arc to Inscribe
< 1 > Tangent from the P.C.
< 2 > Tangent from the P.I.
< 3 > Non-Tangent from the P.C.
< E > Exit Inscribe Arc

Select the first option, **Tangent from the PC**, by pressing 1 or by clicking your mouse on the **< 1 >** in the selection box.

Enter the Arc Center Point

Type in the desired point number and press ↵Enter.

Enter the Arc End Point

Type in the desired point number and press ↵Enter.

Enter the Delta Angle
(D.MMSS, <Enter> if unknown)

Type in the delta angle in a D.MMSS format and press ↵Enter. If you do not know this value, just press ↵Enter.

Enter the Chord Length
(<Enter> if unknown)

Type in the chord length and press ↵Enter. If you do not know this value, just press ↵Enter.

Enter the Arc Length
(<Enter> if unknown)

Type in the arc length and press ↵Enter. If you do not know this value, just press ↵Enter.

Enter the Tangent Length
(<Enter> if unknown)

Type in the tangent length and press ↵Enter. If you do not know this value, just press ↵Enter.

Enter the Radius Length
(<Enter> if unknown)

Type in the radius length and press ↵Enter. If you do not know this value, just press ↵Enter.

Enter Curve Direction
(0=Left 1=Right)

Press **0** ↵Enter if the curve proceeds to the left, otherwise press **1** ↵Enter. The direction of the curve is relative to the forward direction of travel.

Survey 4.0 will respond to correct and sufficient data by computing the arc's center point and end point, and then printing the center point number and coordinates, the central angle, arc, radius, tangent, chord length and chord bearing; and the arc end point number and coordinates.

Curve Offset from (P1) to

Type in the number of the offset point you are setting and press ↵Enter. The variable **P1** represents the curve end point as shown in Figure 7-6. The point number will be given in the prompt.

Curve Offset Distance (- if offset inside)

Type in the **HORIZONTAL** offset distance from the currently occupied point to the offset point and press Enter. If the offset point lies inside the arc, between the arc point and the center point, enter the offset distance as a negative value.

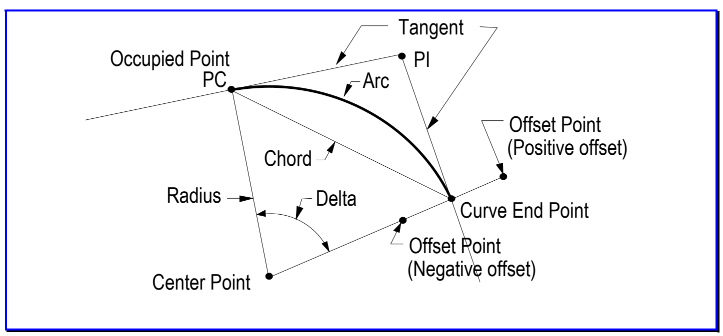
RECALLING DISTANCES

Recalled distances are always positive values. Do not use a recalled distance as an offset value if you need to enter the value as a negative number.

DEFINED OFFSET DISTANCES

Even if the **Offset Define** *routine (**OD** - Section 10.18) has been used to build an offset table, this routine will ignore the table and require you to manually enter offset distances. Entries are required because the sign of a curve offset value has a different meaning than that of a linear offset routine. In a curve offset, a negative value will be to an offset point INSIDE of the curve, toward the center point, and a positive value will be to an offset point OUTSIDE of the curve, away from the center point. This contrasts with linear offset routines in which negative and positive values indicate LEFT and RIGHT offsets.*

Following a correct offset entry, Survey 4.0 will print the bearing and distance to the offset point, the offset point number, ID and the coordinates.



Inscribe a Tangent Arc from the PC with Offsets: Figure 7-6

Point			Northing	Easting
Assign				
1	PC Point		1000.0000	2000.0000
10	Point on Tangent		814.5632	2074.9213
	Central Angle	72°00'00.0"		
	Radius	270.000		
	Direction of Curvature	Right		
	Offset Inside	30.000		
	Offset Outside	50.000		

Given the information above, Start At 10, Inverse to 1 (to set the tangent bearing), and then Inscribe a Tangent Arc from the PC to set points 2 and 3.

Point			Northing	Easting
Start				
10	Point on Tangent		814.5632	2074.9213
IN	N 22°00'00.0" W	200.000		
1	PC Point		1000.0000	2000.0000
Running Macro: OTanPC				
Exit Side Shots, resume at point				
1	PC Point		1000.0000	2000.0000
IC				
2	Arc Center Point		1101.1437	2250.3397
	Central Angle	72°00'00.0"		
	Radius	270.000		
	Arc	339.292		
	Tangent	196.166		
	Chord	317.404		
	Chord Bearing	N 14°00'00.0" E		
3	Arc End Point		1307.9758	2076.7870
CO	S 40°00'00.0" E	30.000	from Base Point 3	
4	OS 30.000 Inside Pt. 3		1284.9944	2096.0707
CO	N 40°00'00.0" W	50.000	from Base Point 3	
5	OS 50.000 Outside Pt. 3		1346.2780	2044.6476

Example 7.6

Survey 4.0
Simplicity Surveying Series

7.07 INSCRIBE A TANGENT ARC FROM THE PI WITH OFFSETS

Code: IO

FUNCTION: The INSCRIBE A TANGENT ARC FROM THE PI WITH OFFSETS routine is used to compute the PC, center point, and end point of a tangent arc from a known PI, and then set radial offsets to the curve end point.

NOTES

1. This routine is a macro program and is subject to the special data entry rules below:

- ***a. Point Overwrite Protection DOES NOT EXIST in macros.***
- *b. Use only point numbers, not names or the [+] or [-] keys. c. Required points must have been previously assigned coordinates.*
- *d. You can exit a macro routine at any prompt by entering [E].*

2. The information prompted for in this routine is shown in Figure 7-7. This routine may be solved by any of the following criteria:

***Delta & Chord** known;*	***Chord & Tangent** known;*
***Delta & Arc** known;*	***Chord & Radius** known;*
***Delta & Tangent** known;*	***Arc & Radius** known;*
***Delta & Radius** known;*	***Tangent & Radius** known.*

Enter data for at least two of these known items. If you have additional data, you may enter it but it is not necessary to do so. Insufficient data will result in an incorrect solution.

*3. This routine assumes that the PI point is the currently occupied point. To establish a different point as the PI, use the **Start At** (**ST** - Section 10.01) or **Go To Point** (**GT** - Section 10.02) routine. **Remember, Start At clears the Traverse Length and Area Sum accumulators, and this routine will increment those values.***

Select Routine

To inscribe a tangent arc from the PI and set offsets to the end point, type `IO` at **Select Routine** or type `IO` [Enter] at any point number prompt. Since this routine code is shared by other inscribe arc routines, a selection box will appear.

Select the type of arc to Inscribe
< 1 > Tangent from the P.C.
< 2 > Tangent from the P.I.
< 3 > Non-Tangent from the P.C.
< E > Exit Inscribe Arc

Select the second option, **Tangent from the PI**, by pressing 2 or by clicking your mouse on the **< 2 >** in the selection box.

Enter the Arc PC Point

Type in the desired point number and press Enter.

Enter the Arc Center Point

Type in the desired point number and press Enter.

Enter the Arc End Point

Type in the desired point number and press Enter.

Enter the Delta Angle (D.MMSS, <Enter> if unknown)

Type in the delta angle in a D.MMSS format and press Enter. If you do not know this value, just press Enter.

Enter the Chord Length (<Enter> if unknown)

Type in the chord length and press Enter. If you do not know this value, just press Enter.

Enter the Arc Length (<Enter> if unknown)

Type in the arc length and press Enter. If you do not know this value, just press Enter.

Enter the Tangent Length (<Enter> if unknown)

Type in the tangent length and press Enter. If you do not know this value, just press Enter.

Enter the Radius Length (<Enter> if unknown)

Type in the radius length and press Enter. If you do not know this value, just press Enter.

Enter Curve Direction (0=Left 1=Right)

Press **0** Enter if the curve proceeds to the left, otherwise press **1** Enter. The direction of the curve is relative to the forward direction of travel.

Survey 4.0 will respond to correct and sufficient data by computing the arc's P.C., center point, and end point; and then printing the P.C. point number and coordinates; the center point number and coordinates; the central angle, arc, radius, tangent, chord length and chord bearing; and the arc end point number and coordinates.

Curve Offset from (P1) to

Type in the number of the offset point you are setting and press Enter. The variable **P1** represents the curve end point as shown in Figure 7-7. The point number will be given in the prompt.

Curve Offset Distance (- if offset inside)

Type in the **HORIZONTAL** offset distance from the currently occupied point to the offset point and press ↵Enter. If the offset point lies inside the arc, between the arc point and the center point, enter the offset distance as a negative value.

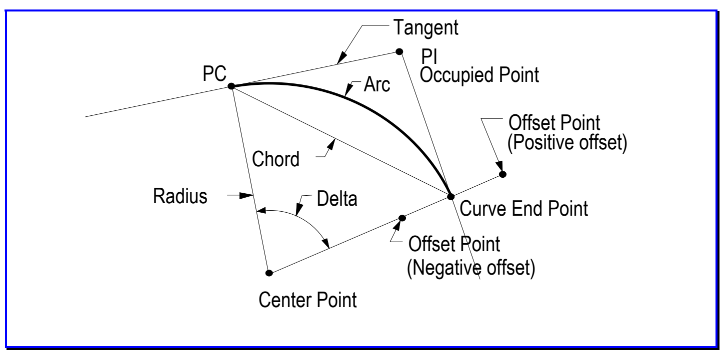
RECALLING DISTANCES

Recalled distances are always positive values. Do not use a recalled distance as an offset value if you need to enter the value as a negative number.

DEFINED OFFSET DISTANCES

Even if the **Offset Define** *routine (**OD** - Section 10.18) has been used to build an offset table, this routine will ignore the table and require you to manually enter offset distances. Entries are required because the sign of a curve offset value has a different meaning than that of a linear offset routine. In a curve offset, a negative value will be to an offset point INSIDE of the curve, toward the center point, and a positive value will be to an offset point OUTSIDE of the curve, away from the center point. This contrasts with linear offset routines in which negative and positive values indicate LEFT and RIGHT offsets.*

Following a correct offset entry, Survey 4.0 will print the bearing and distance to the offset point, the offset point number, ID and the coordinates.



Inscribe a Tangent Arc from the PI with Offsets: Figure 7-7

Point			Northing	Easting
Assign				
10	Point on Tangent		814.5632	2074.9213
11	PI of Arc		1181.8819	1926.5149
	Central Angle	72°00'00.0"		
	Chord	317.404		
	Direction of Curvature	Right		
	Offset Inside	30.000		
	Offset Outside	50.000		

Given the information above, Start At 10, Inverse to 11 (to set the tangent bearing), and then Inscribe a Tangent Arc from the PI to set points 1, 2 and 3.

Point			Northing	Easting
Start				
10	Point on Tangent		814.5632	2074.9213
IN	N 22°00'00.0" W	396.166		
11	PI of Arc		1181.8819	1926.5149
Running Macro: OTanPI				
TR	S 22°00'00.0" E	196.166		
1	Arc PC		999.9995	2000.0002
Exit Side Shots, resume at point				
1	Arc PC		999.9995	2000.0002
IC				
2	Arc Center Point		1101.1433	2250.3398
	Central Angle	72°00'00.0"		
	Radius	270.000		
	Arc	339.292		
	Tangent	196.166		
	Chord	317.404		
	Chord Bearing	N 14°00'00.0" E		
3	Arc End Point		1307.9753	2076.7871
CO	S 40°00'00.0" E	30.000	from Base Point 3	
4	OS 30.000 Inside @ Pt. 3		1284.9944	2096.0708
CO	N 40°00'00.0" W	50.000	from Base Point 3	
5	OS 50.000 Outside @ Pt. 3		1346.2775	2044.6478

Example 7.7

Survey 4.0
Simplicity Surveying Series

7.08 INSCRIBE A NON-TANGENT ARC FROM THE PC WITH OFFSETS

Code: IO

FUNCTION: The INSCRIBE A NON-TANGENT ARC FROM THE PC WITH OFFSETS routine is used to compute the center point and end point of a non-tangent arc from a known PC, and then set radial offsets to the curve end point.

NOTES

1. This routine is a macro program and is subject to the special data entry rules below:

a. Point Overwrite Protection DOES NOT EXIST in macros.

b. Use only point numbers, not names or the [+] or [-] keys. c. Required points must have been previously assigned coordinates.

d. You can exit a macro routine at any prompt by entering [E].

2. The information prompted for in this routine is shown in Figure 7-8. This routine may be solved by any of the following criteria:

***Delta & Chord** known;*	***Chord & Tangent** known;*
***Delta & Arc** known;*	***Chord & Radius** known;*
***Delta & Tangent** known;*	***Arc & Radius** known;*
***Delta & Radius** known;*	***Tangent & Radius** known.*

Enter data for at least two of these known items. If you have additional data, you may enter it but it is not necessary to do so. Insufficient data will result in an incorrect solution.

*3. This routine assumes that the PC point is the currently occupied point. To establish a different point as the PC, use the **Start At** (**ST** - Section 10.01) or **Go To Point** (**GT** - Section 10.02) routine. **Remember, Start At clears the Traverse Length and Area Sum accumulators, and this routine will increment those values.***

Select Routine

To inscribe a non-tangent arc from the PC and set offsets to the end point, type `IO` at **Select Routine** or type `IO` [Enter] at any point number prompt. Since this routine code is shared by other inscribe arc routines, a selection box will appear.

Select the type of arc to Inscribe
< 1 > Tangent from the P.C.
< 2 > Tangent from the P.I.
< 3 > Non-Tangent from the P.C.
< E > Exit Inscribe Arc

Select the third option, **Non-Tangent from the PI**, by pressing 3 or by clicking your mouse on the **< 3 >** in the selection box.

Enter the Arc Center Point

Type in the desired point number and press Enter.

Enter the Arc End Point

Type in the desired point number and press Enter.

Enter the Delta Angle
(D.MMSS, <Enter> if unknown)

Type in the delta angle in a D.MMSS format and press Enter. If you do not know this value, just press Enter.

Enter the Chord Length
(<Enter> if unknown)

Type in the chord length and press Enter. If you do not know this value, just press Enter.

Enter the Arc Length
(<Enter> if unknown)

Type in the arc length and press Enter. If you do not know this value, just press Enter.

Enter the Tangent Length
(<Enter> if unknown)

Type in the tangent length and press Enter. If you do not know this value, just press Enter.

Enter the Radius Length
(<Enter> if unknown)

Type in the radius length and press Enter. If you do not know this value, just press Enter.

Enter Curve Direction
(0=Left 1=Right)

Press `0` Enter if the curve proceeds to the left, otherwise press `1` Enter. The direction of the curve is relative to the forward direction of travel.

Enter the Chord Bearing
(D.MMSS w/No Quad Code)

Type in the chord bearing in a **D.MMSS** format (***without a quad code***) and press Enter. ***You cannot recall a bearing for this entry.***

Enter the Chord Bearing Quad
(1=NE, 2=SE, 3=SW, 4=NW, 5=AZ)

Type in the quad code number and press Enter.

Survey 4.0 will respond to correct and sufficient data by computing the arc's center point and end point; and then printing the center point number and coordinates; the central angle, arc, radius, tangent, chord length and chord bearing; and the arc end point number and coordinates.

Curve Offset from (P1) to

Type in the number of the offset point you are setting and press ↵Enter. The variable **P1** represents the curve end point as shown in Figure 7-8. The point number will be given in the prompt.

Curve Offset Distance (- if offset inside)

Type in the **HORIZONTAL** offset distance from the currently occupied point to the offset point and press ↵Enter. If the offset point lies inside the arc, between the arc point and the center point, enter the offset distance as a negative value.

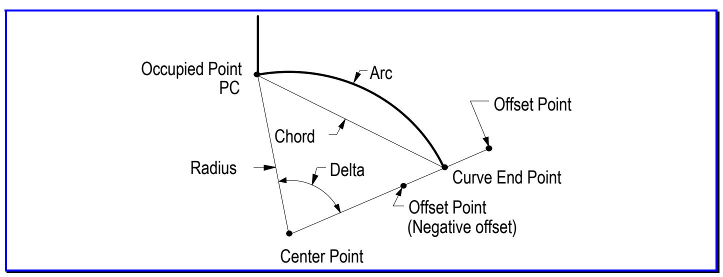
RECALLING DISTANCES

Recalled distances are always positive values. Do not use a recalled distance as an offset value if you need to enter the value as a negative number.

DEFINED OFFSET DISTANCES

Even if the **Offset Define** *routine (**OD** - Section 10.18) has been used to build an offset table, this routine will ignore the table and require you to manually enter offset distances. Entries are required because the sign of a curve offset value has a different meaning than that of a linear offset routine. In a curve offset, a negative value will be to an offset point INSIDE of the curve, toward the center point, and a positive value will be to an offset point OUTSIDE of the curve, away from the center point. This contrasts with linear offset routines in which negative and positive values indicate LEFT and RIGHT offsets.*

Following a correct offset entry, Survey 4.0 will print the bearing and distance to the offset point, the offset point number, ID and the coordinates.



Inscribe a Non-Tangent Arc from the PC with Offsets: Figure 7-8

Point			Northing	Easting
Assign				
1	Arc PC		1000.0000	2000.0000
	Radius	270.000		
	Tangent	196.166		
	Chord Bearing	N 14°00'00.0" E		
	Direction of Curvature	Right		
	Offset Inside	30.000		
	Offset Outside	50.000		

Given the information above, Start At 1, and then Inscribe a Non-Tangent Arc from the PC to set points 2 and 3.

Point			Northing	Easting
Start				
1	Arc PC		1000.0000	2000.0000
Running Macro: ONTanPC				
TR	N 14°00'00.0" E	317.403		
3	Arc End Point		1307.9750	2076.7868
IN	S 14°00'00.0" W	317.403		
1	Arc PC		1000.0000	2000.0000
SS	N 68°00'00.0" E	269.999		
2	Arc Center Point		1101.1435	2250.3390
Exit Side Shots, resume at point				
1	Arc PC		1000.0000	2000.0000
IC				
2	Arc Center Point		1101.1435	2250.3390
	Central Angle	72°00'00.0"		
	Radius	269.999		
	Arc	339.291		
	Tangent	196.166		
	Chord	317.403		
	Chord Bearing	N 14°00'00.0" E		
3	Arc End Point		1307.9750	2076.7868
CO	S 40°00'00.0" E	30.000	from Base Point 3	
4	OS 30.000 Inside @ Pt. 3		1284.9944	2096.0706
CO	N 40°00'00.0" W	50.000	from Base Point 3	
5	OS 50.000 Outside @ Pt. 3		1346.2780	2044.6476

Example 7.8

Survey 4.0
Simplicity Surveying Series

7.09 CURVE OFFSET

Code: CO

FUNCTION: The CURVE OFFSET routine is used to set radial offsets to a point on a curve

IMPORTANT

This routine requires that a curve be current in memory. *You may only run this routine* ***immediately*** *after setting or accessing a point through the* **Traverse Arc** *(TA - Section 7.11),* **Inverse Curve** *(IC - Section 7.01) or* **Inverse Obtuse Curve** *(OC - Section 7.02) routines. You must currently be in one of these routines to use the* **Curve Offset** *routine.*

Traverse Arc from (P1) to
or
Inverse (Obtuse) Curve from PC point (P1) thru Center point (P2) to point

To set curve offset points, type **CO** ↵Enter at the prompt for the next curve point.

Curve Offset from (P1) to

Type in the number of the offset point you are setting and press ↵Enter. The variable **P1** represents the currently occupied point as shown in Figure 7-9. The point number will be given in the prompt.

Curve Offset Distance
(- if offset inside)

Type in the **HORIZONTAL** offset distance from the currently occupied point to the offset point (P2)and press ↵Enter. If the offset point lies inside the arc, between the arc point and the center point, enter the offset distance as a negative value.

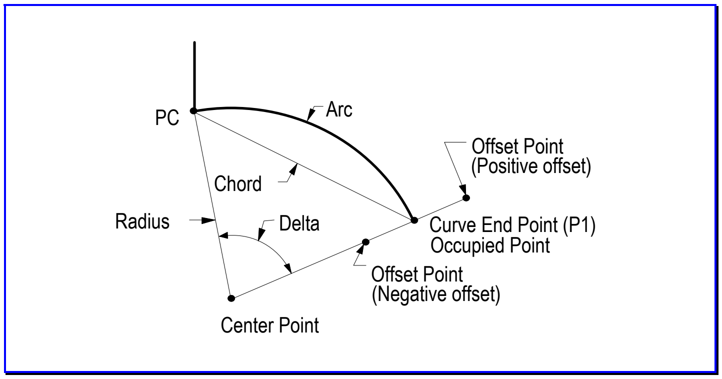
RECALLING DISTANCES

Recalled distances are always positive values. Do not use a recalled distance as an offset value if you need to enter the value as a negative number.

DEFINED OFFSET DISTANCES

Even if the **Offset Define** *routine (***OD** *- Section 10.18) has been used to build an offset table, this routine will ignore the table and require you to manually enter offset distances. Entries are required because the sign of a curve offset value has a different meaning than that of a linear offset routine. In a curve offset, a negative value will be to an offset point INSIDE of the curve, toward the center point, and a positive value will be to an offset point OUTSIDE of the curve, away from the center point. This contrasts with linear offset routines in which negative and positive values indicate LEFT and RIGHT offsets.*

Following a correct offset entry, Survey 4.0 will print the bearing and distance to the offset point, the offset point number, ID and the coordinates.



Curve Offsets: Figure 7-9

Point			Northing	Easting
Assign				
1	PC Point		1000.0000	2000.0000
2	Arc Center Point		1101.1438	2250.3396
3	Arc End Point		1307.9758	2076.7870
	Inside Offset	30.000		
	Outside Offset	50.000		

Given the information above, Start At 1, Inverse the curve to point 3, and set offsets at point 3.

Point			Northing	Easting
Start				
1	PC Point		1000.0000	2000.0000
IC				
2	Arc Center Point		1101.1438	2250.3396
	Central Angle	72°00'00.1"		
	Radius	270.000		
	Arc	339.292		
	Tangent	196.167		
	Chord	317.404		
	Chord Bearing	N 14°00'00.0" E		
3	Arc End Point		1307.9758	2076.7870
CO	S 40°00'00.0" E	30.000	from Base Point 3	
4	OS 30.000 Inside Pt. 3		1284.9944	2096.0706
CO	N 40°00'00.0" W	50.000	from Base Point 3	
5	OS 50.000 Outside Pt. 3		1346.2780	2044.6476

Example 7.9

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Survey 4.0
Simplicity Surveying Series

7.10 Code: TP

THREE POINT CURVE

Not available in Survey Lite

FUNCTION: The THREE POINT CURVE routine is used to compute the center point of a curve that passes through three known points.

NOTES

1. This routine is a macro program and is subject to the special data entry rules below:

a. ***Point Overwrite Protection DOES NOT EXIST in macros.***

b. Use only point numbers, not names or the [+] *or* [−] *keys. c. Required points must have been previously assigned coordinates.*

d. You can exit a macro routine at any prompt by entering [E].

2. The information prompted for in this routine is shown in Figure 7-10.

Select Routine

To calculate the center point of a curve that passes through three known points, type **TP** at **Select Routine** or type **TP** [Enter] at any point number prompt.

Enter 1st Curve Point

Type in the number of the first point on the curve and press [Enter]. *This point must have coordinates!*

Enter 2nd Curve Point

Type in the number of the second point on the curve and press [Enter]. *This point must lie between the first and third curve points and it must have coordinates!*

Enter 3rd Curve Point

Type in the number of the third point on the curve and press [Enter]. *This point must have coordinates!*

Enter Curve Center Point

Type in the number you want to assign to this point and press [Enter].

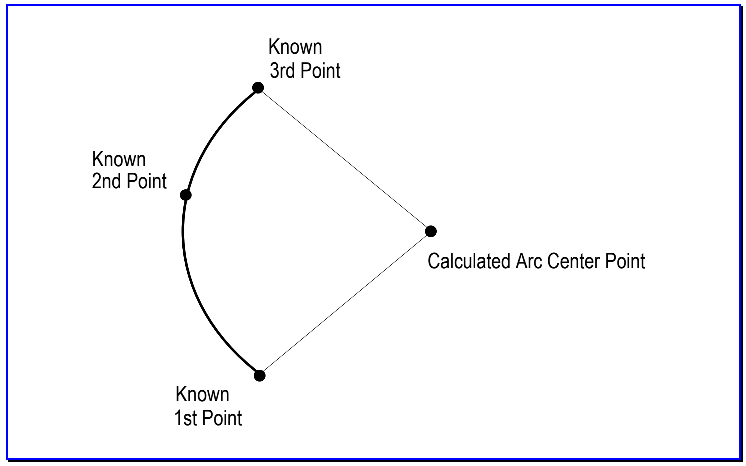
Survey 4.0 will respond to your completed point entries by calculating the coordinates of the center point of an (acute) arc that passes through the three known points. The center point number and coordinates will be printed out and you will be returned to a **Select Routine** prompt. Use the **Inverse Curve** routine (**IC** - Section 7.01) to view the curve data.

Point			Northing	Easting
Assign				
1	1st Point		1000.0000	2000.0000
2	2nd Point		1202.2876	2000.0000
3	3rd Point		1307.9758	2076.7870

Given the points above, calculate the center point of a curve that passes through all three points. Then inverse the curve from 1 to 2 and from 2 to 3.

Point			Northing	Easting
4	Arc Center Point		1101.1438	2250.3396
Start				
1	1st Point		1000.0000	2000.0000
IC				
4	Arc Center Point		1101.1438	2250.3396
	Central Angle	44°00'00.1"		
	Radius	270.000		
	Arc	207.345		
	Tangent	109.087		
	Chord	202.288		
	Chord Bearing	N 0°00'00.0" E		
2	2nd Point		1202.2876	2000.0000
IC				
4	Arc Center Point		1101.1438	2250.3396
	Central Angle	28°00'00.0"		
	Radius	270.000		
	Arc	131.947		
	Tangent	67.319		
	Chord	130.638		
	Chord Bearing	N 36°00'00.0" E		
3	3rd Point		1307.9758	2076.7870

Example 7.10



Three Point Curve: Figure 7-10

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Survey 4.0
Simplicity Surveying Series

7.11 TRAVERSE ARC

Code: TA

FUNCTION: The TRAVERSE ARC routine is used to compute the coordinates of a point lying along an arc when given the coordinates of the point of curvature (P.C.), the coordinates of the center point of the arc, and one other of the following four parameters: the arc length; the chord length; the tangent length; or the central angle (delta) of the arc.

Select Routine

To traverse along a circular arc, where the arc center point is either known or computable, type **TA** at **Select Routine** or type **TA** Enter at any point number prompt.

Center point

Type in the number of the center point of the arc and press Enter.

Select:
< 1 > Traverse to Center point
< 2 > Assign Center point coordinates
< E > Exit this Routine

If the center point has not previously been assigned coordinates you must provide them by either traversing to the center point, or by entering the coordinates. Press 1 or 2, or click your mouse on **< 1 >** or **< 2 >** in the selection box. For option 1, follow the **Traverse** instructions in Section 6.14. For option 2, follow the **Enter and Assign** instructions in Section 10.15. Upon the successful insertion of the center point, Survey 4.0 will continue.

Traverse Arc from (P1) to

Type in the number of the point you are traversing along the arc to and press Enter. The point **P1** represents the currently occupied point. The point number will be given in the prompt.

Arc, Chord, Tangent or Delta

Type in the known value followed by the letter **A**, **C**, or **T** (for **A**rc, **C**hord, or **T**angent), and press Enter. For example, type **100C** Enter to set a curve with a chord equal to 100.

NOTES

1. If you omit the letter designation, Survey 4.0 assumes that you have entered a delta angle.

2. If your arc is to proceed clockwise from the PC to the end point, enter the value as a positive number. Likewise, if your arc is to proceed counter-clockwise, enter the value as a negative number.

Save the PI as a COGO point (Yes/No)

If you want Survey 4.0 to compute and save the coordinates of the P.I., press [Y] or [1], otherwise press [N] or [0]. If you choose to save the P.I., the point number is assigned automatically.

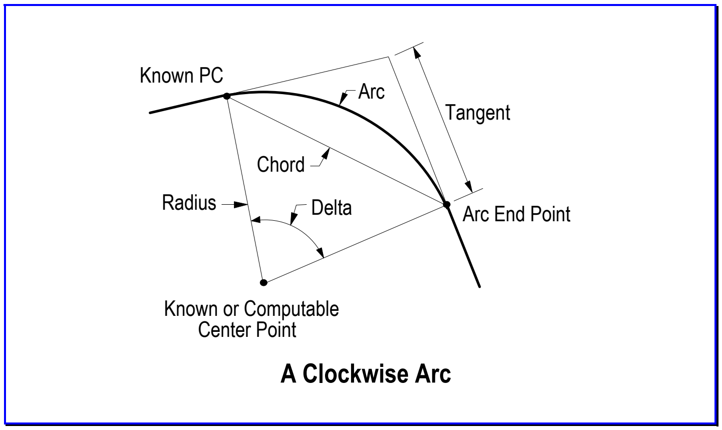
Survey 4.0 will compute the coordinates for the new arc end point, and then print the Central Angle, Radius, Arc, and Tangent Length, Chord and Chord Bearing from the P.C. to the arc end point. The arc end point will become the currently occupied point **P1**, which is also the new P.C. if you continue to traverse along the arc. Also, the bearing from the arc end point back to the center point is now the reference bearing, if one is needed for the next calculation. Therefore, to proceed away from the arc end point tangent to the traversed arc, you would enter the **Traverse** routine (**TR** - Section 6.14) and input an angle of 90 degrees (or 100 grads) AR or AL as the case may be.

Point			Northing	Easting
Assign				
1	PC Point		1000.0000	2000.0000
2	Arc Center Point		1101.1438	2250.3396
	Arc	339.292		

Given the information above, Start At 1 and Traverse an arc to point 3.

Point			Northing	Easting
Start				
1	PC Point		1000.0000	2000.0000
TA				
2	Arc Center Point		1101.1438	2250.3396
	Central Angle	72°00'00.0"		
	Radius	270.000		
	Arc	339.292		
	Tangent	196.166		
	Chord	317.404		
	Chord Bearing	N 14°00'00.0" E		
3	Arc End Point		1307.9758	2076.7870

Example 7.11



Traverse Arc : Figure 7-11

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Survey 4.0
Simplicity Surveying Series

7.12 Code: AO

TRAVERSE ARC WITH OFFSETS

FUNCTION: The TRAVERSE ARC WITH OFFSETS routine is used to compute the coordinates of a point lying along an arc when given the coordinates of the point of curvature (P.C.), the coordinates of the center point of the arc, and one other of the following four parameters: the arc length; the chord length; the tangent length; or the central angle (delta) of the arc. This routine will also set offset points at the curve end point.

Select Routine

To traverse along a circular arc, where the arc center point is either known or computable, and set offset points, type **AO** at **Select Routine** or type **AO** Enter at any point number prompt.

Center point

Type in the number of the center point of the arc and press Enter.

Select:
< 1 > Traverse to Center point
< 2 > Assign Center point coordinates
< E > EXIT this Routine

If the center point has not previously been assigned coordinates you must provide them by either traversing to the center point, or by entering the coordinates. Press 1 or 2, or click your mouse on **< 1 >** or **< 2 >** in the selection box. For option 1, follow the **Traverse** instructions in Section 6.14. For option 2, follow the **Enter and Assign** instructions in Section 10.15.

Upon the successful insertion of the center point, Survey 4.0 will continue.

Traverse Arc from (P1) to

Type in the number of the point you are traversing along the arc to and press Enter. The point **P1** represents the currently occupied point. The point number will be given in the prompt.

Arc, Chord, Tangent or Delta

Type in the known value followed by the letter **A**, **C**, or **T** (for **A**rc, **C**hord, or **T**angent), and press Enter. For example, type **100A** Enter to set a curve with an arc length of 100.

NOTES

1. If you omit the letter designation, Survey 4.0 assumes that you have entered a delta angle.

2. If your arc is to proceed clockwise from the PC to the end point, enter the value as a positive number. Likewise, if your arc is to proceed counter-clockwise, enter the value as a negative number.

Survey 4.0 will compute the coordinates for the new arc end point, and then print the Central Angle, Radius, Arc, and Tangent Length, Chord and Chord Bearing from the P.C. to the arc end point. The arc end point will become the currently occupied point **P1**, which is also the new P.C. if you continue to traverse along the arc. Also, the bearing from the arc end point back to the center point is now the reference bearing, if one is needed for the next calculation. Therefore, to proceed away from the arc end point tangent to the traversed arc, you would enter the **Traverse** routine (**TR** - Section 6.14) and input an angle of 90 degrees (or 100 grads) AR or AL as the case may be.

Curve Offset from (P1) to

Type in the number of the offset point you are setting and press Enter. The variable **P1** represents the currently occupied point as shown in Figure 7-12. The point number will be given in the prompt.

Curve Offset Distance (- if offset inside)

Type in the **HORIZONTAL** offset distance from the currently occupied point to the offset point and press Enter. If the offset point lies inside the arc, between the arc point and the center point, enter the offset distance as a negative value.

RECALLING DISTANCES

Recalled distances are always positive values. Do not use a recalled distance as an offset value if you need to enter the value as a negative number.

DEFINED OFFSET DISTANCES

Even if the **Offset Define** *routine (**OD** - Section 10.18) has been used to build an offset table, this routine will ignore the table and require you to manually enter offset distances. Entries are re-*

quired because the sign of a curve offset value has a different meaning than that of a linear offset routine. In a curve offset, a negative value will be to an offset point INSIDE of the curve, toward the center point, and a positive value will be to an offset point OUTSIDE of the curve, away from the center point. This contrasts with linear offset routines in which negative and positive values indicate LEFT and RIGHT offsets.

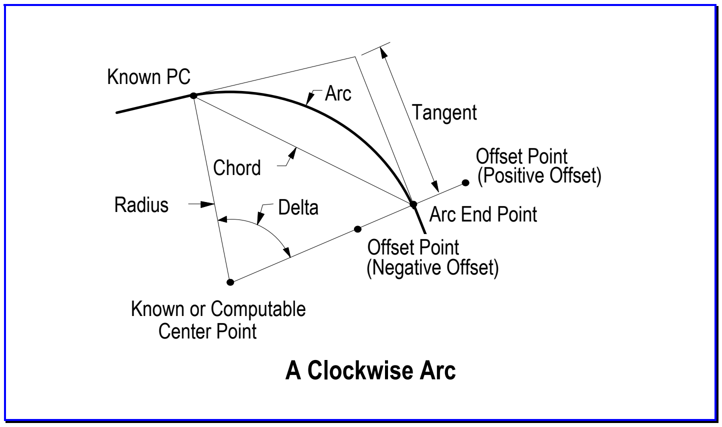
Following a correct offset entry, Survey 4.0 will print the bearing and distance to the offset point, the offset point number, ID and the coordinates.

Point			Northing	Easting
Assign				
1	PC Point		1000.0000	2000.0000
2	Arc Center Point		1101.1438	2250.3396
	Arc	339.292		
	Inside Offset	30.000		
	Outside Offset	50.000		

Given the information above, Start At 1 and Traverse an arc to point 3, then set offsets at point 3.

Point			Northing	Easting
Start				
1	PC Point		1000.0000	2000.0000
TA				
2	Arc Center Point		1101.1438	2250.3396
	Central Angle	72°00'00.0"		
	Radius	270.000		
	Arc	339.292		
	Tangent	196.166		
	Chord	317.404		
	Chord Bearing	N 14°00'00.0" E		
3	Arc End Point		1307.9758	2076.7870
CO	S 40°00'00.0" E	30.000	from Base Point 3	
4	OS 30.000 Inside Pt. 3		1284.9944	2096.0706
CO	N 40°00'00.0" W	50.000	from Base Point 3	
5	OS 50.000 Outside Pt. 3		1346.2780	2044.6476

Example 7.12



Traverse Arc with Offsets: Figure 7-12

Survey 4.0
Simplicity Surveying Series

7.13 Code: CD

CIRCULAR CURVE (BY DEFLECTIONS)

Not available in Survey Lite

FUNCTION: The CIRCULAR CURVE (BY DEFLECTIONS) routine is used to compute a circular curve layout (by deflections) and then automatically import the curve data back into COGO.

NOTE

This routine interacts with COGO! Do not use this routine to compute a stand-alone ***Circular Curve by Deflection*** *problem. Instead, use the* ***Curve by Deflections*** *program (**U2** - Section 13.02) from the* ***Utility Menu****.*

Select Routine

To compute a circular curve layout (by deflections) and then automatically import the curve data back into COGO, type **CD** at **Select Routine** or type **CD** ↵Enter at any point number prompt.

At this point, Survey 4.0 loads and runs the utility program ***Circular Curve by Deflections***. While running this program, Survey 4.0 will output the data to a disk file in the form of a keystroke file. When the Circular Curve program is completed, control will transfer back to the COGO program. The keystroke file will be executed and the circular curve points (but no offset points) will be written into your data file. The operating instructions and an example problem for this routine may be found in Section 13.02.

NOTES

1. Point numbering is automatic.

2. This routine assumes that the current reference bearing is a tangent backsight for the curve.

3. This routine assumes that the PC point is the currently occupied point. To establish a different point as the PC, use the ***Start At*** *(**ST** - Section 10.01) or* ***Go To Point*** *(**GT** - Section 10.02) routine.*

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Survey 4.0
Simplicity Surveying Series

7.14 Code: SP

SPIRAL CURVE (FROM THE PI)

Lite

Not available in Survey Lite

FUNCTION: The SPIRAL CURVE (FROM THE PI) routine is used to compute a spiral curve layout (as staked from the PI) and then automatically import the curve data back into COGO.

NOTE

This routine interacts with COGO! Do not use this routine to compute a stand-alone ***Spiral Curve*** *problem. Instead, use the* ***Spiral Curve Solution*** *program (**U7** - Section 13.07) from the* ***Utility Menu****.*

Select Routine

To compute a spiral curve layout (as staked from the PI) and then automatically import the curve data back into COGO, type **SP** at **Select Routine** or type **SP** ↵Enter at any point number prompt.

At this point, Survey 4.0 loads and runs the utility program ***Spiral Curve*** using the PI staking option. While running this program, Survey 4.0 will output the data to a disk file in the form of a keystroke file. When the Spiral Curve program is completed, control will transfer back to the COGO program. The keystroke file will be executed and the spiral curve points will be written into your data file. The operating instructions and an example problem for this routine may be found in Section 13.07.

NOTES

1. Point numbering is automatic.

2. This routine assumes that the current reference bearing is along the tangent from the PI back to the Tangent to Spiral (TS).

3. This routine assumes that the PI point is the currently occupied point. To establish a different point as the PI, use the ***Start At*** *(**ST** - Section 10.01) or* ***Go To Point*** *(**GT** - Section 10.02) routine.*

Special Application: Offset Spirals

In many cases, it is desirable to compute an offset spiral to your original spiral. While the computation of such an offset spiral is not included in this program, you can obtain a very close approximation. Simply compute your spiral with very short stations, perhaps 10 feet or so. Then, once the data has been imported back to COGO, use the **Traverse Right of Way** routine (**RW** - Section 6.18) to compute an offset line parallel to the spiral stations.

Survey 4.0
Simplicity Surveying Series

8.01 Code: AA

ARC - ARC INTERSECTION

FUNCTION: The ARC-ARC INTERSECTION routine is used to calculate the coordinates of a point generated by the intersection of two arcs.

NOTE

This routine solves only in a CLOCKWISE direction, determined by the path of a line from the 1st center point to the intersection point to the 2nd center point.

Select Routine

To perform an arc-arc intersection, type **AA** at **Select Routine** or type **AA** Enter at any point number prompt.

Arc-Arc FROM Point (P1) THRU Point

Type in the number of the intersection point and press Enter. The variable **P1** represents the currently occupied point, in this case the P.C. of the arc, as shown in Figure 8-1. The point number will be given in the prompt.

Enter a point ID up to 28 characters

If **Names Output** is on, or if you have manually indicated a name assignment by including an **N** after the point number, you may enter a point name. Type in the name and press Enter, or select a predefined name by pressing one of the function keys. You may also press Alt L (or click your mouse on the **Last** button) to use the last point name, or press Alt P (or click your mouse on the **Point** button) to recall a name from another point. If you do not want to assign a name at this time, just press Enter.

Arc-Arc FROM Point (P1) THRU Point (P2) TO Point

Type in the number of the closing point and press Enter. The variable **P2** represents the intersection point as shown in Figure 8-1. The point number will be given in the prompt.

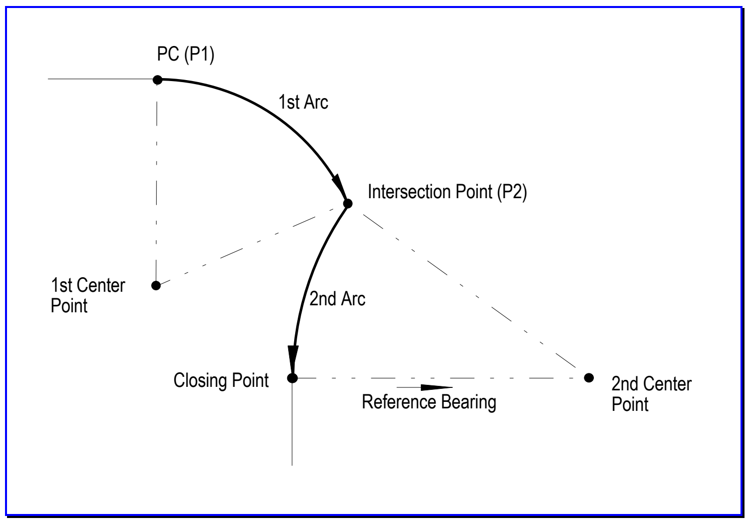
1st Curve's Center Point

Type in the number of the center point of the first arc and press Enter. After the acceptance of a point number the program will inverse the distance from the first center point to the P.C. to establish the first radius distance.

2nd Curve's Center Point

Type in the number of the center point of the second arc and press ↵Enter. After the acceptance of a point number the program will inverse the distance from the second center point to the closing point to establish the second radius distance.

Survey 4.0 will then print out the Central Angle, Radius, Arc, Tangent Length, Chord and Chord Bearing from the P.C. to the intersection point; the intersection point number, ID, and coordinates; the Central Angle, Radius, Arc, Tangent Length, Chord and Chord Bearing from the intersection point to the closing point; and the closing point number, ID, and coordinates. The closing point becomes the currently occupied point, and the bearing from the closing point to the center point of the second arc becomes the reference bearing. You will regain control at a **Select Routine** prompt.



Arc-Arc Intersection: Figure 8-1

Given:

Point		Northing	Easting
Assign			
1	PC (P1)	10249.04867	20021.78894
3	Closing Point	9837.90759	20200.64269
4	1st Radius Point	10000.00000	20000.00000
5	2nd Radius Point	9868.41207	20549.31084

Compute an Arc-Arc Intersection to find the coordinates for the Intersection Point (P2).

Point	Direction	Distance	Northing	Easting
Start				
1	PC (P1)		10249.04867	20021.78894
AA				
4	1st Radius Point		10000.00000	20000.00000
	Central Angle	75° 00' 00.0"		
	Radius	250.000		
	Arc	327.249		
	Tangent	191.832		
	Chord	304.381		
	Chord Bearing	S 47° 30' 00.0 " E		
2	Intersection Point (P2)		10043.41205	20246.20193
AA				
5	2nd Radius Point		9868.41207	20549.31084
	Central Angle	35° 00' 00.0"		
	Radius	350.000		
	Arc	213.803		
	Tangent	110.355		
	Chord	210.494		
	Chord Bearing	S 12° 30' 00.0" W		
3	Closing Point		9837.90759	20200.64269

Example 8.1

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Survey 4.0
Simplicity Surveying Series

8.02 Code: AB

ARC - BEARING INTERSECTION

FUNCTION: The ARC-BEARING INTERSECTION routine is used to calculate the coordinates of a point generated by the intersection of an arc with a line of known bearing.

Select Routine

To perform an arc-bearing intersection, type **AB** at **Select Routine** or type **AB** Enter at any point number prompt.

Arc-Bng. FROM Point (P1) THRU Point

Type in the number of the intersection point and press Enter. The variable **P1** represents the currently occupied point, in this case the P.C. of the arc, as shown in Figure 8-2. The point number will be given in the prompt.

Enter a point ID up to 28 characters

If **Names Output** is on, or if you have manually indicated a name assignment by including an **N** after the point number, you may enter a point name. Type in the name and press Enter, or select a predefined name by pressing one of the function keys. You may also press Alt L (or click your mouse on the **Last** button) to use the last point name, or press Alt P (or click your mouse on the **Point** button) to recall a name from another point. If you do not want to assign a name at this time, just press Enter.

Arc-Bng. FROM Point (P1) THRU Point (P2) TO Point

Type in the number of the closing point and press Enter. The variable **P2** represents the intersection point as shown in Figure 8-2. The point number will be given in the prompt.

Curve's Center Point

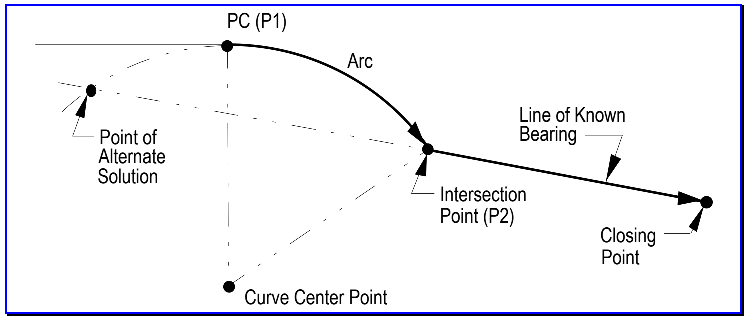
Type in the number of the center point of the arc and press Enter.

Bearing from (P2) to (P3)

Type in a bearing, angle, deflection or azimuth in your pre-specified format and press Enter, or recall a bearing.

Select Solution:
< 1 > (1st solution)
< 2 > (2nd solution)
< E > EXIT without solving

Select solution 1, 2, or E for exit. Survey 4.0 will respond to your selection by printing out the Central Angle, Radius, Arc, Tangent Length, Chord and Chord Bearing from the P.C. to the intersection point; the intersection point number, ID, and coordinates; the bearing and horizontal distance from the intersection point to the closing point; and the closing point number, ID, and coordinates. The closing point becomes the currently occupied point, and the bearing from the closing point to the intersection point becomes the reference bearing. You will regain control at a **Select Routine** prompt.



Arc-Bearing Intersection: Figure 8-2

Given:

Point		Northing	Easting
Assign			
1	PC (P1)	10249.04867	20021.78894
4	Curve's Center Point (P)	10000.00000	20000.00000
5	Closing Point (P3)	9868.41207	20549.31084

Bearing P2 to P3 S 60°00'00.0" E

Compute an Arc-Bearing Intersection to find the coordinates for the Intersection Point (P2). Select solution one.

Point	Direction	Distance	Northing	Easting
Start				
1	PC (P1)		10249.04867	20021.78894
AB				
4	Curve's Center Point (P)		10000.00000	20000.00000
	Central Angle	75°00'00.0"		
	Radius	250.000		
	Arc	327.249		
	Tangent	191.832		
	Chord	304.381		
	Chord Bearing	S 47°30'00.0" E		
2	Intersection Point (P2)		10043.41208	20246.20193
AB	S 60°00'00.0" E	350.00		
5	Closing Point (P3)		9868.41207	20549.31084

Example 8.2

Survey 4.0
Simplicity Surveying Series

8.03 Code: AD

ARC - DISTANCE INTERSECTION

FUNCTION: The ARC-DISTANCE INTERSECTION routine is used to calculate the coordinates of a point generated by the intersection of an arc with a line of known distance.

NOTE
This routine solves only in a CLOCKWISE direction, determined by the path of a line from the 1st center point to the intersection point to the ending point.

Select Routine

To perform an arc-distance intersection, type **AD** at **Select Routine** or type **AD** Enter at any point number prompt.

Arc-Dist. FROM Point (P1) THRU Point

Type in the number of the intersection point and press Enter. The variable **P1** represents the currently occupied point, in this case the P.C. of the arc, as shown in Figure 8-3. The point number will be given in the prompt.

Enter a point ID up to 28 characters

If **Names Output** is on, or if you have manually indicated a name assignment by including an **N** after the point number, you may enter a point name. Type in the name and press Enter, or select a predefined name by pressing one of the function keys. You may also press Alt L (or click your mouse on the **Last** button) to use the last point name, or press Alt P (or click your mouse on the **Point** button) to recall a name from another point. If you do not want to assign a name at this time, just press Enter.

Arc-Dist. FROM Point (P1) THRU Point (P2) TO Point

Type in the number of the closing point and press Enter. The variable **P2** represents the intersection point as shown in Figure 8-3. The point number will be given in the prompt.

Curve's Center Point

Type in the number of the center point of the arc and press Enter.

Distance

Type in the **HORIZONTAL** distance from the intersection point to the closing point and press Enter, or recall a distance between two existing points.

Survey 4.0 will respond to a correctly entered distance by print-ing out the Central Angle, Radius, Arc, Tangent Length, Chord and Chord Bearing from the P.C. to the intersection point; the intersection point number, ID, and coordinates; the bearing and horizontal distance from the intersection point to the closing point; and the closing point number, ID, and coordinates. The closing point becomes the currently occupied point, and the bearing from the closing point to the intersection point becomes the reference bearing. You will return to a **Select Routine** prompt.

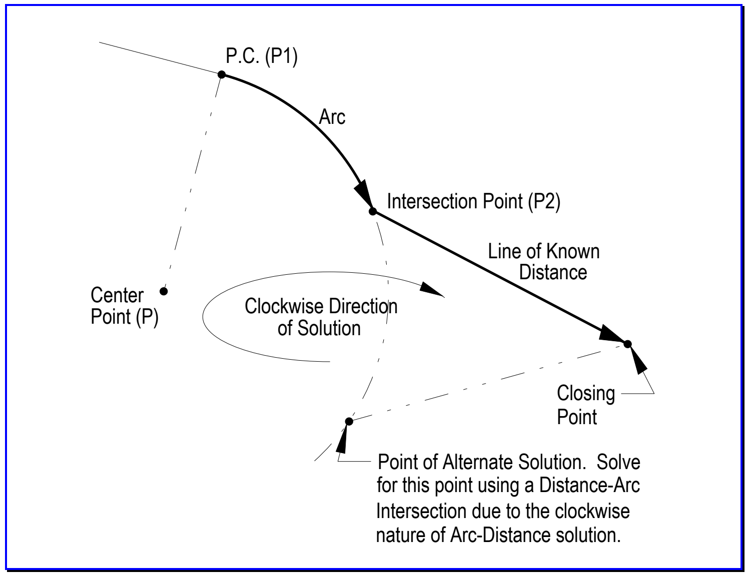
Given:

Point			Northing	Easting
Assign				
1	PC (P1)		10249.04867	20021.78894
4	Curve's Center Point (P)		10000.00000	20000.00000
5	Closing Point		9868.41207	20549.31084
	Distance P2 to P3	350.000		

Compute an Arc-Distance Intersection to find the coordinates for the Intersection Point (P2).

Point	Direction	Distance	Northing	Easting
Start				
1	PC (P1)		10249.04867	20021.78894
AD				
4	Curve's Center Point (P)		10000.00000	20000.00000
	Central Angle	75°00'00.0"		
	Radius	250.000		
	Arc	327.249		
	Tangent	191.832		
	Chord	304.381		
	Chord Bearing	S 47°30'00.0" E		
2	Intersection Point (P2)		10043.41204	20246.20193
AD	S 60°00'00.0" E	350.00		
5	Closing Point		9868.41207	20549.31084

Example 8.3



Arc-Distance Intersection: Figure 8-3

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Survey 4.0 Simplicity Surveying Series

8.04 Code: BA

BEARING - ARC INTERSECTION

FUNCTION: The BEARING-ARC INTERSECTION routine is used to calculate the coordinates of a point generated by the intersection of a line of known bearing with an arc.

Select Routine

To perform a bearing-arc intersection, type **BA** at **Select Routine** or type **BA** Enter at any point number prompt.

Bng.-Arc FROM Point (P1) THRU Point

Type in the number of the intersection point and press Enter. The variable **P1** represents the currently occupied point as shown in Figure 8-4. The point number will be given in the prompt.

Enter a point ID up to 28 characters

If **Names Output** is on, or if you have manually indicated a name assignment by including an **N** after the point number, you may enter a point name. Type in the name and press Enter, or select a predefined name by pressing one of the function keys. You may also press Alt L (or click your mouse on the **Last** button) to use the last point name, or press Alt P (or click your mouse on the **Point** button) to recall a name from another point. If you do not want to assign a name at this time, just press Enter.

Bng.-Arc FROM Point (P1) THRU Point (P2) TO Point

Type in the number of the closing point and press Enter. The variable **P2** represents the intersection point as shown in Figure 8-4. The point number will be given in the prompt.

Bearing from (P1) to (P2)

Type in a bearing, angle, deflection or azimuth in your pre-specified format and press Enter, or recall a bearing.

Curve's Center Point

Type in the number of the center point of the arc and press Enter. In most cases this routine will present two solutions representing the distance from the occupied point to the intersection point.

Select Solution:
< 1 > (1st solution)
< 2 > (2nd solution)
< E > EXIT without solving

Select solution 1, 2, or E for exit. Survey 4.0 will respond to your selection by printing out the bearing and horizontal distance from the occupied point to the intersection point; the intersection point number, ID, and coordinates; the Central Angle, Radius, Arc, Tangent Length, Chord and Chord Bearing from the intersection point to the closing point; and the closing point number, ID and coordinates. The closing point becomes the currently occupied point, and the bearing from the closing point to the arc center point becomes the reference bearing. You will regain control at a **Select Routine** prompt.

Given:

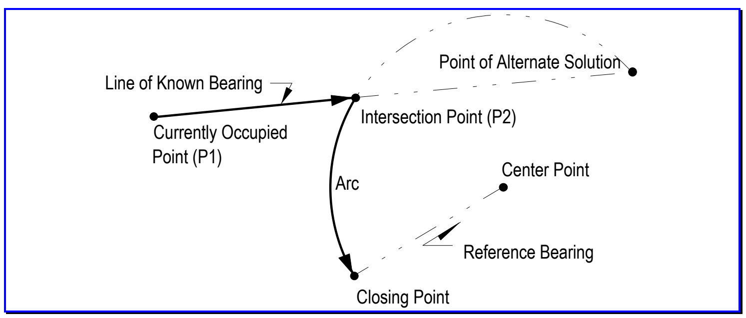
Point		Northing	Easting
Assign			
1	Occupied Point (P1)	10249.04867	20021.78894
3	Closing Point	9837.90759	20200.64269
5	Arc Center Point (P)	9868.41207	20549.31084

Bearing P1 to P2 S 47°30'00.0" E

Compute a Bearing-Arc Intersection to find the coordinates for the Intersection Point (P2). Use solution one.

Point	Direction	Distance	Northing	Easting
Start				
1	Occupied Point (P1)		10249.04867	20021.78894
BA	S 47°30'00.0" E	304.381		
2	Intersection Point (P2)		10043.41205	20246.20193
BA				
5	Arc Center Point (P)		9868.41207	20549.31084
	Central Angle	35°00'00.0"		
	Radius	350.000		
	Arc	213.803		
	Tangent	110.355		
	Chord	210.494		
	Chord Bearing	S 12°30'00.0" W		
3	Closing Point		9837.90759	20200.64269

Example 8.4



Bearing-Arc Intersection: Figure 8-4

Survey 4.0
Simplicity Surveying Series

8.05 Code: BB

BEARING - BEARING INTERSECTION

FUNCTION: The BEARING-BEARING INTERSECTION routine is used to calculate the location of a point generated by the intersection of two lines of known bearing.

Select Routine

To perform a bearing-bearing intersection, type **BB** at **Select Routine** or type **BB** ↵Enter at any point number prompt.

Bng.-Bng. FROM Point (P1) THRU Point

Type in the number of the intersection point and press ↵Enter. The variable **P1** represents the currently occupied point as shown in Figure 8-5. The point number will be given in the prompt.

Enter a point ID up to 28 characters

If **Names Output** is on, or if you have manually indicated a name assignment by including an **N** after the point number, you may enter a point name. Type in the name and press ↵Enter, or select a predefined name by pressing one of the function keys. You may also press Alt L (or click your mouse on the **Last** button) to use the last point name, or press Alt P (or click your mouse on the **Point** button) to recall a name from another point. If you do not want to assign a name at this time, just press ↵Enter.

Bng-Bng FROM Point (P1) THRU Point (P2) TO Point

Type in the number of the closing point and press ↵Enter. The variable **P2** represents the intersection point as shown in Figure 8-5. The point number will be given in the prompt.

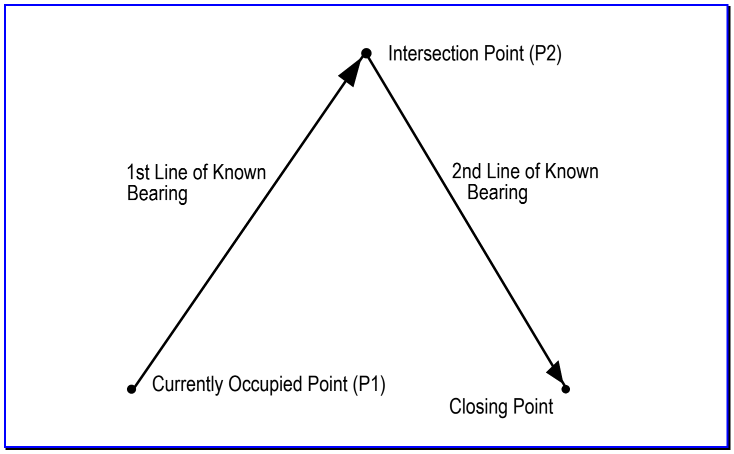
Bearing from (P1) to (P2)

Type in a bearing, angle, deflection or azimuth in your pre-specified format and press ↵Enter, or recall a bearing.

Bearing from (P2) to (P3)

Type in a bearing, angle, deflection or azimuth in your pre-specified format and press ↵Enter, or recall a bearing.

Survey 4.0 will respond to a correct response by printing out the bearing and horizontal distance from the currently occupied point to the intersection point; the intersection point number, ID, and coordinates; the bearing and horizontal distance from the intersection point to the closing point; and the closing point number, ID, and coordinates. The closing point becomes the currently occupied point, and the bearing from the closing point to the intersection point becomes the reference bearing. You will regain control at a **Select Routine** prompt.



Bearing-Bearing Intersection: Figure 8-5

Given:

Point		Northing	Easting
Assign			
1	Occupied Point (P1)	10249.04867	20021.78894
3	Closing Point (P3)	9837.90759	20200.64269

Bearing P1 to P2 S 47°30'00.0" E
Bearing P2 to P3 S 12°30'00.0" W

Compute a Bearing-Bearing Intersection to find the coordinates for the Intersection Point (P2).

Point	Direction	Distance	Northing	Easting
Start				
1	Occupied Point (P1)		10249.04867	20021.78894
BB	S 47°30'00.0" E	304.381		
2	Intersection Point (P2)		10043.41205	20246.20193
BB	S 12°30'00.0" W	210.494		
3	Closing Point (P3)		9837.90759	20200.64269

Example 8.5

Survey 4.0 Simplicity Surveying Series

8.06 Code: BD

BEARING - DISTANCE INTERSECTION

FUNCTION: The BEARING-DISTANCE INTERSECTION routine is used to calculate the location of a point generated by the intersection of a line of known bearing with a line of known distance.

Select Routine

To perform a bearing-distance intersection, type **BD** at **Select Routine** or type **BD** [Enter] at any point number prompt.

Bng.-Dist. FROM Point (P1) THRU Point

Type in the number of the intersection point and press [Enter]. The variable **P1** represents the currently occupied point as shown in Figure 8-6. The point number will be given in the prompt.

Enter a point ID up to 28 characters

If **Names Output** is on, or if you have manually indicated a name assignment by including an **N** after the point number, you may enter a point name. Type in the name and press [Enter], or select a predefined name by pressing one of the function keys. You may also press [Alt] [L] (or click your mouse on the **Last** button) to use the last point name, or press [Alt] [P] (or click your mouse on the **Point** button) to recall a name from another point. If you do not want to assign a name at this time, just press [Enter].

Bng.-Dist. FROM Point (P1) THRU Point (P2) TO Point

Type in the number of the closing point and press [Enter]. The variable **P2** represents the intersection point as shown in Figure 8-6. The point number will be given in the prompt.

Bearing from (P1) to (P2)

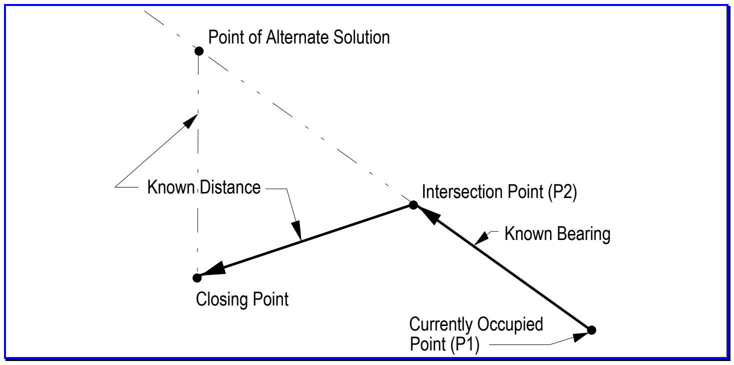
Type in a bearing, angle, deflection or azimuth in your pre-specified format and press [Enter], or recall a bearing.

Distance from (P2) to (P3)

Type in the **HORIZONTAL** distance and press [Enter], or recall a distance between two existing points. In most cases, this routine will present two solutions, representing the distance from the occupied point to the intersection point.

Select Solution:
< 1 > (1st solution)
< 2 > (2nd solution)
< E > EXIT without solving

Select solution 1, 2, or E for exit. The program will respond to your selection by printing out the bearing and horizontal distance from the occupied point to the intersection point; the intersection point number, ID, and coordinates; the bearing and horizontal distance from the intersection point to the closing point; and the closing point number, ID, and coordinates. The closing point becomes the currently occupied point, and the bearing from the closing point to the intersection point becomes the reference bearing. You will regain control at a **Select Routine** prompt.



Bearing-Distance Intersection: Figure 8-6

Given:

Point		Northing	Easting
Assign			
5	Occupied Point (P1)	9868.41207	20549.31084
4	Closing Point (P3)	10000.00000	20000.00000

Bearing P1 to P2 N 60°00'00.0" W
Distance P2 to P3 250.000

Compute a Bearing-Distance Intersection to find the coordinates for the Intersection Point (P2). Use solution one.

Point	Direction	Distance	Northing	Easting
Start				
5	Occupied Point (P1)		9868.41207	20549.31084
BD	N 60°00'00.0" W	350.000		
2	Intersection Point (P2)		10043.41208	20246.20193
BD	S 80°00'00.0" W	250.000		
4	Closing Point (P3)		10000.00000	20000.00000

Example 8.6

Survey 4.0 Simplicity Surveying Series

8.07 Code: DA

DISTANCE - ARC INTERSECTION

FUNCTION: The DISTANCE-ARC INTERSECTION routine is used to calculate the location of a point generated by the intersection of a line of known distance with an arc.

NOTE

This routine solves only in a CLOCKWISE direction, determined by the path of a line from the starting point to the intersection point to the arc center point.

Select Routine

To perform a distance-arc intersection, type **DA** at **Select Routine** or type **DA** Enter at any point number prompt.

Dist.-Arc FROM Point (P1) THRU Point

Type in the number of the intersection point and press Enter. The variable **P1** represents the currently occupied point as shown in Figure 8-7. The point number will be given in the prompt.

Enter a point ID up to 28 characters

If **Names Output** is on, or if you have manually indicated a name assignment by including an **N** after the point number, you may enter a point name. Type in the name and press Enter, or select a predefined name by pressing one of the function keys. You may also press Alt L (or click your mouse on the **Last** button) to use the last point name, or press Alt P (or click your mouse on the **Point** button) to recall a name from another point. If you do not want to assign a name at this time, just press Enter.

Dist.-Arc FROM Point (P1) THRU Point (P2) TO Point

Type in the number of the closing point and press Enter. The variable **P2** represents the intersection point as shown in Figure 8-7. The point number will be given in the prompt.

Distance

Type in the **HORIZONTAL** distance and press Enter, or recall a distance between two existing points.

Curve's Center Point

Type in the number of the center point of the arc and press Enter. Survey 4.0 will print out the bearing and horizontal distance from the currently occupied point to the intersection point; the intersection point number, ID, and coordinates; the Central Angle, Radius, Arc, Tangent, Chord and Chord Bearing from the intersection point to the closing point; and the closing point number, ID, and coordinates. The closing point becomes the currently occupied point, and the bearing from the closing point to the center point of the arc becomes the reference bearing. You will regain control at a **Select Routine** prompt.

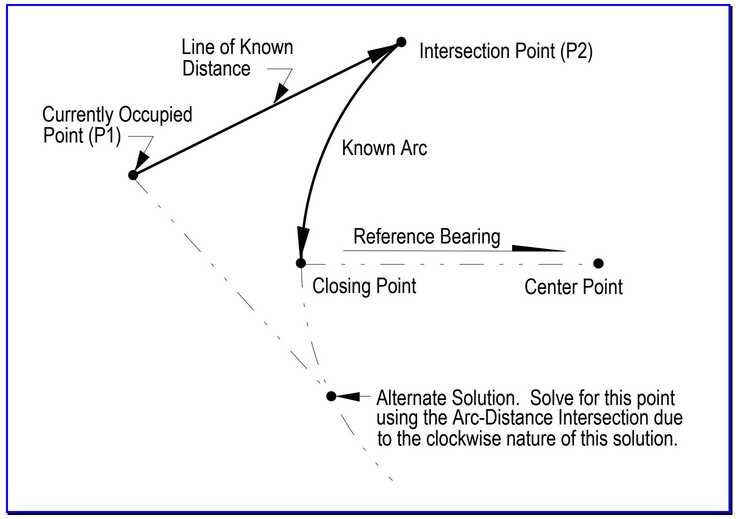
Given:

Point			Northing	Easting
Assign				
4	Occupied Point (P1)		10000.00000	20000.00000
3	Closing Point		9837.90759	20200.64269
5	Arc Center Point (P)		9868.41207	20549.31084
	Distance P1 to P2	250.000		

Compute a Distance-Arc Intersection to find the coordinates for the Intersection Point (P2).

Point	Direction	Distance	Northing	Easting
Start				
4	Occupied Point (P1)		10000.00000	20000.00000
DA	N 80°00'00.0" E	250.000		
2	Intersection Point (P2)		10043.41205	20246.20194
DA				
5	Arc Center Point (P)		9868.41207	20549.31084
	Central Angle	35°00'00.0"		
	Radius	350.000		
	Arc	213.803		
	Tangent	110.355		
	Chord	210.494		
	Chord Bearing	S 12°30'00.0" W		
3	Closing Point		9837.90759	20200.64269

Example 8.7



Distance-Arc Intersection: Figure 8-7

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Survey 4.0
Simplicity Surveying Series

8.08 Code: DB

DISTANCE - BEARING INTERSECTION

FUNCTION: The DISTANCE-BEARING INTERSECTION routine is used to calculate the location of a point generated by the intersection of a line of known distance with a line of known bearing.

Select Routine

To perform a distance-bearing intersection, type **DB** at **Select Routine** or type **DB** [Enter] at any point number prompt.

Dist.-Bng. FROM Point (P1) THRU Point

Type in the number of the intersection point and press [Enter]. The variable **P1** represents the currently occupied point as shown in Figure 8-8. The point number will be given in the prompt.

Enter a point ID up to 28 characters

If **Names Output** is on, or if you have manually indicated a name assignment by including an **N** after the point number, you may enter a point name. Type in the name and press [Enter], or select a predefined name by pressing one of the function keys. You may also press [Alt] [L] (or click your mouse on the **Last** button) to use the last point name, or press [Alt] [P] (or click your mouse on the **Point** button) to recall a name from another point. If you do not want to assign a name at this time, just press [Enter].

Dist.-Bng. FROM Point (P1) THRU Point (P2) TO Point

Type in the number of the closing point and press [Enter]. The variable **P2** represents the intersection point as shown in Figure 8-8. The point number will be given in the prompt.

Distance from (P1) to (P2)

Type in the **HORIZONTAL** distance and press [Enter], or recall a distance between two existing points.

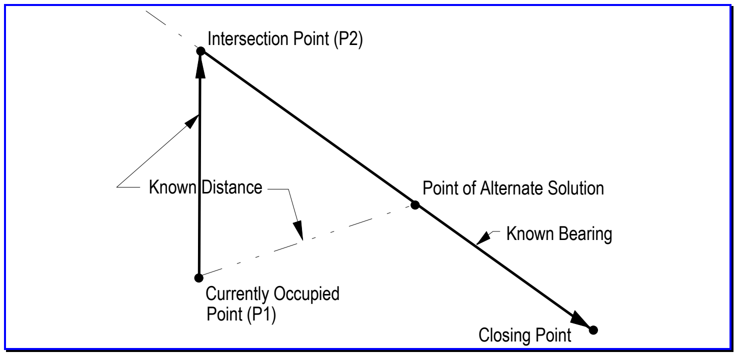
Bearing from (P2) to (P3)

Type in a bearing, angle, deflection or azimuth in your pre-specified format and press [Enter], or recall a bearing.

In most cases, this routine will present two solutions, representing the distance from the intersection point to the closing point.

Select Solution:
< 1 > (1st solution)
< 2 > (2nd solution)
< E > EXIT without solving

Select solution 1, 2, or E for exit. Survey 4.0 will respond to your selection by printing out the bearing and horizontal distance from the occupied point to the intersection point; the intersection point number, ID, and coordinates; the bearing and horizontal distance from the intersection point to the closing point; and the closing point number, ID and coordinates. The closing point becomes the currently occupied point, and the bearing from the closing point to the intersection point becomes the reference bearing. You will regain control at a **Select Routine** prompt.



Distance-Bearing Intersection: Figure 8-8

Given:

Point			Northing	Easting
Assign				
4	Occupied Point (P1)		10000.00000	20000.00000
5	Closing Point (P3)		9868.41207	20549.31084
	Distance P1 to P2	250.000		
	Bearing P2 to P3	S 60°00'00.0" E		

Compute a Distance-Bearing Intersection to find the coordinates for the Intersection Point (P2). Use solution two.

Point	Direction	Distance	Northing	Easting
Start				
4	Occupied Point (P1)		10000.00000	20000.00000
DB	N 20°00'00.0" W	250.000		
2	Intersection Point (P2)		10234.92317	19914.49500
DB	S 60°00'00.0" E	733.022		
5	Closing Point (P3)		9868.41207	20549.31084

Example 8.8

Survey 4.0
Simplicity Surveying Series

8.09 Code: DD

DISTANCE - DISTANCE INTERSECTION

FUNCTION: The DISTANCE-DISTANCE INTERSECTION routine is used to calculate the location of a point generated by the intersection of two lines of known distance.

NOTE

This routine solves only in a CLOCKWISE direction, determined by the path of a line from the starting point to the intersection point to the ending point.

Select Routine

To perform a distance-distance intersection, type **DD** at **Select Routine** or type **DD** Enter at any point number prompt.

Dist.-Dist. FROM Point (P1) THRU Point

Type in the number of the intersection point and press Enter. The variable **P1** represents the currently occupied point as shown in Figure 8-9. The point number will be given in the prompt.

Enter a point ID up to 28 characters

If **Names Output** is on, or if you have manually indicated a name assignment by including an **N** after the point number, you may enter a point name. Type in the name and press Enter, or select a predefined name by pressing one of the function keys. You may also press Alt L (or click your mouse on the **Last** button) to use the last point name, or press Alt P (or click your mouse on the **Point** button) to recall a name from another point. If you do not want to assign a name at this time, just press Enter.

Dist.-Dist. FROM Point (P1) THRU Point (P2) TO Point

Type in the number of the closing point and press Enter. The variable **P2** represents the intersection point as shown in Figure 8-9. The point number will be given in the prompt.

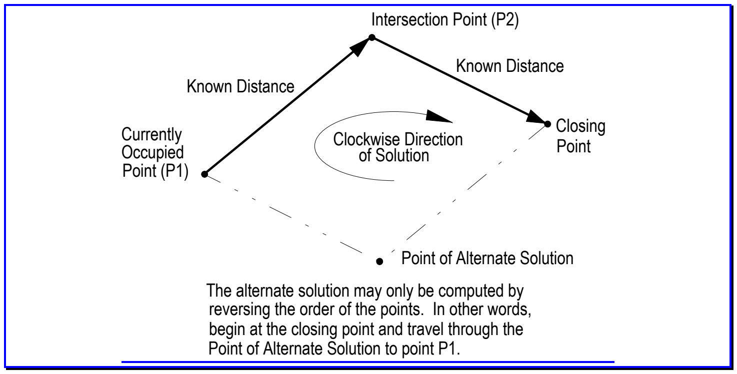
Distance from (P1) to (P2)

Type in the **HORIZONTAL** distance and press Enter, or recall a distance between two existing points.

Distance from (P2) to (P3)

Type in the **HORIZONTAL** distance and press Enter, or recall a distance between two existing points.

Survey 4.0 will respond to a correctly entered distance by printing out the bearing and horizontal distance from the currently occupied point to the intersection point, the intersection point number, ID, and coordinates; the bearing and horizontal distance from the intersection point to the closing point; and the closing point number, ID, and coordinates. The closing point becomes the currently occupied point, and the bearing from the closing point to the intersection point becomes the reference bearing. You will regain control at a **Select Routine** prompt.



Distance-Distance Intersection: Figure 8-9

Given:

Point			Northing	Easting
Assign				
4	Occupied Point (P1)		10000.00000	20000.00000
5	Closing Point (P3)		9868.41207	20549.31084
	Distance P1 to P2	250.000		
	Distance P2 to P3	350.000		

Compute a Distance-Distance Intersection to find the coordinates for the Intersection Point (P2).

Point	Direction	Distance	Northing	Easting
Start				
4	Occupied Point (P1)		10000.00000	20000.00000
DD	N 80°00'00.0" E	250.000		
2	Intersection Point (P2)		10043.41205	20246.20194
DD	S 60°00'00.0" E	350.000		
5	Closing Point (P3)		9868.41207	20549.31084

Example 8.9

Survey 4.0
Simplicity Surveying Series

8.10 OFFSET INTERSECTION

Code: OI

FUNCTION: The OFFSET INTERSECTION routine is used to calculate the location of a point generated by the intersection of two lines lying at known perpendicular distances from two lines of known bearing.

Select Routine

To perform an offset intersection, type **OI** at **Select Routine** or type **OI** [Enter] at any point number prompt.

IMPORTANT!

*This routine uses the currently occupied point as the point from which you will begin the intersection. To change this point, use **Start At** (**ST** - Section 10.01), or **Go To Point** (**GT** - Section 10.02) to establish the desired location of occupation.*

Offset Intersection Point

Type in the number of the intersection point and press [Enter].

Enter a point ID up to 28 characters

If **Names Output** is on, or if you have manually indicated a name assignment by including an **N** after the point number, you may enter a point name. Type in the name and press [Enter], or select a predefined name by pressing one of the function keys. You may also press [Alt] [L] (or click your mouse on the **Last** button) to use the last point name, or press [Alt] [P] (or click your mouse on the **Point** button) to recall a name from another point. If you do not want to assign a name at this time, just press [Enter].

1st Bearing from (P1)

Type in a bearing, angle, deflection or azimuth in your pre-specified format and press [Enter], or recall a bearing. Point **P1** represents the currently occupied point as shown in Figure 8-10. The actual point will be given in the prompt.

1st Offset Distance

Type in a positive or negative **HORIZONTAL** distance and press [Enter]. The sign of the distance is determined by facing the same direction as the 1st bearing and noting whether the intersection point will lie to the right (positive) or left (negative) of the line.

2nd Bearing from (P1)

Type in a bearing, angle, deflection or azimuth in your pre-specified format and press ↵Enter, or recall a bearing. Point **P1** represents the currently occupied point as shown in Figure 8-10. The actual point will be given in the prompt.

2nd Offset Distance

Type in a positive or negative **HORIZONTAL** distance and press ↵Enter. The sign of the distance is determined by facing the same direction as the 2nd bearing and noting whether the intersection point lies to the right (positive) or left (negative) of the line.

Following the correct entry of the 2nd offset distance, Survey 4.0 computes and prints the coordinates of the offset intersection point, the intersection point number and ID, the 1st and 2nd offset bearings and distances, and the coordinates, point number and ID of the point used to set the intersection.

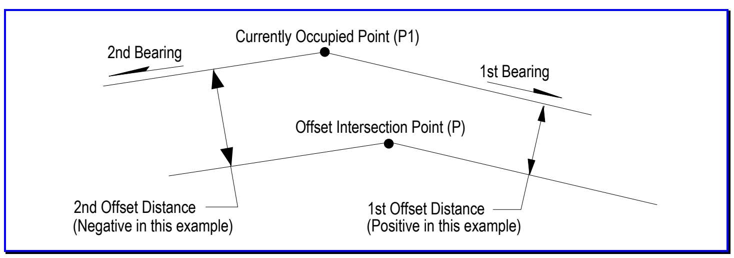
Given:

Point		Northing	Easting
Assign			
4	Occupied Point (P1)	10000.00000	20000.00000
	1st Bearing & Offset	S 80°00'00.0" E	40.00
	2nd Bearing & Offset	S 40°00'00.0" W	-25.00

Compute an Offset Intersection to find the coordinates for Point (P2).

Point	Direction	Distance	Northing	Easting
Start				
4	Occupied Point (P1)		10000.00000	20000.00000
OI	S 80°00'00.0" E	40.000		
OI	S 40°00'00.0" W	-25.000		
By Offset Intersection				
2	Intersection Point (P2)		9959.60513	19998.73986

Example 8.10



Offset Intersection: Figure 8-10

Survey 4.0
Simplicity Surveying Series

8.11 PERPENDICULAR LINE, STATION & OFFSET

Code: LS

FUNCTION: The PERPENDICULAR LINE, STATION & OFFSET routine computes the perpendicular offset distance from a point to a defined baseline and also the baseline station at the point of perpendicular intersection.

Select Routine

To perform a perpendicular line, station and offset calculation, type `LS` at **Select Routine** or type `LS` [Enter] at any point number prompt.

Start at

Type in the point number of the beginning of the baseline and press [Enter]. This point should also contain the beginning station number as a part of the point name. If no stationing data is available, the station will be assumed to be 0+00. Stationing may be entered through the **Identify Point** routine (**ID**-Section 10.15).

NOTE

In most cases, the ***Start At*** *prompt will not be seen and the program will assume you want to start at the last used point. To assign a new starting point, use the* ***Start At*** *routine (**ST** - Section 10.01).*

Perpendicular Offset Base Point (P1) Bearing

Type in the bearing of the baseline as it travels away from the base point and press [Enter]. This bearing may also be a recalled bearing. The variable **P1** represents the currently occupied base point and will be given in the prompt.

Compute Offset at Point(s)

Type in a point number or point string and press [Enter]. Survey 4.0 will compute and report the station and offset distance. Continue entering points as needed. When you have completed your point entry, type [Enter] to return to **Select Routine**.

Given:

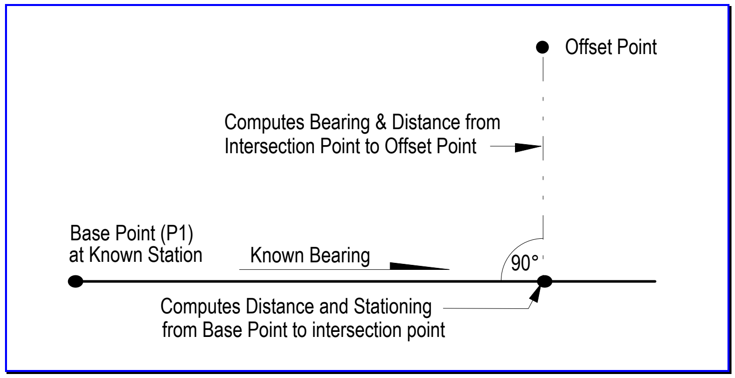
Points		Northing	Easting
Assign			
1	#0+00 Base Point	10255.00000	19144.00000
2	Offset Point	10010.00000	19650.00000
3	Offset Point	9975.00000	19900.00000
4	Offset Point	10000.00000	20000.00000
5	Offset Point	11000.00000	20200.00000

Base Bearing N 88° 00' 00" E

Use Line Station & Offset routine to find stations and coordinates for the intersection points for offset points 2, 3, 4 and 5.

Point	Direction	Distance	Northing	Easting
Start				
1	#0+00 Base Point		10255.00000	19144.00000
LS	N 88°00'00.0" E	497.141		
Sta.	#4+97.141		10272.34998	19640.83854
LS	S 02°00'00.0" E	262.510		
2	Offset Point		10010.00000	19650.00000
Start				
1	#0+00 Base Point		10255.00000	19144.00000
LS	N 88°00'00.0" E	745.768		
Sta.	#7+45.768		10281.02691	19889.31330
LS	S 02°00'00.0" E	306.213		
3	Offset Point		9975.00000	19900.00000
Start				
1	#0+00 Base Point		10255.00000	19144.00000
LS	N 88°00'00.0" E	846.579		
Sta.	#8+46.579		10284.54519	19990.06346
LS	S 02°00'00.0" E	284.719		
4	Offset Point		10000.00000	20000.00000
Start				
1	#0+00 Base Point		10255.00000	19144.00000
LS	N 88°00'00.0" E	1081.357		
Sta.	#10+81.357		10292.73881	20224.69811
LS	N 02°00'00.0" W	707.692		
5	Offset Point		11000.00000	20200.00000

Example 8.11



Perpendicular Line, Station & Offset: Figure 8-11

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Survey 4.0
Simplicity Surveying Series

8.12 PERPENDICULAR ARC, STATION & OFFSET

Code: AS

FUNCTION: The PERPENDICULAR ARC, STATION & OFFSET routine computes the perpendicular offset distance from a point to a defined arc and also the baseline station at the point of intersection perpendicular to the arc.

Select Routine

To perform a perpendicular arc, station and offset calculation, type **AS** at **Select Routine** or type **AS** Enter at any point number prompt.

Start at

Type in the point number of the beginning of the arc baseline and press Enter. This point should also contain the beginning station number as a part of the point name. If no stationing data is available, the station will be assumed to be 0+00. Stationing may be entered through the **Identify Point** routine (**ID**-Section 10.15).

NOTE

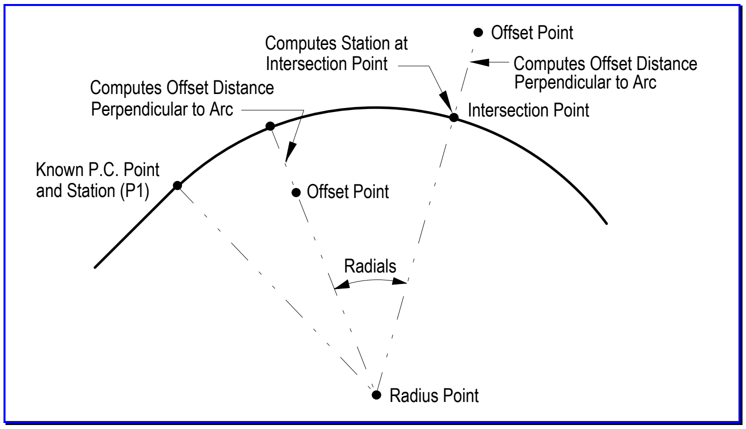
*In most cases, the **Start At** prompt will not be seen and the program will assume you want to start at the last used point. To assign a new starting point, use the **Start At** routine (**ST** - Section 10.01).*

Compute Offset to Curve with PC Point (P1) thru Radius point

Type in the point number of the center point of the arc and press Enter. The variable **P1** represents the currently occupied point as shown in Figure 8-12.

Compute Offset to Curve with PC Point (P1) thru Radius point (P) to point

Type in a point number and press Enter. The variable **P** represents the arc center point as shown in Figure 8-12. Survey 4.0 will compute and report the station and offset distance, and also the curve data to the arc station point. Offset distances inside of the curve are reported as negative values. Continue entering points as needed. When you have completed your point entry, press Enter to return to **Select Routine**.



Perpendicular Arc, Station & Offset: Figure 8-12

Given:

Points		Northing	Easting
Assign			
1	Offset Point	9976.44079	20012.08887
2	Offset Point	10003.99719	20150.72224
4	#0+00 Base Point	10000.00000	20000.00000
5	Arc Center Point	9750.95133	20021.78894

Use Arc Station & Offset routine to find stations and coordinates for the intersection points for offset points 1 and 2.

Point	Direction	Distance	Northing	Easting
Start				
4	#0+00 Base Point		10000.00000	20000.00000
Arc to Offset point from PC point 4 through Radius point 5				
	Central Angle	2°32'12.4"		
	Radius	250.000		
	Arc	11.069		
	Offset @ Station	0+11.069		
	Sta. Coords.		10000.72033	20011.04442
	Offset from Arc	-24.302		
1	Offset Point		9976.44079	20012.08887
Arc to Offset point from PC point 4 through Radius Point 5				
	Central Angle	32°00'00.0"		
	Radius	250.000		
	Arc	139.626		
	Offset @ Station	1+39.626		
	Sta. Coords.		9973.70296	20135.28656
	Offset from Arc	34.000		
2	Offset Point		10003.99719	20150.72224

Example 8.12

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8.13 **Code: PO**

PERPENDICULAR OFFSET

FUNCTION: The PERPENDICULAR OFFSET routine calculates the perpendicular offset distance from a point to a known baseline. The horizontal distance along the baseline from the base point to the intersection point is also calculated.

Select Routine

To perform a perpendicular offset calculation, type **PO** at **Select Routine** or type **PO** Enter at any point number prompt.

Perpendicular Offset Base Point (P1) Bearing

Type in the bearing of the baseline as it travels away from the base point and press Enter. You may also recall a bearing. The variable **P1** represents the currently occupied base point as shown in Figure 8-13. The point number will be given in the prompt.

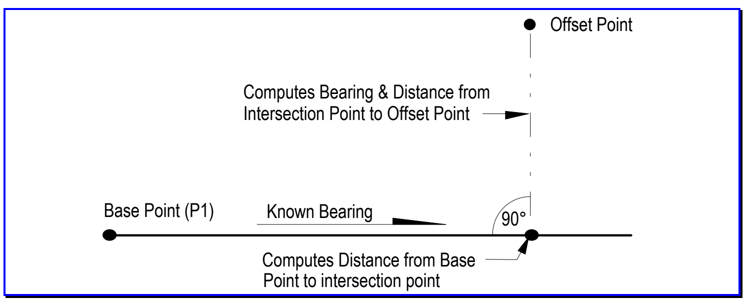
Compute Offset at Point(s)

Type in a point number or point string and press Enter. Survey 4.0 will compute and report the baseline and horizontal offset distance. Continue entering points as needed. When you have completed your point entry, press Enter to return to **Select Routine**.

NOTES

1. If you have entered a point string or defined Figure and the routine encounters an undefined point, the point will be skipped.

2. Coordinates of the temporary intersection point 0 (zero) are not retained.



Perpendicular Offset: Figure 8-13

Given:

Points		Northing	Easting
Assign			
1	Base Point	10255.00000	19144.00000
2	Offset Point	10010.00000	19650.00000
3	Offset Point	9975.00000	19900.00000
4	Offset Point	10000.00000	20000.00000
5	Offset Point	11000.00000	20200.00000

Base Bearing N 88° 00' 00" E

Use Perpendicular Offset routine to find offsets and coordinates for the intersection points for offset points 2, 3, 4 and 5.

Point	Direction	Distance	Northing	Easting
Start				
1	Base Point		10255.00000	19144.00000
PO	N 88°00'00.0" E	497.141		
Temporary Intersection Point			10272.34998	19640.83854
PO	S 02°00'00.0" E	262.510		
2	Offset Point		10010.00000	19650.00000
Start				
1	Base Point		10255.00000	19144.00000
PO	N 88°00'00.0" E	745.768		
Temporary Intersection Point			10281.02691	19889.31330
PO	S 02°00'00.0" E	306.213		
3	Offset Point		9975.00000	19900.00000
Start				
1	Base Point		10255.00000	19144.00000
PO	N 88°00'00.0" E	846.579		
Temporary Intersection Point			10284.54519	19990.06346
PO	S 02°00'00.0" E	284.719		
4	Offset Point		10000.00000	20000.00000
Start				
1	Base Point		10255.00000	19144.00000
PO	N 88°00'00.0" E	1081.357		
Temporary Intersection Point			10292.73881	20224.69811
PO	N 02°00'00.0" W	707.692		
5	Offset Point		11000.00000	20200.00000

Example 8.13

Survey 4.0

Simplicity Surveying Series

8.14 CUL-DE-SAC

Code: C1

Lite

Not available in Survey Lite

FUNCTION: The CUL-DE-SAC routine is used to compute the points necessary for the layout of a center-aligned cul-de-sac from two known points. This routine is a macro.

NOTES

1. This routine is a macro program and is subject to the special data entry rules below:

- ***a. Point Overwrite Protection DOES NOT EXIST in macros.***
- *b. Use only point numbers, not names or the + or − keys.*
- *c. Required points must have been previously assigned coordinates.*
- *d. You can exit a macro routine at any prompt by entering E.*

2. The information prompted for in this routine is shown in Figure 8-14, in the order in which the prompts occur.

Select Routine

To solve a cul-de-sac, type `C1` at **Select Routine** or type `C1` Enter at any point number prompt.

Enter Cul-de-Sac Center Point

Type in the number of the known cul-de-sac center point and press Enter. *This point must have coordinates!*

Enter Centerline Point

Type in the number of a known point that lies on the roadway centerline and press Enter. *This point must have coordinates!*

Enter Entrance Curve Center Point

Type in the point number you want to assign to this point and press Enter.

Enter Entrance Curve P.C.

Type in the point number you want to assign to this point and press Enter.

Enter Entrance Curve P.R.C. to Cul-de-Sac

Type in the point number you want to assign to this point and press Enter.

Enter Exit Curve Center Point

Type in the point number you want to assign to this point and press [Enter].

Enter Exit Curve Ending Point

Type in the point number you want to assign to this point and press [Enter].

Enter Cul-de-Sac P.R.C. to Exit Curve

Type in the point number you want to assign to this point and press [Enter].

Enter the Entrance/Exit Curve Radius

Type in the desired radius length and press [Enter].

Enter the Cul-de-Sac Radius

Type in the desired radius length and press [Enter].

Enter 1/2 of the Road R/W

Type in 1/2 of the right-of-way distance of the incoming road and press [Enter]. Survey 4.0 will compute and print out the cul-de-sac points and you will be returned to **Select Routine**.

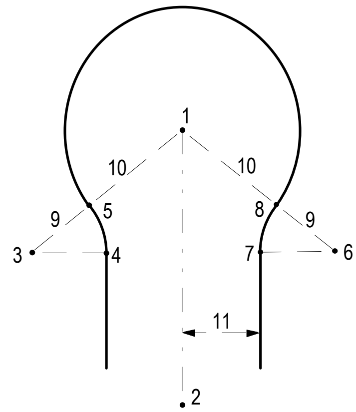
Given:

Point		Northing	Easting
Assign			
1	Cul-de-Sac Center Point	10000.00000	20000.00000
2	Point on Centerline	9753.79806	20043.41204

Compute a Cul-de-Sac having a Cul-de-Sac Radius of 75.00 and an Entrance Curve Radius of 25.00 and a Right-of-Way of 80.00.

Point		Northing	Easting
3	Entrance Curve Center Point	9913.87396	19949.18361
4	P.C. Entrance Curve	9918.21516	19973.80381
5	P.R.C. into Cul-de-Sac	9935.40547	19961.88771
6	Exit Curve Center Point	9936.44822	20077.20862
7	Exit Curve Ending Point	9932.10702	20052.58843
8	P.R.C. out of Cul-de-Sac	9952.33617	20057.90647

Example 8.14



1. Cul-de-Sac Center Point
2. Point on Centerline
3. Center Point of Entrance Curve
4. P.C. of Entrance Curve
5. P.R.C. from Entrance Curve to Cul-de-Sac
6. Center Point of Exit Curve
7. P.T. of Exit Curve
8. P.R.C. from Cul-de-Sac to Exit Curve
9. Entrance/Exit Curve Radius
10. Cul-de-Sac Radius
11. 1/2 of Road Right-of-Way

Cul-de-Sac: Figure 8-14

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Survey 4.0
Simplicity Surveying Series

8.15 CUL-DE-SAC - CORNER

Code: C2

Not available in Survey Lite

FUNCTION: The CUL-DE-SAC - CORNER routine is used to compute the points necessary for the layout of a corner-based cul-de-sac from three known points. This routine is a macro.

NOTES

1. This routine is a macro program and is subject to the special data entry rules below:

*a. **Point Overwrite Protection DOES NOT EXIST in macros.***

b. Use only point numbers, not names or the + or − keys. c. Required points must have been previously assigned coordinates.

d. You can exit a macro routine at any prompt by entering E.

2. This routine must be solved in a clockwise direction, exactly as pictured in Figure 8-15.

3. The information prompted for in this routine is shown in Figure 8-15, in the order in which the prompts occur.

Select Routine

To solve a corner cul-de-sac, type C2 at **Select Routine** or type C2 Enter at any point number prompt.

Enter Cul-de-Sac Center Point

Type in the number of the known cul-de-sac center point and press Enter. *This point must have coordinate!*

Enter 1st Centerline Point

Type in the number of the 1st known point that lies on the roadway centerline and press Enter. *This point must have coordinates and it must lie to the left of the cul-de-sac!*

Enter 2nd Centerline Point

Type in the number of the 2nd known point that lies on the roadway centerline and press Enter. *This point must have coordinates and it must lie to the right of the cul-de-sac!*

Enter Entrance Curve Center Point

Type in the point number you want to assign to this point and press Enter.

Enter Entrance Curve P.C.

Type in the point number you want to assign to this point and press Enter.

Enter Entrance Curve P.R.C. to Cul-de-Sac

Type in the point number you want to assign to this point and press Enter.

Enter Exit Curve Center Point

Type in the point number you want to assign to this point and press Enter.

Enter Exit Curve Ending Point

Type in the point number you want to assign to this point and press Enter.

Enter Cul-de-Sac P.R.C. to Exit Curve

Type in the point number you want to assign to this point and press Enter.

Enter Corner Curve Center Point

Type in the point number you want to assign to this point and press Enter.

Enter Corner Curve P.C.

Type in the point number you want to assign to this point and press Enter.

Enter Corner Curve Ending Point

Type in the point number you want to assign to this point and press Enter.

Enter the Entrance/Exit Curve Radius

Type in the desired radius length and press Enter.

Enter the Cul-de-Sac Radius

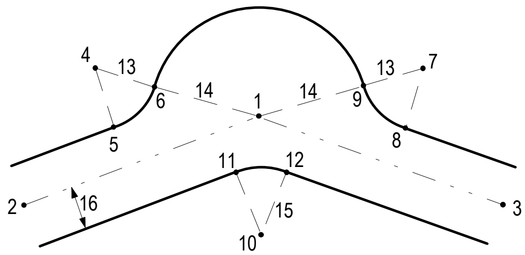
Type in the desired radius length and press Enter.

Enter the Corner Curve Radius

Type in the desired radius length and press Enter.

Enter 1/2 of the Road R/W

Type in 1/2 of the right-of-way distance of the incoming road and press Enter. Survey 4.0 will compute and print out the cul-de-sac points and return you to **Select Routine**.



1. Cul-de-Sac Center Point
2. 1st Point on Centerline
3. 2nd Point on Centerline
4. Center Point of Entrance Curve
5. P.C. of Entrance Curve
6. P.R.C. from Entrance Curve to Cul-de-Sac
7. Center Point of Exit Curve
8. Exit Curve Ending Point
9. P.R.C. from Cul-de-Sac to Exit Curve
10. Center Point of Corner Curve
11. P.C. of Corner Curve
12. Corner Curve End
13. Entrance/Exit Curve Radius
14. Cul-de-Sac Radius
15. Corner Curve Radius
16. 1/2 of Road Right-of-Way

Corner Cul-de-Sac: Figure 8-15

Given:

Point		Northing	Easting
Assign			
1	Cul-de-Sac Center Point	10000.00000	20000.00000
2	1st Point on Centerline	9753.79806	20043.41204
3	2nd Point on Centerline	10234.92316	20085.50504

Compute a corner Cul-de-Sac having a Cul-de-Sac Radius of 75.00, an Entrance Curve Radius of 25.00, a Corner Curve Radius of 35.00, and a Right-of-Way of 80.00.

Point		Northing	Easting
4	Entrance Curve Center Point	9913.87396	19949.18361
5	P.C. Entrance Curve	9918.21516	19973.80381
6	P.R.C. into Cul-de-Sac	9935.40547	19961.88771
7	Exit Curve Center Point	10093.64177	19964.91126
8	Exit Curve Ending Point	10085.09126	19988.40358
9	P.R.C. out of Cul-de-Sac	10070.23132	19973.68345
10	Corner Curve Center Point .	9993.23273	20077.35025
11	P.C. Corner Curve	9987.15504	20042.88198
12	Corner Curve Ending Point	10005.20343	20044.46101

Example 8.15

Survey 4.0 Simplicity Surveying Series

8.16 **Code: C3**

CUL-DE-SAC - LEFT / RIGHT OFFSET

Lite

Not available in Survey Lite

FUNCTION: The CUL-DE-SAC LEFT/RIGHT routine is used to compute the points necessary for the layout of a cul-de-sac that is offset left or right from the right-of-way, from two known points. This routine is a macro.

NOTES

1. This routine is a macro program and is subject to the special data entry rules below:

a. Point Overwrite Protection DOES NOT EXIST in macros.

b. Use only point numbers, not names or the + or − keys. c. Required points must have been previously assigned coordinates.

d. You can exit a macro routine at any prompt by entering E.

2. The information prompted for in this routine is shown in Figure 8-16, in the order in which the prompts occur.

Select Routine

To solve a left offset or right offset cul-de-sac, type C3 at **Select Routine** or type C3 Enter at any point number prompt.

Select Cul-de-Sac Offset Direction
< 1 > Left Offset
< 2 > Right Offset
< E > Exit

Select the desired offset direction by pressing 1, 2, or E to Exit. Refer to Figure 8-16 to determine the correct offset orientation.

Enter Offset Point to Cul-de-Sac Center Point

Type in the number of the known point offset to the cul-de-sac center point and press Enter. *This point must have coordinates!*

Enter Centerline Point

Type in the number of a known point that lies on the roadway centerline and press Enter. *This point must have coordinates!*

Enter Cul-de-Sac P.T.

Type in the point number you want to assign to this point and press Enter.

Enter Cul-de-Sac Center Point

Type in the point number you want to assign to this point and press Enter.

Enter Entrance Curve Center Point

Type in the point number you want to assign to this point and press Enter.

Enter Entrance Curve P.C.

Type in the point number you want to assign to this point and press Enter.

Enter Entrance Curve P.R.C. to Cul-de-Sac

Type in the point number you want to assign to this point and press Enter.

Enter Cul-de-Sac Radius

Type in the desired radius length and press Enter.

Enter Entrance Curve Radius

Type in the desired radius length and press Enter.

Enter 1/2 of the Road R/W

Type in 1/2 of the right-of-way distance of the incoming road and press Enter. Survey 4.0 will compute and print out the cul-de-sac points and you will be returned to **Select Routine**.

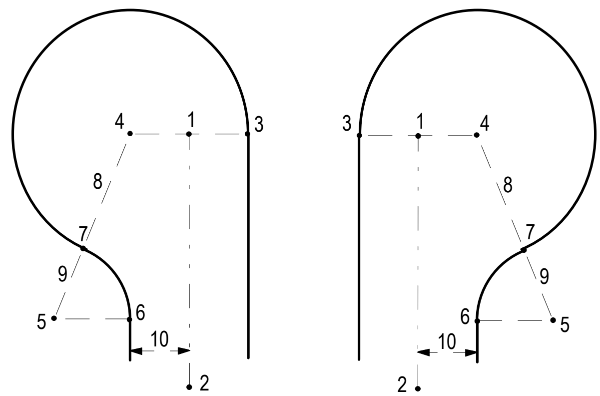
Given:

Point		Northing	Easting
Assign			
1	Offset to CDS Center Point	10000.00000	20000.00000
2	Point on Centerline	9753.79806	20043.41204

Compute a Left Offset Cul-de-Sac having a Cul-de-Sac Radius of 75.00 and an Entrance Curve Radius of 35.00 and a Right-of-Way of 80.00.

Point		Northing	Easting
3	Cul-de-Sac P.T.	10006.94593	20039.39231
4	Cul-de-Sac Center Point	9993.92231	19965.53173
5	Entrance Curve Center Point	9886.06362	19943.93306
6	P.C. Entrance Curve	9892.14131	19978.40133
7	P.R.C. into Cul-de-Sac	9920.38230	19950.80536

Example 8.16



1. Offset Point to Cul-de-Sac Center Point
2. Point on Centerline
3. Cul-de-Sac P.T.
4. Cul-de-Sac Center Point
5. Center Point of Entrance Curve
6. P.C. of Entrance Curve
7. P.R.C. from Entrance Curve to Cul-de-Sac
8. Cul-de-Sac Radius
9. Entrance Curve Radius
10. 1/2 of Road Right-of-Way

Cul-de-Sac Offset Left & Right: Figure 8-16

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Survey 4.0
Simplicity Surveying Series

8.17 INTERSECTION - CORNER

Code: I 2

Not available in Survey Lite

FUNCTION: The INTERSECTION-CORNER routine is used to compute the points necessary for the layout of a corner, from two known points. This routine is a macro.

NOTES

1. This routine is a macro program and is subject to the special data entry rules below:

a. Point Overwrite Protection DOES NOT EXIST in macros.

b. Use only point numbers, not names or the + or − keys. c. Required points must have been previously assigned coordinates.

d. You can exit a macro routine at any prompt by entering E.

2. The information prompted for in this routine is shown in Figure 8-17, in the order in which the prompts occur.

3. This routine must be solved in a clockwise direction as defined by a course traveling from the 2nd Centerline Point (3) through the Centerline Intersection Point (1) to the 1st Centerline Point (2).

Select Routine

To solve a corner intersection, type `I2` at **Select Routine** or type `I2` Enter at any point number prompt.

Enter Centerline Intersection Point

Type in the number of the Centerline Intersection Point and press Enter. *This point must have coordinates!*

Enter 1st Centerline Point

Type in the number of a known point that lies on the roadway centerline and press Enter. *This point must have coordinates!*

Enter 2nd Centerline Point

Type in the number of a known point that lies on the roadway centerline and press Enter. *This point must have coordinates!*

Enter Corner Curve Center Point

Type in the point number you want to assign to this point and press Enter.

Enter Inside Corner Curve P.C.

Type in the point number you want to assign to this point and press [Enter].

Enter Inside Corner Curve Ending Point

Type in the point number you want to assign to this point and press [Enter].

Enter Outside Corner Curve P.C.

Type in the point number you want to assign to this point and press [Enter].

Enter Outside Corner Curve Ending Point

Type in the point number you want to assign to this point and press [Enter].

Enter Centerline Curve Radius

Type in the desired radius length and press [Enter].

Enter 1/2 of the Road R/W

Type in 1/2 of the right-of-way distance of the incoming road and press [Enter]. Survey 4.0 will compute and print out the corner points and you will be returned to **Select Routine**.

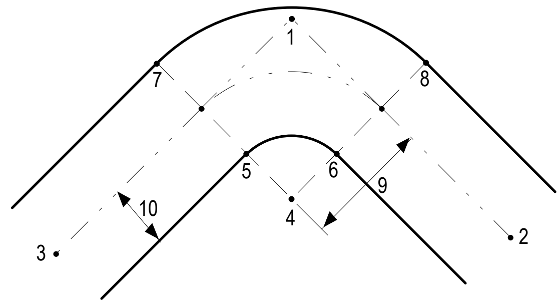
Given:

Point		Northing	Easting
Assign			
1	Intersection Center Point	10000.00000	20000.00000
2	Point on Centerline	9860.00000	20140.00000
3	Point on Centerline	9910.00000	19820.00000

Compute a Corner having a Centerline Radius of 75.00 and a Right-of-Way of 80.00.

Point		Northing	Easting
4	Corner Curve Center Point	9908.74296	19985.19102
5	Inner Curve P.C.	9940.04791	19969.53854
6	Inner Curve Ending Point	9933.49170	20009.93976
7	Outer Curve P.C.	10011.60208	19933.76145
8	Outer Curve Ending Point	9990.06024	20066.50830

Example 8.17



1. Centerline Intersection Point
2. 1st Point on Centerline
3. 2nd Point on Centerline
4. Corner Curve Center Point
5. P.C. of Inside Corner Curve
6. Inside Corner Curve Ending Point
7. P.C. of Outside Corner Curve
8. Outside Corner Curve Ending Point
9. Centerline Curve Radius
10. 1/2 of Road Right-of-Way

Intersection - Corner: Figure 8-17

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Survey 4.0
Simplicity Surveying Series

8.18 INTERSECTION - CURVING TEE

Code: I3

Not available in Survey Lite

FUNCTION: The INTERSECTION-CURVING TEE routine is used to compute the points necessary for the layout of a Tee-Intersection with a curving primary right-of-way. This routine is a macro.

NOTES

1. This routine is a macro program and is subject to the special data entry rules below:

- ***a. Point Overwrite Protection DOES NOT EXIST in macros.***
- *b. Use only point numbers, not names or the [+] or [-] keys. c. Required points must have been previously assigned coordinates.*
- *d. You can exit a macro routine at any prompt by entering [E].*

2. The information prompted for in this routine is shown in Figure 8-18, in the order in which the prompts occur.

3. The distance from the Primary Curve Center Point to the Centerline Intersection Point, (2 to 1 on Figure 8-18), must be greater that the distance from the Centerline Intersection Point to the point on Secondary Centerline, (1 to 3 on Figure 8-18) .

Select Routine

To solve a curving tee intersection, type `I3` at **Select Routine** or type `I3` [Enter] at any point number prompt.

Select the Primary R/W Type
< 1 > Curved R/W
< 2 > Straight R/W
< E > Exit

Select the curved (primary) right-of-way type by pressing [1]. Refer to Figure 8-18 for an index to the remainder of the prompts for this routine.

Enter Centerline Intersection Point

Type in the number of the known centerline intersection point and press [Enter]. *This point must have coordinates!*

Enter Primary Curve Center Point

Type in the number of the primary curve's center point and press [Enter]. *This point must have coordinates!*

Enter a Point on the Intersecting Centerline

Type in the number of any point on the intersecting centerline and press Enter. *This point must have coordinates!*

Enter 1st Corner Curve Center Point

Type in the desired point number and press Enter.

Enter 1st Corner Curve P.C.

Type in the desired point number and press Enter.

Enter 1st Corner Curve P.T.

Type in the desired point number and press Enter.

Enter 2nd Corner Curve Center Point

Type in the desired point number and press Enter.

Enter 2nd Corner Curve P.C.

Type in the desired point number and press Enter.

Enter 2nd Corner Curve P.T.

Type in the desired point number and press Enter.

Enter 1/2 of the Primary Road R/W

Type in 1/2 of the total right-of-way width of the primary road and press Enter.

Enter 1/2 of the Intersecting Road R/W

Type in 1/2 of the total right-of-way width of the intersecting road and press Enter.

Enter the Corner Curve Radius

Type in the desired radius length and press Enter.

Enter the Primary Curve Centerline Radius

Type in the *known* centerline radius length and press Enter. Because this is a macro, you cannot recall this distance, nor can the program compute it when it is first used in the solution. Therefore, it must be entered at this time.

Survey 4.0 will compute and print out the intersection points and you will be returned to **Select Routine**.

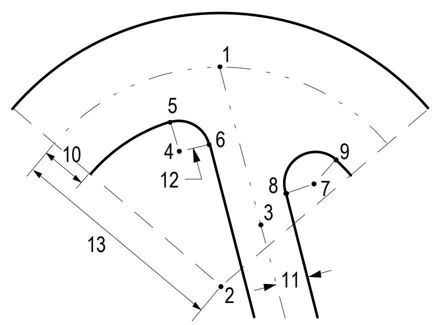
Given:

Point		Northing	Easting
Assign			
1	CL Intersection Point	10000.00000	20000.00000
2	Center Pt. Primary Curve	9000.00000	20100.00000
3	Point on Centerline	9600.00000	20200.00000

Compute a Curving Tee Intersection having a Primary Right-of-Way of 80.00, a Secondary Right-of-Way of 60.00, a Corner Curve Radius of 25.00, and a Primary Centerline Radius of 1004.988.

Point		Northing	Easting
4	1st Curve Center Point	9931.34659	19972.83484
5	1st Curve P.C.	9956.11676	19969.45274
6	1st Curve P.T.	9942.52693	19995.19552
7	2nd Curve Center Point	9939.94972	20091.51701
8	2nd Curve P.C	9928.76938	20069.15633
9	2nd Curve P.T	9964.94870	20091.29139

Example 8.18



1. Centerline Intersection Point
2. Center Point of Primary Curve
3. Point on Intersecting Centerline
4. Center Point of 1st Corner Curve
5. P.C. of 1st Corner Curve
6. P.T. of 1st Corner Curve
7. Center Point of 2nd Corner Curve
8. P.C. of 2nd Corner Curve
9. P.T. of 2nd Corner Curve
10. 1/2 of Primary Road Right-of-Way
11. 1/2 of Secondary Road Right-of-Way
12. Corner Curve Radius
13. Primary Curve Centerline Radius

Intersection - Curving Tee: Figure 8-18

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Survey 4.0
Simplicity Surveying Series

8.19 INTERSECTION - TEE

Code: I3

Not available in Survey Lite

FUNCTION: The INTERSECTION-TEE routine is used to compute the points necessary for the layout of a Tee-Intersection with a straight primary right-of-way. This routine is a macro.

NOTES

1. This routine is a macro program and is subject to the special data entry rules below:

- ***a. Point Overwrite Protection DOES NOT EXIST in macros.***
- *b. Use only point numbers, not names or the [+] or [-] keys. c. Required points must have been previously assigned coordinates.*
- *d. You can exit a macro routine at any prompt by entering [E].*

2. The information prompted for in this routine is shown in Figure 8-19, in the order in which the prompts occur.

Select Routine

To solve a straight tee intersection, type `I3` at **Select Routine** or type `I3` [Enter] at any point number prompt.

Select the Primary R/W Type
< 1 > Curved R/W
< 2 > Straight R/W
< E > Exit

Select the straight (primary) right-of-way type by pressing [2]. Refer to Figure 8-19 for an index to the remainder of the prompts for this routine.

Enter Intersection Center Point

Type in the number of the known centerline intersection point and press [Enter]. *This point must have coordinates!*

Enter 1st point on Primary Centerline

Type in the number of the 1st known centerline point and press [Enter]. *This point must have coordinates!*

Enter 2nd point on Primary Centerline

Type in the number of the 2nd known Centerline Point and press [Enter]. *This point must have coordinates!*

Enter a point on the Secondary Centerline

Type in the number of a known point on the Secondary Centerline and press [Enter]. *This point must have coordinates!*

Enter 1st Corner Curve Center Point	Type in the point number you want to assign to this point and press Enter.
Enter 1st Corner Curve P.C.	Type in the point number you want to assign to this point and press Enter.
Enter 1st Corner Curve P.T.	Type in the point number you want to assign to this point and press Enter.
Enter 2nd Corner Curve Center Point	Type in the point number you want to assign to this point and press Enter.
Enter 2nd Corner Curve P.C.	Type in the point number you want to assign to this point and press Enter.
Enter 2nd Corner Curve P.T.	Type in the point number you want to assign to this point and press Enter.
Enter the Corner Curve Radius	Type in the desired radius length and press Enter.
Enter 1/2 of the Primary road R/W	Type in 1/2 of the total right-of-way width of the primary road and press Enter.
Enter 1/2 of the Secondary road R/W	Type in 1/2 of the total right-of-way width of the secondary road and press Enter. Survey 4.0 will compute and print out the intersection points and you will be returned to **Select Routine**.

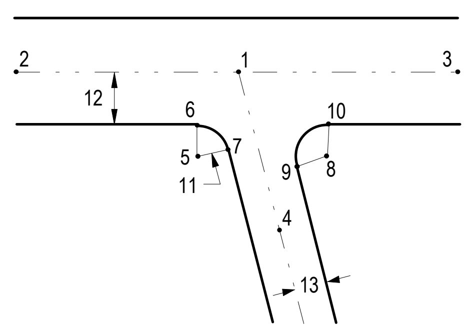
Given:

Point		Northing	Easting
Assign			
1	CL Intersection Point	10000.00000	20000.00000
2	Point on Primary Centerline	9965.27036	19803.03845
3	Point on Primary Centerline	10034.72964	20196.96155
4	Point on Secondary C.Line	9600.00000	20200.00000

Compute a Tee Intersection having a Primary Right-of-Way of 80.00, a Secondary Right-of-Way of 60.00 and a Corner Curve Radius of 25.00.

Point		Northing	Easting
5	1st Curve Center Point	9929.38064	19973.81781
6	1st Curve P.C.	9954.00084	19969.47660
7	1st Curve P.T.	9940.56098	19996.17849
8	2nd Curve Center Point	9949.30904	20086.83735
9	2nd Curve P.C	9938.12870	20064.47667
10	2nd Curve P.T	9973.92923	20082.49614

Example 8.19



1. Centerline Intersection Point
2. 1st Point on Centerline
3. 2nd Point on Centerline
4. Point on Secondary Centerline
5. Center Point of 1st Corner Curve
6. P.C. of 1st Corner
7. P.T. of 1st Corner
8. Center Point of 2nd Corner Curve
9. P.C. of 2nd Corner
10. P.T. of 2nd Corner
11. Corner Curve Radius
12. 1/2 of Primary Right-of-Way
13. 1/2 of Secondary Right-of-Way

Intersection - Straight Tee: Figure 8-19

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Survey 4.0
Simplicity Surveying Series

8.20 INTERSECTION - 4 WAY

Code: I4

Not available in Survey Lite

FUNCTION: The INTERSECTION - FOUR WAY routine is used to compute the points necessary for the layout of an intersection created by two intersecting rights-of-way. This routine is a macro.

NOTES

1. This routine is a macro program and is subject to the special data entry rules below:

*a. **Point Overwrite Protection DOES NOT EXIST in macros.***

b. Use only point numbers, not names or the + or − keys. c. Required points must have been previously assigned coordinates.

d. You can exit a macro routine at any prompt by entering E.

2. The information prompted for in this routine is shown in Figure 8-20, in the order in which the prompts occur.

Select Routine

To solve a four way intersection, type **I4** at **Select Routine** or type **I4** Enter at any point number prompt.

Enter Intersection Center Point

Type in the number of the known centerline intersection point and press Enter. *This point must have coordinates!*

Enter 1st point on Primary Centerline

Type in the number of the 1st known primary centerline point and press Enter. *This point must have coordinates!*

Enter 2nd point on Primary Centerline

Type in the number of the 2nd known primary centerline point and press Enter. *This point must have coordinates!*

Enter 1st point on Secondary Centerline

Type in the number of the 1st known secondary centerline point and press Enter. *This point must have coordinates!*

Enter 2nd point on Secondary Centerline

Type in the number of the 2nd known secondary centerline point and press Enter. *This point must have coordinates!*

Enter 1st Corner Curve Center Point	Type in the point number you want to assign to this point and press Enter.
Enter 1st Corner Curve P.C.	Type in the point number you want to assign to this point and press Enter.
Enter 1st Corner Curve P.T.	Type in the point number you want to assign to this point and press Enter.
Enter 2nd Corner Curve Center Point	Type in the point number you want to assign to this point and press Enter.
Enter 2nd Corner Curve P.C.	Type in the point number you want to assign to this point and press Enter.
Enter 2nd Corner Curve P.T.	Type in the point number you want to assign to this point and press Enter.
Enter 3rd Corner Curve Center Point	Type in the point number you want to assign to this point and press Enter.
Enter 3rd Corner Curve P.C.	Type in the point number you want to assign to this point and press Enter.
Enter 3rd Corner Curve P.T.	Type in the point number you want to assign to this point and press Enter.
Enter 4th Corner Curve Center Point	Type in the point number you want to assign to this point and press Enter.
Enter 4th Corner Curve P.C.	Type in the point number you want to assign to this point and press Enter.
Enter 4th Corner Curve P.T.	Type in the point number you want to assign to this point and press Enter.
Enter the Corner Curve Radius	Type in the desired radius length and press Enter.
Enter 1/2 of the Primary road R/W	Type in 1/2 of the right-of-way distance of the primary road and press Enter.

Enter 1/2 of the Secondary road R/W

Type in 1/2 of the right-of-way distance of the secondary road and press [Enter]. Survey 4.0 will compute and print out the intersection points and you will be returned to **Select Routine**.

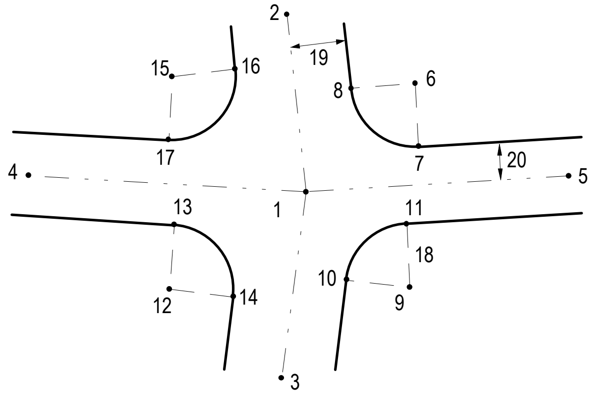
Given:

Point Assign		Northing	Easting
1	CL Intersection Point	10000.00000	20000.00000
2	Point on Primary Centerline	10200.00000	20000.00000
3	Point on Primary Centerline	9800.00000	19965.00000
4	Pnt. on Secondary Centerline	10035.00000	19803.00000
5	Pnt. on Secondary Centerline	10087.00000	20492.00000

Compute a Four Way Intersection having Corner Curve Radii of 25.00, a Primary Right-of-Way of 80.00 and a Secondary Right-of-Way of 60.00.

Point		Northing	Easting
6	1st Corner Center Point	10067.34717	20065.00000
7	1st Corner P.C.	10042.72909	20069.35320
8	1st Corner P.T.	10067.34717	20040.00000
9	2nd Corner Center Point	9954.40435	20058.00857
10	2nd Corner P.C.	9958.71385	20033.38281
11	2nd Corner P.T.	9979.02242	20053.65537
12	3rd Corner Center Point	9957.19335	19926.52103
13	3rd Corner P.C.	9981.80789	19930.89417
14	3rd Corner P.T.	9952.88384	19951.14679
15	4th Corner Center Point	10067.40951	19935.00000
16	4th Corner P.C.	10067.40951	19960.00000
17	4th Corner P.T.	10042.79497	19930.62686

Example 8.20



1. Centerline Intersection Point
2. 1st Point on Primary Centerline
3. 2nd Point on Primary Centerline
4. 1st Point on Secondary Centerline
5. 2nd Point on Secondary Centerline
6. Center Point of 1st Corner Curve
7. P.C. of 1st Corner Curve
8. P.T. of 1st Corner Curve
9. Center Point of 2nd Corner Curve
10. P.C. of 2nd Corner Curve
11. P.T. of 2nd Corner Curve
12. Center Point of 3rd Corner Curve
13. P.C. of 3rd Corner Curve
14. P.T. of 3rd Corner Curve
15. Center Point of 4th Corner Curve
16. P.C. of 4th Corner Curve
17. P.T. of 4th Corner Curve
18. Corner Curve Radius
19. 1/2 of Primary Road Right-of-Way
20. 1/2 of Secondary Road Right-of-Way

Intersection - 4 Way: Figure 8-20

Survey 4.0
Simplicity Surveying Series

8.21 Code: SB

SECTION BREAKDOWN - QUARTERS

Not available in Survey Lite

FUNCTION: The SECTION BREAKDOWN - QUARTERS routine is used to compute the quarter corners and center of section from the section corners, for a standard section. ***This routine should not be used on Sections 1-7, 18, 19, 30 or 31****. This routine is a macro.*

NOTES

1. This routine is a macro program and is subject to the special data entry rules below:

- ***a. Point Overwrite Protection DOES NOT EXIST in macros.***
- *b. Use only point numbers, not names or the [+] or [−] keys.*
- *c. Required points must have been previously assigned coordinates.*
- *d. You can exit a macro routine at any prompt by entering [E].*

2. The information prompted for in this routine is shown in Figure 8-21, in the order in which the prompts occur.

Select Routine

To breakdown a section into quarters, type **SB** at **Select Routine** or type **SB** [Enter] at any point number prompt.

Breakdown a Section into
< 1 > Quarters
< 2 > Sixteenths
< E > Exit

Select the quarters breakdown option by pressing [1]. Refer to Figure 8-21 for an index to the remainder of the prompts for this routine.

Enter the Known NE Section Corner

Type in the number of the known NE section corner and press [Enter]. *This point must have coordinates!*

Enter the Known SE Section Corner

Type in the number of the known SE section corner and press [Enter]. *This point must have coordinates!*

Enter the Known SW Section Corner

Type in the number of the known SW section corner and press [Enter]. *This point must have coordinates!*

Enter the Known NW Section Corner

Type in the number of the known NW section corner and press Enter. *This point must have coordinates!*

NOTE

The remainder of the point entries may contain known and unknown points. Coordinates for known points may be "held". To "hold" or preserve the coordinates of a known point, enter the point number as a decimal number, i.e. enter point 5 as a "held" point by entering **.5** Enter.

Enter the East 1/4 Corner

Type in the number of the East 1/4 corner and press Enter.

Enter the South 1/4 Corner

Type in the number of the South 1/4 corner and press Enter.

Enter the West 1/4 Corner

Type in the number of the West 1/4 corner and press Enter.

Enter the North 1/4 Corner

Type in the number of the North 1/4 corner and press Enter.

Enter the Center of Section

Type in the number of the center of section and press Enter.

Survey 4.0 will compute and print out the section corner points and you will be returned to **Select Routine**.

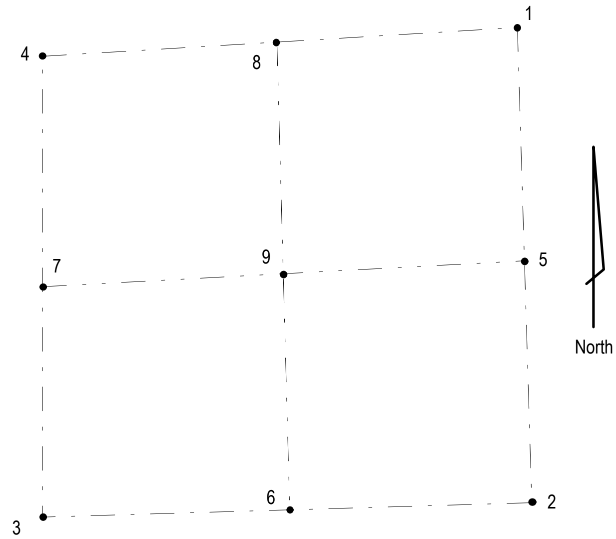
Given:

Point		Northing	Easting
Assign			
1	NE Section Corner	10000.00000	20000.00000
2	SE Section Corner	4734.68879	20047.22612
3	SW Section Corner	4685.26608	14746.20151
4	NW Section Corner	9856.12146	14748.73348

Compute a Section Breakdown into quarters from the four known corners.

Point		Northing	Easting
5	East 1/4 Corner	7367.34440	20023.61306
6	South 1/4 Corner	4709.97744	17396.71382
7	West 1/4 Corner	7270.69377	14747.46750
8	North 1/4 Corner	9928.06073	17374.36674
9	Center of Section	7319.01908	17385.54027

Example 8.21



1. NE Section Corner
2. SE Section Corner
3. SW Section Corner
4. NW Section Corner
5. East 1/4 Corner
6. South 1/4 Corner
7. West 1/4 Corner
8. North 1/4 Corner
9. Center of Section

Section Breakdown - Quarters: Figure 8-21

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Survey 4.0
Simplicity Surveying Series

8.22 Code: SB

SECTION BREAKDOWN - SIXTEENTHS

Lite
Not available in Survey Lite

FUNCTION: The SECTION BREAKDOWN - SIXTEENTHS routine is used to compute the quarter and sixteenth corners and center of section from the section corners, for a standard section. ***This routine should not be used on Sections 1-7, 18, 19, 30 or 31.*** *This routine is a macro.*

NOTES

1. This routine is a macro program and is subject to the special data entry rules below:

a. Point Overwrite Protection DOES NOT EXIST in macros.

b. Use only point numbers, not names or the + or − keys. c. Required points must have been previously assigned coordinates.

d. You can exit a macro routine at any prompt by entering E.

2. The information prompted for in this routine is shown in Figure 8-22, in the order in which the prompts occur.

Select Routine

To breakdown a section into sixteenths, type **SB** at **Select Routine** or type **SB** Enter at any point number prompt.

Breakdown a Section into
< 1 > Quarters
< 2 > Sixteenths
< E > Exit

Select the sixteenths breakdown option by pressing 2. Refer to Figure 8-22 for an index to the remainder of the prompts for this routine.

Enter the Known NE Section Corner

Type in the number of the known NE section corner and press Enter. *This point must have coordinates!*

Enter the Known SE Section Corner

Type in the number of the known SE section corner and press Enter. *This point must have coordinates!*

Enter the Known SW Section Corner

Type in the number of the known SW section corner and press Enter. *This point must have coordinates!*

Enter the Known NW Section Corner

Type in the number of the known NW section corner and press [Enter]. *This point must have coordinates!*

NOTE

The remainder of the point entries may contain known and unknown points. Coordinates for known points may be "held". To "hold" or preserve the coordinates of a known point, enter the point number as a decimal number, i.e. enter point 5 as a "held" point by entering **.5** [Enter].

Enter the East 1/4 Corner

Type in the number of the East 1/4 corner and press [Enter].

Enter the South 1/4 Corner

Type in the number of the South 1/4 corner and press [Enter].

Enter the West 1/4 Corner

Type in the number of the West 1/4 corner and press [Enter].

Enter the North 1/4 Corner

Type in the number of the North 1/4 corner and press [Enter].

Enter the Center of Section

Type in the number of the center of section and press [Enter].

Enter the North 1/16 Corner on the East Line

Type in the desired point number for this point and press [Enter].

Enter the South 1/16 Corner on the East Line

Type in the desired point number for this point and press [Enter].

Enter the East 1/16 Corner on the South Line

Type in the desired point number for this point and press [Enter].

Enter the West 1/16 Corner on the South Line

Type in the desired point number for this point and press [Enter].

Enter the South 1/16 Corner on the West Line

Type in the desired point number for this point and press [Enter].

Enter the North 1/16 Corner on the West Line

Type in the desired point number for this point and press [Enter].

Enter the West 1/16 Corner on the North Line

Type in the desired point number for this point and press [Enter].

Enter the East 1/16 Corner on the North Line

Type in the desired point number for this point and press [Enter].

Enter the North 1/16 Corner on the Center Line

Type in the desired point number for this point and press [Enter].

Enter the South 1/16 Corner on the Center Line

Type in the desired point number for this point and press [Enter].

Enter the East 1/16 Corner on the Center Line

Type in the desired point number for this point and press [Enter].

Enter the West 1/16 Corner on the Center Line

Type in the desired point number for this point and press [Enter].

Enter the Center of the NE 1/4

Type in the desired point number for this point and press [Enter].

Enter the Center of the SE 1/4

Type in the desired point number for this point and press [Enter].

Enter the Center of the SW 1/4

Type in the desired point number for this point and press [Enter].

Enter the Center of the NW 1/4

Type in the desired point number for this point and press [Enter].

Survey 4.0 will compute and print out the section points and you will be returned to **Select Routine**.

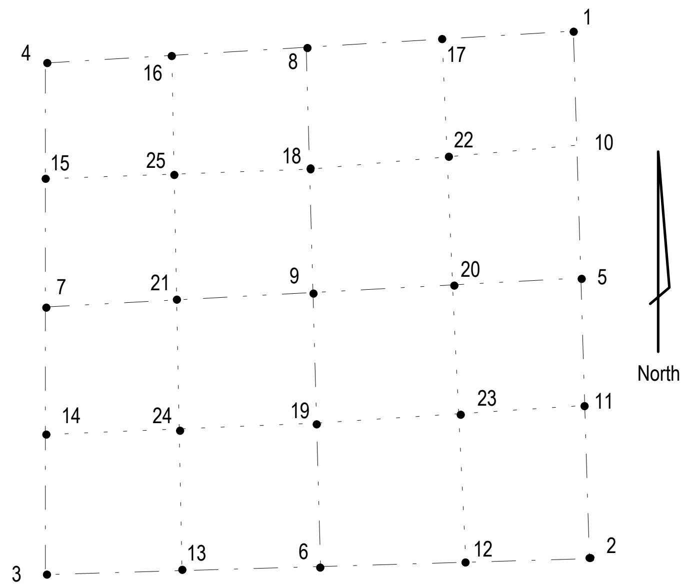
Given:

Point		Northing	Easting
Assign			
1	NE Section Corner	10000.00000	20000.00000
2	SE Section Corner	4734.68879	20047.22612
3	SW Section Corner	4685.26608	14746.20151
4	NW Section Corner	9856.12146	14748.73348

Compute a Section Breakdown into sixteenths from the known corners.

Point		Northing	Easting
5	E 1/4 Corner	7367.34440	20023.61306
6	S 1/4 Corner	4709.97744	17396.71382
7	W 1/4 Corner	7270.69377	14747.46750
8	N 1/4 Corner	9928.06073	17374.36674
9	Center of Section	7319.01908	17385.54027
10	N 1/16 Cor. - East Line	8683.67220	20011.80653
11	S 1/16 Cor. - East Line	6051.01659	20035.41959
12	E 1/16 Cor. - South Line	4722.33311	18721.96997
13	W 1/16 Cor. - South Line	4697.62176	16071.45766
14	S 1/16 Cor. - West Line	5977.97993	14746.83450
15	N 1/16 Cor. - West Line	8563.40762	14748.10049
16	W 1/16 Cor. - North Line	9892.09109	16061.55011
17	E 1/16 Cor. - North Line	9964.03036	18687.18337
18	N 1/16 Cor. - Center Line	8623.53990	17379.95350
19	S 1/16 Cor. - Center Line	6014.49826	17391.12704
20	E 1/16 Cor. - Center Line	7343.18174	18704.57666
21	W 1/16 Cor. - Center Line	7294.85642	16066.50388
22	Center NE 1/4	8653.60606	18695.88002
23	Center SE 1/4	6032.75742	18713.27331
24	Center SW 1/4	5996.23909	16068.98077
25	Center NW 1/4	8593.47376	16064.02700

Example 8.22



1. NE Section Corner
2. SE Section Corner
3. SW Section Corner
4. NW Section Corner
5. East 1/4 Corner
6. South 1/4 Corner
7. West 1/4 Corner
8. North 1/4 Corner
9. Center of Section
10. North 1/16 Corner - East Line
11. South 1/16 Corner - East Line
12. East 1/16 Corner - South Line
13. West 1/16 Corner - South Line
14. South 1/16 Corner - West Line
15. North 1/16 Corner - West Line
16. West 1/16 Corner - North Line
17. East 1/16 Corner - North Line
18. North 1/16 Corner - Center Line
19. South 1/16 Corner - Center Line
20. East 1/16 Corner - Center Line
21. West 1/16 Corner - Center Line
22. Center of the NE 1/4
23. Center of the SE 1/4
24. Center of the SW 1/4
25. Center of the NW 1/4

Section Breakdown - Sixteenths: Figure 8-22

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Survey 4.0
Simplicity Surveying Series

9.01 Code: AR

AREA PRINTOUT

FUNCTION: The AREA PRINTOUT routine is used to obtain the area in square feet (or meters) of a closed plane figure.

NOTES

1. You may obtain the area of any closed figure, including curves, provided you began your traversed and/or inversed path with the **Start At** *routine (**ST** - Section 10.01).*

*2. Area calculations are valid only for **CLOSED** figures. If the Northing and Easting coordinates of your starting point do not match the Northing and Easting coordinates of your ending point, the area calculated and reported by this routine will be grossly inaccurate.*

3. This routine clears the Area Sum and Traverse Length accumulators after reporting the area.

4. Conversions used: 1 acre = 43,560 square feet; 1 hectare = 10,000 square meters; and 1 cuerda = 3,930.3956 square meters.

Select Routine

To calculate and print out the area of a closed traverse in square feet (or meters) and acres (hectares or cuerdas), type **AR** at **Select Routine** or type **AR** ↵Enter at any point number prompt. The program will print out the area in the units that you have specified on the Configuration Menu.

After reporting the area, the internal area accumulator is cleared. The starting point for the next routine is the same as the last point number entered prior to calling the area routine. If you wish to begin from a different point, use the **Start At** routine (**ST** - Section 10.01).

Given:

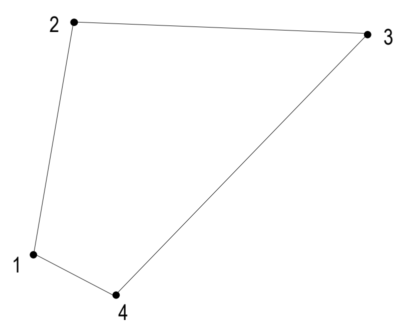
Point		Northing	Easting
Assign			
1	SW Corner Lot 1	9794.5430	19731.4138
2	NW Corner Lot 1	10008.7249	19750.1523
3	NE Corner Lot 1	9997.4144	20074.0413
4	SE Corner Lot 1	9769.3943	19777.2902

Use Inverse and Area to compute the area of the tract formed by the points shown above.

Point	Direction	Distance	Northing	Easting
Start				
1	SW Corner Lot 1		9794.5430	19731.4138
IN	N 5° 00' 00.0" E	215.000		
2	NW Corner Lot 1		10008.7249	19750.1523
IN	S 88° 00' 00.0" E	324.086		
3	NE Corner Lot 1		9997.4144	20074.0413
IN	S 52° 27' 42.3" W	374.238		
4	SE Corner Lot 1		9769.3943	19777.2902
IN	N 61° 16' 09.0" W	52.317		
1	SW Corner Lot 1		9794.5430	19731.4138

Area = 43753.3745 Sq. Feet or 1.0044 Acres

Example 9.1



Area: Figure 9-1

Survey 4.0 Simplicity Surveying Series

9.02 Code: PA

POINT TO POINT AREA

FUNCTION: The POINT TO POINT AREA routine is used to inverse around a tract and obtain an enclosed area without printing out the bearings and distances of the boundaries.

NOTES

1. You CANNOT key in individual points during this routine. All entries must be in the form of a point number string or entered as a defined figure name.

2. You must have a minimum of three known points to use this routine.

3. This routine clears the Area Sum and Traverse Length accumulators after reporting the area.

Select Routine

To compute and print out the area of an enclosed tract in square feet (meters) and acres (hectares or cuerdas), without printing out the bearings and distances of the parcel's boundaries, type **PA** at **Select Routine** or type **PA** ↵Enter at any point number prompt.

Enter Point to Point Area string

Type in a point number string or a defined figure name and press ↵Enter. Unless your last leg is an arc, it is not necessary that your ending point be the same as your starting point, since Survey 4.0 will automatically return to the starting point. If your last leg is an arc, you must include a reference to the starting point after the arc. For example, in the string **7,2,9,8*6,7**, the final **7** tells Survey 4.0 where to stop the arc. If you were obtaining the area of a four sided tract **1,2,3,4**, you do not need to place a reference to point **1** after the **4**.

The enclosed area will be reported in the units of measurement specified on the Configuration Menu. After reporting the area, the internal area accumulator is cleared and you will regain control at a **Select Routine** prompt.

Given:

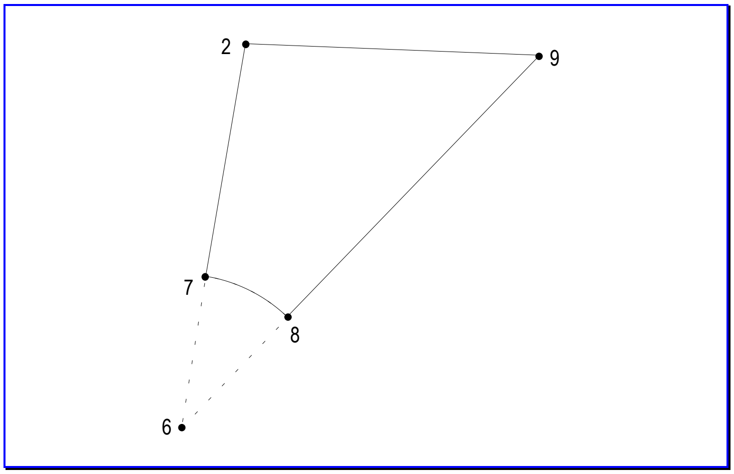
Point		Northing	Easting
Assign			
2	NW Corner Lot 1	10008.7249	19750.1523
6	Center Point of Arc	9729.7904	19725.7487
7	SW Corner Lot 1	9794.5430	19731.4138
8	SE Corner Lot 1	9769.3943	19777.2902
9	NE Corner Lot 1	9997.4144	20074.0413

Use Point to Point Area to compute the area of the tract formed by the point string 7, 2, 9, 8 *6, 7

Point	Direction	Distance	Northing	Easting
Point to Point Area				

Boundary: 7,2,9,8*6,7
Area = 43560.0014 Sq. Feet or 1.0000 Acres

Example 9.2



Point to Point Area: Figure 9-2

Survey 4.0
Simplicity Surveying Series

9.03 PREDETERMINED AREA TWO SIDES PARALLEL

Code: P1

Not available in Survey Lite

FUNCTION: The PREDETERMINED AREA - 2 SIDES PARALLEL routine is used to compute the length of three sides of a four sided tract of known area. This routine requires the subject tract to have two sides that are parallel. Additionally, the directions of the non-parallel sides and the coordinates of the end points of one of the parallel line segments must be known.

Select Routine

To compute the unknown three sides of a four sided tract of known area, type `P1` at **Select Routine** or type `P1` [Enter] at any point number prompt.

First Base Point

Type in a point number (for point P1 as shown in Figure 9-3) which defines one end of the base line lying between points P1 and P2 and press [Enter].

Second Base Point

Type in the point number (for point P2 as shown in Figure 9-3) which defines the other end of the base line lying between points P1 and P2 and press [Enter].

Point on line from (P2) is

Type in an identifying point number (for point P3 as shown in Figure 9-3) which will lie on the line extending from point P2 and press [Enter]. The point number for point **P2** will be given in the prompt. *NOTE: Point name assignment is not available.*

Point on line from (P1) is

Type in an identifying point number (for point P4 as shown in Figure 9-3) which will lie on the line extending from point P1 and press [Enter]. The point number for point **P1** will be given in the prompt. *NOTE: Point name assignment is not available.*

Bearing from (P2) to (P3)

Type in the bearing from point **P2** to point **P3** in your chosen format, or recall a bearing between any two points in memory and press [Enter]. The actual point numbers will be given in the prompt.

Bearing from (P1) to (P4)

Type in the bearing from point **P1** to point **P4** in your chosen format, or recall a bearing between any two points in memory and press [Enter]. The actual point numbers will be given in the prompt.

Required Area

Type in the required data in square feet (or square meters if metric) and press [Enter]. Values may be entered as acres, hectares or cuerdas by placing the letter **A**, **H** or **C** behind the numeric portion of your response. For example, enter 1.75 acres as **1.75A** [Enter].

If a solution is possible, the program will compute and print the bearing and distance data from point P1 to P2 to P3 to P4 and back to P1. The required area will also be printed and you will be returned to a **Select Routine** prompt.

Given:

Point		Northing	Easting
Assign			
1	Point P1	10000.0000	20000.0000
2	Point P2	10008.7249	19750.1523

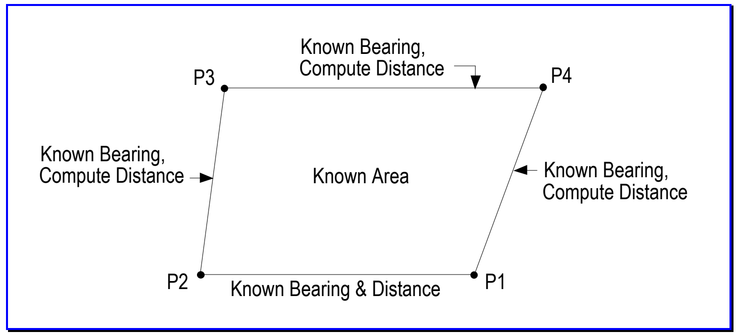
Bearing from P2 to P3 N 5° 00' 00.0" E
Bearing from P1 to P4 N 15° 00' 00.0" E
Req'd. Area = 76230.0000 Sq. Feet or 1.7500 Acres

Use the Predetermined Area - Two Sides Parallel routine to compute the area of the tract formed by the given information.

Point	Direction	Distance	Northing	Easting
Predetermined Area				
1	Point P1		10000.0000	20000.0000
IN	N 88° 00' 00.0" W	250.000		
2	Point P2		10008.7249	19750.1523
IN	N 5° 00' 00.0" E	277.826		
3	Point P3		10285.4941	19774.3665
IN	S 88° 00' 00.0" E	299.513		
4	Point P4		10275.0412	20073.6971
IN	S 15° 00' 00.0" W	284.744		
1	Point P1		10000.0000	20000.0000

Area = 76230.0000 Sq. Feet or 1.7500 Acres

Example 9.3



Predetermined Area - Two Sides Parallel: Figure 9-3

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Survey 4.0
Simplicity Surveying Series

9.04 PREDETERMINED AREA LINE THRU A POINT

Code: P2

Not available in Survey Lite

FUNCTION: The PREDETERMINED AREA - LINE THRU A POINT routine is used to compute the length of two sides of a three sided tract of known area. This routine requires the coordinates of the end points of one of the line segments and also the direction of one of the other two line segments.

Select Routine

To compute the unknown two sides of a three sided tract of known area, type **P2** at **Select Routine** or type **P2** [Enter] at any point number prompt.

First Base Point

Type in a point number (for point P1 as shown in Figure 9-4) which defines one end of the base line lying between points P1 and P2 and press [Enter].

Second Base Point

Type in the point number (for point P2 as shown in Figure 9-4) that defines the other end of the base line lying between points P1 and P2 and press [Enter].

Point on line from (P2) is

Type in an identifying point number (for point P3 as shown in Figure 9-4) which will lie on the line extending from point P2 and press [Enter]. The point number for point **P2** will be given in the prompt. *NOTE: Point name assignment is not available.*

Bearing from (P2) to (P3)

Type in the bearing from point **P2** to point **P3** in your chosen format, or recall a bearing between any two points in memory and press [Enter]. The actual point numbers will be given in the prompt.

Required Area

Type in the required data in square feet (or square meters if metric) and press [Enter]. Values may be entered as acres, hectares or cuerdas by placing the letter **A**, **H** or **C** behind the numeric portion of your response. For example, enter 1.75 acres as **1.75A** [Enter].

If a solution is possible, the program will compute and print the bearing and distance data from point P1 to P2 to P3 and back to

P1. The required area will also be printed and you will be returned to a **Select Routine** prompt.

Given:

Point		Northing	Easting
Assign			
1	Point P1	10000.0000	20000.0000
2	Point P2	10008.7249	19750.1523

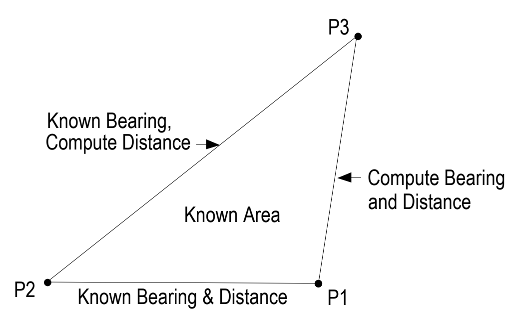
Bearing from P2 to P3 N 30° 00' 00.0" E
Req'd. Area = 43560.0000 Sq. Feet or 1.0000 Acres

Use the Predetermined Area - Line Thru a Point routine to compute the area of the tract formed by the given information.

Point	Direction	Distance	Northing	Easting
Predetermined Area				
1	Point P1		10000.0000	20000.0000
IN	N 88° 00' 00.0" W	250.000		
2	Point P2		10008.7249	19750.1523
IN	N 30° 00' 00.0" E	394.678		
3	Point P3		10350.5261	19947.4913
IN	S 8° 31' 10.3" E	354.437		
1	Point P1		10000.0000	20000.0000

Area = 43560.0000 Sq. Feet or 1.0000 Acres

Example 9.4



Predetermined Area - Line Thru a Point: Figure 9-4

Survey 4.0
Simplicity Surveying Series

9.05 PREDETERMINED AREA RADIAL SIDES

Code: P3

Lite
Not available in Survey Lite

FUNCTION: The PREDETERMINED AREA - RADIAL SIDES routine is used to compute the three unknown sides of a four sided tract of known area, when the tract has a curved side of known radius. This routine requires the coordinates of the end points of one of the line segments and also the direction of the straight line segment lying adjacent to the known line segment. The coordinates of the center point of the arc must also be known.

Select Routine

To compute the unknown three sides of a four sided tract of known area, when the tract has a curved side of known radius, type **P3** at **Select Routine** or type **P3** Enter at any point number prompt.

First Base Point

Type in a point number (for point P1 as shown in Figure 9-5) which defines one end of the base line lying between points P1 and P2 and press Enter.

Second Base Point

Type in the point number (for point P2 as shown in Figure 9-5) that defines the other end of the base line lying between points P1 and P2 and press Enter.

Point on line from (P2) is

Type in an identifying point number (for point P3 as shown in Figure 9-5) which will lie on the line extending from point **P2** and press Enter. The point number for point **P2** will be given in the prompt. *NOTE: Point name assignment is not available.*

Point on Arc from (P1) is

Type in an identifying point number (for point P4 as shown in Figure 9-5) which lies along the arc extending from point **P1** and press Enter. The point number for point **P1** will be given in the prompt. *NOTE: Point name assignment is not available.*

Radius Point

Type in an identifying point number (for point P5 as shown in Figure 9-5) which marks the center point of the arc extending from point P1 to point P4 and press Enter.

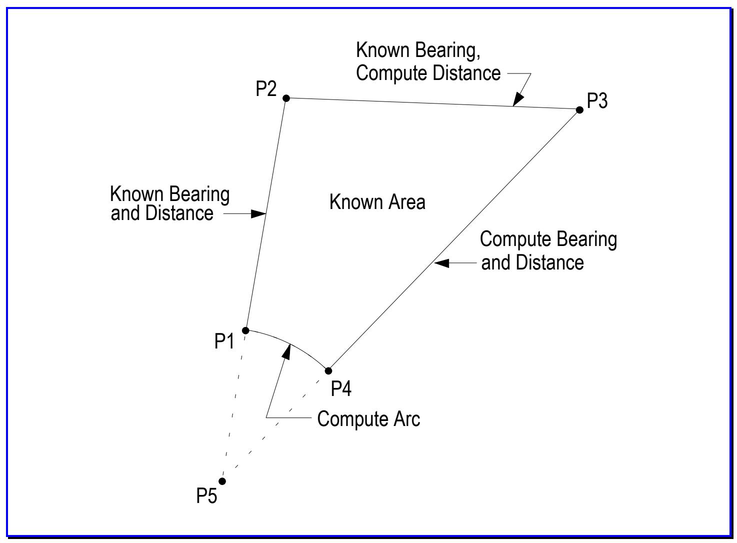
Bearing from (P2) to (P3)

Type in the bearing from point **P2** to point **P3** in your chosen format, or recall a bearing between any two points in memory and press ↵Enter. The actual point numbers will be given in the prompt.

Required Area

Type in the required data in square feet (or square meters if metric) and press ↵Enter. Values may be entered as acres, hectares or cuerdas by placing the letter **`A`**, **`H`** or **`C`** behind the numeric portion of your response. For example, enter 1.75 acres as **`1.75A`** ↵Enter.

If a solution is possible, the program will compute and print the bearing and distance data from point P1 to P2 to P3 to P4 and back along the arc to P1. The required area will also be printed and you will be returned to a **Select Routine** prompt.



Predetermined Area - Radial Sides: Figure 9-5

Given:

Point		Northing	Easting
Assign			
1	Point P1	9794.5430	19731.4138
2	Point P2	10008.7249	19750.1523
5	Center Point P5	9729.7904	19725.7487

Bearing from P2 to P3 S 88° 00' 00.0" E
Req'd. Area = 43560.0000 Sq. Feet or 1.0000 Acres

Use the Predetermined Area - Radial Sides routine to compute the area of the tract formed by the given information.

Point	Direction	Distance	Northing	Easting
Predetermined Area				
1	Point P1		9794.5430	19731.4138
IN	N 5° 00' 00.0" E	215.000		
2	Point P2		10008.7249	19750.1523
IN	S 88° 00' 00.0" E	324.086		
3	Point P3		9997.4144	20074.0413
IN	S 52° 27' 42.2" W	374.238		
4	Point P4		9769.3943	19777.2902
IN				
5	Center Point P5		9729.7904	19725.7487
	Central Angle	47° 27' 42.2"		
	Radius	65.000		
	Arc	53.844		
	Tangent	28.575		
	Chord	52.317		
	Chord Bearing	N 61° 16' 08.9" W		
1	Point P1		9794.5430	19731.4138

Area = 43560.0007 Sq. Feet or 1.0000 Acres

Example 9.5

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Survey 4.0
Simplicity Surveying Series

10.01 START AT

Code: ST

FUNCTION: The START AT routine is used to introduce a new currently occupied point into the COGO routines. This routine should also be used prior to inversing for area calculation to clear the Area Sum and Traverse Length accumulators.

NOTES

1. This routine is the only routine that clears the Area Sum and Traverse Length accumulators.

2. You must use this routine when you begin a new traverse that you intend to balance.

3. DO NOT use this routine in the middle of an area calculation or your area will be cleared. Use the **Go To Point** *routine (**GT** - Section 10.02).*

Select Routine

To begin a routine at a point other than the currently occupied point, or to begin a routine after which you will request an area print out, type **ST** at **Select Routine** or type **ST** [Enter] at any point number prompt.

Start at

Type in the starting point number and press [Enter]. If the point has not yet been assigned coordinates, the program will request them. Follow the **Enter and Assign** procedure (**EA** - Section 10.15).

The monitor will display the word **START** followed by the point number, ID, and point coordinates.

Survey 4.0
Simplicity Surveying Series

10.02 GO TO POINT

Code: GT

FUNCTION: The GO TO POINT routine is used to introduce a new currently occupied point into the COGO routines ***without*** *clearing the Area Sum and Traverse Length accumulators.*

NOTE
This routine ***does not*** *clear the Area Sum and Traverse Length accumulators.*

Select Routine

To perform a routine at a point other than the currently occupied point press **GT** at **Select Routine** or type **GT** Enter at any point number prompt.

Go To Point

Type in the point number and press Enter. If the point has not yet been assigned coordinates, the program will request them. Follow the **Enter and Assign** procedure (**EA** - Section 10.15).

The monitor will display the words **GO TO** followed by the point number, ID, and coordinates.

Survey 4.0
Simplicity Surveying Series

10.03 ENTER BACKSIGHT BEARING

Code: EB

FUNCTION: The ENTER BACKSIGHT BEARING routine is used to change the value of the reference bearing.

NOTE
*This routine **does not** clear the Area Sum and Traverse Length accumulators.*

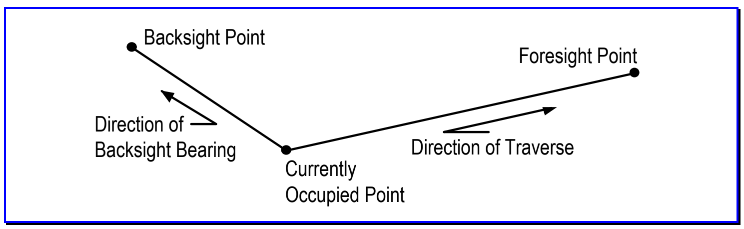
Select Routine

To enter a backsight bearing, type **EB** at **Select Routine** or type **EB** ↵Enter at any point number prompt.

Enter Backsight Bearing

Enter the bearing, angle, deflection or azimuth in your pre-specified format, or recall a bearing between any two points in memory. You will regain control at **Select Routine**.

Use this routine to change your backsight bearing at any time. The backsight bearing must be entered such that the bearing proceeds from the currently occupied point to the backsight point.



Direction of Backsight Bearing: Figure 10-1

Survey 4.0
Simplicity Surveying Series

10.04 AUTO POINT NUMBERING

Code: AN

FUNCTION: The AUTO POINT NUMBERING routine is used to activate and deactivate automatic point numbering. This routine works as a toggle switch.

WARNING!
This routine is not recorded into keystroke files. Do not manually edit your keystroke files to include this routine!

Select Routine

To activate or deactivate automatic point numbering, type **AN** at **Select Routine** or type **AN** Enter at any point number prompt.

Survey 4.0 will report the new point numbering status and you will regain control at **Select Routine**.

Automatic point numbering affects those routines that create points, such as the **Traverse** routine (**TR** - Section 6.14). When automatic point numbering is on, Survey 4.0 seeks out the first available point beyond the point number of the currently occupied point.

When automatic point numbering is off, you can press + Enter or − Enter for semi-automatic point numbering. These key combinations seek out the next available point number in forward and backward directions respectively.

Survey 4.0
Simplicity Surveying Series

10.05 RENUMBER POINTS

Code: RP

*FUNCTION: The RENUMBER POINTS routine is used to **relocate** a block of points from their current numerical basis to some other numerical basis within the limits of allowable point capacity. The original point numbers are cleared.*

WARNINGS!

1. This routine is not recorded into keystroke files. Do not manually edit your keystroke files to include this routine!

2. This routine may overwrite points that lie within the target range. Use this routine with caution!

Select Routine

To renumber any point or range of points, type **RP** at a **Select Routine** prompt or type **RP** [Enter] at any request for a point number. The routine begins by accessing the **Blank Point Scan** routine (**BP** - Section 10.10) to produce a listing of unused points. This listing is provided as a guide for use in determining the target range for point relocation.

< 1 > Save a backup coordinate file
< 2 > Continue without a backup file
< 3 > EXIT this Routine

Survey 4.0 now provides you with an opportunity to create a backup file. The backup file is useful if you later find that you have made an error in renumbering and wish to restore your original coordinate file. To create a backup file, type [1]. Press [2] to continue the renumber routine without a backup file. ***Remember, whenever you create a backup file, you overwrite any previous backup file.***

Renumber Points: Start at

Type in the number marking the start of the point range you wish to renumber and press [Enter].

End at

Type in the number marking the end of the point range you wish to renumber and press [Enter]. If you want to renumber only a single point, press [Enter] without typing in any value. If you want to renumber all of the points from the starting point to the end of the file, press [R] [Enter].

New starting point number

Type in the new starting point number and press ↵Enter. It is this value that marks the beginning of the ***targeted range***. The targeted range extends from this point to a point number equal to the value of this point plus the difference between the starting and ending points previously entered. For example, if you are renumbering points 1 through 10, and you enter a new starting point number of 101, the targeted range is from point 101 to point 110.

WARNING! Do you want Point Overwrite protection? (Yes/No)

If your point **Overwrite Protection** (**OP** - Section 10.06) is disabled, you are given an opportunity to reinstate it. Overwrite protection guards against the accidental erasure of point data as Survey 4.0 renumbers your points and we strongly suggest using it. Answer by pressing Y or N. At this time, Survey 4.0 will begin renumbering the given point(s).

Point (P1) exists! Trying to overwrite with point (P2) Press <S>kip <O>verwrite <A>ssign New Number <E>xit

If you are using overwrite protection, you may from time to time see a request for instructions on how to handle a point overwrite situation. The point numbers **P1** and **P2** are given in the prompt, along with each point's coordinates and a point name, if it has one. You can exit the renumbering process at this prompt, but be aware that any points accessed prior to this message have been renumbered. For example, in the illustration above, the points are actually renumbered backwards from 110 to 101.

Renumber Points: Start at?

At the conclusion of the renumber routine, you are returned to the initial **Start at** prompt. If you do not want to continue this routine, type your next routine code and press ↵Enter, or simply press ↵Enter to return to **Select Routine**.

Survey 4.0
Simplicity Surveying Series

10.06 Code: OP

OVERWRITE PROTECTION

FUNCTION: The OVERWRITE PROTECTION routine is used to activate and deactivate automatic point overwrite protection. This routine works as a toggle switch.

WARNING!
This routine is not recorded into keystroke files. Do not manually edit your keystroke files to include this routine!

Select Routine

To activate or deactivate automatic point overwrite protection, type **OP** at **Select Routine** or type **OP** ↵Enter at any point number prompt.

Survey 4.0 will report the new point overwrite protection status and you will regain control at **Select Routine**.

When overwrite protection is **On**, Survey 4.0 will warn you that you are about to overwrite an existing point. You will be given the opportunity to either change the point number or continue and overwrite the point.

You may also manually override the point overwrite protection by placing an asterisk immediately after the point number, for example **45*** ↵Enter. Using the manual override will suppress the warning message.

Survey 4.0
Simplicity Surveying Series

10.07 COORDINATE TRANSFORMATION POINT & ROTATION ANGLE KNOWN

Code: CT

FUNCTION: The COORDINATE TRANSFORMATION routine is used to project the coordinates of one plane onto another plane through the use of rotation, translation and/or scaling. The option for Point & Rotation Angle Known is used when the base point and angle of rotation around that base point are known.

Select Routine

To transform (rotate, translate and/or scale) coordinates for a point or range of points, type **CT** at **Select Routine** or type **CT** Enter at any prompt for a point number.

< 1 > Save a backup coordinate file
< 2 > Continue without a backup file
< 3 > EXIT this Routine

Survey 4.0 now provides you with an opportunity to create a backup file. The backup file is useful if you later find that you have made an error in transformation and wish to restore your original coordinate file. To create a backup file, press 1. Press 2 to continue the transformation routine without a backup file. ***Remember, whenever you create a backup file, you overwrite any previous backup file.***

Coordinate Transformation
< 1 > Point & Rotation Angle Known

The Survey 4.0 Coordinate Transformation menu contains two transformation options, and six conversion options. To select the **Point & Rotation Angle Known** option, press 1.

Base Point

Type in the number of the point which is to serve as the basis for the transformation option and press Enter. The specified point will be the point around which other points will be rotated, and the difference between the old and new coordinates of the specified point will serve as the basis for translation.

Coordinates for point (P)

If you intend to change the base point coordinates as part of your coordinate transformation proceedings, you may now specify the new coordinates, pressing Enter after each entry. If you are not changing the base point coordinates, press Esc. The point number **P** will be given in the prompt.

Angle of Rotation

You can either enter a rotation angle or rotate to a desired bearing. Rotation angles are entered as turned to the right, but left angles may be entered as negative values.

Enter a rotation angle by:

1. Typing in the angle in your chosen angle entry format; or
2. Recalling a value from the calculator memory; or
3. Measuring an angle by entering **MA** and answering the prompts for the **Instrument At**, **Backsight At** and **Sight Point**. Enter point numbers (not a name, [+] or [−] key) at each request.

You can rotate to a desired bearing by:

1. Typing in the bearing in your chosen angle entry format, ***including the quad code***; or
2. Recalling a bearing by point numbers.

If you choose to rotate to a bearing, you will also need to supply a **Foresight Point** number. This point sets the initial (unrotated) bearing from the base point.

Scale Factor

If you want to enter a scale factor, for example to adjust to a state plane coordinate system, Type in the factor and press [↵Enter]. If you do not want to enter a scale factor, simply press [↵Enter] or [1] [↵Enter].

You can also enter a scale factor by using Survey 4.0's in-line calculator function. Suppose you want to rotate a coordinate base and convert your coordinates from a local datum of approx. 600 feet elevation to sea level elevation. Given that the mean radius of the earth at average latitude is 20,906,000 feet, you could apply a scale factor of 20906000/(20906000+600) or 0.999971301. To calculate an exact scale factor, you may use the calculator and recall a value by entering [?] at the **Scale Factor** prompt, or you may enter the word **CALC** and the equation you want to calculate. For example, **CALC (20906000/(20906000+600))** [↵Enter].

Transform Points: From To

Type in a single point number or the point numbers between which you wish to transform (separating them with a comma or dash), and press [↵Enter].

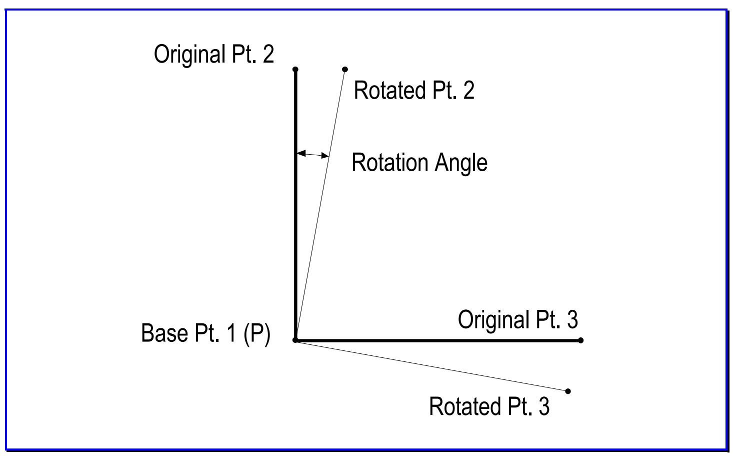
NOTE

*You may use a comma instead of a dash, but **unlike other routines**, the numbers entered will still represent a point range. For example, the entries **`1-5`** and **`1,5`** will both access points 1, 2, 3, 4 and 5.*

SELECT:
< B > Begin Transformation
< R > Redo Parameters
< C > Change Points
< E > EXIT Transformation

At this point, you will be given one last opportunity to exit the routine or respecify the parameters. Make your selection by pressing B, R, C or E. If you choose to exit, you will be returned to a **Select Routine** prompt.

If you choose to continue with the translation, Survey 4.0 will print out the translation parameters and transform the specified coordinates. After the transformation has been completed, you will be returned to the **Transform Points** prompt. To exit this routine, press Enter to return to the Transformation Menu and then press E. Transformed coordinates may be viewed by using the **List Coordinates** routine (**LC** - Section 10.20).



Coordinate Translation - Base Point & Rotation Angle Known: Figure 10-2

Given:

Point		Northing	Easting
Assign			
1	Base Point	10000.0000	20000.0000
2		10200.0000	20000.0000
3		10000.0000	20200.0000

Rotate points 2 & 3 by 10 ° (to the right) around point 1 and translate all points to a new basis of 5000, 10000. Use a scale factor of 1.

Point		Northing	Easting
1	Base Point	5000.0000	10000.0000
2		5196.9916	10034.7296
3		4965.2704	10196.9616

Example 10.01

Given:

Point	Northing	Easting	Elev.
Assign			
1	10000.0000	10000.0000	100.0
2	10100.0000	10000.0000	101.0
3	10100.0000	10100.0000	101.0
4	10000.0000	10100.0000	100.0

Translate points 1-4 using only a scale factor or 0.999755. Your angle is 0° (to the right). Translate around base point 1 and retain your original coordi- nate basis. Use Point & Rotation Angle Known option.

Point	Northing	Easting	Elev.
1	10000.0000	10000.0000	100.0
2	10099.9755	10000.0000	101.0
3	10099.9755	10099.9755	101.0
4	10000.0000	10099.9755	100.0

Example 10.02

Given:

Point		Northing	Easting	Elev.
Assign				
1	Base Point	10000.0000	10000.0000	100.0
2		10100.0000	10000.0000	101.0
3		10100.0000	10100.0000	101.0
4		10000.0000	10100.0000	100.0
1	New Base Point	10000.0000	10000.0000	25.0

Translate points 1-4 to change only the elevations by 75 feet. Your angle is 0° (to the right). Translate around base point 1 and retain your original co- ordinate basis. Use Point & Rotation Angle Known option.

Point	Northing	Easting	Elev.
1	10000.0000	10000.0000	25.0
2	10100.0000	10000.0000	26.0
3	10100.0000	10100.0000	26.0
4	10000.0000	10100.0000	25.0

Example 10.03

Survey 4.0
Simplicity Surveying Series

10.08 Code: CT
COORDINATE TRANSFORMATION TWO POINTS KNOWN IN EACH SYSTEM

FUNCTION: The COORDINATE TRANSFORMATION routine is used to project the coordinates of one plane onto another plane through the use of rotation, translation and/or scaling. The option for Two Points Known in Each System is used to transform points when two corresponding points are known in each system.

Select Routine

To transform (rotate, translate and/or scale) coordinates for a point or range of points, type **CT** at **Select Routine** or type **CT** [Enter] at any prompt for a point number.

< 1 > Save a backup coordinate file
< 2 > Continue without a backup file
< 3 > EXIT this Routine

Survey 4.0 now provides you with an opportunity to create a backup file. The backup file is useful if you later find that you have made an error in transformation and wish to restore your original coordinate file. To create a backup file, press [1]. Press [2] to continue the transformation routine without a backup file. ***Remember, whenever you create a backup file, you overwrite any previous backup file.***

Coordinate Transformation
< 2 > Two Points Known in Each System

The Survey 4.0 Coordinate Transformation menu contains two transformation options, and six conversion options. To select the **Two Points Known in Each System** option, press [2].

Base Point

Type in the number of the point which is to serve as the basis for the transformation option and press [Enter].

Coordinates for point (P1)

If you intend to change the base point coordinates as part of your coordinate transformation proceedings, you may now specify the new coordinates, pressing [Enter] after each entry. If you are not changing the base point coordinates, press [Esc]. The point number **P1** will be given in the prompt.

2nd Point

Type in the number of the second known point in the first system and press [Enter].

Coordinates for point (P2)

Type in the coordinates for the point in the second system that corresponds to the first system's second known point, pressing Enter after each entry. If you are not changing the coordinates from the values shown, press Esc. The point number **P2** will be given in the prompt.

The rotation angle and scale factor are now calculated from the coordinate values of the four known points.

Transform Points:
From
To

Type in a single point number or the point numbers between which you wish to transform (separating them with a comma or dash), and press Enter.

NOTE
You may use a comma instead of a dash, but ***unlike other routines****, the numbers entered will still represent a point range. For example, the entries* **`1-5`** *and* **`1,5`** *will both access points 1, 2, 3, 4 and 5.*

SELECT:
< B > Begin Transformation
< R > Redo Parameters
< C > Change Points
< E > EXIT Transformation

At this point, you will be given one last opportunity to exit the routine or respecify the parameters. Make your selection by pressing B, R, C or E. If you choose to exit, you will be returned to a **Select Routine** prompt.

If you choose to continue with the translation, Survey 4.0 will print out the translation parameters and transform the specified coordinates. After the transformation has been completed, you will be returned to the **Transform Points** prompt. To exit this routine, press Enter to return to the Transformation Menu and then press E. Transformed coordinates may be viewed by using the **List Coordinates** routine (**LC** - Section 10.20).

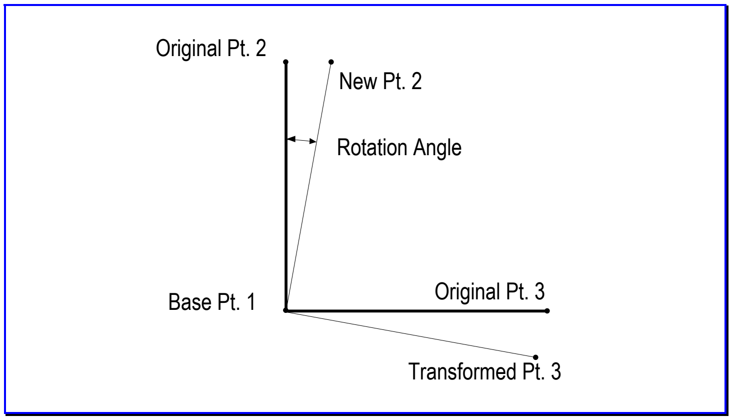
Given:

Point		Northing	Easting
Assign			
1	Original Base Point	10000.0000	20000.0000
1	New Base Point	5000.0000	10000.0000
2	Original Point 2	10200.0000	20000.0000
2	New Point 2	5196.9916	10034.7296
3		10000.0000	20200.0000

Transform original points 1-3 to a new basis of 5000, 10000. Use the new point 1 and 2 coordinates for rotation and scale information. Perform the operation using the option for Two Points Known in Each System.

Point		Northing	Easting
1	New Base Point	5000.0000	10000.0000
2	New Point 2	5196.9916	10034.7296
3		4965.2704	10196.9616

Example 10.04



Coordinate Translation - Two Points Known in Each System: Figure 10-3

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Survey 4.0
Simplicity Surveying Series

10.09 COORDINATE TRANSFORMATION METRIC CONVERSIONS

Code: CT

FUNCTION: The COORDINATE TRANSFORMATION routine is used to project the coordinates of one plane onto another plane through the use of rotation, translation and/or scaling. The option for Metric Conversion is used to transform your co-ordinates from US units to International and Metric units and vice versa..

Select Routine

To transform (rotate, translate and/or scale) coordinates for a point or range of points, type **CT** at **Select Routine** or type **CT** ↵Enter at any prompt for a point number.

< 1 > Save a backup coordinate file
< 2 > Continue without a backup file
< 3 > EXIT this Routine

Survey 4.0 now provides you with an opportunity to create a backup file. The backup file is useful if you later find that you have made an error in transformation and wish to restore your original coordinate file. To create a backup file, press 1. Press 2 to continue the transformation routine without a backup file. ***Remember, whenever you create a backup file, you overwrite any previous backup file.***

< 3 > US Survey Foot to Meters
< 4 > US Survey Foot to Int'l Foot
< 5 > Meters to US Survey Foot
< 6 > Meters to Int'l Foot
< 7 > Int'l Foot to Meters
< 8 > Int'l Foot to US Foot

The Survey 4.0 Coordinate Transformation menu contains two transformation options, and six conversion options. Select the a conversion option by pressing the number corresponding to the metric transformation desired. The conversion factors used for these options are shown below, and the specific conversion factor chosen will also be displayed on your monitor.

US Survey Foot to Meters:
1m = 39.37" or 1' = 0.304800609601219m

US Survey Foot to International Foot:
0.3048m (int'l) = 0.304800609601219m (US) or
1' (int'l) = 0.999998012358944' (US)

Meters to US Survey Foot:
1m = 39.37" or 3.28083333333333'

Meters to International Foot:
1' = 0.3048m or 1m = 3.28083989501312'
International Foot to Meters:
1' = 0.3048m
International Foot to US Foot:
0.304800609601219m (US) = 0.3048m (int'l) or
1' (US) = 1.000002000004' (int'l)

Transform Points:
From
To

Type in a single point number or the point numbers between which you wish to transform (separating them with a dash), and press Enter.

NOTE

You may use a comma instead of a dash, but ***unlike other routines****, the numbers entered will still represent a point range. For example, the entries* **`1-5`** *and* **`1,5`** *will both access points 1, 2, 3, 4 and 5.*

SELECT:
< B > Begin Transformation
< R > Redo Parameters
< C > Change Points
< E > EXIT Transformation

At this point, you will be given one last opportunity to exit the routine or respecify the parameters. Make your selection by pressing B, R, C or E. If you choose to exit, you will be returned to a **Select Routine** prompt.

If you choose to continue with the translation, Survey 4.0 will print out the translation parameters and transform the specified coordinates. After the transformation has been completed, you will be returned to the **Transform Points** prompt. To exit this routine, press Enter to return to the Transformation Menu and then press E. Transformed coordinates may be viewed by using the **List Coordinates** routine (**LC** - Section 10.20).

Survey 4.0
Simplicity Surveying Series

10.10 BLANK POINT SCAN

Code: BP

FUNCTION: The BLANK POINT SCAN routine reads through the data file and reports all ***unused*** *point numbers, up to the current maximum point capacity of your system.*

NOTES

1. Since point coordinates are held in your computer's RAM memory, the scanning process is quite rapid.

2. Reported points are presented in a linear fashion, not in a column. Where applicable, points will be reported in ranges consisting of a beginning point, a dash to indicate a range of points, and an ending point. Ranges presented in this manner are all inclusive, that is the beginning and ending points specified have also been found to be blank. A typical report may look something like: 12, 15, 57-155, 175-5000.

Select Routine

To scan the coordinate file for blank points, type **BP** at **Select Routine** or type **BP** ↵Enter at any prompt for a point number.

Blank Point Scan
Now scanning for blank points.

The program will then report all of the unused point numbers found. After the report, you will be returned to a **Select Routine** prompt.

Survey 4.0
Simplicity Surveying Series

10.11 Code: CC

CLEAR COORDINATES

FUNCTION: The CLEAR COORDINATES routine is used to erase all coordinate point data from a point or range of points.

NOTE

Clearing is bi-directional. It makes no difference if you clear from a low point number to a high point number or vice versa.

Select Routine

To clear the coordinates for a point or range of points, type **CC** at **Select Routine** or type **CC** [↵Enter] at any point number prompt.

< 1 > Save a backup coordinate file
< 2 > Continue without a backup file
< 3 > EXIT this Routine

Survey 4.0 first provides an opportunity to create a backup file. The backup file is useful to restore your original coordinate file if you make any errors in point selection. To create a backup file, press [1]. Press [2] to continue without a backup file. ***Remember, whenever you create a backup file, you overwrite any previous backup file.***

Clear Point(s)

Type in any of the following:

1. A single point number, such as **5** [↵Enter];
2. A string of point numbers separated by commas, such as **3,5,7** [↵Enter];
3. A range of point numbers separated by a dash, such as **3-17** [↵Enter];
4. A combination of methods 2 and 3, such as **1,3-7,12,15,20-35** [↵Enter];
5. A defined figure name (preceded by F:), such as **F:Lot 7** [↵Enter];
6. Or [A] [↵Enter] to clear ALL of your data points.

The coordinates and point names will be cleared from each point in the specified range including the starting and ending points. This procedure will continue until you exit it by pressing [E] [↵Enter] at the **Clear Point(s)** prompt. Upon exiting the routine, you will be returned to a **Select Routine** prompt.

Survey 4.0
Simplicity Surveying Series

10.12 Code: CN

CLEAR POINT NAMES

FUNCTION: The CLEAR POINT NAMES routine is used to erase point names (or stations) from a point or range of points.

NOTE

Clearing is bi-directional. It makes no difference if you clear from a low point number to a high point number or vice versa.

Select Routine

To clear the names for a point or range of points, type **CN** at **Select Routine** or type **CN** Enter at any point number prompt.

< 1 > Save a backup coordinate file
< 2 > Continue without a backup file
< 3 > EXIT this Routine

Survey 4.0 first provides an opportunity to create a backup file. The backup file is useful to restore your original coordinate file if you make any errors in point selection. To create a backup file, press 1. Press 2 to continue without a backup file. ***Remember, whenever you create a backup file, you overwrite any previous backup file.***

Clear Names for Points

Type in any of the following:

1. A single point number, such as **5** Enter;
2. A string of point numbers separated by commas, such as **3,5,7** Enter;
3. A range of point numbers separated by a dash, such as **3-17** Enter;
4. A combination of methods 2 and 3, such as **1,3-7,12,15,20-35** Enter;
5. A defined figure name (preceded by F:), such as **F:Lot 7** Enter;
6. Or A Enter to clear ALL of your data points.

The names will be cleared from each point in the specified range including the starting and ending points. This procedure will continue until you exit it by pressing E Enter at the **Clear Names for Points** prompt. Upon exiting the routine, you will return to a **Select Routine** prompt.

Survey 4.0
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10.13 Code: CB

COPY BLOCK OF POINTS

FUNCTION: The COPY BLOCK OF POINTS routine is used to copy a block of points from their current numerical basis to some other numerical basis within the limits of allowable point capacity, while not erasing the original points.

WARNINGS!

1. This routine is not recorded into keystroke files. Do not manually edit your keystroke files to include this routine!

2. This routine may overwrite points that lie within the target range. Use this routine with caution!

Select Routine

To copy a point or block of points, type **CB** at a **Select Routine** prompt or type **CB** [Enter] at any request for a point number. The routine begins by accessing the **Blank Point Scan** routine (**BP** - Section 10.10) to produce a listing of unused points. This listing is provided as a guide for use in determining the target range for point copying.

< 1 > Save a backup coordinate file
< 2 > Continue without a backup file
< 3 > EXIT this Routine

Survey 4.0 now provides you with an opportunity to create a backup file. The backup file is useful if you later find that you have made an error in copying and wish to restore your original coordinate file. To create a backup file, press [1]. Press [2] to continue the copy block routine without a backup file. ***Remember, whenever you create a backup file, you overwrite any previous backup file.***

Copy Block Pts. Start at

Type in the number marking the start of the point range you wish to copy and press [Enter]. If you want to copy all of the points, press [A] [Enter].

End at

Type in the number marking the end of the point range you wish to copy and press [Enter]. If you want to copy only a single point, press [Enter] without typing any value. If you want to copy all of the points from the starting point to the end of the file, press [R] [Enter].

New starting point number

Type in the new starting point number and press Enter. It is this value that marks the beginning of the ***targeted range***. The targeted range extends from this point to a point number equal to the value of this point plus the difference between the starting and ending points previously entered. For example, if you are copying points 1 through 10, and you enter a new starting point number of 101, the targeted range is from point 101 to point 110.

WARNING! Do you want Point Overwrite protection? (Yes/No)

If your point **Overwrite Protection** (**OP** - Section 10.06) is disabled, you are given an opportunity to reinstate it. Overwrite protection guards against the accidental erasure of point data as Survey 4.0 copies your points and we strongly suggest using it. Answer by pressing Y or N. At this time, Survey 4.0 will begin copying the given point(s).

Point (P1) exists! Trying to overwrite with point (P2) Press <S>kip <O>verwrite <A>ssign New Number <E>xit

If you are using overwrite protection, you may from time to time see a request for instructions on how to handle a point overwrite situation. The point numbers **P1** and **P2** are given in the prompt, along with each point's coordinates and a point name, if it has one. You can exit the copying process at this prompt, but be aware that any points accessed prior to this message have been copied. For example, in the illustration above, the points are actually copied backwards from 110 to 101.

Copy Block Pts. Start at

At the conclusion of the copy block routine, a new Blank Point Scan will be issued and you will be returned to the initial **Start at** prompt. If you do not want to continue this routine, type your next routine code and press Enter, or simply press Enter to return to **Select Routine**.

NOTE

***Copy Block** simply creates another copy of specified coordinate points at a new point location without disturbing the original points. Use the **Renumber Points** routine (**RP** - Section 10.05) to renumber a point or block of points without retaining the original points.*

Survey 4.0
Simplicity Surveying Series

10.14 DEFINE FIGURE

Code: DF

FUNCTION: The DEFINE FIGURE routine is used to assemble random and/or sequential point numbers into a listing which may then be treated as a single entity.

WARNING!
This routine is not recorded into keystroke files. Do not manually edit your keystroke files to include this routine!

Select Routine

To incorporate a group of point numbers into a defined figure, type **DF** at a **Select Routine** prompt or type **DF** [Enter] at any request for a point number.

SELECT:
< D > Define/Edit a figure
< C > Clear a figure
< V > View a figure
< L > List all figures
< E > Exit this Routine

The **Define Figure** menu contains four figure options plus an Exit option. Select the option you want by pressing [D], [C], [V], [L] or [E]. The specific instructions for each of the four figure options are given below. Pressing [E] will return you to a **Select Routine** prompt.

When you are entering data into the text entry fields contained in this routine, there are certain key presses that you should be aware of. These are:

Press [F1] to step through figures;
Press [Alt] [C] to clear a field;
Press [Alt] [R] to restore a field;
Press [Enter], [Tab], [↑], and [↓] to move between fields;
Press [Esc] to exit a field, saving changes;
Press [End] to jump to the end of a field;
Press [Home] to jump to the beginning of a field;
Press [F12] for Help.

You may also use [←] or [→] to position the cursor in the field and then use the [Insert], [Delete], and [Bk Spc] keys to make editing changes.

Option D
Define/Edit Figure Name:

If you have chosen to Define or Edit a figure, you must begin by entering a figure name. A figure name can be any combination of letters, numbers and spaces, up to 65 characters in length. If you are defining a new figure, type in a figure name and press Enter. If you want to edit an existing figure, type in the existing figure name and press Enter, or press F1 to step through the figures until you reach the figure you want to edit. If you step through figures with F1, you must press Esc or Enter to clear the fields before F1 will step to the next figure.

WARNING!
If you are editing a figure name, be aware that the point string is assembled by adding the points to the name. The resulting string can be no longer than 128 characters, including three special spacer characters inserted by Survey 4.0. If your string is longer than 128 characters, some point numbers may be lost when the string is truncated. Solve this problem by creating a second figure that contains the lost points, and have the first figure call the second figure.

While Survey 4.0 often requires you to identify a figure by placing an **F:** in front of the figure name, your actual figure names must not begin with an **F:**. For example, **Lot 7, Block 1** is a legal figure name while **F:Lot 7, Block 1** is not.

Points:

Type in the point numbers, (no point names are allowed), according to the rules and examples that follow and press Enter. Upon the conclusion of each assignment, you will be returned to the initial **Define/Edit Figure Name** prompt. Press Esc to exit to the Define Figure menu.

If your figure calls another figure, you must place an **F:** before the second figure's name. For example, the figure Parcel 1 is defined as points 1-4 plus figure Parcel 2 which contains points 7, 9, 12 and 15. Type in Figure 1 as **1-4,F:Parcel 2** Enter. Because figures can call other figures, it is possible to lock your computer into an endless loop. For example, Figure 1 may call Figure 2 which may call Figure 3 which may call Figure 1, and so on. If your computer does begin to loop through calculations in this manner, press Esc to break the loop.

RULES FOR DEFINED POINT STRINGS

1. Separate single points by a comma, for example **1,3,5,7**
2. Separate a consecutive range of points by a dash, for example **1-7**
3. Identify a radius point for an ***acute*** curve (delta less than 180° or 200 grads) with an asterisk (*****), a less than symbol (**<**) or the letter **R**. Identify a radius point for an ***obtuse*** curve (delta greater than or equal to 180° or 200 grads) with a greater than symbol (**>**) or the letter **O**.
4. Use only a radius point identifier to separate the PC and the radius point of a curve. For example **5*10,8** sets an acute curve from 5 through center point 10 to end point 8. Don't place a comma after the 5.
5. Curve points **cannot** be entered in ranges.
6. **DO NOT** start your point string with a radius point identifier (*****, **<**, **R**, **O**, or **>**).
7. Preface any referenced figures with an **F:** and do not add any points after the referenced figure.

Use care when entering your point string since the program will not attempt to screen your entry for illegal characters or unassigned points.

The **Points** field may be either one or two lines lone, depending upon the number of points entered into it, and also on the total length of the figure name and the point string. The maximum length of the combined figure name and point string is 128 characters. Survey 4.0 reserves three characters for its own use, leaving you entry space for 125 characters. Figures, however, can call other figures which effectively overcomes any size limitation.

Option C
Clear
Figure Name:

If you have chosen to Clear a figure, you must begin by entering a figure name. Type in a figure name and press Enter or press F1 to step through the figures until you reach the figure you want to clear.

Clear this Figure? (Yes/No)

As each figure is displayed, answer this prompt by pressing Y or 1 for Yes, or N or 0 for No. After clearing or not clearing the figure, Survey 4.0 will return to the **Clear Figure Name** prompt. Press Esc to exit to the Define Figure menu.

Option V
View
Figure Name:

If you have chosen to View a figure, you must begin by entering a figure name. Type in a figure name and press ↵Enter or press F1 to step through the figures until you reach the figure you want to view.

Press any key to continue

As each figure is displayed, you must press any key (except Esc) to continue and Survey 4.0 will return to the **View Figure Name** prompt. Press Esc to exit to the Define Figure menu.

Option L
List all figures

If you have chosen to List your defined figures, you need do nothing more. Survey 4.0 will list all of your figures to your selected output device and then return to the Define Figure menu.

In your figure listings, you will notice that the figure name is separated from the figure points by the character **»**. The **»** character and the space on either side of it constitute the three reserved characters that Survey 4.0 uses to internally mark the division between the figure name and the point string.

Survey 4.0
Simplicity Surveying Series

10.15 ENTER & ASSIGN

Code: EA

FUNCTION: The ENTER & ASSIGN routine is used to assign Northing, Easting and elevation coordinates to a point number, or to change the coordinates of an existing point.

Select Routine

To assign coordinates to a point number, type **EA** at a **Select Routine** prompt or type **EA** [Enter] at any request for a point number.

Enter & Assign pt.

Type in the number of the point to which you wish to assign coordinates and press [Enter]. If you intend to assign a point identification also at this time and your names output status is currently Off, follow the point number immediately with the letter **N**, such as **125N**. The letter **N** is not needed if the names output status is on.

Coordinates for point (P)
Northing
Easting
Elevation

Entering a point number opens the coordinate entry box. The variable **P** is the previously entered point which will be given in the prompt. Also given in the entry box are the coordinate values currently assigned to the point. If the point has not been used, these values will be zero. Type in each value followed by [Enter]. You may type over previous values, but be aware that any previous characters remaining in any entry field become a part of that field's entry when you press [Enter]. Other valid key presses include:

Press [Alt] [C] to clear a field;
Press [Alt] [R] to restore a field;
Press [Enter], [Tab], [↑], and [↓] to move between fields;
Press [Esc] to cancel changes and exit the entry menu;
Press [End] to jump to the end of a field;
Press [Home] to jump to the beginning of a field;

You may also use [←] or [→] to position the cursor in the field and then use the [Insert], [Delete], and [Bk Spc] keys to make editing changes.

If your **Names Output** status (**NO** - Section 11.11) is **On**, or if you have indicated that you want to add a point identification, you will be presented with a point name entry field. The data entry procedure for name entries is contained in the **Identify Point** instructions (**ID** - Section 10.17).

Upon the conclusion of the data entry for each point, Survey 4.0 will print the point number, ID, and its coordinates. You will be returned to the **Enter & Assign pt.** prompt. Press ↵Enter or enter any valid routine code to exit this routine.

NOTE

If you want to assign or modify only the elevation of a point, use the **Enter Elevation** *routine (**EZ** - Section 10.16)*

Survey 4.0
Simplicity Surveying Series

10.16 ENTER ELEVATION

Code: EZ

Lite
Not available in Survey Lite

FUNCTION: The ENTER ELEVATION routine is used to assign (or change) an elevation to an existing point.

Select Routine

To assign or change the elevation of a point, type **EZ** at a **Select Routine** prompt or type **EZ** [Enter] at any request for a point number.

Assign Elevation to pt.

Type in the number of the point to which you wish to assign an elevation and press [Enter].

Coordinates for point (P)
Northing
Easting
Elevation

Entering a point number opens the coordinate entry box. The variable **P** is the previously entered point which will be given in the prompt. Also given in the entry box are the coordinate values currently assigned to the point. Normally, the entry field for the **Elevation** will be highlighted, awaiting your elevation entry. However, if the point has not been used, the entry field for the **Northing** will be the highlighted field, and you may treat the data entry as though you were in the **Enter & Assign** routine, (**EA** - Section 10.15).

Type in the elevation value followed by [Enter]. If you need to change the Northing and/or Easting value, you may do so by pressing [↑] to access those fields. You may type over previous values but be aware that any previous characters remaining in any entry field become a part of that field's entry when you press [Enter]. Other valid key presses include:

Press [Alt] [C] to clear a field;
Press [Alt] [R] to restore a field;
Press [Enter], [Tab], [↑], and [↓] to move between fields;
Press [Esc] to cancel changes and exit the entry menu;
Press [End] to jump to the end of a field;
Press [Home] to jump to the beginning of a field.

You may also use ← or → to position the cursor in the field and then use the Insert, Delete, and Bk Spc keys to make editing changes.

Upon the conclusion of the data entry for each point, Survey 4.0 will print the point number, ID, and its coordinates. You will be returned to the **Assign Elevation to pt.** prompt. Press ↵Enter or enter any valid routine code to exit this routine.

Survey 4.0
Simplicity Surveying Series

10.17 Code: ID

IDENTIFY POINT

FUNCTION: The IDENTIFY POINT routine is used to add or change an identifying name or station on a previously assigned point.

Select Routine

To add a point name or station to a point whose coordinates already exist in the memory, type `ID` at a **Select Routine** prompt or type `ID` [Enter] at any request for a point number.

Assign ID to point number

Type in the number of the point to which you wish to assign a name and press [Enter]. If the point is unused, you will be prompted for the point's coordinates as though you were in the **Enter & Assign** routine, (**EA** - Section 10.15).

Enter a point ID up to 28 characters

Type in the point name followed by [Enter], or select one of the previously defined point names (see **Point Name Define**, **ND** - Section 10.19) by pressing the corresponding function key. Point names are subject to a 28 character limit. Valid key presses include:

Press [Alt] [C] to clear a field;
Press [Alt] [P] to recall a name from another point;
Press [Alt] [L] to recall the last entered point name;
Press [Alt] [E] or [Esc] to exit without assigning an ID.

The program will respond to an accepted point ID assignment by printing the point number, ID, and its coordinates. You will be returned to the **Assign ID to point number** prompt.

NOTE
This routine may be used to assign stationing. For station numbering rules, see Section 3.03.

Survey 4.0
Simplicity Surveying Series

10.18 OFFSET DEFINE

Code: OD

FUNCTION: The OFFSET DEFINE routine is used to create a selection table of up to 10 user-defined offset distance values. These values may then be used in the Traverse routines that set offset points.

WARNING!
This routine is not recorded into keystroke files. Do not manually edit your keystroke files to include this routine!

Select Routine

To create an offset distance table, type **OD** at a **Select Routine** prompt or type **OD** [Enter] at any request for a point number.

Current Offset Values (table)

The current offset values are presented in an entry window table. Use your [↑], [↓] or mouse to move the highlight bar to the value you want to add or change. Type in the new value and press [Enter]. Enter Right offsets as positive values and Left offsets as negative values. The directions Right and Left are relative to the foresight direction. *Enter the farthest right offset first and proceed to the left with subsequent entries if you want your offsets ultimately set from left to right.*

To clear a value, place the highlight bar on the correct line and press [0] [Enter] or [C], (or click your mouse on the **Clear** button).

To restore a value that was originally present when the entry window opened, place the highlight bar on the correct line and press [R], (or click your mouse on the **Restore** button).

To exit the window, press [Esc] or [E], (or click your mouse on the **Exit** button) and you will return to **Select Routine**.

When the window closes, the offset values are stored on your disk for later use. If present, offset table values are used in routines that set offset points. When used in conjunction with automatic point numbering (Section 10.04), the offset table creates a very fast tool for setting offsets. For example, using the **Traverse With Offsets** routine (**TO** - Section 6.16), traversing to a centerline point and setting up to 10 offset points may be accomplished by entering only the centerline bearing and distance.

NOTES

1. Offset distances must not be slope distances.

*2. Offset distances are stored in a file that has the same root name as your data file, but has an **.OFF** extension.*

3. Offset distances may have a maximum of four decimal places.

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Simplicity Surveying Series

10.19 POINT NAME DEFINE

Code: ND

FUNCTION: The POINT NAME DEFINE routine is used to assemble up to 10 user-defined names into a selection table for easy accessibility during the Identify Point routine.

WARNING!
This routine is not recorded into keystroke files. Do not manually edit your keystroke files to include this routine!

Select Routine

To assemble up to 10 names into a selection table, type **ND** at a **Select Routine** prompt or type **ND** Enter at any request for a point number.

User Definable Point Names (table)

The currently defined names are presented in an entry window table. Use your ↑, ↓ or mouse to move the highlight bar to the name you want to add or change. Type in the new name and press Enter. ***Names must be between three and 28 characters in length.*** Names over 28 characters will be truncated to a 28 character length. Names may not begin with a **#** unless the name represents a station number.

To clear a name, place the highlight bar on the correct line and press Alt C, (or click your mouse on the **Clear** button). To restore a name that was originally present when the entry window opened, place the highlight bar on the correct line and press Alt R, (or click your mouse on the **Restore** button). To exit the window, press Alt E or Esc, (or click your mouse on the **Exit** button), and you will return to **Select Routine**.

When the window closes, the names are stored on your disk for later use. If present, defined names will be assigned to function keys F1 through F10, and they will appear on the Identify Point entry window to help speed your names entry.

NOTES

1. Names are stored in the Config path in file ***Survey-4.NME****.*

2. Do not place an apostrophe (a single quote mark such as ') into any point name. While no error will result during a normal session, Survey 4.0 uses the apostrophe to identify comments in keystroke and macro files. When you replay a keystroke file, characters appearing after an apostrophe are ignored and subsequently eliminated.

Survey 4.0
Simplicity Surveying Series

10.20 Code: LC

LIST COORDINATES

FUNCTION: The LIST COORDINATES routine is used to display and/or print a listing of points which have been assigned coordinates.

Select Routine

To list the coordinates for any point or range of points, type **LC** at a **Select Routine** prompt or type **LC** ↵Enter at any request for a point number.

List Point(s)

Type in any of the following:

1. A single point number, such as **5** ↵Enter;
2. A string of point numbers separated by commas, such as **3,5,7** ↵Enter;
3. A range of point numbers separated by a dash, such as **3-17** ↵Enter;
4. A combination of methods 2 and 3, such as **1,3-7,12,15,20-35** ↵Enter;
5. A defined figure name (preceded by F:), such as **F:Lot 7** ↵Enter;
6. The letter **B** followed by two point numbers, such as **B5,27** ↵Enter to list points bounded by the coordinates of the given points. ***Points must be in lower left-upper right order or vice-versa. Upper left-lower right order won't work!***;
7. The letter **R** followed by a point number and a distance, such as **R5,1000** ↵Enter to list points lying within the given radius from the given point;
8. ? ↵Enter *name* ↵Enter or just *name* ↵Enter, to list the first point exactly matching the given point name, for example **Iron Pin** ↵Enter;

9. [=] ***name*** [↵Enter], to list all points exactly matching the given point name, for example **=Iron Pin** [↵Enter];

10. [>] ***name*** [↵Enter] or [<] ***name*** [↵Enter], to list points partially matching the given point name, for example [>]**Iron Pin** [↵Enter];

11. [F8] or [F9] to list data points one at a time, one lower or higher than the last listed point.

12. Or [A] [↵Enter] to sequentially list ALL of your data points.

Each selected point number, its coordinates and ID will be printed. This procedure will continue until you exit it by entering a valid routine code or [E] [↵Enter] at the the **List Point(s)** prompt. Upon exiting the routine, you will be returned to a **Select Routine** prompt.

NOTES

1. Press [S] or [Esc] to stop any listing in progress.

2. If you select option 8, the first matching point found in the file will be listed. This may not be the lowest point number.

3. If you select option 9 or 10, you will be presented with each point match and asked to press [E] to Exit and stop the search, [P] to Print the point or [S] to Skip the point and continue searching. Also, points will be listed in the order that they appear within the file, not necessarily in sequential order.

Survey 4.0
Simplicity Surveying Series

10.21 Code: SC

STORE COORDINATES

FUNCTION: The STORE COORDINATES routine is used to manually force the storing and packing of a coordinate file, and to create a backup file.

WARNING!
This routine is not recorded into keystroke files. Do not manually edit your keystroke files to include this routine!

NOTE
Coordinate storage is actually an automatic process that occurs every 25 points. This routine is provided for users who want to force a storage operation at other intervals. It is also used to remove unused records and compact your data file and to construct a backup data file.

Select Routine

To store your coordinates, type SC at a **Select Routine** prompt or type SC ↵Enter at any request for a point number.

Construct a Backup File? (Yes/No)

Press Y or 1 for Yes to construct a backup file, or N or 0 to skip the backup file construction. ***Remember: A new backup file will overwrite any previously constructed backup file.***

After answering the above prompt, your coordinates will be stored, and if selected, a backup file will be created. Your program printout will be stamped with the date and time of the backup operation. You will be returned to a **Select Routine** prompt.

NOTE
For extra safety, backup files are stored in the configuration directory.

Survey 4.0
Simplicity Surveying Series

10.22 RECOVER COORDINATES

Code: RC

FUNCTION: The RECOVER COORDINATES routine is used to load the coordinates from a backup data file.

WARNINGS!

1. This routine is not recorded into keystroke files. Do not manually edit your keystroke files to include this routine!

2. All coordinates currently in memory will be overwritten by the restoring process. You cannot selectively restore points with this routine.

NOTE

This routine will function only when a backup coordinate file exists.

Select Routine

To recover your backup coordinates, type **RC** at a **Select Routine** prompt or type **RC** Enter at any request for a point number.

Restore Backup File from *date* at *time* (Yes/No)

The ***date*** and ***time*** of the last backup file are given in the prompt. Press Y, 1, or click your mouse on the word **Yes** to recover a backup file. Otherwise, Press N, 0, or click your mouse on the word **No** to skip the backup file recovery.

After answering the above prompt, Survey 4.0 will execute your instructions and you will be returned to a **Select Routine** prompt.

Survey 4.0
Simplicity Surveying Series

11.01 CONFIGURATION MENU

Code: CM

FUNCTION: The CONFIGURATION MENU routine is used to change Survey 4.0's configuration settings from within COGO.

WARNING!

This routine is not recorded into keystroke files. Do not manually edit your keystroke files to include this routine!

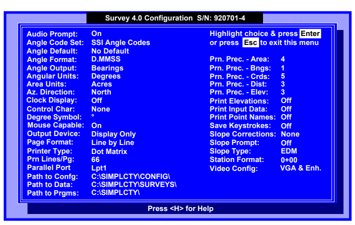
NOTES

1. When called from inside COGO, certain configuration items cannot be changed. The number of unavailable items depends upon whether or not you are recording keystrokes at the time that the Configuration Menu is called. See Section 5.04.

2. Four items which are inaccessible from the Configuration Menu, may be accessed directly from within COGO. These are: **Output Device** *(**PR**inter - **PR**: Section 11.10);* **Save Keystrokes** *(**SK** - Section 12.03);* **Print Point Names** *(**N**ames **O**utput - **NO**: Section 11.11); and* **Slope Angles** *(**SA** - Appendix E).*

Select Routine

To change Survey 4.0's configuration settings, type **CM** at **Select Routine** or type **CM** Enter at any point number prompt. The **Configuration Menu** will appear.



Change your configuration settings as desired and press (or click your mouse on) Esc to exit the menu. You will be returned to a **Select Routine** prompt.

Anytime you access the Configuration Menu ***and make a change***, the configuration settings are saved in a disk file that is used to establish the runtime configuration whenever you start a Survey 4.0 session.

See Sections 5.02 through 5.04 for detailed information on the use of the Configuration Menu and specific configuration settings.

Survey 4.0
Simplicity Surveying Series

11.02 CLEAR WORK SPACE

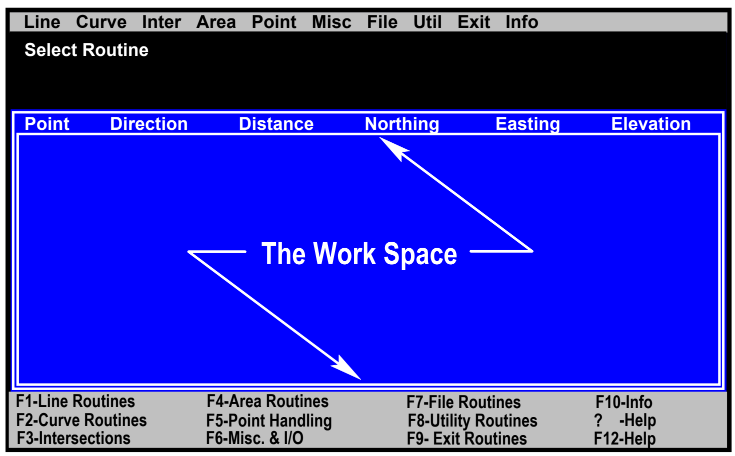
Code: CW

FUNCTION: The CLEAR WORK SPACE routine is used to erase that portion of your display which contains computed data, such as bearings, distances and coordinates.

WARNING!
This routine is not recorded into keystroke files. Do not manually edit your keystroke files to include this routine!

Select Routine

To clear the work space, type **CW** at **Select Routine** or type **CW** Enter at any point number prompt. The work space portion of monitor will clear and you will return to **Select Routine**.



The Survey 4.0 Work Screen: Figure 11-1

Survey 4.0
Simplicity Surveying Series

11.03 Code: CF

CONSTANT FACTOR

FUNCTION: The CONSTANT FACTOR routine is used to introduce a constant to be used as a scaling multiplier on distance entries.

Select Routine

To enter a constant factor for use as a scale factor, grid factor or correction factor, type **CF** at **Select Routine** or type **CF** Enter at any point number prompt.

Enter Multiplier

Type in the desired factor and press Enter.

To invoke the constant factor on a particular distance, preface your distance entry with the letter **C**. For example, if the multiplier is 0.90 and the measured distance was 300.00, an entry of **C300** would yield a distance entry of **270.00**, which equals 0.90 ∗ 300.

If you attempt to use a constant factor when one has not been defined, Survey 4.0 will prompt you for a factor.

SPECIAL APPLICATIONS

1. The **Constant Factor** *has two pre-programmed applications.*

A. A value followed by the letter **T** *will cause the correction factor to become a temperature correction for steel tapes. For example, the entry* **88T** *will convert to a factor for 88 degrees F. of 1+0.0000065∗(88-68), (1+0.000003611∗(T-20) in metric units). The number entered may be the temperature in deg. F., or deg. C., (if working in metric units). The formula assumes the tape was standardized at 68 deg. F., (or 20 deg. C.),*

B. A multiplier followed by the letter **A***, signals the computer that you are going to create a correction factor for the atmospheric effect on distances measured with an infrared*

EDM. The monitor will accept the first entry as a temperature in deg. F., (or deg. C. if working in metric units), and then request a pressure which is in inches of Hg. (or mm. Hg. if working in metric units). The correction factor will be computed as:

1+(278.45-((10.5P)/(1+(T*0.002175)))) (English units)
1+(278.45-((0.3865P)/(1+(T*0.003661)))) (Metric units)

where P is the pressure in inches (or mm.) Hg, and T is the temperature in degrees F, (or deg. C.). Check this factor against the specifications of your EDM before using.

2. Some other convenient uses for the constant factor are as a scale factor, grid factor or as the distance of 66.00 feet, which would allow you to enter all of your distances in chains.

Survey 4.0
Simplicity Surveying Series

11.04 POP-UP CALCULATOR

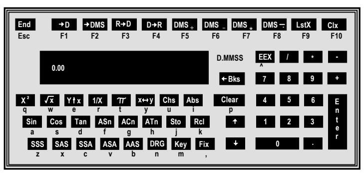
Code: PC

FUNCTION: The POP-UP CALCULATOR routine is used to activate a pop-up surveying calculator within COGO.

WARNING!
This routine is not recorded into keystroke files. Do not manually edit your keystroke files to include this routine!

Select Routine

To activate the pop-up calculator inside COGO, type **PC** at **Select Routine** or type **PC** ↵Enter at any point number prompt.



The **S4-Calc Pop-up Calculator** will appear on your monitor, allowing you to perform intermediate calculations, and/or triangle solutions, the results of which may be transported back to COGO.

For more information, see:
- Sections 15.01 & 15.02 for a detailed description of S4-Calc;
- Sections 15.03 & 15.04 for data entry and calculations;
- Section 15.05 for angular math and trigonometric functions;
- Section 15.06 for other math functions;
- Section 15.07 for memory functions;
- Section 15.08 for triangle solutions.

Survey 4.0 Simplicity Surveying Series

11.05 FORM FEED

Code: FF

FUNCTION: The FORM FEED routine is used to advance the printed output to the top of the next page.

Select Routine

To send the printer a form feed, type **FF** at **Select Routine** or type **FF** Enter at any point number prompt.

Enter new page number or press <Enter> for *n*?

This prompt provides you an opportunity to change the number of the next page. The next logical page number, ***n***, will be given in the prompt. Type any number and press Enter, or just press Enter to accept the number given in the prompt.

The printer will advance to the top of the next page and a page stamp and standard page heading will be placed at the top of the page.

NOTE

This routine functions only when the output option has been set to 2 (Display & Printer), 3 (Display, Printer & File), or 4 (Display & File). See Section 11.10.

Survey 4.0
Simplicity Surveying Series

11.06 Code: KL

KEYBOARD LOCK

FUNCTION: The KEYBOARD LOCK routine is used to deactivate the keyboard and blank the screen while you are away from your computer.

WARNING!
This routine is not recorded into keystroke files. Do not manually edit your keystroke files to include this routine!

Select Routine

To activate the keyboard lock, type **KL** at **Select Routine** or type **KL** Enter at any point number prompt. Survey 4.0 will completely clear your computer screen, except for a colored message box.

DO NOT DISTURB! Computer is in use.
Keyboard status: Keyboard is locked.

About every eight seconds, the message box will change color and relocate itself at various positions on your monitor. This is done for two reasons: it indicates to other potential users that your computer is indeed running, and; the constant relocation of the image prevents any "burning in" of the image on the monitor, should your computer be left in this state for an extended period of time.

To unlock your computer and continue in Survey 4.0, simply type **UNLOCK**. Your computer screen will be restored to the exact state that you left it.

NOTE
Colors for the message box are chosen at random, and some combinations are brutally ugly. Occasionally, the foreground and background colors are even the same color, causing the message itself to become invisible for the duration of that particular eight second time slice.

Survey 4.0
Simplicity Surveying Series

11.07 Code: NP

NEW PAGE

FUNCTION: The NEW PAGE routine is used to print a page stamp and standard heading. Options are provided to change the page number of the next printed page, and/or advance the printed output to the top of the next page.

Select Routine

To print a page stamp and standard heading, type **NP** at **Select Routine** or type **NP** ↵Enter at any point number prompt.

Next Printed Page Number is *n* Enter New Number for Next Printed Page

The next logical page number, ***n***, will be given in the prompt. Type any number and press ↵Enter, or just press ↵Enter to accept the number given in the prompt.

Issue a form feed now? (Yes/No)

If you want to issue a form feed at this time, press Y, 1, or click your mouse on the word **Yes**. Otherwise, press N, 0, or click your mouse on the word **No**. If you choose to issue a form feed, the printer will advance to the next page. After executing your instructions, Survey 4.0 will return you to **Select Routine**.

NOTES

1. This routine functions only when the output option has been set to 2 (Display & Printer), 3 (Display, Printer & File), or 4 (Display & File). See Section 11.10.

2. This routine is especially useful when you have started a session without the printer on, or when you need to start your printout on a particular page number to continue a job.

Survey 4.0
Simplicity Surveying Series

11.08 PAGE HEADING

Code: PH

FUNCTION: The PAGE HEADING routine is used to place a standard page heading on your printed output.

Select Routine

To print a standard page heading, type **PH** at **Select Routine** or type **PH** ↵Enter at any point number prompt. A heading of:

Point Quad Direction Distance Northing Easting Elevation

will be printed and you will return to **Select Routine**.

NOTES

1. This routine functions only when the output option has been set to 2 (Display & Printer), 3 (Display, Printer & File), or 4 (Display & File). *See Section 11.10.*

2. This routine does not advance the printer to the top of the next page.

Survey 4.0
Simplicity Surveying Series

11.09 PAGE STAMP

Code: PS

FUNCTION: The PAGE STAMP routine is used to alter the contents of the job heading that is placed on the printouts. Unless altered by this routine, the page stamp will normally consist of the information contained in the JOB file.

Select Routine

To specify a page stamp to be placed on your printout, type **PS** at **Select Routine** or type **PS** Enter at any point number prompt. An instruction window will appear below the prompt area.

A page stamp containing the date, time, page number, and standard heading will be printed on each page. You may also add your name and up to four lines of job description (75 char. each). Press <Enter> after each line.

<Home> Beginning of Line	<End> End of Line	<Esc> Exit Routine
<Arrows> Move In/Between Fields	<Insert> Insert Char.	<Del> Delete Char.
<Alt><C> Clears Current Field	<Enter> Next Field	<Tab> Next Field

By:

Type in your name or initials and press Enter.

Dsc:

This prompt will appear up to four times. At each occurrence, type in up to 75 characters of information indicating job name, client, etc. Press Enter after each line.

At any time, you may press Esc to exit this routine. Lines added or edited up to that point will be changed in your Job file with an affirmative answer to the prompt:

Do you want to write the current page stamp info to a JOB file? (Yes/No)

To save your changes to the Job file, press Y, 1 or click your mouse on the word **Yes**. Otherwise, press N, 0 or click your mouse on the word **No**. Even if you elect not to save changes to your Job file, the page stamp information has been altered, at least for the current session. This feature allows you to use the Page Stamp routine to create an abbreviated page heading, saving some space on each page of your printouts.

Survey 4.0 Simplicity Surveying Series

11.10 Code: PR

PRINTER ON / OFF

FUNCTION: The PRINTER ON/OFF routine is used to select the output device(s).

Select Routine

To specify the data output device, type **PR** at **Select Routine** or type **PR** Enter at any point number prompt.

Select Output Device(s)
Now: *current setting*

< 1 > Display Only
< 2 > Display & Printer
< 3 > Display, Printer & File
< 4 > Display & File

The prompt area will display the ***current setting*** in the prompt line, along with a selection box of four output choices. Press (or click your mouse on) the number corresponding to your desired choice. After your selection, you will be returned to **Select Routine**.

If you choose either option 3 or 4, your output is sent to an ASCII text file in your data directory that shares the same root name as your data file, but has the extension **.DOC**. This file is always appended, never overwritten. Each time you access these options, data is simply added to the file.

NOTES

1. This routine functions only when the output option has been set to 2 (Display & Printer), 3 (Display, Printer & File), or 4 (Display & File). See Section 11.10.

2. Options 3 and 4 are not available in Survey Lite.

Survey 4.0
Simplicity Surveying Series

11.11 Code: NO

NAMES OUTPUT

FUNCTION: The NAMES OUTPUT routine is used to change the status of the continuous point names output from ON to OFF or vice versa.

Select Routine

To alter the current setting of the names output mode, type **NO** at **Select Routine** or type **NO** Enter at any point number prompt.

Names output now ON (OFF)

Survey 4.0 will assume the opposite of its previous output status and display the appropriate message. You will regain control at a **Select Routine** prompt.

When the names output default is **On**, any point which has a name, station, or comment identifier will have that identifier printed along with the coordinates whenever the said point is accessed. Also, you will be prompted for a point name whenever a new point is created.

NOTE

Since name storage is disk oriented and not held in RAM, turning on the names output will considerably slow down the operation of your program. If you are careful to remember to back up files from a RAM disk, utilizing a RAM disk for data storage will recover most, if not almost all, of the operating speed lost by using this routine.

Survey 4.0
Simplicity Surveying Series

11.12 REMARKS

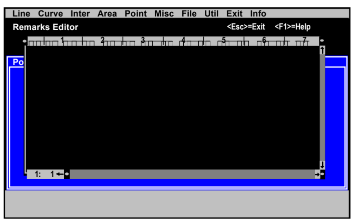
Code: RE

FUNCTION: The REMARKS routine is used to place comments on your printouts.

WARNING!
This routine is not recorded into keystroke files. Do not manually edit your keystroke files to include this routine!

Select Routine

To activate the remarks routine, type **RE** at **Select Routine** or type **RE** Enter at any point number prompt. The **Remarks Editor** window will open.



Following the ***S4-Edit*** instructions presented in Section 16, type your remarks into the editor window. For help with editor key presses, press F1.

When you have finished entering your remarks, press (or click your mouse on) Esc to exit the editor.

Print Remark?
< Y > Yes
< N > No
< A > Abandon Changes & Restart

To exit the Remarks Editor, you must indicate whether or not you want to place your remark on your printout. To print the remark, press Y or click your mouse on the **< Y >**. To erase your remark and return to **Select Routine**, press N or click your mouse on the **< N >**. If you have made a mistake in your remark and wish to re-enter it, press A or click your mouse on **< A >**. Choosing to abandon and restart will cause the editing window to clear, close and then re-open to a blank screen.

NOTES

1. This routine functions only when the output option has been set to 2 (Display & Printer), 3 (Display, Printer & File), or 4 (Display & File). See Section 11.10.

2. If you elect not to print your remark, it will be lost. Remarks are not saved in memory.

Survey 4.0
Simplicity Surveying Series

11.13 Code: PD

PRINT INPUT DATA

FUNCTION: The PRINT INPUT DATA routine is used to toggle the printout of your input data from ON to OFF, or OFF to ON.

WARNING!
This routine is not recorded into keystroke files. Do not manually edit your keystroke files to include this routine!

Select Routine

To alter the current print (input) data status, type **PD** at **Select Routine** or type **PD** Enter at any point number prompt.

Echo of Input Data is On (Off)

Survey 4.0 will assume the opposite of its previous output status and display the appropriate message. You will regain control at a **Select Routine** prompt.

Turning the print input data toggle **On** will result in the printing out of your input data while in the "traverse" modes. This printout will enable you to review your data input at a later time.

REGARDING MACRO PROGRAMS
Turning the print input data toggle **On** *will result in the printing out of your* **PROMPT** *statements and responses while running a macro.*

Survey 4.0
Simplicity Surveying Series

11.14 Code: VS

VIEW COORDINATE SCREEN

FUNCTION: The VIEW COORDINATE SCREEN routine is used to obtain a graphical representation of your coordinate data. A graphics card is required. No attempt is made to provide the ability to dump the screen to a printer at a specified scale. Scaling between the points is relative.

WARNING!
This routine is not recorded into keystroke files. Do not manually edit your keystroke files to include this routine!

Select Routine

To activate the view screen, type **VS** at **Select Routine** or type **VS** [Enter] at any point number prompt. The existing program screen will be saved and then cleared, and the monitor will display the **View Screen** option box.

VIEW SCREEN: Select a Viewing Option:

< 1 > **Display all points**
< 2 > **Display a range of points**
< 3 > **Display points in a NS-EW range**
< 4 > **Display points within ? feet of a base point**
< 5 > **Load existing drawing**
< A > **Adjust Screen Attributes**
< E > **EXIT to Select Routine**

WINDOWS NOTE
If you are running in Windows, you may need to switch to a full screen mode. If you don't see the ***View Screen*** *option box display after pressing* ***VS****, press* [Alt] [Enter].

Select your desired option by pressing (or clicking your mouse on) the corresponding number. If you choose to exit the routine, the original program screen will be restored and you will be returned to a **Select Routine** prompt.

NOTE
***Option 5** will only be displayed if a drawing file exists on the data disk. See the **Save Drawing** portion of the section entitled **Inside the Drawing Screen**, later in this section.*

Option 1
Display All Points

This option will display all of the currently existing coordinate points, placing a point number by each point. *Continue at the section entitled **Inside the Drawing Screen**.*

Option 2
Display a Range of Points

This option will display all of the currently existing coordinate points that lie between two user-specified point numbers, placing a point number by each point.

Enter STARTING point

Type the starting point number and press Enter.

Enter ENDING point or R for Remainder

Enter the ending point number and press Enter. If you want to display all the points in the file that are numbered higher than the specified starting point, press R Enter. The specified points will be displayed and a point number will be placed by each point. *Continue at the section entitled **Inside the Drawing Screen**.*

Option 3
Display Points in a NS-EW Range

This option will display all of the currently existing coordinate points that lie between two pair of user-specified coordinates. A point number will be placed by each point shown.

Enter the LOW Northing (or P# where # is a point number)

Type in the lowest desired Northing coordinate value and press Enter. You may also respond to this prompt by typing in the letter **P** followed immediately by the number of the point that would mark the lower left corner of your viewing screen. *If you do so, skip the next three prompts.*

Enter the LOW Easting

Type in the lowest desired Easting value and press Enter.

Enter the HIGH Northing

Type in the highest desired Northing value and press Enter.

Enter the HIGH Easting

Type in the lowest desired Easting value and press ↵Enter. *Skip the next prompt.*

Enter the next point number

If you responded to the first prompt with a point number, you must now enter the number of the point that would mark the upper right corner of your viewing screen.

After scanning the point data, Survey 4.0 displays only those points that fit within the specified limits. *Continue at the section entitled **Inside the Drawing Screen**.*

Option 4
Display Points within ? Feet of a Base Point

This option will display all of the currently existing coordinate points that lie within a given radius from a base point. A point number will be placed by each point shown.

Enter BASE Point

Type the base point number and press ↵Enter. The base point is the point that will be positioned in the center of the viewing screen.

Enter VIEWING RADIUS

Type in the viewing radius and press ↵Enter. All points that lie within the radius distance from the base point will be displayed. *Continue at the section entitled **Inside the Drawing Screen**.*

Option 5
Load Existing Drawing

If you have selected option 5, Survey 4.0 will now load the image stored under the name of the file you are working on. Please be certain that the disk containing the image is in the proper drive and ready to load data before selecting this option. *Continue at the section entitled **Inside the Drawing Screen**.*

NOTE

Option 5 *will only be displayed on the* ***View Screen*** *options box if a drawing file exists on the data disk. See the* ***Save Drawing*** *portion of the section entitled* ***Inside the Drawing Screen****, later in this section.*

Option [A]

Adjust Screen Attributes

Survey 4.0 allows you to adjust the screen attributes so that the arc and line segments that you draw inside the viewing screen will meet at the corners. This option will be most valuable to laptop owners, since laptops possess smaller screen displays that do not conform to standard screen aspect ratios.

Change Aspect Ratio: Arc should match line segments at both ends.

The screen display consists of a drawing of a quarter circle. The object of this exercise is to match the line segments to the arc at both ends of the arc. To accomplish this, press [+] and/or [-] until the lines exactly touch the ends of the arc. When you have achieved the desired result, press [Esc] to quit this adjustment routine. The new aspect ratio will be saved for reference in future viewing sessions.

Inside the Drawing Screen

After you have made the appropriate responses to the prompts for your selected viewing option, the viewing screen will display all of the requested points along with a North arrow. If you are using a mouse, the coordinates of the tip of the mouse pointer will be displayed in the upper left corner of the screen. As you move the mouse, the coordinates change accordingly. This feature may be helpful to obtain the ***approximate*** coordinates of any point on the screen.

At this time, you are free to add lines, arcs, and/or points to your drawing. To assist you, you are given the following key assignments:

Select a function:

[L]ine Draw	[P]oint Place	[N]ew Drawing	[S]ave Drawing	Last Point [+]1
[A]rc Draw	[E]raser Set	[Q]uit View Screen	[D]rawing Print	Last Point [-]1

To use any function, press the corresponding letter, or click your mouse on the function name.

Line Draw

To draw a line between any two points, press [L]. The program will prompt you for a **Starting point** and **Ending point** number. Type in each point number as requested, pressing [↵Enter] after each entry. After drawing the line, the ending point becomes the new starting point and the program will request a new ending point. If you wish to change the starting point, press L to re-initialize the sequence.

Arc Draw

To draw an arc between any two points, press A. The program will prompt you for a **Starting point**, **Ending point** and **Center point** number. Type in each point number as requested, pressing ↵Enter after each entry. After drawing the arc, the ending point becomes the new starting point and the program will request a new ending point. If you wish to change the starting point, press A to re-initialize the sequence.

CAUTION!
When placing arcs, the arc will always proceed counter-clockwise from the specified starting point.

Point Place

To draw and number a point(s), press P. The program will prompt you for a **Point** number. Type in the number and press ↵Enter.

If you specify a point that does not exist, the program will prompt you for the **Northing** and **Easting** coordinates for the point. Type in each value, pressing ↵Enter after each entry. The new point number and coordinates will be written into the data file.

Eraser Set

When the Eraser status is **ON**, pressing key E will turn the eraser **OFF**, and vice versa. To erase a line or arc placed in error, turn the eraser **ON** and re-trace the object that was placed in error. Remember to turn the eraser off when you are ready to resume your drawing. The current status of the eraser is shown in the lower right corner of your display.

NOTE
The eraser does not erase points.

New Drawing

To restart with a fresh drawing screen, press N. The screen will be cleared and you will be placed back at the **View Screen** option menu.

Quit View Screen

To exit the drawing routine and return to a **Select Routine** prompt, press Q or Esc. The original program screen will be restored and you will be returned to COGO.

Save Drawing

To save the currently displayed drawing to a disk file, press S. Be sure to have a disk with an adequate supply of free space available to receive the drawing data. Disk space requirements are as follows: CGA - 16,384 bytes; EGA - 28,672 bytes; and VGA - 38,912 bytes. You may check available disk space before entering the **View Screen** routine by pulling down the **Info** menu at **Select Routine**.

NOTE
Hercules monochrome graphics screens cannot be saved by this routine.

Drawing Print

To print the currently displayed drawing to an **Epson**, **IBM** or **HP Laserjet** compatible printer, press D. You will be given a printer menu, from which you must select the correct printer option. Press (or click your mouse on) the number that corresponds to your printer hardware. If you want to abort the printing process, answer the printer option prompt by pressing E to exit. Your printer must be on and on line or this operation will be aborted.

If you have printed a drawing, upon exiting the View Screen routine you will be given a chance to re-align your printer forms before continuing. The prompt area will display the message:

Line up your printer paper to the top of the next form and press any key to print a page heading & continue, or press <Esc> to redirect output.

If you no longer want to print your output, press Esc and refer to Section 11.10 for output choices. Otherwise, line up your printer form and press any key, except Esc.

NOTES

1. Due to varying printer resolutions and screen aspect ratios, the View Coordinate Screen routine has been designed to show you a visually correct representation of your work in progress. No attempt is made to manipulate the screen aspect ratios to provide a scaled printer plot. This feature is provided only to serve as a tool, not as a plotter.

2. Drawings are not printed into COGO output disk files.

3. Hercules monochrome graphics screens cannot be printed by this routine.

*4. For finished, annotated drawings, we recommend using **The Draftsman** (Section 14.07) with **Generic CADD**, or **Cogo-Mate** (Section 14.04) with **AutoCAD**.*

Last Point + 1
Last Point - 1

To specify an ending point that either immediately follows the given starting point, press + at any point number request. Likewise, to specify an ending point that immediately precedes the given starting point, press -.

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11.15 DOS SHELL

Code: DS

FUNCTION: The DOS SHELL routine allows you to access DOS level functions from within COGO.

WARNING!
This routine is not recorded into keystroke files. Do not manually edit your keystroke files to include this routine!

Select Routine

To access DOS functions from within COGO, type `DS` at **Select Routine** or type `DS` [Enter] at any point number prompt.

Enter a DOS Command or just press <Enter> for a DOS window

The DOS Shell routine functions two ways: as a ***Command Line Interface***, or as a full screen ***DOS Session***.

Command Line Interface

There will be times when you need to access only a single DOS command, for example, when you want to format a disk. The best way to handle this type of operation is with the DOS Command Line Interface. Simply type in the DOS command and press [Enter], such as:

`FORMAT A:/f:1.44/s` [Enter]

which will format a 3½", 1.44mb disk (`/f:1.44`) in drive `A:` and copy the DOS system files (`/s`) to it. Two other excellent uses of this type of command are:

`COPY C:\Simplcty\Surveys\Oakwoods.* A:` [Enter]

`Diskcopy A: B:` [Enter]

The first command would backup your data files from your hard drive to a floppy disk by copying all of the associated `Oakwoods` files from the `C:` drive, `\Simplcty\Surveys` directory to a floppy disk in drive `A:`. The second command would be used to make a copy in drive `B:` of a disk in drive `A:`.

After executing a command of this type, Survey 4.0 will continue at **Select Routine**.

DOS Session

Just as there are times when you need to access only a single DOS command, there will be other times when you want to access more than one DOS command. For example, suppose you need to format a disk before copying some files to it. When this is the case, press ↵Enter without typing any DOS command. The program screen will clear and you will be given the message:

Survey 4.0 DOS Shell   Type EXIT & press ENTER to return to Survey 4.0.

This message will usually be accompanied by a listing of your DOS version, and perhaps an indication of your currently occupied drive and directory. The latter display depends upon the ***Prompt*** commands that you have placed into your ***Autoexec.Bat*** start-up batch file. Please note that the above message will not remain on your display throughout your DOS session.

You are now free to do as you wish inside the DOS file, even to the point of shutting down your computer. As a precaution to guard against problems caused by running other programs within the shell, Survey 4.0 closes all data files before opening the shell.

You may run other programs from the DOS shell, to the extent that you have enough RAM to do so. The amount of memory you have available will depend on your computer's configuration. (Running under Microsoft DOS 5.0 with Quarterdeck's QEMM 6.1 memory manager software, our computers have approximately 480Kb of space available.)

To exit the shell, type **`EXIT`** and press ↵Enter at any DOS prompt. The Survey 4.0 screen will be restored and your data will be re-loaded so that you may continue your COGO computations.

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12.01 ASCII FILE EXCHANGE

Code: AX

FUNCTION: The ASCII FILE EXCHANGE routine is used to import and export ASCII data files.

Select Routine

To activate the ASCII File Exchange routine, type **AX** at **Select Routine** or type **AX** Enter at any point number prompt.

Select an ASCII Exchange
< 1 > Read an ASCII File
< 2 > Write an ASCII File
< 3 > Define ASCII File Formats
< E > EXIT to Select Routine

Make your selection by pressing (or clicking your mouse on) the number or letter corresponding to the desired item.

Option 1
Read an ASCII File

Choose this option if you wish to load an ASCII data file into Survey 4.0. You will be offered six **Read** choices in a selection menu.

< 1 > CogoMate UCL file

Press (or click your mouse on) 1 to load a **CogoMate UCL** (User Coordinate List). A CogoMate UCL file is created by CogoMate to export points created inside AutoCAD back into Survey 4.0. *Only points which have been assigned a point number in the UCL file will be imported.*

< 2 > Comma Delimited file

Press (or click your mouse on) 2 to load a **Comma Delimited** file. The file structure contains elements that are separated by commas. The order of the elements is defined in the **ASCII.FMT** file, created by the **Define ASCII File Formats** option on the opening **ASCII File Exchange** menu.

< 3 > Space Delimited file (P N E Z "text")

Press (or click your mouse on) 3 to load a **Space Delimited** file. The file structure contains elements that are separated by spaces. These elements must be in the order of Point, Northing, Easting, elevation, and description (P N E Z "text").

< 4 > Fielded ASCII file

Press (or click your mouse on) 4 to load a **Fielded ASCII** file. The file structure contains elements that are placed into rigidly defined columns. The order of the elements is defined in the **ASCII.FMT** file, created by the **Define ASCII File Formats** option on the opening **ASCII File Exchange** menu.

< 5 > Star*Net Coordinate file

Press (or click your mouse on) 5 to load a **Star*Net Coordinate** file. A Star*Net file is created by the Star*Net Least Squares Adjustment program from StarPlus Software.

< 6 > Draftsman UCL File

Press (or click your mouse on) 6 to load a **Draftsman UCL** (User Coordinate List). A Draftsman UCL file is created by The Draftsman to export points created inside Generic CADD back into Survey 4.0.

Enter the Full Name of the Input File, including path and extension

Type in the complete name of the input file and press Enter.

WARNING! Do you want Point Overwrite protection? (Yes/No)

To activate point overwrite protection, press Y, 1, or click your mouse on the word **Yes**. Otherwise, press N, 0, or click your mouse on the word **No**. Since the ASCII import routine will attempt to merge the ASCII file data into Survey 4.0, overwrite protection is important to keep any existing Survey 4.0 points from being overwritten. When the ASCII import routine encounters an existing point with overwrite protection **On**, you will receive a message similar to:

```
Point 2 exists!  Trying to overwrite with point 2

Exist    NE Corner of Block 1        10000.0000      20000.0000
New      NW Corner of Block 3        10752.1244      20259.3184

Press:   <S>kip    <O>verwrite    <A>ssign New Number    <E>xit
```

In the first message line, the first point number given is the existing Survey 4.0 point. The second point number is the number of the incoming point. Press (or click on) S to skip importing the point, O to overwrite the existing point with the imported point, A to assign a new number to the imported point, or E to exit the routine.

New point number?

If you choose to assign a new number, type in that number and press Enter. If your new number is that of an occupied point, you will receive the overwrite warning prompt. This time however, the point numbers listed in the first line will not be the same number.

Option 2

Write an ASCII File

Choose this option if you wish to write Survey 4.0 data to an ASCII data file. You will be offered five **Write** choices in a selection menu. To see examples of these formats, use the **Edit/ View File** routine (**EF** - Section 12.02) and load the file named `FILETYPE.DOC` from your Survey 4.0 program directory.

< 1 > CogoMate file

Press (or click your mouse on) 1 to write a **CogoMate** file. A CogoMate file created by Survey 4.0 allows you to export Survey 4.0's coordinate data into AutoCAD via Simplicity Systems' CogoMate program.

< 2 > Contour file (P,N,E,Z)

Press (or click your mouse on) 2 to write a **Contour** file. The file structure contains elements that are separated by commas. These elements will be in the order of Point, Northing, Easting, and elevation, (P,N,E,Z). Use this file structure for programs such as LI Contour and LI Contour V+. *Only points that have an elevation value other than zero will be placed into the file.*

< 3 > Comma Delimited file

Press (or click your mouse on) 3 to write a **Comma Delimited** file. The file structure contains elements that are separated by commas. The order of the elements is defined in the **ASCII.FMT** file, created by the **Define ASCII File Formats** option on the opening **ASCII File Exchange** menu.

< 4 > Space Delim. file (PNEZ)

Press (or click your mouse on) 4 to write a **Space Delimited** file. The file structure contains elements that are separated by spaces. These elements will be in the order of Point, Northing, Easting, and elevation, (PNEZ). You will also be given the option of writing the point descriptor as a quoted string ("text enclosed by quote marks") with this format.

< 5 > Fielded ASCII file

Press (or click your mouse on) 5 to write a **Fielded ASCII** file. The file structure contains elements that are placed into rigidly defined columns. The order of the elements is defined in the **ASCII.FMT** file, created by the **Define ASCII File Formats** option on the opening **ASCII File Exchange** menu.

Enter the Full Output File Name including path and extension

Type in the complete name of the output file and press [Enter].

WARNING! File exists! Overwrite? (Yes/No)

If the specified output file exists, you will be warned. Press [Y], [1], or click your mouse on the word **Yes** to overwrite the file. Otherwise, press [N], [0], or click your mouse on the word **No** to return to the output filename prompt. ***WARNING!*** *A backup file* ***is not*** *created!*

Enter the starting point number or A for All

Type in the starting point number of the group of points that you want to export and press [Enter]. If you want to export the entire file, press [A] [Enter].

Enter the ending point number or R for Remainder of File

Type in the ending point number of the group of points that you want to export and press [Enter]. If you want to export the remainder of the file, press [R] [Enter].

If you have not selected an [A]**ll** or [R]**emainder** option, these last two prompts continue, allowing you to selectively build an export file of individually chosen and/or grouped points. Exit to **Select Routine** by pressing [E] [Enter].

Option [3]

Define ASCII File Formats

Choose this option if you wish to define the **Comma Delimited** and/or **Fielded** ASCII data file formats.

Current Comma Delimited File = PNEZD Change this format? (Yes/No)

This prompt shows you the current comma delimited file format. For example, the format **PNEZD** indicates that each line of the file contains five elements, separated by a comma. These are the **P**oint, the **N**orthing, the **E**asting, the Elevation (as **Z**) and the **D**escription. (For obvious reasons, your descriptions should not contain commas, lest they be dissected into little chunks.) To change the format press [Y], [1], or click your mouse on the word **Yes**. Otherwise, press [N], [0], or click your mouse on the word **No**.

Enter a New Comma Delimited Format: Use only letters P N E Z D for Point, Northing, Easting, Elevation and Description.

Type in your new comma delimited file format using the letters. shown in the prompt. Use only the letters **P**, **N**, **E**, **Z**, and **D**, and **DO NOT** place any spaces or commas into your entry. You do not need to use all of the letters, and you may use a letter more than once, if such a file is required for a special application. When you have finished defining your file, press [Enter].

Current Fielded File Format is:
P 4
N 9.6
E 9.6
Z 5.4
D 28.1
Change this format? (Yes/No)

This prompt shows you the current fielded file format. The file's elements are defined by the letters **P**, **N**, **E**, **Z**, and **D**, just like a comma delimited file. The numbers following the letters indicate the number of columns reserved for that particular entry. For example, the format **P 4**, **N 9.6**, **E 9.6**, **Z 5.4**, **D 28.1** indicates the following: The **P**oint number occupies the first **4** columns of the line; the **N**orthing occupies the next **16** columns, **9** columns to the left of a decimal **point**, the decimal point itself, and **6** columns to the right of the decimal point; the **E**asting occupies the next **16** columns, **9** columns to the left of a decimal **point**, the decimal point itself, and **6** columns to the right of the decimal point; the elevation **Z** occupies the next **10** columns, **5** columns to the left of a decimal **point**, the decimal point itself, and **4** columns to the right of the decimal point; and finally the Description occupies the next **29** columns, **28** columns of text following a **1** column space between the description and the elevation. To change the format press Y, 1, or click your mouse on the word **Yes**. Otherwise, press N, 0, or click your mouse on the word **No**.

Press Field *n* ID Letter:
P N E Z D or Q to Quit

This prompt sequence will repeat up to five times to allow you a chance to enter all five of the possible fields. The number of the sequence will be given in the prompt as ***n***. Press the field letter but **DO NOT** press ↵Enter.

Number of places

If you have pressed **P**, type in the number of columns you want to reserve for the point number and press ↵Enter. Return to the **ID** letter prompt if you were not in the final sequence.

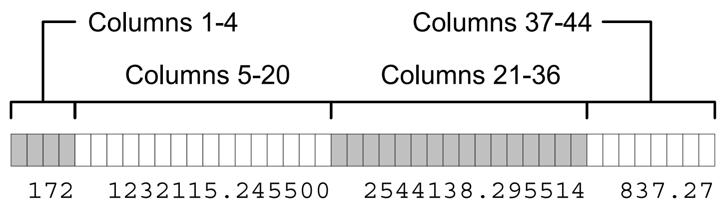
Number of Whole places
Number of Decimal places

If you have pressed **N**, **E**, or **Z**, type in the number of columns you want to reserve for the whole number portion of your value and press ↵Enter. Now type in the number of decimal places and press ↵Enter. Return to the **ID** letter prompt if you were not in the final sequence.

Number of places
Number of spaces preceding the description

If you have pressed **D**, type in the number of columns you want to reserve for the point description portion and press ↵Enter. Now type in the number of spaces that you want to precede the description and press ↵Enter. Return to the **ID** letter prompt if you were not in the final sequence.

Notice that there is no provision for introducing spaces between the numerical values. Spaces are entered by increasing the size of the field on the left side of the decimal points. For example, in the format, **P 4**, **N 9.6**, **E 9.6**, **Z 5.2**, suppose point 172 had a Northing of 1232115.2455, an Easting of 2544138.295514, and an elevation of 837.27. That particular line would look like:



The spaces preceding the coordinate values are a result of the sizing of the fields. Northing and Easting field spacing of 7.6 would have resulted in no spaces being present, while spacing of 12.6 would have resulted in five blank spaces.

WARNING!
Make sure your fields are adequately sized to handle the data being exported. Undersized fields will result in erroneous data transfers.

When you have finished defining your file formats, the data is stored in the file **ASCII.FMT** in the Survey 4.0 configuration path.

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12.02 Code: EF
EDIT / VIEW FILE

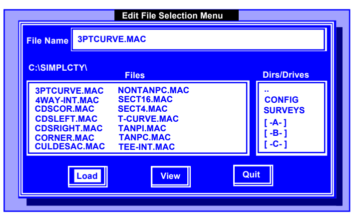
FUNCTION: The EDIT / VIEW FILE routine is used to activate the S4-Edit program from within COGO to view and edit text files, keystroke files, and macro programs.

Select Routine

To use the Edit/View File routine, type **EF** at **Select Routine** or type **EF** [↵Enter] at any point number prompt.

Edit File:

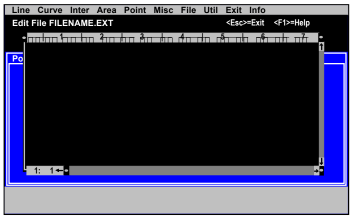
Type the name of the file or macro you wish to view, edit, or create, and press [↵Enter]. Be sure to specify the path for your file as part of the filename. You may also press: [F1] to load the current **KEY** (keystroke) file; [F2] to load the current **DOC** (output data) file; [F10] to Exit; [F11] for an Edit File Selection Menu; or [F12] for Help. If you select [F1] or [F2], the chosen document will be automatically loaded into the **S4-Edit Window**. Please skip the next screen and prompt, and continue at the **S4-Edit Window** prompt.



If you pressed [F11], the **Edit File Selection Menu** should now be visible. This menu allows you to select the file you wish to edit or view. Enter the file name into the **File Name** window, or select the file from the **Files** window with your mouse or the cursor keys. Complete instructions for the use of the Selection Menu are contained in Section 17.06.

File not found. Is this a new file? (Yes/No)

If your specified file does not exist, you will receive this message. Press [Y], [1], or click your mouse on the word **Yes** if you are creating a new file. If you are viewing or editing an existing file and you receive this message, it is likely that your path is incorrect. Press [N], [0], or click your mouse on the word **No**, which will allow you to re-enter the filename.



You are now ready to begin editing or viewing your file. On-line help is available by pressing F1. Detailed instructions for using the editor can be found in Section 16.

When you are finished working on your file, press Esc.

Save Changes?
< Y > Yes
< N > No
< A > Abandon Changes & Restart

Press Y, 1, or click your mouse on the **< Y >** to save your file. Press N, 0, or click your mouse on the **< N >** to quit the editor without saving the file. Press A or click your mouse on the **< A >** to restart the editor session.

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12.03 Code: SK

SAVE KEYSTROKES

FUNCTION: The SAVE KEYSTROKES routine is used to record your keystrokes into a file for editing and playback at a later time. This is a toggle switch.

WARNING!

***Read Section 3.13!** Serious irreparable damage to your data files **WILL** result from the misuse of the keystroke recording, editing, and playback features! Simplicity Systems, Inc. will not be responsible for any data loss you experience. **If you are not 100% certain that you know what you are doing with these routines, DO NOT USE THEM!** At the very least, store backup copies of all pertinent files in some location other than your designated data directory.*

Select Routine

To activate or deactivate the Save Keystrokes feature, type **SK** at **Select Routine** or type **SK** ↵Enter at any point number prompt. If keystroke recording was **On**, it will be turned **Off** and you will receive the message:

Keystroke saving mode is Off

Keystroke file exists!
< A > Append to existing file
< O > Overwrite existing file
< E > EXIT to Select Routine

If a keystroke file exists, you will receive a warning prompt offering you three choices. Press (or click your mouse on) the letter corresponding to your desired choice. If you choose to **Exit to Select Routine**, your keystroke file will remain closed.

If you choose to **Append** the file, your keystrokes will be recorded into the original file, beginning at the end of the file. You will receive the message:

Keystroke saving mode is On... Appending EXISTING Keystroke File

If you choose to **Overwrite** the file, your original keystroke file will be renamed with a **.BKY** extension and a new **.KEY** file will be started. You will receive the message:

Keystroke saving mode is On... Writing NEW Keystroke File

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12.04 RUN FILE

Code: RF

FUNCTION: The RUN FILE routine is used to run the active job's Keystroke File.

WARNING!

Read Section 3.13! *Your keystroke file may need to be edited before you run it. Serious irreparable damage to your data files* ***WILL*** *result from the misuse of the keystroke recording, editing, and playback features! Simplicity Systems, Inc. will not be responsible for any data loss you experience.* ***If you are not 100% certain that you know what you are doing with these routines, DO NOT USE THEM!*** *At the very least, store backup copies of all pertinent files in some location other than your designated data directory.*

Select Routine

To Run a Keystroke File, type **RF** at **Select Routine** or type **RF** [Enter] at any point number prompt.

< 1 > Save a backup coordinate file
< 2 > Continue without a backup file
< E > EXIT this Routine

Survey 4.0 first provides an opportunity to create a backup file.

DO IT NOW!!!

The backup file is useful to restore your original coordinate file if you make any errors in point selection. To create a backup file, press [1]. Press [2] to continue without a backup file, **AT YOUR OWN RISK.** ***Remember, whenever you create a backup file, you overwrite any previous backup file.***

The above prompt is also your last chance to abort this routine before running the keystroke file. If you have not used the **Edit/View File** routine (**EF** - Section 12.02) to check the contents of the keystroke file for potential trouble areas, we urge you to press [E] to exit this routine and review your file now. If you have not yet read Section 3.13, definitely read it now.

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12.05 RUN MACRO FILE

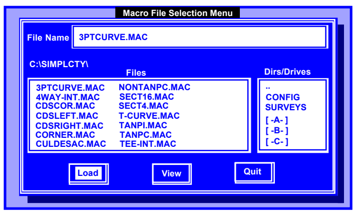
Code: RM

Not available in Survey Lite

FUNCTION: The RUN MACRO FILE routine is used to select and run a Macro Program file.

Select Routine

To Run a Macro File, type **RM** at **Select Routine** or type **RM** Enter at any point number prompt.



The **Macro File Selection Menu** should now be visible. This menu allows you to select and run your macro program.

Enter the macro name into the **File Name** window, or select the macro from the **Files** window with your mouse or cursor keys. Complete instructions for the use of the Macro File Selection Menu are contained in Section 17.06.

After you have entered or selected a macro to run, Survey 4.0 will close the Macro File Selection Menu and run your macro. You will be returned to **Select Routine**.

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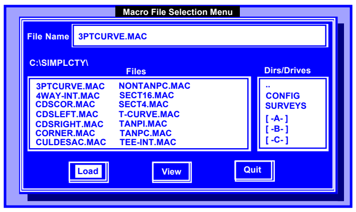
12.06 WRITE / EDIT A MACRO FILE

Code: WM

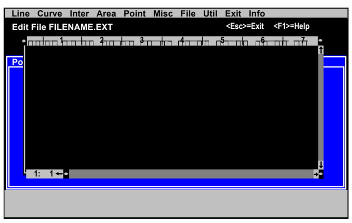
FUNCTION: The WRITE / EDIT A MACRO FILE routine is used to write and edit macro program files.

Select Routine

To Write and/or Edit a Macro File, type **WM** at **Select Routine** or type **WM** [Enter] at any point number prompt.



The **Macro File Selection Menu** should now be visible. This menu allows you to select the macro program you wish to edit, or enter a name for the macro program you wish to write. Enter the macro name into the **File Name** window, or select the macro from the **Files** window with your mouse or cursor keys. Complete instructions for the use of the Macro File Selection Menu are contained in Section 17.06.



After you have entered or selected a macro filename, Survey 4.0 will present the **S4-Edit Window**. If you are editing an existing macro, the macro programming code will appear in the window.

You are now ready to begin editing or writing your file. On-line help is available by pressing [F1]. Detailed instructions for using the editor can be found in Section 16. Detailed instructions for writing a macro file can be found in Section 17. When you have finished working on your file, press [Esc].

Save Changes?
< Y > Yes
< N > No
< A > Abandon Changes & Restart

Press [Y], [1], or click your mouse on the **< Y >** to save your file. Press [N], [0], or click your mouse on the **< N >** to quit the editor without saving the file. Press [A] or click your mouse on the **< A >** to restart the editor session.

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12.07 Code: LF

WRITE A LEGAL FILE

FUNCTION: The WRITE A LEGAL FILE routine is used to assemble Survey 4.0 data into a file that can be transformed into a legal description by LegalEase.

Select Routine

To Write a Legal (Data) File, type **LF** at **Select Routine** or type **LF** ↵Enter at any point number prompt.

Legal Description Interface
Enter a LegalEase filename

Type in the desired filename and press ↵Enter. The name entered becomes the output filename for the data inversed by the Legal File routine. This name will also be given to your description when it is processed by the ***LegalEase*** program. When entering a name, **DO NOT** specify a drive, directory or a filename extension. If you do, they will be deleted. Survey 4.0 will store legal files in the current data file disk and directory location, and will automatically place a **.LGL** extension on the filename. Remember, a filename cannot be longer than 8 characters.

File Exists! Overwrite? (Yes/No)

If the specified file exists, you will be warned. Press Y, 1, or click your mouse on the word **Yes** to overwrite the existing file. *(A backup file will not be created.)* Otherwise, press N, 0, or click your mouse on the word **No** to respecify the name.

Start at

You will now begin to inverse around the tract you want to describe, but first you must tell Survey 4.0 where to start. Type in the starting point number and press ↵Enter.

Inverse from (P) to

The starting point **P** will be given in the prompt. Use the **Inverse** (**IN** - Section 6.03), **Inverse Curve** (**IC** - Section 7.01), and **Inverse Obtuse Curve** (**OC** - Section 7.02) routines to inverse around your tract. When you have finished, you may place the area of a ***CLOSED*** parcel into the file by using the **Area** routine (**AR** - Section 9.01). Do not use the **Area** routine if you have an ***OPEN*** traverse. To close out your legal file, type **LF**. Your file will be closed and you will remain at **Select Routine**.

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12.08 LegalEase PROCESSOR

Code: LE

FUNCTION: The LegalEase PROCESSOR routine is used to activate the LegalEase Processor window from within COGO.

Select Routine

To activate the LegalEase Processor, type **LE** at **Select Routine** or type **LE** ↵Enter at any point number prompt.

At this point, Survey 4.0 will save and clear the screen, and then transfer control to the ***LegalEase*** program. Since you may create any number of legal files in Survey 4.0, you may use any Legal-Ease processing session to process more than one description file. When you finish with LegalEase, Survey 4.0 will restore your working screen and resume at **Select Routine**.

Instructions for the actual usage of LegalEase are contained in the LegalEase manual.

What is LegalEase?

LegalEase is a user-customizable legal description processor that uses Survey 4.0 data to quickly create a finished legal description. LegalEase lets you tailor descriptions of geometric conditions to match your own style, while assuring accurate description mathematics. You may store, print and/or export your description into other programs, such as The Draftsman. Currently $149, (as of 8/92, subject to change without notice). Contact Simplicity Systems at 1-800-777-7978.

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12.09 Code: RR

WRITE A RoadRunner FILE

Lite
Not available in Survey Lite

FUNCTION: The WRITE A RoadRunner FILE routine is used to construct a file of Survey 4.0 data that is correctly configured for RoadRunner.

NOTE
This routine uses the currently occupied point as the base point in a **Perpendicular Line, Station and Offset** *routine. If you want to begin at a different point other than the point now occupied, use the* **Start At** *(ST - Section 10.01) or* **Go To Point** *(GT - Section 10.02) routines.*

Select Routine

To activate the Write a RoadRunner File routine, type **RR** at **Select Routine** or type **RR** ↵Enter at any point number prompt.

RoadRunner Data File Name? (press <Enter> for filename)

Type in the name you want to assign to your RoadRunner file and press ↵Enter, or just press ↵Enter to accept the filename shown in the prompt. If you enter a filename, specify a drive and directory. The **.RR** filename extension will be added automatically. If you do not specify a drive and directory, the file will be created in the currently logged data directory.

RoadRunner Project Name

Type in the project name and press ↵Enter. Pressing ↵Enter without typing in a project name causes Survey 4.0 to use the RoadRunner file name as the project name. See your RoadRunner documentation for a description of the project name.

Road Name

Type in the road name and press ↵Enter. Pressing ↵Enter without typing in a project name causes Survey 4.0 to use the RoadRunner file name as the road name. See your RoadRunner documentation for a description of the road name.

Select the File Type
< O >riginal Ground
< C >onstruction Grades
< E >xit

This is simply an identifier for the file type. Press O or C to indicate the correct file type. See your RoadRunner documentation for a description of the file types.

At this point, Survey 4.0 continues with the **Perpendicular Line, Station & Offset** routine (**LS** - Section 8.11). Use this routine and the **Perpendicular Arc, Station & Offset** routine (**AS** - Section 8.12) to assemble baseline and offset data.

Compute Offset at Point(s)

When you have finished accumulating data, type `RR` Enter.

RoadRunner file is ACTIVE
Select:
< P > Process current RoadRunner file
< D > Delete data and Start a New File
< E > Exit this prompt & Continue RR

The accumulated station and offset data must now be sorted, grouped and correctly formatted for the RoadRunner program. Press P, or click your mouse on **< P >**, to process the RoadRunner file. Otherwise select D or E.

Not enough records to process a RoadRunner data file

The **Write a RoadRunner File** routine can process from 2 to 500 records into a RoadRunner file. If your data file does not contain the minimum number of records required, you will receive this prompt and be returned to the **Perpendicular Line, Station & Offset** routine (**LS** - Section 8.11) to continue. (A record consists of the station and offset distance for one point.)

Starting Station

Type in the station at which you want to begin your RoadRunner file and press Enter. You do not need to precede the station with `#`, nor do you need to include a `+`, i.e. `14+50` is the same as `1450`. (NOTE to Metric users: `1+450` is the same as `1450`.)

Station Interval

Type in the distance between stations and press Enter.

Station Tolerance

To compensate for points that are not perfectly perpendicular to a station, you may enter a station tolerance. This is simply the distance before and after the station that will be treated as if it were the station. For example, a tolerance of `5` feet would group all points from 0+45 to 0+55 with station 0+50. Type in the station tolerance and press Enter. *WARNING! If you just press Enter, a tolerance of zero is entered and you might not be able to assemble a workable file.*

Your RoadRunner file will now be processed and you will be returned to **Select Routine**. The processed file may be imported into RoadRunner as an ASCII data file. See your RoadRunner documentation for complete RoadRunner instructions.

What is RoadRunner?

RoadRunner is a powerful, flexible and easy-to-use construction staking and cross sectional earthwork program. RoadRunner data files may be constructed from within Survey 4.0, or you may enter your data directly into the program. Cross section data may be plotted on a dot matrix printer or exported into Generic CADD. RoadRunner is $495, with smaller, upgradable versions available for $95 and $195, (as of 8/92, subject to change without notice). Contact Simplicity Systems at 1-800-777-7978.

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Survey 4.0
Simplicity Surveying Series

13.01 Code: U1

CIRCULAR CURVE

FUNCTION: The CIRCULAR CURVE routine will solve a circular curve given any one pair of the 29 possible parameters.

NOTE

When entering angular data into this routine, remember that the data entry format must match your COGO **Angle Format**.

PARAMETERS

This routine will solve a circular curve when given any one of the 29 possible conditions shown below.

KNOWN Central Angle &
- *Long Chord*
- *Arc Length*
- *Tangent*
- *Mid Ordinate*
- *External*
- *Sector Area*
- *Radius*
- *Degree of Curve-Arc*
- *Degree of Curve-Chord*

KNOWN Radius &
- *Long Chord*
- *Arc Length*
- *Tangent*
- *Mid Ordinate*
- *External*
- *Sector Area*

KNOWN Degree of Curve-Arc &
- *Long Chord*
- *Arc Length*
- *Tangent*
- *Mid Ordinate*
- *External*
- *Sector Area*

KNOWN Degree of Curve-Chord &
- *Long Chord*
- *Arc Length*
- *Tangent*
- *Mid Ordinate*
- *External*
- *Sector Area*

KNOWN Long Chord & *Tangent*

KNOWN Arc Length & *Sector Area*

Select Routine

To compute a circular curve solution, type `U1` at a **Select Routine** prompt, or type `U1` [Enter] at any request for a point number. After saving and clearing the COGO display screen, the routine will be loaded.

Do you want a printout (Yes/No)

If you entered this routine from the Simplicity Program Menu instead of from COGO, you will be asked if you want a printout. Press Y or 1 to send the results to a printer, N or 0 to work the problem entirely on the display. If you entered this routine from inside COGO, the COGO output device settings will be in force.

Select First Parameter:
< 1 > Central Angle Known
< 2 > Radius Known
< 3 > Degree of Curve Known - Arc
< 4 > Degree of Curve Known - Chord
< 5 > Long Chord Known
< 6 > Arc Length Known
< E > EXIT

Select the known parameter by pressing the number denoting the first parameter known, or press E to exit this routine. Survey 4.0 will then prompt for the value of the chosen parameter. Type in the data requested and press Enter.

After an acceptable data entry, the program will issue a menu of the available second parameter entries. Since the exact parameter list is dependent upon the first parameter selected, no secondary parameter listing will be reproduced in this manual. Select the known second parameter by pressing the number denoting the parameter known, or press R to return to the first parameter menu. Survey 4.0 will again prompt for the value of the chosen parameter. Type in the data requested and press Enter.

After your final entry, the program will solve for the remainder of the circular curve data.

NOTE

If you entered this routine from outside of COGO, option 2 in the next prompt will read, **< 2 > Exit**.

Select:
< 1 > Next Problem or
< 2 > Return to COGO

Make your selection by pressing 1 or 2. If you choose option 2, **Return to COGO**, each of the computed values will be marked by a letter and you will be prompted:

You may import up to 2 values, V1 & V2, back to COGO. Enter the letter(s) of the values(s) you choose. Press key < F10 > to EXIT at any time.

If your solution contains 1 or 2 values that you want to use in COGO, select the values to be imported by pressing the letters identifying the values wanted. The program automatically returns to COGO after two values have been selected. You may also exit the routine by pressing F10.

To use an imported value at an appropriate COGO prompt, type in **V1** Enter for the first chosen value, or **V2** Enter for the second chosen value. The letter need not be a capital letter.

Circular Curve Solution

Central Angle	=	37° 15' 20.0"
Deg. Curve-Arc	=	11° 27' 33.0"
Deg.Cur.-Chord	=	11 °28' 42.0"
Radius	=	500.000
Arc Length	=	325.116
Long Chord	=	319.419
Tangent	=	168.538
Mid Ordinate	=	26.193
External	=	27.641
Fillet Area	=	2990.237
Sector Area	=	81279.008
Segment Area	=	5607.614

Example 13.1

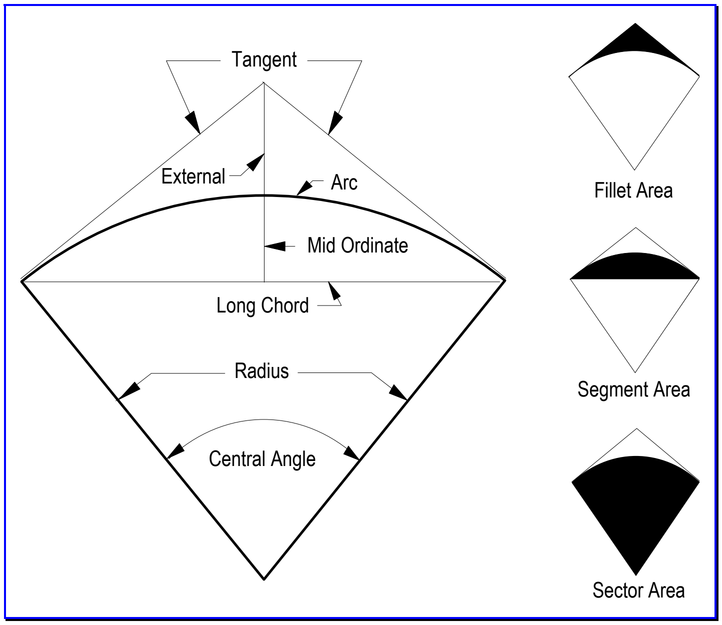

Figure 13-1: Circular Curves

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Survey 4.0
Simplicity Surveying Series

13.02 Code: U2

CURVE BY DEFLECTIONS

FUNCTION: The CURVE BY DEFLECTIONS routine will generate staking notes for a circular curve based on the deflection angle from the tangent to each station.

NOTES

1. This routine may be called from within the COGO ***Curve Menu*** *and used to generate a keystroke macro. The keystroke macro may then be exported and run inside COGO to generate coordinate points for every curve station. See* ***Circular Curve*** *(**CD** - Section 7.13).*

2. When entering angular data into this routine, remember that the data entry format must match your COGO ***Angle Format****.*

Select Routine

To compute a deflection layout for any circular curve, type **U2** at a **Select Routine** prompt, or type **U2** [Enter] at any request for a point number. After saving and clearing the COGO display screen, the routine will be loaded.

Do you want a printout (Yes/No)

If you entered this routine from the Simplicity Program Menu instead of from COGO, you will be asked if you want a printout. Press [Y] or [1] to send the results to a printer, [N] or [0] to work the problem entirely on the display. If you entered this routine from inside COGO, the COGO output device settings will be in force.

Central Angle

Type in the central angle and press [Enter].

Select Known Item:
< 1 > Radius
< 2 > Degree of Curve - Arc
< 3 > Degree of Curve - Chord

Select the known item by pressing [1], [2] or [3] , or press [F10] to exit the routine. Type in the requested radius or the requested degree of curve and press [Enter]. If you select **Degree of Curve - Chord**, the curve calculations will be based on a chord definition.

Offset (Enter = 0.00)

Type in the offset value and press [Enter], or just press [Enter] for a **0** offset. To offset inside the curve, enter a negative offset value.

Select Option: **< 1 > Station of P.I. Known** **< 2 > Station of P.C. Known**	Select the appropriate option by pressing [1] or [2], or press [F10] to exit the routine.
Station of PI (or PC)	If you select the PC option, pressing [Enter] without entering any data will result in a station entry of **0+00** (or **0+000** metric). Otherwise type in the station and press [Enter].
Stationing Interval	Type in the distance between stations and press [Enter].
Curving to the LEFT or to the RIGHT? (L/R)	If your curve proceeds to the left, press [L], otherwise press [R]. Your response sets the proper orientation for the deflection angles. Survey 4.0 will respond to this last entry by computing the solution. If you entered this routine from the COGO **Curve Menu**, the program will not print the solution, but instead it will wait for you to return to COGO before printing it. If you compute a new curve before returning to COGO, be aware that only the curve computed last is contained in the keystroke file that returns to COGO. If you have chosen not to obtain a printout, from time to time you will see **Press < Enter > to Continue** whenever the display screen is full. These delays are programmed at specific intervals to allow you to view data on the monitor during the running of the program. To continue with the solution, simply press [Enter].
Additional Stations	After completion of the problem, you will be given an opportunity to compute the curve data for any intermediate station on the curve. To compute any extra stations, type in the desired station and press [Enter], and the curve data will be computed. At any time you wish to exit the program, press [F10].
Select: **< 1 > Next Problem or** **< 2 > Return to COGO**	Make your selection by pressing [1] or [2]. If you entered this routine from outside of COGO, option 2 will read, **< 2 > Exit**.
Run Curve Layout (Yes/No)	If you entered this routine from the COGO **Curve Menu**, you have one last prompt to answer. If you want to lay out the curve inside COGO, press [Y], [1], or click your mouse on the word **Yes**. Otherwise, press [N], [0], or click your mouse on the word **No**.

You can lay out the curve at a later time with the **Run Macro File** routine (**RM** - Section 12.05). Select or enter the filename **D-CURVE.MAC**. If you use this method, remember that Survey 4.0 expects you to be at the curve PC when you lay out the curve. Also remember that the deflection angles will be turned from the forward extension of the last reference bearing.

NOTE

The file ***D-CURVE.MAC*** *is stored in the Survey 4.0 program directory.*

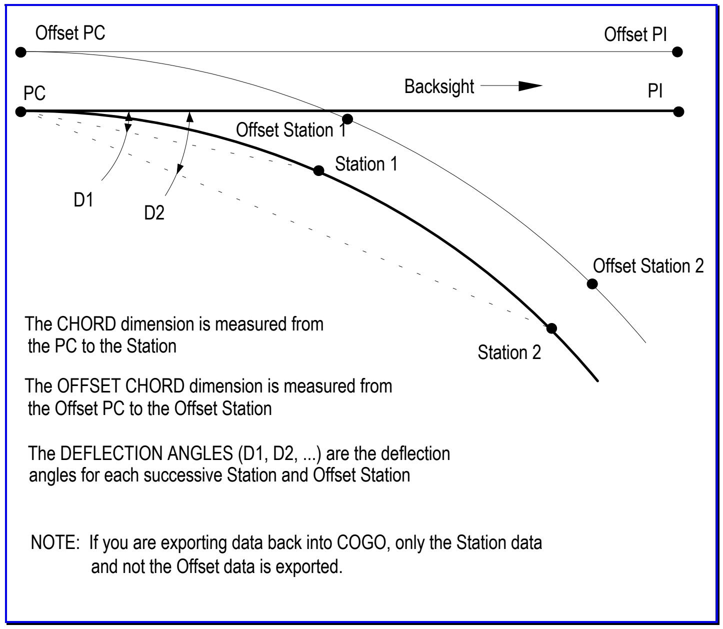
Circular Curve Layout by Deflections

Central Angle	75° 45' 30.0"
Degree of Curve - Arc	20° 50' 05.4"
Degree of Curve - Chord	20° 57' 04.9"
Radius	275.000
Arc Length	363.614
Chord Length	337.699
Tangent Length	213.921
Offset	3.000
Deflection/Foot in Minutes	6.250

Sub Arc	Deflection	Chord	Offset Chord
25.000	2° 36' 15.7"	24.991	25.264
50.000	5° 12' 31.3"	49.931	50.476
75.000	7° 48' 47.0"	74.768	75.583
100.000	10° 25' 02.7"	99.450	100.535
125.000	13° 01' 18.4"	123.927	125.279
150.000	15° 37' 34.0"	148.147	149.764
175.000	18° 13' 49.7"	172.062	173.939
200.000	20° 50' 05.4"	195.621	197.755

Station	Deflection	Chord	Offset Chord	Short Chord	Offset S.Chord
P.C.					
0+72.50	0° 00' 00.0"	0.000	0.000	0.000	0.000
1+00.00	2° 51' 53.2"	27.489	27.788	27.489	27.788
2+00.00	13° 16' 55.9"	126.361	127.740	99.450	100.535
3+00.00	23° 41' 58.6"	221.068	223.480	99.450	100.535
4+00.00	34° 07' 01.3"	308.487	311.852	99.450	100.535
4+36.11	37° 52' 45.0"	337.699	341.383	36.088	36.482
P.T.					

Example 13.2



Curve by Deflections: Figure 13-2

Survey 4.0
Simplicity Surveying Series

13.03 Code: U3

CURVE BY TANGENT OFFSETS

FUNCTION: The CURVE BY TANGENT OFFSETS routine will generate staking notes for a circular curve based on the offsets from the tangent to each station.

NOTE
When entering angular data into this routine, remember that the data entry format must match your COGO ***Angle Format****.*

Select Routine

To compute a tangent offset layout for any circular curve, type **U3** at a **Select Routine** prompt, or type **U3** [Enter] at any request for a point number. After saving and clearing the COGO display screen, the routine will be loaded.

Do you want a printout (Yes/No)

If you entered this routine from the Simplicity Program Menu instead of from COGO, you will be asked if you want a printout. Press [Y] or [1] to send the results to a printer, [N] or [0] to work the problem entirely on the display. If you entered this routine from inside COGO, the COGO output device settings will be in force.

Station of PI

Type in the station of the P.I. and press [Enter].

Central Angle

Type in the central angle and press [Enter].

Select Known Item:
< 1 > Radius
< 2 > Degree of Curve - Arc
< 3 > Degree of Curve - Chord

Select the known item by pressing [1], [2] or [3] , or press [F10] to exit the routine. Type in the requested radius or the requested degree of curve and press [Enter]. If you select **Degree of Curve - Chord**, the curve calculations will be based on a chord definition.

Stationing Interval

Type in the distance between stations and press [Enter]. Survey 4.0 will respond to this last entry by computing the solution.

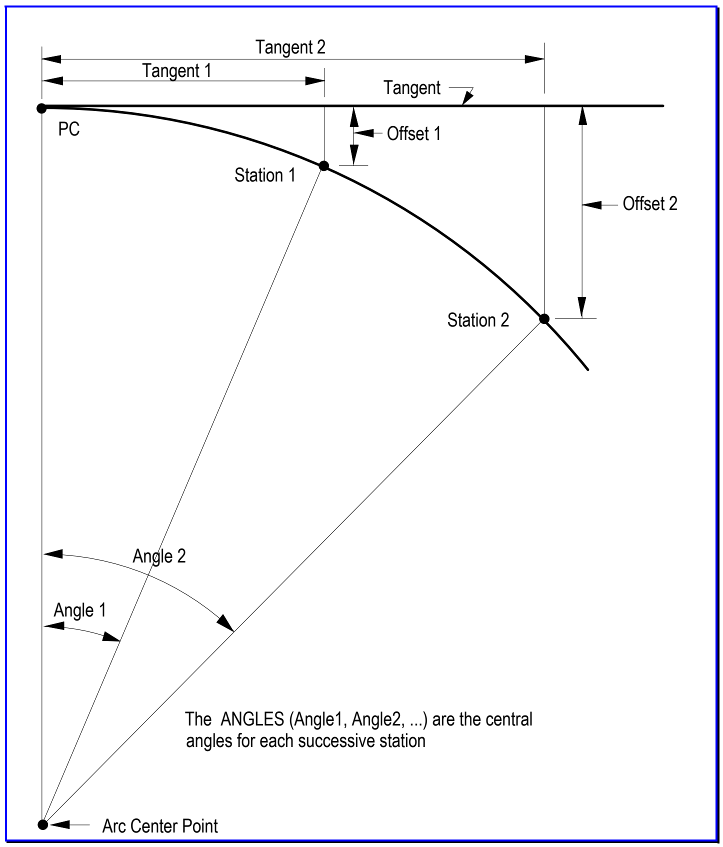
If you have chosen not to obtain a printout, from time to time you will see **Press [Enter] to Continue** whenever the display screen is full. These delays are programmed at specific intervals to allow you to view data on the monitor during the running of the program. To continue with the solution, simply press [Enter].

Additional Stations

After completion of the problem, you will be given an opportunity to compute the curve data for any intermediate station on the curve. To compute any extra stations, type in each desired station and press [Enter], and the curve data will be computed. At any time you wish to exit the program, press [F10].

Select:
< 1 > Next Problem or
< 2 > Return to COGO

Make your selection by pressing [1] or [2]. If you entered this routine from outside of COGO, option 2 will read, **< 2 > Exit**.



Curve by Tangent Offsets: Figure 13-3

Circular Curve Layout by Tangent Offsets

Central Angle = 75° 30' 45.0"
Curve Radius = 100.000
Station of P.I. = 5+00.00

Station	Central Angle	Tangent	Offset
P.C. 4+22.55	0° 00' 00.0"	0.000	0.000
4+25.00	1° 24' 04.7"	2.446	0.030
4+50.00	15° 43' 30.9"	27.102	3.743
4+75.00	30° 02' 57.1"	50.074	13.440
4+88.45	37° 45' 22.5"	61.230	20.938
P.T. 5+54.35	0° 00' 00.0"	0.000	0.000
5+50.00	2° 29' 29.4"	4.347	0.095
5+25.00	16° 48' 55.6"	28.929	4.276
5+00.00	31° 08' 21.8"	51.712	14.409
4+88.45	37° 45' 22.5"	61.230	20.938

External Distance = 26.483

Example 13.3

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Survey 4.0 Simplicity Surveying Series

13.04 Code: U4

CURVE BY CHORD OFFSETS

FUNCTION: The CURVE BY CHORD OFFSETS routine will generate staking notes for a circular curve based on the offset from the tangent and long chord to each station.

NOTE

*When entering angular data into this routine, remember that the data entry format must match your COGO **Angle Format**.*

Select Routine

To compute a chord offset layout for any circular curve, type **U4** at a **Select Routine** prompt, or type **U4** Enter at any request for a point number. After saving and clearing the COGO display screen, the routine will be loaded.

Do you want a printout (Yes/No)

If you entered this routine from the Simplicity Program Menu instead of from COGO, you will be asked if you want a printout. Press Y or 1 to send the results to a printer, N or 0 to work the problem entirely on the display. If you entered this routine from inside COGO, the COGO output device settings will be in force.

Central Angle

Type in the central angle and press Enter.

Select Known Item:
< 1 > Radius
< 2 > Degree of Curve - Arc
< 3 > Degree of Curve - Chord

Select the known item by pressing 1, 2 or 3 , or press F10 to exit the routine. Type in the requested radius or the requested degree of curve and press Enter. If you select **Degree of Curve - Chord**, the curve calculations will be based on a chord definition.

Select Option:
< 1 > Station of P.I. Known
< 2 > Station of P.C. Known

Select the appropriate option by pressing 1 or 2, or press F10 to exit the routine.

Station of PI (or PC)

If you have selected the PC option, pressing Enter without entering any data will result in a station entry of **0+00** (or **0+000** metric). Otherwise type in the station and press Enter.

Stationing Interval

Type in the distance between stations and press [↵Enter].

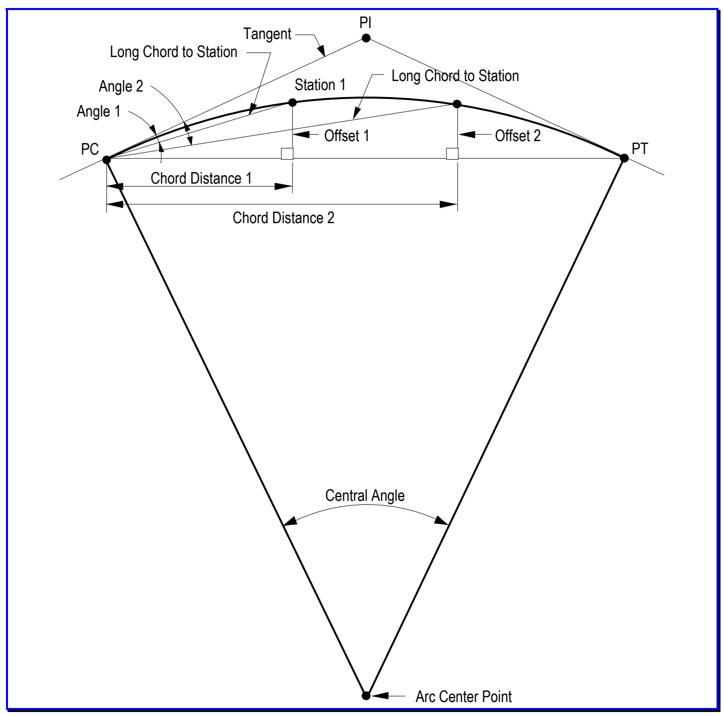
If you have chosen not to obtain a printout, from time to time you will see **Press [Enter] to Continue** whenever the display screen is full. These delays are programmed at specific intervals to allow you to view data on the monitor during the running of the program. To continue with the solution, simply press [↵Enter].

Additional Stations

After completion of the problem, you will be given an opportunity to compute the curve data for any intermediate station on the curve. To compute any extra stations, type in each desired station and press [↵Enter], and the curve data will be computed. At any time you wish to exit the program, press [F10].

Select:
< 1 > Next Problem or
< 2 > Return to COGO

Make your selection by pressing [1] or [2]. If you entered this routine from outside of COGO, option 2 will read, **< 2 > Exit**.



Curve by Chord Offsets: Figure 13-4

Circular Curve Layout by Chord Offsets

Central Angle	75° 00' 00.0"
Curve Radius	250.000
Station of P.C.	0+00.000
Arc Length	327.249
Chord Length	304.381
Tangent Length	191.832

Station	Deflection	Long Chord	Chord Offset	Chord
P.C.				
0+00.000	0° 00' 00.0"	0.000	0.000	0.000
0+50.000	5° 43' 46.5"	49.917	26.282	42.438
1+00.000	11° 27' 33.0"	99.335	43.609	89.251
1+50.000	17° 11' 19.4"	147.760	51.290	138.572
2+00.000	22° 55' 05.9"	194.709	49.020	188.437
2+50.000	28° 38' 52.4"	239.713	36.888	236.858
3+00.000	34° 22' 38.9"	282.321	15.378	281.902
3+27.249	37° 30' 00.0"	304.381	0.000	304.381
P.T.				

Example 13.4

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Survey 4.0
Simplicity Surveying Series

13.05 Code: U5

EDM SLOPE REDUCTION

FUNCTION: The EDM SLOPE REDUCTION routine will reduce EDM slope measurements to horizontal and vertical components. Horizontal distances are available for four different elevations: at the EDM; at the target; at an average elevation; and at sea level.

NOTE

When entering angular data into this routine, remember that the data entry format must match your COGO ***Angle Format****.*

Select Routine

To reduce EDM slope data, type **U5** at a **Select Routine** prompt, or type **U5** [Enter] at any request for a point number. After saving and clearing the COGO display screen, the routine will be loaded.

Do you want a printout (Yes/No)

If you entered this routine from the Simplicity Program Menu instead of from COGO, you will be asked if you want a printout. Press [Y] or [1] to send the results to a printer, [N] or [0] to work the problem entirely on the display. If you entered this routine from inside COGO, the COGO output device settings will be in force.

Leg Number

Type in any numeric designation, 1-999, and press [Enter]. The leg number is for identification only and is not required in the solution. In fact, you may bypass the leg number entry by simply pressing [Enter].

Slope Distance

Type in the measured slope distance and press [Enter].

Angle (1) or Elev. of Inst. & Target (2) known (1 or 2)

Select the known option by pressing [1] or [2]. Continue with the appropriate instructions below.

Option 1
Slope Angle known

Angle

Type in the slope angle and press Enter. If you are shooting level, simply press Enter. The angular entry must be in the same format as you would enter it into COGO.

NOTE
*This can be either a **zenith** angle or a **vertical** angle. See Section 3.08 for further information on how the program determines the angle type.*

Elevation at the Instrument

Type in the elevation at the instrument station and press Enter. If this elevation is unchanged from a previous problem, simply pressing Enter will re-enter the previous value.

Height of the Distance Meter

Type in the height of the distance meter above the elevation of the occupied point and press Enter. ***This is not an elevation!***

Height of the Prism Assembly

Type in the height of the prism above the elevation of the target station and press Enter. ***This is not an elevation!***

Height of the Theodolite

Type in the height of the theodolite above the elevation of the occupied point and press Enter. ***This is not an elevation!***

Height of the Target

Type in the height of the target above the elevation of the target station and press Enter. ***This is not an elevation!***

After accepting the required height values, Survey 4.0 will respond by producing a display similar to the first one shown in Example 13.5. Skip to the prompt, **Compute a Horizontal Distance at an Elevation of**, which follows Option 2.

Option 2
Elevations Known

Elevation at the Instrument

Type in the elevation at the instrument and press Enter.

Height of the Distance Meter

Type in the height of the distance meter above the elevation of the occupied point and press Enter. ***This is not an elevation!***

Elevation at the Target Station

Type in the target station elevation and press [↵Enter].

Height of the Prism

Type in the height of the prism above the elevation of the target station and press [↵Enter]. ***This is not an elevation!*** Survey 4.0 will respond by producing a display similar to the second one shown in Example 13.5.

Compute a Horizontal Distance at an Elevation of ? (Press F1 for Next Shot or F2 to Change Setup)

Type in any elevation at which you wish to compute the horizontal distance and press [↵Enter], and the computed distances will be printed. You may repeat this sequence for any number of elevations.

To enter another shot from this same setup, press [F1]. To change the setup and continue this routine, press [F2]. If you want to exit the program, press [F10].

Select:
< 1 > Next Problem or
< 2 > Return to COGO

Make your selection by pressing [1] or [2]. If you entered this routine from outside of COGO, option 2 will read, **< 2 > Exit**.

Leg	Slope Distance	Zenith Angle	Elevation at EDM	EDM Height	Prism Height	Theod. Height	Target Height
1	10582.880	87 40 44.0	4462.420	5.470	5.400	5.470	5.400

Avg. Elev. Horiz. Dist	Sea Level Horiz. Dist	Horiz. Dist at EDM	Horiz. Dist at Target
10574.104	10571.738	10573.995	10574.213

Uncor. Target Elevation	Curv/Ref Correction	Corrected Target Elev
4891.094	2.297	4893.392

Typical EDM Reduction - Option 1

Leg	Slope Distance	Elevation at EDM	Inst. Height	Elev. at Target	Prism Height	Horiz. Distance
1	5113.550	551.250	5.510	675.880	4.750	5112.049

Avg. Elev. Horiz. Dist.	Sea Level Horiz. Dist	Horiz. Dist at EDM	Horiz. Dist at Target
5112.049	5111.899	5112.034	5112.065

Typical EDM Reduction - Option 2

Example 13.5

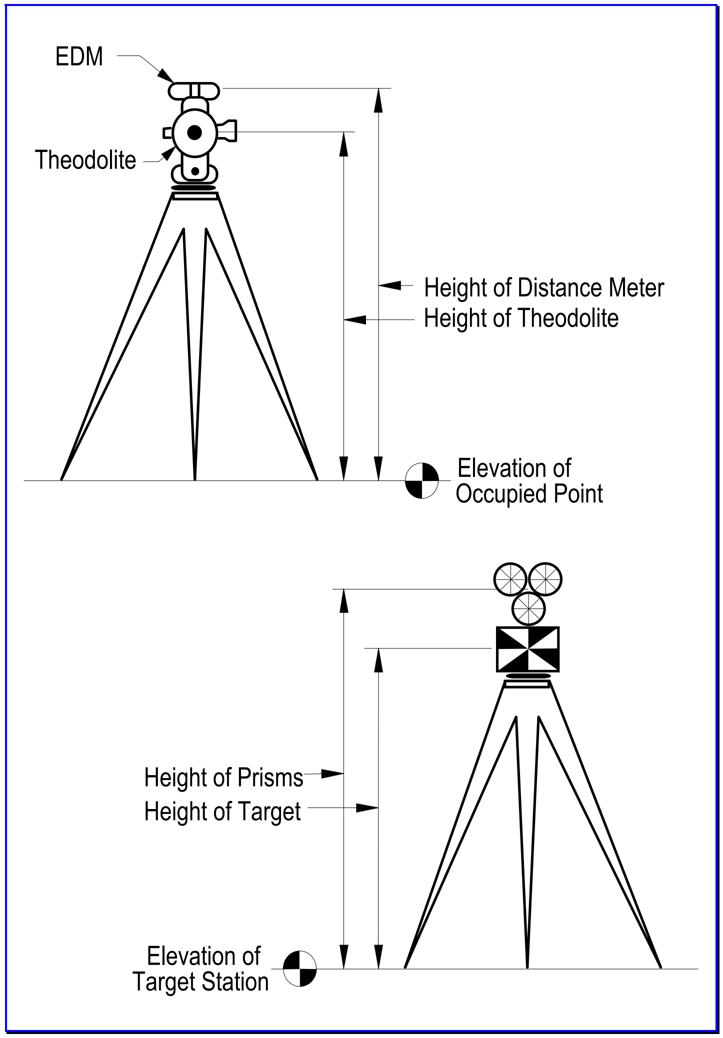


Illustration of EDM H.I.'s: Figure 13-5

Survey 4.0
Simplicity Surveying Series

13.06 Code: U6

STADIA REDUCTION

FUNCTION: The STADIA REDUCTION routine will stadia measurements to horizontal and vertical components.

NOTE

When entering angular data into this routine, remember that the data entry format must match your COGO ***Angle Format****.*

Select Routine

To perform stadia reductions, type `U6` at a **Select Routine** prompt, or type `U6` [Enter] at any point number request. After saving and clearing the COGO display screen, the routine will be loaded.

Do you want a printout (Yes/No)

If you entered this routine from the Simplicity Program Menu instead of from COGO, you will be asked if you want a printout. Press [Y] or [1] to send the results to a printer, [N] or [0] to work the problem entirely on the display. If you entered this routine from inside COGO, the COGO output device settings will be in force.

Stadia Interval Constant K (Default = 100)

Type in the stadia interval constant and press [Enter]. If the constant is equal to 100, simply press [Enter].

OPTION

If you want to enter measured distances instead of stadia intervals, answer the ***Stadia Interval Constant*** *prompt by typing* [M] [Enter]*. The program will skip to the* ***Starting Elevation*** *request. Additionally, instead of requesting an* ***Interval****, the program will request a* ***Distance****. Type in the slope distance and press* [Enter] *at each distance prompt.*

Distance from Center of Instrument to Principal Focus C (Default = 0.0)

Type in the value for **C** and press [Enter]. If **C** equals zero, simply press [Enter].

Starting Elevation (Default = 100)

Type in the elevation of the instrument station and press [Enter].

Height of the Instrument

Type in the height of the instrument above the elevation of the occupied point and press Enter.

Point Number

Type in a point designation and press Enter. This designation may be in alphanumeric form, up to 12 characters in length. To continue without entering any designation, just press Enter.

Angle

Type in the slope angle and press Enter. If you are shooting level, simply press Enter. The angular entry must be in the same format as you would enter it into COGO.

NOTE

*This can be either a **zenith** angle or a **vertical** angle. See Section 3.08 for further information on how the program determines the angle type.*

Reading

Type in the rod reading (middle stadia hair) and press Enter.

Interval

Type in the rod interval (difference between the top and bottom stadia hairs) and press Enter. Survey 4.0 will respond by printing the point designation, the slope angle, the rod reading, the rod interval, the vertical and horizontal distances and the elevation of each point.

The program will return to a request for the next point number. To exit the routine, press F10 at the **Point Number** prompt.

Select:
< 1 > Next Problem or
< 2 > Return to COGO

Make your selection by pressing 1 or 2. If you entered this routine from outside of COGO, option 2 will read, **< 2 > Exit**.

Stadia Reduction

Stadia Interval Constant K	100.000
Distance from Center of Instrument to Principal Focus C	0.000
Starting Elevation	830.000
Height of the Instrument	4.330

Point	Slope Angle	Interval	Reading	Vertical	Horizontal	Elevation
1	Z 84 00 00.0	5.250	6.340	54.577	519.264	882.567
2	Z 81 30 00.0	4.770	4.850	69.731	466.579	899.211

Note: Z = Zenith Angle

Example 13.06

Survey 4.0
Simplicity Surveying Series

13.07 Code: U7

SPIRAL CURVE SOLUTION

FUNCTION: The SPIRAL CURVE routine will generate staking notes for a Euhler spiral curve, either from the Tangent to Spiral or from the PI of the spiral's tangents.

NOTES

1. This routine may be called from within the COGO **Curve Menu** *and used to generate a keystroke macro. The keystroke macro may then be exported and run inside COGO to generate coordinate points for every curve station. See* **Spiral Curve** *(SP - Section 7.14).*

2. When entering angular data into this routine, remember that the data entry format must match your COGO **Angle Format***.*

Select Routine

To compute a spiral curve layout, type **U7** at a **Select Routine** prompt, or type **U7** [Enter] at any point number request. After saving and clearing the COGO display screen, the routine will be loaded.

Do you want a printout (Yes/No)

If you entered this routine from the Simplicity Program Menu instead of from COGO, you will be asked if you want a printout. Press [Y] or [1] to send the results to a printer, [N] or [0] to work the problem entirely on the display. If you entered this routine from inside COGO, the COGO output device settings will be in force.

Length of Spiral

Type in the spiral length and press [Enter].

Select Known Item:
< 1 > Radius
< 2 > Degree of Curve - Chord
< 3 > Degree of Curve - Arc

Select the known item by pressing [1], [2] or [3] , or press [F10] to exit the routine. Type in the requested radius or the requested degree of curve and press [Enter]. If you select **Degree of Curve - Chord**, the curve calculations will be based on a chord definition.

Select:
< 1 > Station of TS Known
< 2 > Station of PI Known

Select the known item by pressing [1] or [2], or press [F10] to exit the routine.

Station of PI (or TS)

Type in the requested station value and press Enter.

SPECIAL APPLICATION: Offset Spirals in COGO

In many cases, it is desirable to compute an offset spiral to your original spiral. While the computation of such an offset spiral is not included in this program, you can obtain a close approximation. The next two prompts ask you to specify stationing intervals. To approximate an offset spiral in COGO, simply compute your spiral with very short stations, perhaps 10 feet or so. Then, once the data has been imported back to COGO, use the **Traverse Right of Way** *routine (**RW** - Section 6.18) to compute an offset line parallel to the spiral stations.*

Stationing Interval on Spiral

Type in the distance between stations along the spiral and press Enter.

Stationing Interval on Curve

Type in the distance between stations along the circular curve and press Enter. To use the same value as your spiral interval, just press Enter.

Intersection Angle of Tangents at P.I.

Type in the intersection angle and press Enter.

Curving to the LEFT or to the RIGHT? (L/R)

If your curve proceeds to the left, press L, otherwise press R. Your response to this prompt sets the proper orientation for the deflection angles.

Select:
< 1 > Stake from TS & ST Stations
< 2 > Stake from PI

The curve may be laid out in one of two ways. Option 1 , assumes that your transit will be set up twice, once at the ***Tangent to Spiral*** (TS) and again at the ***Spiral to Tangent*** (ST). Both setups assume that you are backsighting the ***Point of Intersection*** (PI) of the tangents. Option 2 assumes that your transit will be set up at the ***Point of Intersection*** (PI) of the tangents and that you will be backsighting the ***Tangent to Spiral*** (TS) and the ***Spiral to Tangent*** (ST). Enter the chosen staking method by pressing 1 or 2.

NOTE

If you entered this routine from the COGO ***Curve Menu****, only option 2 is available to you. You will not be given a choice of staking methods.*

Survey 4.0 will respond to this last entry by computing the solution. If you entered this routine from the COGO **Curve Menu**, the program will not print the solution, but instead it will wait for you to return to COGO before printing it. If you compute a new curve before returning to COGO, be aware that only the curve computed last is contained in the keystroke file that returns to COGO.

If you have chosen not to obtain a printout, from time to time you will see **Press [Enter] to Continue** whenever the display screen is full. These delays are programmed at specific intervals to allow you to view data on the monitor during the running of the program. To continue with the solution, simply press [Enter].

Select:
< 1 > Next Problem
< 2 > Return to COGO
< 3 > ReStake from New Station

After completion of the problem, and if you did not enter this routine from the **Curve Menu**, you will be given an opportunity to re-compute the curve data using the other available staking method. Make your selection by pressing [1], [2] or [3]. If you choose option [3], the problem solution will be repeated assuming a staking method which is the opposite of the previous solution.

NOTE

If you entered this routine from the COGO ***Curve Menu****, only options 1 and 2 are available to you. Option 3 will not be visible. If you did not enter this routine from the* ***Curve Menu****, option 2 will read* ***< 2 > Exit****.*

Run Curve Layout (Yes/No)

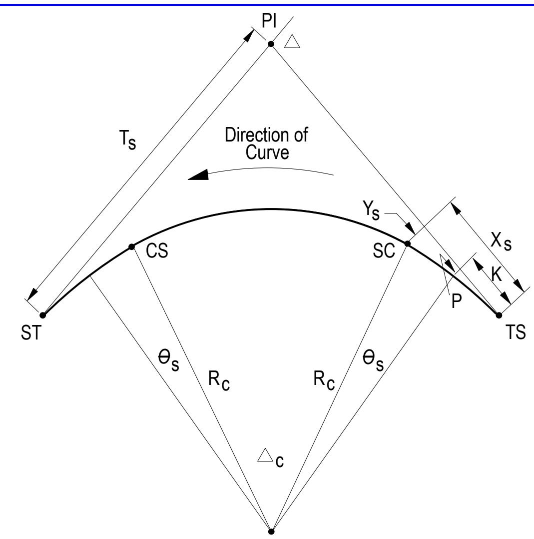
If you entered this routine from the COGO **Curve Menu**, you have one last prompt to answer. If you want to lay out the curve inside COGO, press [Y], [1], or click your mouse on the word **Yes**. Otherwise, press [N], [0], or click your mouse on the word **No**.

You can lay out the curve at a later time with the **Run Macro File** routine (**RM** - Section 12.05). Select or enter the filename `S-CURVE.MAC`. If you use this method, remember that Survey 4.0

expects you to be at the curve PI when you lay out the curve. Also remember that the angles will be turned from the last reference bearing, which should be the tangent.

NOTE

*The file **`S-CURVE.MAC`** is stored in the Survey 4.0 program directory.*



TS = Tangent to Spiral
SC = Spiral to Curve
CS = Curve to Spiral
ST = Spiral to Tangent
θ_S = Total Spiral Angle
Δ = Intersection Angle of Tangents at the PI
Δ_C = Central Angle of Circular Curve
Y_S = Tangent Offset at SC
X_S = Tangent Distance from TS at SC
R_C = Radius of Osculating Circle
P = Offset from Tangent to PC of Osculating Circle
K = Tangent Distance from TS to Shifted PC
T_S = Total Tangent Distance from the PI to the ST (or TS)

Spiral Curve parameters: Figure 13-6

Sprial Curve Layout

Length of Spiral	150.000
Curve Radius	380.000
Station of P.I.	8+50.000
Stationing Interval on Spiral	50.000
Stationing Interval on Curve	100.000
Intersection Angle of Tangents at P.I.	105° 00' 00.0"
Tangent Dist from PI to TS	573.339
OS from TS to PC of Circle (p)	2.464
Offset to the shifted PC (k)	74.903
Direction of Curvature	Right

Deflections from Transit at T.S. & S.T. Stations, backsighting the P.I.

Station	Deflection	L.Chord	S.Chord	Tangent	Offset
T.S.					
2+76.66	0° 00' 00.0"	0.000	0.000	0.000	0.000
3+00.00	0° 05' 28.5"	23.339	23.339	23.339	0.037
3+50.00	0° 54' 03.9"	73.332	49.996	73.323	1.153
4+00.00	2° 32' 53.5"	123.241	49.984	123.120	5.479
4+26.66	3° 46' 05.6"	149.740	26.656	149.417	9.841
S.C.					
4+26.66	3° 46' 05.6"	149.740	0.000	149.417	9.841
5+00.00	8° 03' 06.1"	221.688	73.225	219.503	31.051
6+00.00	14° 47' 17.0"	316.419	99.712	305.938	80.764
6+99.85	21° 52' 40.6"	405.588	99.567	376.377	151.134
S.T.					
11+23.05	0° 00' 00.0"	0.000	0.000	0.000	0.000
11+00.00	0° 05' 20.4"	23.047	23.047	23.047	0.036
10+50.00	0° 53' 38.1"	73.040	49.996	73.031	1.140
10+00.00	2° 32' 10.2"	122.951	49.985	122.830	5.441
9+73.05	3° 46' 05.6"	149.740	26.948	149.417	9.841
C.S.					
9+73.05	3° 46' 05.6"	149.740	0.000	149.417	9.841
9+00.00	8° 01' 59.0"	221.406	72.935	219.233	30.940
8+00.00	14° 46' 03.7"	316.150	99.712	305.706	80.587
7+00.00	21° 52' 02.8"	405.462	99.712	376.288	151.019
6+99.85	21° 52' 40.6"	405.588	0.146	376.377	151.134

Apex Distance = 248.265

Example 13.7

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Survey 4.0
Simplicity Surveying Series

13.08 Code: U8

VERTICAL ALIGNMENT

FUNCTION: The VERTICAL ALIGNMENT routine will calculate the stationing and elevations along a combination of vertical curves and uniform grades.

NOTES

1. All Entry and Exit grades are entered as percents. For example, a 0.025 slope would be entered as a percent grade of 2.50 percent, preceded by a minus sign if necessary.

2. When entering angular data into this routine, remember that the data entry format must match your COGO ***Angle Format****.*

Select Routine

To calculate vertical alignments, type **U8** at a **Select Routine** prompt, or type **U8** [Enter] at any request for a point number. After saving and clearing the COGO display screen, the routine will be loaded.

Do you want a printout (Yes/No)

If you entered this routine from the Simplicity Program Menu instead of from COGO, you will be asked if you want a printout. Press [Y] or [1] to send the results to a printer, [N] or [0] to work the problem entirely on the display. If you entered this routine from inside COGO, the COGO output device settings will be in force.

Select Mode:
< 1 > Vertical Curve
< 2 > Uniform Grade

Select the type of leg to be calculated by pressing [1] or [2]. Proceed with the appropriate instructions for the solution mode chosen.

Mode [1]
Vertical Curve

% Entry Grade
(Default = *nn.nnn*%)

Type in the percent entry grade and press [Enter], or simply press [Enter] to accept the default value (***nn.nnn***) displayed in the prompt. If the segment you are now computing is a continuation of a prior segment, the default value (***nn.nnn***) will be equal to the last exit grade.

% Exit Grade (Default = 0%)

Type in the percent exit grade and press Enter, or simply press Enter to accept the default value of 0%.

Select Option:
< 1 > Station of P.I. Known
< 2 > Station of P.C. Known

Select the appropriate option by pressing 1 or 2, or press F10 to exit the routine.

Station of PI (or PC)

Type in the station and press Enter, or accept any default station offered by simply pressing Enter. If you have selected the PC option, a default response of station ***x+xx*** will be offered in the prompt. If the segment you are now computing is a continuation of a prior segment, the value of the default station (***x+xx***) will be the value of the final station of the last segment.

Elevation at PI (or PC) Station

Type in the requested elevation and press Enter, or accept any default elevation offered by simply pressing Enter. If you have selected the PC option, a default response of elevation ***zzz.zzz*** will be offered in the prompt. If the segment you are now computing is a continuation of a prior segment, the value of the default elevation (***zzz.zzz***) will be the value of the elevation at the final station of the last segment.

Select Known Option:
< 1 > Length of Curve
< 2 > High (or Low) Elevation
< 3 > Station and Elevation

Survey 4.0 now offers a choice of three conditions. Select the known condition by pressing 1, 2 or 3, and proceed with the instructions for the option chosen.

Mode 1 - Option 1
Length of Curve Known

Length of Curve

Type in the curve length and press Enter.

Stationing in feet (meters)

Please continue with the instructions for the response to this prompt which follow the discussion for **Mode 1 - Option 3**.

Mode 1 - Option 2
High (or Low) Elevation Known

High (or Low) Elevation — Type in the value of the elevation and press Enter.

The Computed Length is *yyyy.yyy*. — The program will now compute a length of curve (*yyyy.yyy*) and display it for your approval. Please continue with the instructions for the response to this prompt which appear in the discussion for **Mode 1 - Option 3**.

Mode 1 - Option 3
Station and Elevation Known

Known Station — Type in the known station and press Enter.

Elevation at Known Station — Type in the known elevation and press Enter. The program will now compute a length of curve and display:

The Computed Length is *yyyy.yyy*. Press <Enter> if correct or enter corrected length — The program will now compute a length of curve (*yyyy.yyy*) and display it for your approval. If the displayed length is acceptable, press Enter, if not, type in the correct value and press Enter.

Mode 1 - All Options
Stationing in feet (meters) — Type in the distance between stations and press Enter. At this point, Survey 4.0 will generate the vertical curve solution.

If you have chosen not to obtain a printout, from time to time you will see **Press [Enter] to Continue** whenever the display screen is full. These delays are programmed at specific intervals to allow you to view data on the monitor during the running of the program. To continue with the solution, simply press Enter.

After completion of the problem, you will be given an opportunity to compute data for any intermediate station or elevation along the curve. You will see the message:

Enter a station to compute an elevation, OR enter an elevation (followed by an *, such as 752*) to compute the station(s), OR press key F1 to CONTINUE

You may now enter any station and the elevation will be computed, or you may enter an elevation and compute the station.

Press [F1] to continue with another segment in your vertical alignment solution. You will be returned to the **Select Mode** prompt which is described at the beginning of the instructions for this routine. To end the routine, press [F10].

Select:
< 1 > Next Problem or
< 2 > Return to COGO

Make your selection by pressing [1] or [2]. If you entered this routine from outside of COGO, option 2 will read, **< 2 > Exit**.

Mode [2]
Uniform grade

% Entry Grade
(Default = *nn.nnn*%)

Type in the percent entry grade and press [Enter], or simply press [Enter] to accept the default value (***nn.nnn***) displayed in the prompt. If the segment you are now computing is a continuation of a prior segment, the default value (***nn.nnn***) will be equal to the last exit grade.

NOTE

*To enter the **beginning** and **ending elevations** instead of a grade, type in the beginning elevation followed by an asterisk (*****), or simply type [*] [Enter] to accept the last elevation of zzz.zzz. If the segment you are now computing is a continuation of a prior segment, the default value (zzz.zzz) will be equal to the ending elevation of the last station. After accepting the beginning elevation entry, the program will ask for the ending elevation. Type in the elevation and press [Enter].*

Beginning Station
(Default = *x+xx*)

Type in the station and press [Enter], or accept the default station offered (***x+xx***) by simply pressing [Enter]. If the segment you are now computing is a continuation of a prior segment, the value of the default station (***x+xx***) will be the value of the final station of the last segment.

Elevation at Beginning Station (Default = *zzz.zzz*)

Type in the requested elevation and press [Enter], or accept the default elevation offered by simply pressing [Enter]. If the segment you are now computing is a continuation of a prior segment, the value of the default elevation (*zzz.zzz*) will be the value of the elevation at the final station of the last segment.

Length of Segment

Type in the segment length and press [Enter].

Stationing in feet (meters)

Type in the distance between stations and press [Enter]. At this point, Survey 4.0 will generate the vertical alignment solution.

If you have chosen not to obtain a printout, from time to time you will see **Press [Enter] to Continue** whenever the display screen is full. These delays are programmed at specific intervals to allow you to view data on the monitor during the running of the program. To continue with the solution, simply press [Enter].

After completion of the problem, you will be given an opportunity to compute data for any intermediate station or elevation along the curve. You will see the message:

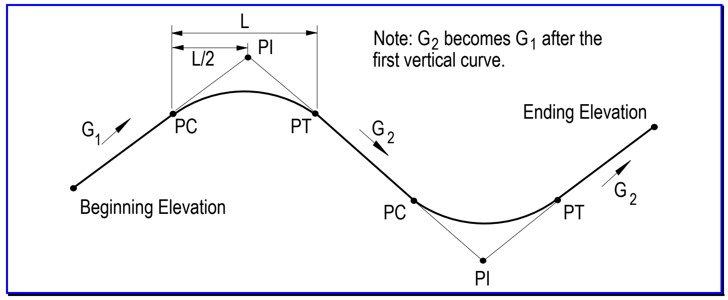
Enter a station to compute an elevation, OR enter an elevation (followed by an *, such as 752*) to compute the station(s), OR press key F1 to CONTINUE

You may now enter any station and the elevation will be computed, or you may enter an elevation and compute the station.

Press [F1] to continue with another segment in your vertical alignment solution. You will be returned to the **Select Mode** prompt which is described at the beginning of the instructions for this routine. To end the routine, press [F10].

Select:
< 1 > Next Problem or
< 2 > Return to COGO

Make your selection by pressing [1] or [2]. If you entered this routine from outside of COGO, option 2 will read, **< 2 > Exit**.



Vertical Alignment: Figure 13-7

Vertical Alignment Solution

Uniform Grade = 2.500%   Segment Length = 300.000'

STATION	ELEVATION
0+00.00	100.000
0+50.00	101.250
1+00.00	102.500
1+50.00	103.750
2+00.00	105.000
2+50.00	106.250
3+00.00	107.500

Grade In = 2.500% Grade Out = -3.000% Curve Length = 200.000'

STATION	ELEVATION
4+00.00	110.000 P.I.
3+00.00	107.500 P.C.
3+50.00	108.406
3+90.91	108.636 HIGH POINT
4+00.00	108.625
4+50.00	108.156
5+00.00	107.000 P.T.

Uniform Grade = -3.000%   Segment Length = 300.000'

STATION	ELEVATION
5+00.00	107.000
5+50.00	105.500
6+00.00	104.000
6+50.00	102.500
7+00.00	101.000
7+50.00	99.500
8+00.00	98.000

Example 13.8

Survey 4.0
Simplicity Surveying Series

13.09 Code: U9

UNIVERSAL TRIANGLE

FUNCTION: The UNIVERSAL TRIANGLE routine will solve for the unknown sides and/or angles of a triangle when one set of five possible parameters is known.

PARAMETERS

This routine will solve a triangle when given any one of the five possible conditions shown below.

Three Sides Known (SSS)
Two Sides and the Included Angle Known (SAS)
Two Sides and the Opposite Angle Known (SSA)
Two Angles and the Included Side Known (ASA)
Two Angles and the Opposite Side Known (AAS)

NOTES

*1. The triangle solutions contained in the pop-up calculator **S4-Calc**, follow these basic instructions.*

2. When entering angular data into this routine, remember that the data entry format must match your COGO ***Angle Format****.*

Select Routine

To calculate any triangle, type `U9` at a **Select Routine** prompt, or type `U9` [Enter] at any request for a point number. After saving and clearing the COGO display screen, the routine will be loaded.

Do you want a printout (Yes/No)

If you entered this routine from the Simplicity Program Menu instead of from COGO, you will be asked if you want a printout. Press [Y] or [1] to send the results to a printer, [N] or [0] to work the problem entirely on the display. If you entered this routine from inside COGO, the COGO output device settings will be in force.

Select Solution:
< 1 > Side - Side - Side
< 2 > Side - Angle - Side
< 3 > Side - Side - Angle
< 4 > Angle - Side - Angle
< 5 > Angle - Angle - Side

Select the desired option by pressing any number, 1 through 5.

Answer the distance and/or angle queries as they appear on the monitor. Press Enter after each data entry.

Select:
< 1 > Acute Solution
< 2 > Obtuse Solution

If the problem has two solutions, you will also be asked to select the acute solution, or the obtuse solution. Press 1 or 2. An ***acute*** solution is one in which all of the included angles are less than 90 degrees. An ***obtuse*** solution is one in which one of the included angles has a value lying between 90 degrees and 180 degrees.

Survey 4.0 will now solve the triangle, or report that no solution may be made from the data given.

NOTE
If you entered this routine from outside of COGO, option 2 in the next prompt will read, **< 2 > Exit**.

Select:
< 1 > Next Problem or
< 2 > Return to COGO

Make your selection by pressing 1 or 2. If you choose option 2, **Return to COGO**, each of the computed values will be marked by a letter and you will be prompted:

You may import up to 2 values, V1 & V2, back to COGO. Enter the letter(s) of the values(s) you choose. Press key < F10 > to EXIT at any time.

If your solution contains 1 or 2 values that you want to use in COGO, select the values to be imported by pressing the letters identifying the values wanted. The program automatically returns to COGO after two values have been selected. You may also exit the routine by pressing F10.

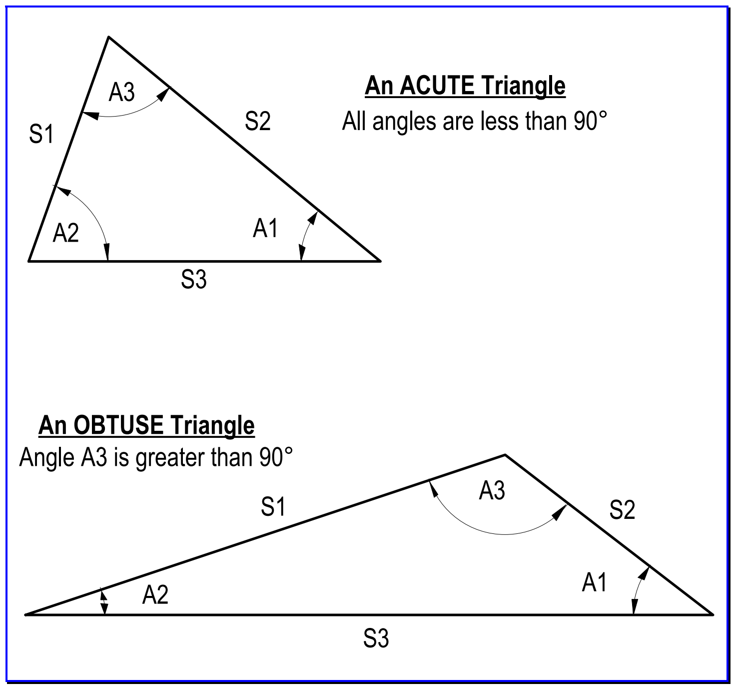
To use an imported value at an appropriate COGO prompt, type in **V1** Enter for the first chosen value, or **V2** Enter for the second chosen value. The letter need not be a capital letter.

Universal Triangle Solution

1st Side =		175.255
	Included Angle =	42° 58' 01.6"
2nd Side =		341.262
	Included Angle =	29° 16' 52.8"
3rd Side =		244.225
	Included Angle =	107° 45' 05.5"
1st Side		

Area = 20381.8813 Sq.Ft. or 0.4679 Acres

Example 13.9



Acute and Obtuse Triangles: Figure 13-8

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Survey 4.0
Simplicity Surveying Series

13.10 Code: FM

FILE MANAGER

FUNCTION: The FILE MANAGER routine is used to import and export data in a variety of file formats, and also to back up and copy disk data files.

NOTE

Some of the routines of the File Manager will behave differently, depending upon whether or not this routine was called from within COGO, or as a stand-alone program. Please remain aware of how you started the File Manager so that you may more easily follow the prompts presented herein.

Select Routine

To access the File Manager, type **FM** at a **Select Routine** prompt, or type **FM** Enter at any request for a point number. After saving and clearing the COGO display screen, the **File Manager Menu** will be loaded.

Select:
< 1 > Copy a Job
< 2 > Erase a Job
< 3 > Merge Two Jobs
< 4 > Rename a Job
< 5 > Convert a data file to Survey 4.0
< 6 > Convert a Survey 4.0 data file
< E > Exit

Make your selection by pressing any number 1 through 6, or press E to Exit.

If you entered the File Manager from within COGO, option 2 will be dimmed and inaccessible. Also affected are options 1, 3, 5 and 6. Option 1 assumes that the job to copy is the file currently active in memory. Option 3 assumes that the first file to merge is the file currently active in memory. Option 5 will not only convert a data file into a Survey 4.0 format, but it will import the file directly into the current Survey 4.0 file. Likewise, option 6 will create a file in another format from the current Survey 4.0 file. Finally, if you choose to exit the File Manager, you will return to a **Select Routine** prompt, and not to DOS.

If you have selected any option numbered 1 through 6, please continue with the instructions for the option chosen.

Option 1
Copy a Job

This option will allow you to copy all of the files pertaining to a particular job from one disk to another disk, or from one directory to another directory on the same disk.

Select:
< F > Full copy
< P > Partial copy

Press F if you want to copy the entire job, (including coordinates, keystroke files, defined figures and job files), or press P if you want to copy only a portion of the coordinate files, (to start a new file). Press Esc to exit back to the **File Manager Menu**.

NOTE
If you entered the File Manager from within COGO, this routine assumes that the source file is already in memory. Skip the next prompt.

Source filename

Type in the name of the file to be copied, ***including the drive and directory specifications***, and press Enter. Do not enter a filename extension.

Copy to

Type in the target drive and directory and press Enter. ***Do not include a filename***. Type in only the drive and directory information, ending the specification with a backslash \. For example, **B:** Enter or **B:\JOBS** Enter.

If you want to change the filename specification, you will have to use **Option 4, Rename a Job**, ***after*** copying the files.

Select:
< B > Begin
< R > Respecify

Press B to begin the copy process, R to re-specify the filename specifications, or press Esc to exit back to the **File Manager Menu**. If you are ready to begin the copy process, please be certain that your source and target disks are ready before pressing B. After the copy process has been completed, you will be returned to the **File Manager Menu**.

Option 2
Erase a Job

This option will allow you to delete all of the files pertaining to a particular job from a disk or directory.

NOTE
If you entered the File Manager from within COGO, this routine is not accessible.

Erase file

Type in the name of the file to be erased, ***including the drive and directory specifications***, and press [Enter]. Do not enter a filename extension.

WARNING !!!
Ready to erase (*filename*)
< B > Begin
< R > Respecify

The ***filename*** will be given in the prompt. Press [B] to begin the deletion process, [R] to re-specify the filename specifications, or press [Esc] to exit back to the **File Manager Menu**. If you are ready to begin the deletion process, please be certain that the source disk is ready before pressing [B]. After erasing the specified job files, you will be returned to the **File Manager Menu**.

Option [3]
Merge Two Jobs

This option will combine the coordinate data files of two particular Survey 4.0 jobs.

NOTE
If you entered the File Manager from within COGO, this routine assumes that the first source file is already in memory. Skip the next prompt.

1st Source filename

Type in the name of the first file to be merged, ***including the drive and directory specifications***, and press [Enter]. Do not enter a filename extension.

2nd Source filename

Type in the name of the second file to be merged, ***including the drive and directory specifications***, and press [Enter]. Do not enter a filename extension.

NOTE
If you entered the File Manager from within COGO, this routine assumes that the name of the merge file is the same as the first file, which is already in memory. Skip the next prompt.

Merge to

Type in a target filename specification ***including the drive and directory***, and press [Enter]. Do not include a filename extension.

Select:
< B > Begin
< R > Respecify

Press [B] to begin the merging process, [R] to re-specify the filename specifications, or press [Esc] to exit back to the **File Manager Menu**. If you are ready to begin the merging process, please be certain that your source and target disks are ready before pressing B. If you entered this routine from COGO, you will be returned to the **File Manager Menu** after the merging process has been completed.

WARNING! Do you want Point Overwrite protection? (Yes/No)

To activate point overwrite protection, press Y, 1, or click your mouse on the word **Yes**. Otherwise, press N, 0, or click your mouse on the word **No**. Since the **Merge Two Jobs** routine will attempt to merge the second file into the first file, overwrite protection is important to keep any first file points from being overwritten. When the routine encounters an existing point with overwrite protection **On**, you will receive a message similar to:

```
Point 2 exists!  Trying to overwrite with point 2

Exist    NE Corner of Block 1        10000.0000      20000.0000
New      NW Corner of Block 3        10752.1244      20259.3184

Press:   <S>kip    <O>verwrite     <A>ssign New Number     <E>xit
```

In the first message line, the first point number given is the existing first file point. The second point number is the number of the incoming point from the second file. Press (or click on) S to skip importing the point, O to overwrite the existing point with the imported point, A to assign a new number to the imported point, or E to exit the routine.

New point number?

If you choose to assign a new number, type in that number and press Enter. If your new number is that of an occupied point, you will receive the overwrite warning prompt. This time however, the point numbers listed in the first line will not be the same number.

HOW MERGING WORKS

IF YOU DO NOT USE OVERWRITE PROTECTION:
Points from the 2nd file will be automatically relocated as needed. If your printer is on and on line, a complete listing of relocated points will be printed during the merging process.

If you entered this file from COGO:
When merging files, the data points from the 2nd file specified are merged into the data file already in memory. All point numbers from the 1st file are retained. Points from the 2nd file will be relocated as directed. If your printer is on and on-line, a complete

listing of relocated points will be printed during the merging process.

If you DID NOT enter this file from COGO:
When merging files, the 1st file specified is copied to the target disk and renamed as the target file. After establishing the new target file, data points from the 2nd file specified are merged into the target file. As a result, only the point numbers from the 1st file are retained. Points from the 2nd file will be relocated as directed. If your printer is on and on-line, a complete listing of relocated points will be printed during the merging process.

If you did not enter this file from COGO, you will be given the chance to create a ***Job File*** containing information about the newly created file. An instruction window will appear.

> **A page stamp containing the date, time, page number, and standard heading will be printed on each page. You may also add your name and up to four lines of job description (75 char. each). Press <Enter> after each line.**
>
> | | | |
> |---|---|---|
> | **<Home> Beginning of Line** | **<End> End of Line** | **<Esc> Exit Routine** |
> | **<Arrows> Move In/Between Fields** | **<Insert> Insert Char.** | **<Del> Delete Char.** |
> | **<Alt><C> Clears Current Field** | **<Enter> Next Field** | **<Tab> Next Field** |

By:

Type in your name or initials and press [Enter].

Dsc:

This prompt will appear up to four times. At each occurrence, type in up to 75 characters of information indicating job name, client, etc. Press [Enter] after each line.

At any time, you may press [Esc] to exit this prompt. Lines added or edited up to that point will be placed into the ***Job File***, and you will be returned to the **File Manager Menu**.

Option [4]
Rename a Job

This option will allow you to change the root name of all of the files pertaining to a particular job on a disk or in a directory.

NOTE
If you entered the File Manager from within COGO, you cannot rename the currently loaded job.

Source filename

Type in the name of the job to be renamed, ***including the drive and directory specifications***, and press [Enter]. Do not enter a filename extension.

Rename as

Type in the new name of the job, ***including the drive and directory specifications***, and press [Enter]. Do not enter a filename extension.

WARNING !!!
Ready to Rename
(*filename 1*) as (*filename 2*)
< B > Begin
< R > Respecify

The ***filenames*** will be given in the prompt. Press [B] to begin the renaming process, [R] to re-specify the filename specifications, or press [Esc] to exit back to the **File Manager Menu**. If you are ready to begin the renaming process, please be certain that the source disk is ready before pressing [B]. After renaming the specified job files, you will be returned to the **File Manager Menu**.

Option [5]
Convert a data file to Survey 4.0

This conversion option may be used to restructure a data file created by some other program into a Survey 4.0 compatible format. ***The conversion process will not damage the source file in any way.***

Source filename

Type in the full name of the file to be converted, ***including the drive, directory specification(s), and the filename extension***, and press [Enter].

DIRECT LOADING INTO SURVEY 4.0 COGO

If you entered the File Manager from within COGO, this routine assumes that the name of the **Convert to** *file is the same as the job file specified at the beginning of the COGO session, providing a quick method of starting COGO with a non-Survey 4.0 compatible data file.*

For example, suppose you need to use a file produced by ***Maptech****, and named* ***A:\Johnson.Dat****. As long as the file does not exist in your logged to Survey 4.0 data directory, start Survey 4.0 with the filename* **`Johnson.Dat`***, and verify that it is a new file. At* **Select Routine***, type in* **`FM`** *to call the file manager and then select the option to* **Convert a data file to Survey 4.0***. Enter the source filename as* **`A:\Johnson.Dat`** *and select* **`Maptech`** *as the file format. The* ***Maptech*** *file not only produces a Survey 4.0* *file, but the* ***Maptech*** *data is also waiting for you when you return to* ***Select Routine****.*

Convert to

Type in a target filename specification for the new Survey 4.0 file ***including the drive and directory***, and press Enter. Do not enter a filename extension. *If you entered the File Manager from within COGO, this prompt is skipped.*

Select source file type

A menu of supported file formats will appear on your monitor. Press the letter or number of the format corresponding to the file type to be converted and press Enter.

Select:
< B > Begin
< R > Respecify

Press B to begin the conversion process, R to re-specify the filename specifications, or press Esc to exit back to the **File Manager Menu**. If you are ready to begin the conversion process, please be certain that your source and target disks are ready before pressing B. If you entered this routine from COGO, you will be returned to the **File Manager Menu** after the conversion process has been completed.

HOW CONVERSION WORKS

If you entered this routine from COGO:
When converting files, the data points from the source file specified are written into the target data file and into memory at the same time. ***CAUTION! Any points already in memory that share a point number with an incoming point could be overwritten by the incoming data.*** *As is the case with the* ***Merge Two Jobs*** *routine presented as* ***Option 3****, you will be given a chance to activate* ***Point Overwrite Protection****, which will alert you to potential overwrite situations.*

If you DID NOT enter this routine from COGO:
When converting files, the source file data is copied to the target file in a Survey 4.0 format. This is not a file merging routine, so a new target file is created.

After converting the data, you will be given the chance to create a job file header containing information about the newly created file. An instruction window will appear.

A page stamp containing the date, time, page number, and standard heading will be printed on each page. You may also add your name and up to four lines of job description (75 char. each). Press <Enter> after each line.		
<Home> Beginning of Line	<End> End of Line	<Esc> Exit Routine
<Arrows> Move In/Between Fields	<Insert> Insert Char.	<Del> Delete Char.
<Alt><C> Clears Current Field	<Enter> Next Field	<Tab> Next Field

By:

Type in your name or initials and press Enter.

Dsc:

This prompt will appear up to four times. At each occurrence, type in up to 75 characters of information indicating job name, client, etc. Press Enter after each line.

At any time, you may press Esc to exit this prompt. Lines added or edited up to that point will be placed into the ***Job File***, and you will be returned to the **File Manager Menu**.

Option 6
Convert a data file from Survey 4.0

This conversion option may be used to restructure a Survey 4.0 data file into a format compatible to another COGO program. ***The conversion process will not damage the source file in any way.***

DIRECT WRITING FROM SURVEY 4.0 COGO

If you entered the File Manager from within COGO, this routine assumes that the name of the **Source filename** *is the same as the job file specified at the beginning of the COGO session, providing a quick method of exporting the current Survey 4.0 file.*

*For example, suppose you need to use the current Survey 4.0 file in **Maptech**. At* **Select Routine***, type in* **`FM`** *to call the file manager and then select the option to* **Convert a data file from Survey 4.0***. Enter the target filename and select the* **`Maptech`** *file format.*

Source filename

Type in the name of the file to be converted, ***including the drive and directory specifications***, and press Enter. Do not enter a filename extension. *If you entered the File Manager from within COGO, this prompt is skipped.*

Convert to

Type in the full target filename ***including the drive, directory, and extension***, and press Enter.

Select target file type

A menu of supported file formats will appear on your monitor. Press the letter or number of the format corresponding to the file type to be converted to and press Enter.

Select:
< B > Begin
< R > Respecify

Press B to begin the conversion process, R to re-specify the filename specifications, or press Esc to exit back to the **File Manager Menu**. If you are ready to begin the conversion process, please be certain that your source and target disks are ready before pressing B. You will be returned to the **File Manager Menu** after the conversion process has been completed.

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Survey 4.0 Simplicity Surveying Series

13.11 UPGRADE

Code: UP

FUNCTION: The UPGRADE routine is used to convert a Survey 4.0 Demo version to a Survey Lite version, and/or convert a Survey Lite version to a full Survey 4.0 version. Conversions are done instantly over the telephone.

NOTES

1. If you are already running a full Survey 4.0 version, this routine will be inaccessible.

2. You need to be at your computer when you call. Upgrades can be obtained Monday through Friday by calling 1-800-777-7978 or 1-218-773-8917, from 8:00am to 6:00pm Central time.

*3. Please have your **VISA, MasterCard** or **American Express** card ready when you call.*

Select Routine

To access the upgrade routine, type **UP** at a **Select Routine** prompt, or type **UP** Enter at any request for a point number. You will receive the message:

To Upgrade this program from SURVEY DEMO to SURVEY LITE, call Simplicity at (800) 777-7978 or (218) 773-8917. Have your VISA, Master-Card or American Express card ready for payment. You will be asked for the upgrade code which is: *nnnnnnn* and you will be given an activation number to enter. Enter the activation number: ?

The message will contain a six or seven digit upgrade code. Since this upgrade code (and its corresponding matching code) is generated at random, you will need to be at this screen when you call. You cannot write our response to the code down and type it in later. It just won't work.

NOTES

Notice that the message gives the name of the current version and the next upgrade. If you are running Survey Lite, the message will read from ***SURVEY LITE*** *to* ***SURVEY 4.0****. You can also go directly from a* ***SURVEY DEMO*** *to* ***SURVEY 4.0****.*

When you call us, we will ask you for your name, address, phone number, the cardholder's name, credit card number and expiration date. Then we will ask what you are upgrading from (Demo or Lite), and what you are upgrading to (Lite or Survey 4.0). You will then be asked to hold for a moment while your credit card is approved. Finally, we will ask for the upgrade code that is showing on your screen.

Enter the activation number:

At this point, you will be given a six or seven digit number to enter into the program. You have three chances to type it in correctly. Depending upon your typing proficiency, (and hopefully, it's better than ours), you should receive a short message telling you of your success.

New Simplicity Invoice Number

You will be given the number of the Simplicity Systems' invoice that will be mailed to you for your records. Type in the number you are given and press ↵Enter.

Press <Enter> to Re-start Survey 4.0

After upgrading the program from one version to the next, you will need to re-start Survey 4.0 for all of the options of a particular version to take effect. Don't worry about your data, it's safe. The upgrade routine closed all your data files when you entered it. Simply press ↵Enter to restart your new Survey 4.0 version.

Survey 4.0 Simplicity Surveying Series

14.01 **Code: QU**

QUIT TO MENU

FUNCTION: The QUIT TO MENU routine is used to exit Survey 4.0 and run the Simplicity Systems Menu.

Select Routine

To exit Survey 4.0 and start (or return to) the Simplicity Systems Menu, type **QU** at **Select Routine** or type **QU** Enter at any point number prompt.

You have chosen to EXIT to the MENU. Are you sure? (Yes/No)

To exit Survey 4.0 with this option, press Y, 1, or click your mouse on the word **Yes**. Otherwise, press N, 0, or click your mouse on the word **No** to return to **Select Routine**.

Erase the backup data file? (Yes/No)

If you choose to exit and a backup data file exists, Survey 4.0 will offer you an opportunity to delete the backup file at this time. To delete the backup data file, press Y, 1, or click your mouse on the word **Yes**. Otherwise, press N, 0, or click your mouse on the word **No**.

Survey 4.0 will now close all data files, quit, and start the **Simplicity Systems Menu**.

Survey 4.0
Simplicity Surveying Series

14.02 **Code: SY**

EXIT TO DOS (SYSTEM)

FUNCTION: The EXIT TO DOS routine is used to exit Survey 4.0 and return to DOS.

Select Routine

To exit Survey 4.0 and return to the DOS system, type **SY** at **Select Routine** or type **SY** [Enter] at any point number prompt.

You have chosen to EXIT to DOS. Are you sure? (Yes/No)

To exit Survey 4.0 with this option, press [Y], [1], or click your mouse on the word **Yes**. Otherwise, press [N], [0], or click your mouse on the word **No** to return to **Select Routine**.

Erase the backup data file? (Yes/No)

If you choose to exit and a backup data file exists, Survey 4.0 will offer you an opportunity to delete the backup file at this time. To delete the backup data file, press [Y], [1], or click your mouse on the word **Yes**. Otherwise, press [N], [0], or click your mouse on the word **No**.

Survey 4.0 will now close all data files and quit to the DOS prompt.

Survey 4.0
Simplicity Surveying Series

14.03 Code: NJ

START A NEW JOB

FUNCTION: The START A NEW JOB routine is used to exit the current Survey 4.0 job and begin a new job.

Select Routine

To exit your current Survey 4.0 job and begin a new one, type **NJ** at **Select Routine** or type **NJ** [Enter] at any point number prompt.

You have chosen to Start a New Job. Are you sure? (Yes/No)

To start a new Survey 4.0 job, press [Y], [1], or click your mouse on the word **Yes**. Otherwise, press [N], [0], or click your mouse on the word **No** to return to **Select Routine**.

Erase the backup data file? (Yes/No)

If you confirm your choice to start a new job and a backup data file exists, Survey 4.0 will offer you an opportunity to delete the backup file at this time. To delete the backup data file, press [Y], [1], or click your mouse on the word **Yes**. Otherwise, press [N], [0], or click your mouse on the word **No**.

Survey 4.0 will now close all currently open data files and restart itself so that you may begin a new job.

NOTE

If you need to change the configuration of a restricted access item (see Section 5.04), you can use the ***Start a New Job*** *routine to access the* ***Configuration Menu*** *from the* ***Survey 4.0 Title Screen****.*

Survey 4.0
Simplicity Surveying Series

14.04
EXIT to CogoMate

FUNCTION: The EXIT to CogoMate option is used to quit Survey 4.0 and immediately begin the CogoMate program.

Select Routine

To exit and run CogoMate, pull down the **Exit Menu** by clicking your mouse on the word **Exit** in the **Menu Bar**, or by pressing F9 at **Select Routine**. Using your ↑, ↓ or Space Bar, move the highlight bar to the item **CogoMate** and press ↵Enter, or click your mouse on it.

You have chosen to exit to CogoMate. Are you sure? (Yes/No)

To exit Survey 4.0 with this option, press Y, 1, or click your mouse on the word **Yes**. Otherwise, press N, 0, or click your mouse on the word **No** to return to **Select Routine**. If you choose to exit, Survey 4.0 closes all data files and runs the batch file **CogoMate.BAT**.

The batch file **CogoMate.BAT** must be present in the Survey 4.0 program directory before this option will be accessible. If the batch file does not exist, the menu item will be dimmed. The batch file may be written using any text editor, such as ***S4-Edit***. The basic structure of the batch file follows. Omit the comments.

`C:\`	'replace **C** with the actual AutoCAD/CogoMate drive
`CD \`***Directory***	'replace ***Directory*** with the actual AutoCAD/CogoMate directory
`CogoMate`	'the command that actually runs the CogoMate program
`CD \`	'change back to the root directory
`C:`	'change back to the boot drive

What is CogoMate?

CogoMate is a drawing assistant for AutoCAD that allows you to import coordinate data into AutoCAD and then construct an annotated drawing through the use of the point numbers. Currently $399, (as of 8/92, subject to change without notice). Contact Simplicity Systems at 1-800-777-7978.

Survey 4.0 Simplicity Surveying Series

14.05 EXIT to Collector Connector

FUNCTION: The EXIT to Collector Connector option is used to quit Survey 4.0 and immediately begin the Collector Connector program.

Select Routine

To exit and run Collector Connector, pull down the **Exit Menu** by clicking your mouse on the word **Exit** in the **Menu Bar**, or by pressing F9 at **Select Routine**. Using your ↑, ↓ or Space Bar, move the highlight bar to the item **Collector Connector** and press ↵Enter, or click your mouse on it.

You have chosen to EXIT to Collector Connector. Are you sure? (Yes/No)

To use this exit option, press Y, 1, or click your mouse on the word **Yes**. Otherwise, press N, 0, or click your mouse on the word **No** to return to **Select Routine**. If you choose to exit, Survey 4.0 closes all data files and runs the file **ColCon.BAT**.

The batch file **ColCon.BAT** must be present in the Survey 4.0 program directory before this option will be accessible. If the batch file does not exist, the menu item will be dimmed. The batch file may be written using any text editor, such as ***S4-Edit***. The basic structure of the batch file follows. Omit the comments.

`C:\`	'replace `C` with the actual Collector Connector drive
`CD \`***Directory***	'replace ***Directory*** with the actual Collector Connector directory
`CollConn`	'the command that actually runs the Collector Connector program
`CD \`	'change back to the root directory
`C:`	'change back to the boot drive

What is Collector Connector? *Collector Connector provides quick, convenient communications from most ASCII-compatible data collectors, transferring entire files or simple coordinate lists. It includes data file formats for Survey 4.0 and many other third party COGO programs. Currently $149, (as of 8/92, subject to change without notice). Contact Simplicity Systems at 1-800-777-7978.*

Survey 4.0
Simplicity Surveying Series

14.06

EXIT to DigiMate

FUNCTION: The EXIT to DigiMate option is used to quit Survey 4.0 and immediately begin the DigiMate program.

Select Routine

To exit and run DigiMate, pull down the **Exit Menu** by clicking your mouse on the word **Exit** in the **Menu Bar**, or by pressing F9 at **Select Routine**. Using your ↑, ↓ or Space Bar, move the highlight bar to the item **DigiMate** and press ↵Enter, or click your mouse on it.

You have chosen to EXIT to DigiMate. Are you sure? (Yes/No)

To use this exit option, press Y, 1, or click your mouse on the word **Yes**. Otherwise, press N, 0, or click your mouse on the word **No** to return to **Select Routine**. If you choose to exit, Survey 4.0 closes all data files and runs the file **DigiMate.BAT**.

The batch file **DigiMate.BAT** must be present in the Survey 4.0 program directory before this option will be accessible. If the batch file does not exist, the menu item will be dimmed. The batch file may be written using any text editor, such as ***S4-Edit***. The basic structure of the batch file follows. Omit the comments.

`C:\`	'replace `C` with the actual DigiMate drive
`CD \`***Directory***	'replace ***Directory*** with the actual DigiMate directory
`DigiMate`	'the command that actually runs the DigiMate program
`CD \`	'change back to the root directory
`C:`	'change back to the boot drive

What is DigiMate?

DigiMate allows you to effortlessly digitize contours, coordinates, map lines and cross sections into ASCII data files for use by Survey 4.0 and other mapping programs. DigiMate supports most ASCII format digitizers and includes provisions for perimeter, volume and area computations. Currently $149, (as of 8/92, subject to change without notice). Contact Simplicity Systems at 1-800-777-7978.

Survey 4.0 Simplicity Surveying Series

14.07
EXIT to The Draftsman

FUNCTION: The EXIT to The Draftsman option is used to quit Survey 4.0 and immediately begin the Draftsman program.

Select Routine

To exit and run The Draftsman, pull down the **Exit Menu** by clicking your mouse on the word **Exit** in the **Menu Bar**, or by pressing F9 at **Select Routine**. Using your ↑, ↓ or Space Bar, move the highlight bar to the item **Draftsman** and press ↵Enter, or click your mouse on it.

You have chosen to EXIT to Draftsman. Are you sure? (Yes/No)

To use this exit option, press Y, 1, or click your mouse on the word **Yes**. Otherwise, press N, 0, or click your mouse on the word **No** to return to **Select Routine**. If you choose to exit, Survey 4.0 closes all files and runs the file **Draftsman.BAT**.

The batch file **Draftsman.BAT** must be present in the Survey 4.0 program directory before this option will be accessible. If the batch file does not exist, the menu item will be dimmed. The batch file may be written using any text editor, such as ***S4-Edit***. The basic structure of the batch file follows. Omit the comments.

C:	'replace **C** with the actual Draftsman drive
CD *Directory*	'replace ***Directory*** with the actual Draftsman directory
DM4Files	'the command that actually runs the Draftsman program
**CD **	'change back to the root directory
C:	'change back to the boot drive

What is The Draftsman?

The Draftsman is a COGO data interface to Generic CADD, (ver. 5 & up) that allows you to construct a completely annotated and finished drawing inside Generic CADD by using point numbers. Employing a unique flip-screen interface to Generic CADD, it allows you instant drawing feedback. Currently $199, (as of 8/92, subject to change without notice). Contact Simplicity Systems at 1-800-777-7978.

Survey 4.0
Simplicity Surveying Series

14.08

EXIT to DrainCalc

FUNCTION: The EXIT to DrainCalc option is used to quit Survey 4.0 and immediately begin the DrainCalc program.

Select Routine

To exit and run DrainCalc, pull down the **Exit Menu** by clicking your mouse on the word **Exit** in the **Menu Bar**, or by pressing F9 at **Select Routine**. Using your ↑, ↓ or Space Bar, move the highlight bar to the item **DrainCalc** and press ↵Enter, or click your mouse on it.

You have chosen to EXIT to DrainCalc. Are you sure? (Yes/No)

To use this exit option, press Y, 1, or click your mouse on the word **Yes**. Otherwise, press N, 0, or click your mouse on the word **No** to return to **Select Routine**. If you choose to exit, Survey 4.0 closes all files and runs the file **DrainClc.BAT**.

The batch file **DrainClc.BAT** must be present in the Survey 4.0 program directory before this option will be accessible. If the batch file does not exist, the menu item will be dimmed. The batch file may be written using any text editor, such as ***S4-Edit***. The basic structure of the batch file follows. Omit the comments.

`C:\`	'replace **C** with the actual DrainCalc drive
`CD \`***Directory***	'replace ***Directory*** with the actual DrainCalc directory
`DrainClc`	'the command that actually runs the DrainCalc program
`CD \`	'change back to the root directory
`C:`	'change back to the boot drive

What is DrainCalc?

DrainCalc is an open channel, storm sewer and culvert design program that calculates runoff and sizes channels using Soil Conservation Service methods. The program handles earth and concrete channels and seven culvert types including CMP, RCP, RCB, RCPA, CMPA, RCPVE, and RCPHE. Currently $299, (as of 8/92, subject to change without notice). Contact Simplicity Systems at 1-800-777-7978.

Survey 4.0 Simplicity Surveying Series

14.09 EXIT to LegalEase

FUNCTION: The EXIT to LegalEase option is used to quit Survey 4.0 and immediately begin the LegalEase program.

Select Routine

To exit and run LegalEase, pull down the **Exit Menu** by clicking your mouse on the word **Exit** in the **Menu Bar**, or by pressing F9 at **Select Routine**. Using your ↑, ↓ or Space Bar, move the highlight bar to the item **LegalEase** and press ↵Enter, or click your mouse on it.

You have chosen to EXIT to LegalEase. Are you sure? (Yes/No)

To use this exit option, press Y, 1, or click your mouse on the word **Yes**. Otherwise, press N, 0, or click your mouse on the word **No** to return to **Select Routine**. If you choose to exit, Survey 4.0 closes all files and runs the file **LglEase.BAT**.

The batch file **LglEase.BAT** must be present in the Survey 4.0 program directory before this option will be accessible. If the batch file does not exist, the menu item will be dimmed. The batch file may be written using any text editor, such as ***S4-Edit***. The basic structure of the batch file follows. Omit the comments.

C:	'replace **C** with the actual LegalEase drive
CD *Directory*	'replace ***Directory*** with the actual LegalEase directory
LegalEse	'the command that actually runs the LegalEase program
**CD **	'change back to the root directory
C:	'change back to the boot drive

What is LegalEase?

LegalEase is a user-customizable legal description processor that uses Survey 4.0 data to quickly create a finished legal description. LegalEase lets you tailor descriptions of geometric conditions to match your own style, while assuring accurate description mathematics. You can store, print and/or export your description into other programs, such as The Draftsman. Currently $149, (as of 8/92, subject to change without notice). Contact Simplicity Systems at 1-800-777-7978.

Survey 4.0
Simplicity Surveying Series

14.10

EXIT to LI Contour

FUNCTION: The EXIT to LI Contour option is used to quit Survey 4.0 and immediately begin the LI Contour program.

Select Routine

To exit and run LI Contour, pull down the **Exit Menu** by clicking your mouse on the word **Exit** in the **Menu Bar**, or by pressing F9 at **Select Routine**. Using your ↑, ↓ or Space Bar, move the highlight bar to the item **LI Contour** and press ↵Enter, or click your mouse on it.

You have chosen to EXIT to LI Contour. Are you sure? (Yes/No)

To use this exit option, press Y, 1, or click your mouse on the word **Yes**. Otherwise, press N, 0, or click your mouse on the word **No** to return to **Select Routine**. If you choose to exit, Survey 4.0 closes all files and runs the file **LICon.BAT**.

The batch file **LICon.BAT** must be present in the Survey 4.0 program directory before this option will be accessible. If the batch file does not exist, the menu item will be dimmed. The batch file may be written using any text editor, such as ***S4-Edit***. The basic structure of the batch file follows. Omit the comments.

C:	'replace **C** with the actual LI Contour drive
CD *Directory*	'replace ***Directory*** with the actual LI Contour directory
LIVPlus (or **LIC**)	'the command that actually runs the LI Contour program
**CD **	'change back to the root directory
C:	'change back to the boot drive

What is LI Contour?

LI Contour is a menu-driven, triangulated network program that reduces coordinate data to a contour map. Contour maps may be plotted directly or exported to Generic CADD or AutoCAD. LI Contour V+ adds volume calculations. LI Contour sells for $595 with the V+ version at $695, (as of 8/92, subject to change without notice). Contact Simplicity Systems at 1-800-777-7978.

Survey 4.0

Simplicity Surveying Series

14.11

EXIT to RoadRunner

FUNCTION: The EXIT to RoadRunner option is used to quit Survey 4.0 and immediately begin the RoadRunner program.

Select Routine

To exit and run RoadRunner, pull down the **Exit Menu** by clicking your mouse on the word **Exit** in the **Menu Bar**, or by pressing F9 at **Select Routine**. Using your ↑, ↓ or Space Bar, move the highlight bar to the item **RoadRunner** and press ↵Enter, or click your mouse on it.

You have chosen to EXIT to RoadRunner. Are you sure? (Yes/No)

To use this exit option, press Y, 1, or click your mouse on the word **Yes**. Otherwise, press N, 0, or click your mouse on the word **No** to return to **Select Routine**. If you choose to exit, Survey 4.0 closes all files and runs the file **RoadRun.BAT**.

The batch file **RoadRun.BAT** must be present in the Survey 4.0 program directory before this option will be accessible. If the batch file does not exist, the menu item will be dimmed. The batch file may be written using any text editor, such as ***S4-Edit***. The basic structure of the batch file follows. Omit the comments.

C:	'replace **C** with the actual RoadRunner drive
CD *Directory*	'replace ***Directory*** with the actual RoadRunner directory
RoadRun	'the command that actually runs the RoadRunner program
**CD **	'change back to the root directory
C:	'change back to the boot drive

What is RoadRunner?

RoadRunner is a powerful, flexible and easy-to-use construction staking and cross sectional earthwork program. RoadRunner data files may be constructed from within Survey 4.0, or you may enter your data directly into the program. Cross section data may be plotted on a dot matrix printer or exported into Generic CADD. RoadRunner is $495, with smaller, upgradable versions available for $95 and $195, (as of 8/92, subject to change without notice). Contact Simplicity Systems at 1-800-777-7978.

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14.12 EXIT to User Programs 1-10

FUNCTION: The EXIT to User Programs option is used to quit Survey 4.0 and immediately begin a user-specified program.

Select Routine

To exit and run any user-specified program, pull down the **Exit Menu** by clicking your mouse on the word **Exit** in the **Menu Bar**, or by pressing [F9] at **Select Routine**. Using your [↑], [↓] or [Space Bar], move the highlight bar to the desired program and press [↵Enter], or click your mouse on it.

You have chosen to EXIT to *program*. Are you sure? (Yes/No)

To use this exit option, press [Y], [1], or click your mouse on the word **Yes**. Otherwise, press [N], [0], or click your mouse on the word **No** to return to **Select Routine**. The name of the ***program*** will be given in the prompt. If you choose to exit, Survey 4.0 closes all files and runs the file **PRGM*n*.BAT**., where ***n*** represents the number, **01** - **10**, that corresponds to the desired program.

The batch file **PRGM*n*.BAT** must be present in the Survey 4.0 program directory before this option will be accessible. If the batch file does not exist, the menu item will be dimmed. The batch file may be written using any text editor, such as ***S4-Edit***. The basic structure of the batch file follows. Omit the comments.

`C:\`	'replace `C` with the actual ***program*** drive
`CD \`***Directory***	'replace ***Directory*** with the actual ***program*** directory
Program Name	'replace ***Program Name*** with the command that actually runs the specified program
`CD \`	'change back to the root directory
`C:`	'change back to the boot drive

Adding Programs to the EXIT Menu

After you have written your batch files, you need to assemble a listing of programs that Survey 4.0 may place into the exit menu. To do this, create a file named **PROGRAM.LST** in your Survey 4.0 program directory. On each individual line, list the name of the program that corresponds to that line's batch file number. For example, the first line would hold the name of the program that is called by the batch file **PRGM01.BAT**. The second line would hold the name of the program that is called by the batch file **PRGM02.BAT**, and so on.

Select Routine

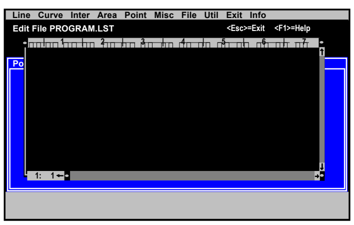
Creating the file **Program.Lst** is easy. From a COGO **Select Routine** prompt, type **EF** to start the Edit File routine.

Edit File:

Type the name **PROGRAM.LST** Enter. Unless you have used the **Dos Shell** routine (**DS** - Section 11.15) to change the active directory, you do not need to specify any path for this file. Survey 4.0 normally runs out of the program path that is specified in the Configuration Menu.

File not found. Is this a new file? (Yes/No)

If **Program.Lst** does not exist, you will receive this message. Press Y, 1, or click your mouse on the word **Yes**. Otherwise, ress N, 0, or click your mouse on the word **No**, and re-enter the correct file name.



The **S4-Edit Window** will now open and you may begin enter-ing program names. Type in each name and press Enter. When you are finished entering names, press Esc to exit the editor.

Detailed instructions for using the editor may be found in Section 16. Online help is available by pressing F1.

Save Changes?
< Y > Yes
< N > No
< A > Abandon Changes & Restart

Press Y, 1, or click your mouse on the **< Y >** to save your file. Press N, 0, or click your mouse on the **< N >** to quit the editor without saving the file. Press A or click your mouse on the **< A >** to restart the editor session.

NOTE

*Programs added to the file **Program.Lst** will not appear on the **EXIT** menu until you have exited and re-started Survey 4.0.*

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Survey 4.0
Simplicity Surveying Series

Section 15
S4-Calc: Using the Pop-Up Calculator

15.01
WHAT IS S4-CALC?

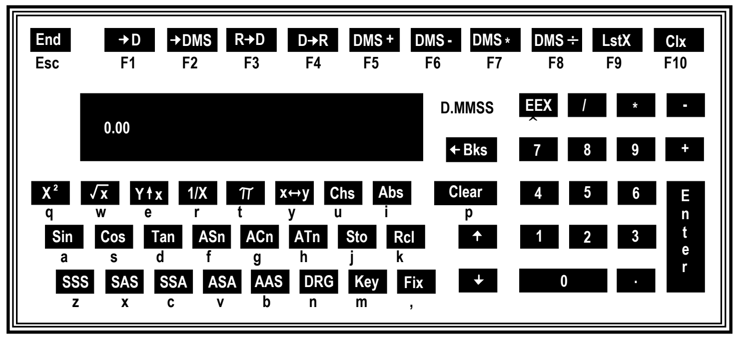
Survey 4.0 contains ***S4-Calc***, a pop-up style surveying calculator, loosely based on the HP-15C calculator from Hewlett Packard. S4-Calc may be run from within the Survey 4.0 COGO routines, or as a stand-alone calculator called from the DOS command line (see Section 15.10). To run S4-Calc from within COGO, type **PC** (for **P**op-up **C**alculator) at **Select Routine**, or type **PC** Enter at any point number prompt.

S4-Calc is a powerful tool containing many features, including:

- A four register stack with HP-style Reverse Polish Notation (RPN) data entry;
- Four function math: +, -, ∗ and ÷;
- Last *x* recall;
- Reciprocals;
- *x y* register swap;
- Pi;
- Change sign;
- Absolute value;
- Exponential math including y^x;
- Trigonometric functions for Sine, Cosine and Tangent;
- Inverse trigonometric functions for ArcSine, ArcCosine and ArcTangent;
- Squares and square roots;
- 16 memory registers that retain data even when your computer is turned off;
- Built-in Universal Triangle solutions for Side Side Side, Side Angle Side, Side Side Angle, Angle Side Angle, and Angle Angle Side;
- The ability to work in various angular formats such as a calculator style D.MMSS format, a decimal degrees format, radians and grads;
- Conversions for radians to and from degrees;
- Angular formatted math including DMS+, DMS-, DMS∗ and DMS÷.

15.02
THE KEYBOARD

The S4-Calc keyboard is a mapped keyboard, i.e. the S4-Calc keys are mapped, or assigned, to various keys on your computer keyboard. The default key assignments are shown in the figure below. If you are working in grads, F3 and F4 will be adjusted accordingly to convert between degrees and grads.



The S4-Calc Keyboard: Figure 15-1

The black keys represent the S4-Calc keys. Printed under several of the keys is the key designation to which the S4-Calc key is assigned. The assigned key display may be toggled on and off by pressing the **Key** key (M).

The numeric keys and math function keys have not been assigned to other keys, but instead correspond to the numeric keypad on your computer keyboard. In order for these numeric keys to function properly, your keyboard **Num Lock** must be engaged.

If you do not have an enhanced keyboard, engaging the **Num Lock** creates another consideration when using ↑ and ↓ to roll the stack. A non-enhanced keyboard is one on which the arrow and page control keys do not have a separate keypad, but rather are assigned to the number keys. To use these keys while your **Num Lock** is engaged, you must press and hold Shift while pressing the appropriate number key.

15.03
DATA ENTRY

S4-Calc is designed to function like your hand-held calculator, with one exception: you can use your mouse, in addition to your keyboard, to access the keys. Certain other functions are provided to assist in *data entry*. These functions allow you to backup to correct an entry mistake; clear the contents of any or all of the memory and stack registers; and set the number of visible decimal places.

Using Your Mouse

To press any key with your mouse, simply point the mouse cursor at the key and press either the left or right mouse button. To avoid multiple key presses, keep your button presses quick and do not double click.

Correcting Entry Errors

If, while typing in a value, you discover that you have made an entry error and you have not yet pressed ↵Enter, press the **←Bks** key (Bk Spc) and correct your error. If you have already pressed ↵Enter, press the Clear X or **Clx** key (F10), and re-enter your value.

Clearing Registers

Clear everything, including the contents of all 16 memory registers and the stack registers, by pressing the **Clear** key (P). To clear only the six reserved memory registers (see Section 15.07), press and hold the Alt key while pressing the **Clear** key (Alt P). To clear only the ten user-assignable registers (see Section 15.07), press and hold the Ctrl key while pressing the **Clear** key (Ctrl P). To clear any single user-assignable register, press and release the keys 0 **Sto** ***n***, where ***n*** is the register number, for example 0 J 3. And finally, to clear only the stack registers, press 0 ↵Enter ↵Enter ↵Enter ↵Enter, to place a null value into each register.

Setting Decimal Places

Internally, S4-Calc works with up to 16 significant digits. The S4-Calc display however, is limited to up to 9 decimal places. Set the number of visual decimal places with the **Fix** key (,), followed by the number of places you want to display. For example, set the display to 6 decimal places by pressing , 6.

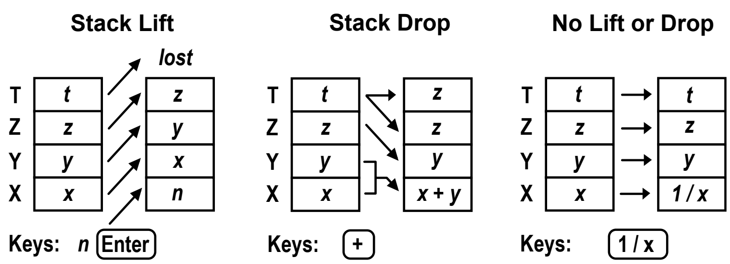
15.04
MANIPULATING THE STACK

In the style of Hewlett Packard calculators, S4-Calc employs an operating logic known as "Reverse Polish Notation", or RPN. This mathematical logic type was first developed as "Polish Notation" by Polish mathematician Jan Lukasiewicz (1878-1956). Unlike conventional algebra which places operators *between* variables, Polish notation placed operators *before* the variables when evaluating algebraic expressions. To optimize calculator entries, HP reversed the process, placing the operators *after* the variables, thus the term "Reverse Polish Notation".

Like HP, S4-Calc uses RPN and a four register stack, (*X*, *Y*, *Z* and *T*) , to manipulate the entry and computation of algebraic data. The procedure results in the elimination of parenthesis by retaining and displaying the intermediate results of your calculations.

Lifts and Drops

When you enter a number into S4-Calc, your entry is placed into the *X* register, causing the contents of the registers to lift. The original *X* value is placed into the *Y* register, *Y* is placed into *Z*, *Z* is placed into *T* and *T's* original contents are lost. This **stack lift** occurs any time a new value is placed into the *X* register.

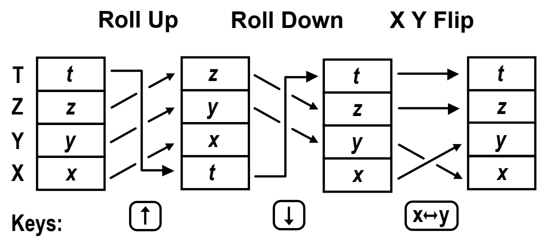


Stack lift and drop functions: Figure 15-2

Illustrated in Figure 15-2 are the "**stack drop**" and "**no lift or drop**" operations. Stack drops occur whenever the contents of two registers are combined through an addition, subtraction, multiplication or division. No lift or drop of the stack occurs in operations that act solely upon the *X* register. These functions include: **1/x;** **x^2**; **√x**; and all trigonometric functions.

Rolls and Flips

When you need to access a value that is not in register *X*, you have three choices: **roll up**; **roll down**; or **x y flip**. Roll the stack up or down by using the arrow keys. Flip, or swap, the contents of the *X* and *Y* registers by pressing the **x↔y** key (Y). Figure 15-3 illustrates the stack roll and register flip operations.



Stack rolls and flips: Figure 15-3

Last *x*

The **Last *x*** register is a separate memory register that retains the value that was last *in the display* before the numeric operation was performed. Pressing the **LstX** key (F9) results in the *Last x* value being placed into the *X* register. This operation is similar to entering a number from the keyboard and pressing ↵Enter, since it results in a stack lift causing the *T* register contents to be lost.

Solving Equations

The four register stack lends powerful equation solving capabilities to S4-Calc. Through the use of the stack, you have the ability to solve complex equations, with the stack registers replacing the parenthesis in your equations. Equations which use the stack to hold intermediate results are called nested equations.

To solve a nested equation, solve the terms in their nested order, beginning with the most deeply nested term. For example, to solve the equation: **145[4+18(9.15/3)]**, you would begin by solving the term (9.15/3), multiply that result by 18, add 4 and multiply by 145. Your keystrokes and register contents would look like:

Keys	X Register	Y Register
9.15	9.15	0.00
↵Enter	9.15	9.15
3	3.00	9.15
/	3.05	0.00
18	18.00	3.05

Keys	X Register	Y Register
*	54.90	0.00
4	4.00	54.90
+	58.90	0.00
145	145.00	58.90
*	8540.50	0.00

VIEWING THE STACK

To view the full stack while running the calculator, press Alt S (anytime). The stack will be shown until you exit S4-Calc.

15.05 ANGULAR MATHEMATICS

When started, S4-Calc will always be initialized to the same angular format that you are running in COGO, either D.MMSS or grads. (There is no D-M-S mode. If you run COGO in D-M-S, S4-Calc will start in the D.MMSS mode.) You may also work in radians or decimal degrees if you prefer, but you must be certain to properly convert any angular memory data to your chosen COGO format before using the data inside COGO. The D-M-S format is not supported in S4-Calc data entry, but it is supported in the memory exportation of calculated triangle data back to COGO. In other words, if your COGO format is D-M-S, work your calculator triangle solutions as D.MMSS. When you return to COGO, your angular entries will be formatted as D-M-S.

To cycle through the choices, use the **DRG** (**D**egrees, **R**adians, **G**rads) function which has been assigned to key N on your keyboard. The assigned format will appear to the right of the calculator display, immediately above the **←Bks** key (Bk Spc).

NOTE

For the purposes of the remainder of this section, we will assume that the chosen format is D.MMSS.

Trigonometric Functions

S4-Calc contains the standard trigonometric functions for Sine, Cosine, Tangent, ArcSine, ArcCosine and ArcTangent. These functions are designed to work in any angular format supported by S4-Calc, freeing you from the burden of conversions to and from decimal degrees. For example, to find the sine of 45° 37' 52.5", key in **45.37525** and press the **Sin** key (A) to reveal the result of **0.714854**. Or, suppose that you have a sine value of 0.428864 and you need to find the angular value. Key in **0.428864** and press the **ASn** key (F) to reveal the result of **25.234376**, or 25° 23' 43.76".

Conversion Functions

S4-Calc contains conversion functions for decimal degrees to and from the D.MMSS format, and degrees (both D.MMSS and decimal) to and from radians. Additionally, when you have selected grads as your angular unit, S4-Calc offers conversions for grads to and from decimal degrees.

To convert from decimal degrees to D.MMSS, key in the value and press the **→DMS** key (F2). To convert from a D.MMSS format to decimal degrees, key in the value and press the **→D** key (F1).

To convert from radians to degrees in your chosen format, key in the value and press the **R→D** key (F3). To convert from degrees to radians, key in the value and press the **D→R** key (F4).

To convert from grads to decimal degrees, press **DRG** key (N) until **Grads** is the select angular unit. Notice that the F3 key which was **R→D** has changed to **G→D**, and that the F4 key which was **D →R** has changed to **D→G**. Now enter the value and press the **G→D** key (F3). To convert from decimal degrees to grads, enter the value and press the **D→G** key (F4).

Angular Arithmetic

S4-Calc allows you to add and subtract formatted angles without first converting them to decimal values. You may also multiply and divide angular values by any other (non-angular) value, without conversions. For example, suppose that you have three angular values and you want to find the average value. The values are 75° 13' 52", 75° 14' 07 and "75° 13' 36". Key in the first value of **75.1352** and press ↵Enter. Key in the next value of **75.1407** and press the **DMS+** key (F5). You should see an intermediate result of **150.2759**. Next, erroneously key in the final value as **75.4336** and press the **DMS+** key (F5). You should see an intermediate result of **226.1135**. Oops! We made a mistake. Press the **LstX** key (F9) to recall the last entered value and press the **DMS-** key (F6). You should once again see an intermediate result of **150.2759**. Now correctly key in the final value of **75.1336** and press the **DMS+** key (F5). You should see an intermediate result of **225.4135**. Now find the average of the three angles by pressing 3 and the **DMS÷** key (F8) to reveal the average angle of **75.135167** or 75° 13' 51.67".

CAUTION!
*Do not confuse the angular math functions with regular +, -, /, and * functions or errors in your calculations will result!*

15.06 OTHER MATH FUNCTIONS

In addition to trigonometric, standard and angular math functions, S4-Calc offers nine other math functions. These are: ***x squared***; ***square root***; ***y to the x power***; ***reciprocal of x***; ***pi***; ***x y register exchange***; ***change sign***; ***absolute value***; and ***exponential math***.

x Squared

To obtain the square of the value contained in the *X* register, press the **x²** key (Q). This operation does not affect the stack.

Square Root of *x*

To obtain the square root of the value contained in the *X* register, press the **√x** key (W). This operation does not affect the stack.

Y raised to the *x* power

To raise the value contained in the *Y* register to the *X* power, type the first value and press ↵Enter to place it into the *Y* register. Then type in the *X* value and press the **Y↑x** key (E). This operation does not affect the stack.

Reciprocal of *x*

To obtain the reciprocal of the value contained in the ***x*** register, press the **1/x** key (R). This operation does not affect the stack.

Pi

To place the value of ***Pi*** into the *X* register, press the **π** key (T). This operation causes a stack lift.

x y Register Exchange

To swap the values of the *X* and *Y* registers, press the **x↔y** key (Y). The *Z* and *T* stack registers are not affected.

Change Sign

To change the sign of the value contained in the *X* register, press the **Chs** key (U). This operation does not affect the stack.

Absolute Value

To obtain the absolute value of the value contained in the *x* register, press the **Abs** key (I). This operation does not affect the stack.

Exponential Math

To enter a value raised to any power of 10, type in the value, press the **EEX** key (^ (or Shift 6)), type in the power of 10 and press ↵Enter. This operation does not affect the stack.

15.07
USING THE MEMORY

In addition to the four operational stacks, S4-Calc contains a 16 register memory. Both the memory registers and the stack memory are non-volatile. The contents of all of the registers are preserved, even when your computer is turned off. Of the 16 memory registers, 10 are user-assignable and six are reserved for triangle solutions.

User-Assignable Memory

User-assignable memory registers are numbered 0-9. To store the current contents of the *X* stack register into any one of these registers, press and release the **Sto** key (J) and then press and release the register number. To recall the contents of any register, press and release the **Rcl** key (K) and then press and release the register number. S4-Calc treats the recalling of a value as though it were an entered value, placing the value into the *X* register and the lifting the stack.

Two additional features are available to assist you in storing and recalling values. S4-Calc displays the words **Store** and **Recall** above the calculator display when the **Sto** and **Rcl** keys are pressed. This display indicates that the next numeric keypress will be taken as the register number. If you have pressed **Sto** or **Rcl** in error, press Esc to cancel the operation.

Additionally, S4-Calc indicates the used or unused status of a memory register by the presence of a dot placed immediately above the register numbers on the numeric keypad. If a register contains any value other than zero, a dot will be shown. If no dot is present, that particular register is empty. Note that the dot indicators apply only to user-assignable memory and not to the reserved memory registers.

Reserved Memory

Reserved memory registers are numbered Alt 0 - Alt 6. These registers function only for S4-Calc's triangle solutions. When you have completed a triangle solution, the triangle's three sides are stored in registers Alt 1, Alt 2 and Alt 3. Likewise, the three angles are stored in registers Alt 4, Alt 5 and Alt 6.

To recall a value from any reserved memory register, press and release the **`Rcl`** key (K), then press and hold the Alt key on your computer keyboard while selecting the register number 1-6.

NOTE

You cannot store any value into a reserved memory register. Any attempt to do so will place the value into user-assignable register 0.

Clearing Memory

You may clear all 16 memory registers by pressing the **`Clear`** key (P). To clear only the reserved memory registers, press and hold Alt while pressing the **`Clear`** key (Alt P). To clear only the user-assignable registers, press and hold Ctrl key while press-ing the **`Clear`** key (Ctrl P). Finally, to clear any single user-assignable register, press and release the keys 0 **`Sto`** ***`n`***, where ***`n`*** is the register number, for example 0 J 3.

15.08 TRIANGLE SOLUTIONS

S4-Calc contains triangle solutions for five triangle problems. The are:

- Three sides known (**`SSS`** - key Z);
- Two sides and the included angle known (**`SAS`** - key X);
- Two sides and the opposite angle known (**`SSA`** - key C);
- Two angles and the included side known (**`ASA`** - key V);
- Two angles and the opposite side known (**`AAS`** - key B).

Select the desired solution by pressing the appropriate key. Depending upon your selection, you will be prompted for the known sides and angles, in the order in which they appear in the solution. Enter each requested item and press ↵Enter. Angles must be entered in the previously selected S4-Calc angular format.

When you have completed entering your data, S4-Calc will display the first side of the triangle. Press ↑ or ↓ to cycle through the other sides and included angles, and also the area. Area is expressed without units. As previously discussed, the triangle's three sides are stored in registers Alt 1, Alt 2 and Alt 3. Likewise, the three angles are stored in registers Alt 4, Alt 5 and Alt 6. The area is not stored. Press the **Clear** key (P) or the **End** key (Esc) to exit the triangle solution mode and return to the normal calculator mode.

15.09
EXITING S4-CALC

Exit S4-Calc by pressing the **End** key (Esc). The S4-Calc window will close and you will be returned either to **Select Routine** or to DOS, depending upon how you started the program.

Using Memory Values in COGO

When you return to COGO from S4-Calc, the contents of the 16 memory registers goes with you. You may access these registers at bearing and distance prompts by responding to them with ? ↵Enter. This response produces a memory window that displays the contents of the memory registers. Registers 0-9 are numbered as such, while registers Alt 0 - Alt 6 are assigned to the letters A-F. Select any value by pressing its corresponding number or letter.

15.10
RUNNING S4-CALC STAND-ALONE

S4-Calc is capable of running as a stand-alone program, without being called from COGO. To call S4-Calc from a DOS prompt, type **S4-CALC** ↵Enter. However, this will work only if the Survey 4.0 program path has been made a part of your computer's search path. If you do not wish to add Survey 4.0's path to your search path, you can copy the **S4-CALC.EXE** and **BRT71EFR.EXE** programs from the directory that contains Survey 4.0 into your root directory or DOS directory. Please refer to your DOS manual for information on the **COPY** and **PATH** functions.

Running S4-Calc in Windows

If you are running Survey 4.0 in Microsoft Windows 3.x, you may wish to access S4-Calc as a stand-alone program which will allow you to leave it running as a separate application as you jump to and from COGO. Running Survey 4.0 and S4-Calc in Windows requires you to follow certain procedures which are covered in detail in Appendix B.

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Survey 4.0
Simplicity Surveying Series

Section 16
S4-Edit: Using the Editor

16.01
SIZE & FILE TYPE LIMITATIONS

The ***S4-Edit*** program is a simple editor included with Survey 4.0 as a utility for writing and editing macro and keystroke files. The editor has a maximum capacity of 64K, or approximately 1500 lines of text. Only ASCII text files should be loaded into the editor. Please do *not* attempt to edit files with a COM or EXE extension since they are not ASCII files and could be damaged.

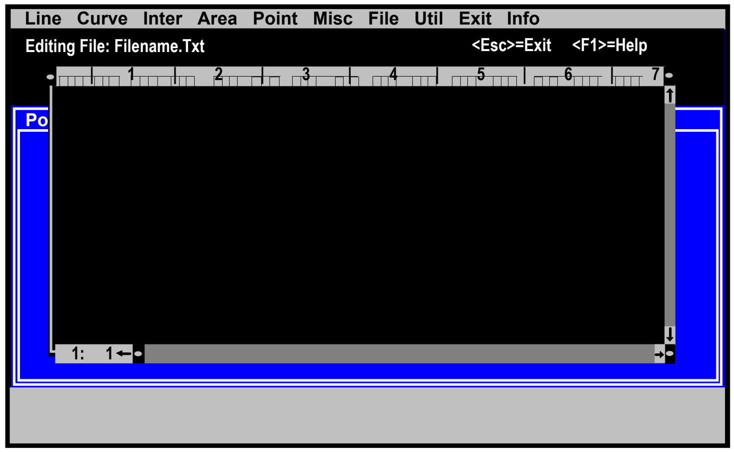
In addition to editing keystroke files, you may find the editor useful for reviewing and printing the DOC files that are produced when sending your printed output to a disk file and the KEY files that you record using the keystroke saving feature of Survey 4.0.

16.02
THE EDIT WINDOW

Upon accessing the **Remarks** routine (**RE** - Section 11.12), or entering a valid filename in the **Edit/View File** (**EF** - Section 12.02) and **Write/Edit Macro** (**WM** - Section 12.06) routines, or electing to edit the Traverse.Key file from within the traverse adjustment routine, the **S4-Edit Window** will appear over the active Survey 4.0 screen, as shown in figure 16-1. Although the Survey 4.0 menu bar appears at the top of the edit screen, it is inoperable.

The edit window opens (almost) full-screen, but can be re-sized and re-positioned virtually anywhere on the screen. It features on-line help (available by pressing F1), full mouse support, word-wrap, screen scrolling, and block operations to insert, delete and copy text. All of the standard editing keys are supported.

The name of the file that you are editing (or creating) is displayed above the edit window. The cursor's row and column location is displayed in the lower left of the edit window and a flashing underscore (_) visually shows that position in the file. The cursor is moved around in the file using standard cursor movement keys, explained later in this section. When the cursor destination is outside the current edit window, the file will be scrolled to keep the cursor visible. The following tables list the cursor movement and file scrolling commands:



The S4-Edit Window: Figure 16-1

To move cursor to:	**Press:**
Line above current line	↑
Line below current line	↓
Character to left	←
Character to right	→
First character in current line	Home
Last character in current line	End
First character in file	Ctrl Page Up
Last character in file	Ctrl Page Dn
First line of edit window	Ctrl Home
Last line of edit window	Ctrl End
First character of prev. word	Ctrl ←
First character of next word	Ctrl →

To scroll text:	**Press:**
Up one window full	Page Up
Down one window full	Page Dn
To the beginning of file	Ctrl Page Up
To the end of file	Ctrl Page Dn

16.03
INSERT, OVERTYPE, COPY & DELETE

The following table lists the common tasks for entering and deleting text:

To:	Do this:
Enter text	Type the text
Insert text	Place cursor at insert point and type the text to be inserted
Type over existing text	Place cursor over the first character to be replaced, press [Insert], type the new text, press [Insert] again to cancel the overtype mode
Copy text to the clipboard	Mark block, press [↵Enter]
Copy text from the clipboard	Press [Shift] [Insert]
Delete text to left of the cursor	Press [Bk Spc]
Delete text at the cursor position	Press [Delete]
Delete a block of text	Mark block, press [Delete]
Delete the current line	Press [Ctrl] [Y]
Insert a new blank line	Press [Ctrl] [N]
Cancel all editing & start over	Press [Esc] then [A]

16.04
MARKING BLOCKS

The [Shift] key combined with any of the cursor movement keys will allow you to mark blocks of text. Marked blocks of selected text will appear ***highlighted*** on your monitor.

To select text, place the cursor at the beginning or end of the text you want to select and press the [Shift] key. If the text that you want to highlight is to the right of the cursor, press the [→] key while continuing to hold down the [Shift] key. Likewise, if the text is to the left of the cursor, press the [←] key while holding down the [Shift] key. Refer to the following table for additional commands for selecting text.

To select text:	Press:
To the left of the cursor	[Shift] [←]
To the right of the cursor	[Shift] [→]
To the beginning of the line	[Shift] [Home]
To the end of the line	[Shift] [End]

To the beginning of the file	[Shift] [Ctrl] [Page Up]	
To the end of the file	[Shift] [Ctrl] [Page Dn]	
In a column format	[Shift] [→]	then
	[Shift] [↓]	until the block is selected.
Several full lines at once	[Shift] [↓]	until the last line is selected.

Regardless of which marking mode you use, the block will be copied to the clip-board as soon as any non-marking key has been pressed. (A non-marking key is any key that isn't used in any of the processes to mark or select text. For example, [↵Enter] is a non-marking key.) If either [Delete] or [Shift] [Delete] is pressed, the block will first be copied to the clip-board and then deleted from the file. To paste the block from the clip-board into the file, place the cursor where you want the text located and press [Shift] [Insert].

16.05 MOUSING AROUND

If you have a mouse, you may use it to select and scroll text and to move or resize the edit window.

To scroll text to the left or right in the edit window, click the left mouse button on the scroll bar at the bottom of the screen. To scroll text up or down in the edit window, click the left mouse button on the scroll bar at right edge of the edit window. Or, press and hold the left button on the arrow icon in either of the scroll bars to move the desired direction. (The arrow icons are found at the top and bottom of the right scroll bar and at the far left and right of the bottom scroll bar.)

To select text in a column format, simply press and hold the left mouse button while moving the mouse first to the right and then downward. To select full lines of text all at once, press and hold the left mouse button while moving the mouse downward first.

To resize the edit window, press the left mouse button on the diamond icon in either the upper left or lower right corner of the window and drag the selected corner to its new location. To return to the original full-screen window size, simply click on the double-arrow icon in the upper right corner.

16.06
SAVING AND/OR PRINTING YOUR CHANGES

When you have finished viewing, editing or creating a file, simply press [Esc] to exit the editor. If you have created a new file or have made any changes to an existing file, you will be given an option to save them.

Save Changes?
< Y > Yes < N > No
< A > Abandon & Restart

Respond by pressing [Y] to exit and save the changes, [N] to exit without saving the changes or [A] to abandon the changes and re-start the editor using the same file. The **Abandon & Restart** option ***does not*** save the changes you have made during the current editing session. If you pressed [Esc] by mistake or if you have additional changes to make to the file, you should exit by pressing [Y] to save the changes and then restart the editor with the same file.

If you are running the editor in stand-alone mode, you will be given an opportunity to print the file. (See Section 16.07)

16.07
STAND-ALONE OPERATION

The Survey 4.0 editor can be run stand-alone (outside the Survey 4.0 program). Using the editor in stand-alone mode adds printing capabilities and provides you with an ASCII text editor for making notes, writing letters, etc.

To run the editor stand-alone, you must first log to the drive and directory to which you installed the Survey 4.0 program. Most often this will be the **\Simplcty** directory on your **C:** or **D:** hard drive. For example, if you installed Survey 4.0 into the directory **D:\Simplcty**, you will first need to log to drive **D:** by typing `D:` [Enter] and then change into the **\Simplcty** directory by typing `CD \Simplcty` [Enter].

After logging to the Survey 4.0 drive and directory, simply type `S4-Edit` [Enter] to start the editor.

Enter the filename:

Enter a filename and then use the editor just like you would if you had started it from within the Survey 4.0 program.

Print this file
< Yes > < No >

Upon leaving the editor when running in stand-alone mode, you will be given an opportunity to print the file. However, the editor prints only to printer port ***LPT1***. If you are using a parallel printer on port ***LPT2*** or if you are using a serial printer, you will need to re-direct your printer port using the ***DOS MODE*** command prior to starting the editor. Refer to your DOS manual for more information.

Enter the filename:

After editing or creating a file, you will be prompted for the next file to edit. Enter another filename or press ↵Enter if you wish to exit the editor and return to your DOS prompt.

SHORTCUT

*You can save time by entering the filename as you start the editor. For example, a file called **PINECREK.TXT** located on drive **C:** in the **LEGALS** directory can be loaded automatically when starting the editor by typing:*

S4-EDIT C:\LEGALS\PINECREK.TXT ↵Enter.

Section 17
Writing Macro Files

17.01
IT'S SIMPLE! THE MACRO CONCEPT

Survey 4.0 contains a programming language that allows you to write your own routines into COGO. The **S**implicity **I**ntegrated **M**acro **P**rogramming **L**anguage **E**xtension, (**SIMPLE**), is a fast and easy macro language designed to work with you to produce custom COGO routines.

The concept of macro programming is not really new. For years, programs such as **SuperKey** from Borland and the **Macro Recorder** within Microsoft Windows have enabled users to record their keystrokes for editing and playback. But **SIMPLE** takes you one step further, by adding commands that allow you to manipulate variables and configuration settings, prompt for information, perform calculations and test for conditional data.

The keystroke file which is the basis for **SIMPLE**, is what makes it easy to use. In fact, if you can solve a COGO problem on the keyboard, you can write a macro program to do it for you. ***SIMPLE*** *macros are essentially nothing more than keystroke files (see Sections 3.13, 12.03 and 12.04) enhanced with data entry and calculation capabilities.*

Survey 4.0 employs macros for a variety of COGO routines, including: section breakdowns; inscribing arcs; computing cul-de-sacs and street intersections; and solving three point curves. Altogether, Survey 4.0 includes 17 macro programs that are used inside COGO. You may view these macros using any ASCII text editor, Survey 4.0's **Edit/View File** routine (**EF** - Section 12.02) or **Write/Edit Macro File** routine (**WM** - Section 12.06), or with Survey 4.0's **S4-Edit** program (Section 16). However, when you view a file, be careful not to alter it in any way unless you have a backup copy.

In the remainder of this section, you will learn the **SIMPLE** macro structure and language syntax, as well as how to write, run, test and debug your macros. You will also see how a recorded keystroke file can assist you in writing your macros.

17.02 PROGRAMMING STRUCTURE

The basic structure of a **SIMPLE** macro consists of the following parts:

- Comments (optional);
- The Variable Counter;
- The SET *Configuration* Statements;
- The SET POINT Statement;
- The SET *Variable* Statement;
- Prompts and Data Entry;
- Calculations and Conditional Tests;
- GOTO Statements and Line Labels;
- Keystroke Statements;
- PAUSE Statements;
- END Statement.

SIMPLE requires rigid location of certain statements, such as the Variable Counter, Prompt and Keystroke statements. Other commands such as the Calculation and Conditional statements have more flexibility, but are still restricted to certain areas within your macro. Still other statements, including Comments and Configuration statements may be placed almost anywhere, but in most cases, their placement will be similar throughout your macro collections. We will discuss each of the statement types in the order in which they most likely will appear.

You will notice that we routinely capitalize the command statements that go into a macro. This is done only for clarity. Statements you place into a macro may be upper case, lower case, or any mixture thereof.

Comments

Comment are statements that begin with an apostrophe, such as:

```
'Sect4.Mac - A Section Breakdown Macro
```

Comments are completely optional. They may appear anywhere in your macro, and in fact, may even appear at the end of any other command line, such as:

```
SET Debug = 1   'Turn the Debugger On
```

Any text appearing after an apostrophe is considered a comment and is ignored during a macro playback. Blank lines, with or without an apostrophe, are another form of comment that is ignored during playback. We recommend the liberal use of comments and blank lines to assist you in documenting and debugging your macros.

The Variable Counter

When you run a macro, Survey 4.0 must internally set aside enough room to accommodate your ***variable*** requirements. (If you are unfamiliar to programming, a programming variable behaves just like an equation variable. It is usually a letter or name to which any value can be assigned.) To reserve enough memory space, Survey 4.0 relies on a **`Count`** statement. ***The Count statement must be the first operational statement in your macro.*** Comments are the only statements that can precede a **`Count`** statement. A typical count statement looks like:

```
COUNT = 15
```

In the statement above, **`Count`** sets aside space for the assignment and/or calculation of 15 variables.

Most of the time, when you begin a macro, you will not know the exact number of variables you will need. Either set aside a large number, or simply write your macro, count the variables needed, and then insert the **`Count`** statement into the beginning of the macro.

SET Configuration Statements

Configuration, or **`SET`** statements, set Survey 4.0's configuration for optimum operation during a macro playback. Several configuration variables are available, and their specific values are listed in the discussion of **`SET`** syntax in Section 17.03.

Generally, **`SET`** statements appear in the beginning of the macro, *after the* **`Count`** *command*, in the form of:

```
SET Debug = 1
```

`SET` statements may appear anywhere in the macro to adjust Survey 4.0's configuration settings, with two exceptions. The exceptions are based on the fact that the **`SET`** values they affect are not *configuration* settings, but rather they are *variable* settings, as described in the next two sub-sections: **`SET POINT`**; and **`SET Variable`**.

NOTES

*1. Some of the variable names, such as **`Code.Set`**, contain a period as part of their name. **Do not omit the period or replace it with a space.** If you do, that particular configuration variable will not be changed.*

*2. All configuration settings changed by a macro **SET** statement, will be restored to their pre-macro settings upon completion of the macro. See the **END** statement.*

SET POINT

A **`SET POINT`** statement is used to assign the number of the currently occupied point to the first available macro variable, **`M(1)`**. In a macro, the **`SET POINT`** statement looks like:

```
SET POINT
```

The `SET POINT` statement may only be used once in any macro. This statement should follow the initial configuration **`SET`** statements, but it ***must come before*** any **`PROMPT`** statements.

SET *Variable*

The **`SET`** ***`Variable`*** statement allows you to assign a particular value to the given macro variable. The macro variable number is used in the statement in the form of **`M(n)`** where **`n`** is the variable number. Variables must be numbered consecutively. For example, if the statement preceding a **`SET`** ***`Variable`*** statement assigns variable **`M(7)`**, you must use variable **`M(8)`** in the **`SET`** ***`Variable`*** statement.

The assigned value may be a number, such as when assigning a constant value to a variable, or it may be a **`+`** or **`-`**, as when assigning the next available point number. Using **`+`** or **`-`** to assign a point number is in effect the same as employing automatic point numbering. Respectively, these statements look like:

```
SET M(8) = 3.14159
SET M(9) = +
```

In the above example, the first statement assigns the value for *pi* to the variable **`M(8)`**. The second statement assigns the first available point number to the variable **`M(9)`**. The later statement is most likely to be used to assign numbers to temporary points that your macro may use.

SET *Variable* statements may only be placed in any of three locations: immediately before a grouping of **PROMPT** statements; within a grouping of **PROMPT** statements; or immediately after a grouping of **PROMPT** statements. You may use any number of **SET *Variable*** statements in a macro.

Prompts and Data Entry

The **PROMPT** statement is the main method of entering data into your macro. When Survey 4.0 encounters a **PROMPT** statement, the statement is displayed on your monitor while Survey 4.0 awaits your response. Type in the requested data and press Enter. A typical prompt statement looks like:

```
PROMPT Enter the Curve Center Point    'M(6)
```

The **'M(6)** at the end of the above statement is simply a comment that identifies what variable the incoming data will be assigned to. We strongly suggest that you use comments such as this to keep track of your variable numbers. Remember, an accurate accounting of variables is necessary to satisfy the requirements of the **COUNT** statement.

PROMPT statements should be placed in a grouping near the beginning of a macro, preferably following the **SET** configuration statements. ***They must come before any calculation and conditional test statements.***

Calculation Statements

Calculation, or **CALC** statements are used to assign calculated values to macro variables. **CALC** statements may be positioned within the macro in two places: after the **PROMPT** grouping; and after conditional statements. The format for the **CALC** statement in either location is the same, however placement does dictate the non-use or use of a variable descriptor. For example: a **CALC** statement placed immediately after a **PROMPT** grouping might look like:

```
CALC (M(6)+M(7))/2    'M(8)
```

This statement would calculate the value of the variable **M(6)** plus the variable **M(7)**, and divide the total by **2**. Since this statement follows the **PROMPT** grouping and comes before any conditional test statements, the calculated value would be assigned to the next available variable. The **'M(8)** at the end of the above statement is simply a comment that identifies the variable to which the incoming data will be assigned.

A **CALC** statement placed within a conditional test (see below) actually has two lines and might look like:

```
8
CALC (M(6)+M(7))/2
```

This statement would also calculate the total of the variable **M(6)** plus the variable **M(7)**, and divide the total by **2**. However, since this statement follows a conditional test statement, the calculated value is assigned to the variable number that immediately precedes the **CALC** statement, in this case **M(8)**.

The **CALC** statement offers many valid mathematical functions in excess of the standard addition, subtraction, multiplication and division functions. Scientific notation and the constants *pi* and *e* are also supported. These functions are listed in Section 17.04.

Conditional Tests

Conditional tests, or **IF** statements, are statements that check to determine if certain conditions are met before the macro will continue with the next line. These **IF** statements may be placed anywhere after the **PROMPT** statements, even within the keystroke statement section. Each **IF** statement must have a corresponding **END IF** statement to mark the end of the conditional code. For example:

```
IF (M(5)>0)
   12
   CALC DMR(M(5))
END IF
```

This example first checks to see if the value assigned to variable **M(5)** is greater than **0**. If it is, the identifier of **12** is reserved to hold the **CALC**ulation which converts a D.MMSS value (which was assigned to **M(5)**) to radians. The **END IF** statement marks the end of the conditional section of code, and while our example included only two lines in this section, any number of statements may occur between the **IF** and **END IF** statements. If the value assigned to variable **M(5)** would have been equal to **0**, the entire conditional section would have been skipped during playback.

`IF` statements may also include more than one term of condition. For example, all of the following statements are valid:

```
IF (M(5)>0) AND (M(6)=0)
IF (M(5)=0) OR (M(6)=0)
IF ((M(5)+M(6))>0) AND (M(7)=M(8))
```

The first statement is satisfied only if the `M(5)` value is greater than `0` ***and*** the `M(6)` value equals `0`. The second statement is satisfied only if the `M(5)` value equals `0` ***or*** the `M(6)` value equals `0`. The third statement is satisfied only if the sum of `M(5) + M(6)` is greater than `0` ***and*** the `M(7)` value equals the `M(8)` value.

IMPORTANT!

IF statements must not be nested! *Each conditional* ***IF*** *statement must be followed by an* ***END IF*** *statement before another* ***IF*** *statement may be executed.*

GOTO Statements and Line Labels

Inserting `GOTO` statements and `Labels` into your macros allow you to move from one area of your macro code to another, bypassing all of the macro code that lies between the `GOTO` statement and the `Label`. A label is simply an identifier that tells the macro program where it should resume operations. For example:

```
GOTO FinishUp
   some intermediate code lines here...
   some intermediate code lines here...
:FinishUp
```

When Survey 4.0 encounters the `GOTO FinishUp` statement, it bypasses all the code lines until it reaches the `:FinishUp` label. At that point, the macro resumes normal playback.

Notice that the label `FinishUp` is preceded by a colon when it stands alone, but not when it is part of the `GOTO` command. The colon is used to identify the name `FinishUp` as a label, so that Survey 4.0 does not attempt to process labels as commands.

Labels may be any combination of alphanumeric characters, and they may be of any practical length. Labels are not case sensitive, for example the statement `GOTO finishup` would find the label

`:FINISHup`, or `:FinishUP`, or even `:FiNiShUp`. ***DO NOT place any spaces between the colon and the label name.*** Since Survey 4.0 processes each macro line only once, labels may be repeated within a macro.

In a macro, `GOTO` statements may be placed anywhere after the `PROMPT` statements. Since Survey 4.0 processes each macro line only once, the referenced label must occur after the `GOTO` statement or the macro will simply run to the end of the file and terminate in error. Use caution if you use repeating label names, since Survey 4.0 will go to the first matching label name after a `GOTO`.

Keystroke Statements

`Keystroke` statements consist mainly of two letter COGO commands and macro variables. The keystroke section is the last major section of a macro, following the `SET` and `PROMPT` statements, and in most cases, also following the `IF` & `END IF` and `CALC` statements.

For example, suppose your macro started at point `13`, assigned to macro variable `M(1)`, and traversed to point `21`, assigned to macro variable `M(2)`. The angle is `90°` turned to the right and the distance is `50.00`. The offset distance has been assigned to macro variable `M(3)`, but the angle has not been assigned to any macro variable. You also want to assign the point ID of `OFFSET 50 RIGHT` to your new point `21`. Your macro's keystroke code for this operation, with comments, would look like this:

```
ST                    'STart at
M(1)                  'Point 13
TR                    'TRaverse
M(2)                  'Point 21
OFFSET 50 RIGHT       'ID for Point 21
90AR                  '90° Angle Right
M(3)                  'Distance of 50'
```

Notice that the codes `ST` and `TR` are standard Survey 4.0 COGO routine codes, and that in effect, the entire listing is nearly what you would enter to complete the procedure from the keyboard. The only exception is the use of the macro variables, which would not even have to be used. However, the macro variables give your macros the flexibility to be used in many varied situations.

To illustrate this point, let's assume that you are in COGO and you have turned on the **Save Keystroke** recorder (**SK** - Section 12.03). Solve the above problem by actually entering the data, and then review the keystroke file. Among other statements, you will see this section of code:

```
ST
13
TR
21
OFFSET 50 RIGHT
90AR
50
```

Does it look familiar? It should. The only difference between this code and the previous macro code is the presence of the point numbers `13` and `21` for the variable `M(1)` and `M(2)`, and the value `50` in place of the variable `M(3)`.

The PAUSE Statement

The **PAUSE** statement does just that, it pauses the macro. A **PAUSE** statement is used to assist you in debugging the macro. When Survey 4.0 encounters a **PAUSE** statement, the program stops, displays the macro line number, and waits for you to press any key to continue. A **PAUSE** statement may be placed anywhere within a macro. See Section 17.07 for additional information on macro debugging procedures.

The END Statement

The **END** statement ends the macro. ***This statement is required, and failure to use this statement will result in a playback error.*** The **END** statement must be placed only at the point that you want the macro to end. This may be anywhere in the macro, for example after a conditional **IF** statement, but most likely it will be at the end of the macro. If you neglect to properly **END** the macro, your original configuration settings will not be restored, and you may receive other errors as Survey 4.0 attempts to read commands that simply are not there.

17.03 COMMAND SYNTAX REFERENCE GUIDE

This section contains a brief reference to the proper syntax and positioning of **SIMPLE** macro commands. This section is meant to supplement, not replace, Section 17.02. Only syntax, function and positioning rules are offered here, and no attempt is made within this section to explain the use of any statement.

Items enclosed in square brackets, `[ item ]`, are optional entries.

CALC

Function: Used to obtain the result of an equation and assign the result to a variable.

Syntax 1: `CALC (Equation)`

Placement: Immediately after a `PROMPT` grouping and before any `IF` statements. Macros may contain any number of `CALC` statements.

If conditional `IF` statements have been executed, a macro variable identifier must be assigned to hold the calculated value, as follows:

Syntax 2:

```
8
CALC (M(6)+M(7))/2
```

Placement: After any conditional `IF` statements have been processed. Macros may contain any number of `CALC` statements.

Comments

Function: Used to place comments into a macro.

Syntax: `'comment - max. 255 character/line`

Placement: Anywhere within the macro, in any quantity.

COUNT

Function: Used to reserve variable space within a macro.

Syntax: `COUNT = number of variables`

Placement: Must be the first operational statement within the macro. Only one `COUNT` statement is allowed per macro.

DEBUG

Function: Used to assist in debugging a macro. When **On**, macro code lines, variables and calculated values are sent to your printer as they are processed.

Syntax: `SET DEBUG = value`
`value` is either `0` for **Off** or `1` for **On**

Placement: Anywhere within the macro, in any quantity.

END

Function: Used to halt the operation of a macro and restore original configuration settings.

Syntax: `END`

Placement: Anywhere within the macro, in any quantity.

GOTO

Function: Used to skip macro code and resume macro operations at a specified location.

Syntax: `GOTO label`
`label` is an alphanumeric name

Placement: Anywhere after the `PROMPT` statements. The label must follow somewhere after the `GOTO` statement and when not a part of the `GOTO` statement, the label must begin with a colon, such as `:LabelName`. Since Survey 4.0 processes each macro line only once, labels may be repeated within a macro, although processing resumes at the first matching label after a `GOTO` statement.

IF & END IF

Function: Used to test for the satisfaction of certain mathematical conditions and process or skip a section of macro code accordingly.

Syntax:

```
IF (test) [And/Or (test)..]
       ...some code here...
END IF
```

Placement: Anywhere after the **PROMPT** statements, even within the keystroke statement section. Each **IF** statement must have a corresponding **END IF** statement to mark the end of the conditional code. **IF** statements may also include more than one term. (See Section 17.02)

IMPORTANT!

IF statements must not be nested! *Each conditional* ***IF*** *statement must be followed by an* ***END IF*** *statement before another* ***IF*** *statement may be executed.*

Keystrokes

Function: Used as macro substitutes for actual key presses. Keystrokes may be point numbers, names, angles, distances, routine codes, or macro variable representations of the same. Macro variable representations consist of the letter **M** followed by an identifying number enclosed in parenthesis, for example **M(7)**.

Syntax Example:

```
ST
M(1)
TR
M(2)
90AR
M(3)
```

Placement: Only one response to a line. Used towards the end of the macro. (See Section 17.02)

PAUSE

Function: Used during debugging to temporarily suspend macro processing and wait for a keypress to continue. The line number of the `PAUSE` statement is displayed at the bottom of the screen during the `PAUSE`.

Syntax: `PAUSE`

Placement: Use anywhere within the macro, in any quantity.

PROMPT

Function: The main method of introducing data into your macro. The macro displays the prompt text and waits for your reply.

Syntax: `PROMPT (text)`

Placement: Should be placed in a grouping near the beginning of the macro, preferably following the `SET` configuration statements. ***They must come before any calculation and conditional test statements.***

SET

Function: Used to set or change Survey 4.0's configuration variables.

Syntax: `SET Angle.Format = 1`

Placement: Generally appear in the beginning of the macro, *after the* `Count` *command*, but may appear anywhere in the macro. Specific variables and their allowable values follow:

`Angle.Format` Sets the angular format: 1 = D.MMSS; 2 = D-M-S

`Angle.Type`	Sets the angle type: 1 = Degrees; 0.9 = Grads
`Audio`	Sets the audio error prompt: 0 = Off; 1 = On
`AutoNum`	Sets automatic point numbering: 0 = Off; 1 = On
`Azimuths`	Sets angular output: 0 = Azimuths; 1 = Bearings
`Angle.Default`	Sets angular input default: 0 = No default; 1 = Azimuths; 2 = Angles Right; 3 = Deflections Right
`Azimuths.Type`	Sets the base azimuth direction: 0 = South; 1 = North
`Code.Set`	Sets the Angle Code Setting: 0 = Simplicity; 1 = Hewlett Packard
`CR.Correct`	Sets the correction for curvature and refraction on EDM reductions: 0 = Off; 1 = On
`Debug`	Sets the macro debugger: 0 = Off; 1 = On
`Echo`	Sets the raw data output: 0 = Off; 1 = On
`Hide.Display`	Sets the display blocker to suppress printing and/or the display of all intermediate macro calculations: 0 = Off; 1 = On
`Metric`	Sets the area units: 1 = Acres; 10 = Hectares; -10 = Cuerdas
`Names`	Sets the point names output: 0 = Off; 1 = On
`Overwrite`	Sets the automatic point overwrite protection: 0 = Off; 1 = On

`Printer`	Sets the output device: 0 = Display Only; 1 = Display and Printer; 2 = Display, Printer & Disk File; 3 = Display & File
`SL.Correct`	Sets the correction to sea level on EDM reductions: 0 = Off; 1 = On
`Slope.Prompt`	Sets the automatic slope prompting: 0 = Off; 1 = On
`Slope.Type`	Sets the slope type: 1 = EDM; 2 = Stadia; 3 = Slope Angles; 4 = Levels; 5 = Total Station; 6 = EDM with Mining Option; 7 = Assigned Elevations
`Trace`	Sets the macro command tracer: 0 = Off; 1 = On

IMPORTANT!
Some of the variable names, such as `Code.Set`*, contain a period as part of their name. Do not omit the period or replace it with a space. If you do, that particular configuration variable will not be set.*

SET M(n)

Function: Used to assign a value to a specific macro variable numbered ***n***.

Syntax: `SET M(n) = value`
where ***n*** is the next available macro identification number and `value` is any number. If assigning a point number, `value` may be `+` or `-` to find an available number automatically.

Placement: Immediately before, after, or within a ***PROMPT*** statement grouping.

SET POINT

Function: Used to assign the number of the currently occupied point to the first available macro variable, `M(1)`.

Syntax: `SET POINT`

Placement: Should follow the initial configuration `SET` statements, but it ***must come before*** any `PROMPT` statements. The `SET POINT` statement ***may only be used once*** in any macro.

TRACE

Function: Used in macro debugging to pause the macro after each line and wait for a keypress. The macro line, line number, variable, and variable value are displayed at the bottom of the screen during each pause.

Syntax: `SET TRACE = value`
`value` is either `0` for **Off** or `1` for **On**

Placement: Anywhere within the macro, in any quantity.

17.04 SUPPORTED MATH FUNCTIONS

Aside from the standard ***addition***, ***subtraction***, ***multiplication*** and ***division***, Survey 4.0 and **SIMPLE** support 38 additional math functions, scientific notation and two constants: ***pi*** and ***e***. All of these functions are available for use in **SIMPLE** macros, and in Survey 4.0's Command Line Calculator as discussed in Section 3.10.

Utilize the math functions with the CALC command, such as:

```
CALC (Equation)
```

You must be sure that all parenthesis are matched pairs or an error will result in your calculations. Also, while you may have more than one math function (other than +, -, ∗ or /) on a line, we recommend that you have no more than two. This potential limitation is more fully discussed in the **CALC Statement and Stack Space** sub-section of Section 17.05

When entering a formula, capitalization is ignored, except for the "`E`" used for scientific notation. To Survey 4.0, a lower case "`e`" represents the constant (2.718281828), and an upper case "`E`" represents an exponent. Examples of scientific notation include:

`10E+3` and `5E-19`

The list of supported operations follows. Included in the list is a reference example of the correct syntax. For the purposes of the example, we will use macro variables `M(1)` and `M(2)` as the objects of the operator.

Trigonometric Functions

`ARCCOS`	**Function:**	Arc Cosine
	Example:	`CALC ARCCOS(M(1))`
`ARCCOSH`	**Function:**	Arc Hyperbolic Cosine
	Example:	`CALC ARCCOSH(M(1))`
`ARCCOT`	**Function:**	Arc Cotangent
	Example:	`CALC ARCCOT(M(1))`
`ARCCOTH`	**Function:**	Arc Hyperbolic Cotangent
	Example:	`CALC ARCCOTH(M(1))`
`ARCCSC`	**Function:**	Arc Cosecant
	Example:	`CALC ARCCSC(M(1))`
`ARCCSCH`	**Function:**	Arc Hyperbolic Cosecant
	Example:	`CALC ARCCSCH(M(1))`
`ARCTANH`	**Function:**	Arc Hyperbolic Tangent
	Example:	`CALC ARCTANH(M(1))`
`ARCSEC`	**Function:**	Arc Secant
	Example:	`CALC ARCSEC(M(1))`
`ARCSECH`	**Function:**	Arc Hyperbolic Secant
	Example:	`CALC ARCSECH(M(1))`
`ARCSIN`	**Function:**	Arc Sine
	Example:	`CALC ARCSIN(M(1))`
`ARCSINH`	**Function:**	Arc Hyperbolic Sine
	Example:	`CALC ARCSINH(M(1))`

ATN
Function: Arc Tangent
Example: `CALC ATN(M(1))`

COS
Function: Cosine
Example: `CALC COS(M(1))`

COT
Function: Cotangent
Example: `CALC COT(M(1))`

COTH
Function: Hyperbolic Cotangent
Example: `CALC COTH(M(1))`

CSC
Function: Cosecant
Example: `CALC CSC(M(1))`

CSCH
Function: Hyperbolic Cosecant
Example: `CALC CSCH(M(1))`

SEC
Function: Secant
Example: `CALC SEC(M(1))`

SECH
Function: Hyperbolic Secant
Example: `CALC SECH(M(1))`

SIN
Function: Sine
Example: `CALC SIN(M(1))`

SINH
Function: Hyperbolic Sine
Example: `CALC SINH(M(1))`

TAN
Function: Tangent
Example: `CALC TAN(M(1))`

TANH
Function: Hyperbolic Tangent
Example: `CALC TANH(M(1))`

Logarithmic Functions

CLG
Function: Common Log (base 10)
Example: `CALC CLG(M(1))`

EXP
Function: Exp (or e^x)
Example: `CALC EXP(M(1))`

LOG
Function: Natural Log (base e)
Example: `CALC LOG(M(1))`

Logic Functions

AND

Function: Logical AND
Example: IF (*exp1*) AND (*exp2*)
Where: *exp1* and *exp2* are expressions

NOT

Function: Logical NOT
Example: CALC NOT(M(1))

OR

Function: Logical OR
Example: IF (*exp1*) OR (*exp2*)
Where: *exp1* and *exp2* are expressions

>

Function: Greater Than
Example: IF (M(1))>(M(2))

<

Function: Less Than
Example: IF (M(1))<(M(2))

=

Function: Equal To
Example: IF (M(1))=(M(2))

NOT ALLOWED

The three functions that follow do not have supported operators. They are presented here with examples illustrating the correct syntax for substitution of these operations.

Function: Not Equal To
Example: IF (M(1))<(M(2))OR(M(1))>(M(2))

Function: Less Than OR Equal To
Example: IF (M(1))<(M(2))OR(M(1))=(M(2))

Function: Greater Than OR Equal To
Example: IF (M(1))>(M(2))OR(M(1))=(M(2))

Conversion Functions

DEG

Function: Radians to Decimal Degrees
Example: CALC DEG(M(1))

DMR

Function: D.MMSS to Radians
Example: CALC DMR(M(1))

DMS

Function: Radians to D.MMSS
Example: CALC DMS(M(1))

GRD

Function: Radians to Grads
Example: CALC GRD(M(1))

`RAD`
Function: Decimal Degrees to Radians
Example: `CALC RAD(M(1))`

`RDG`
Function: Grads to Radians
Example: `CALC RDG(M(1))`

SUBSTITUTES

The two functions that follow do not have supported operators. They are presented here with examples illustrating the correct syntax for substitution of these operations.

Function: Convert decimal degrees to D.MMSS
Example: `CALC DMS(RAD(M(1)))`

Function: Convert D.MMSS to decimal degrees
Example: `CALC DEG(DMR(M(1)))`

Other Math Functions

`+`
Function: Addition
Example: `CALC (M(1)+M(2))`

`-`
Function: Subtraction
Example: `CALC (M(1)-M(2))`

`*`
Function: Multiplication
Example: `CALC (M(1)*M(2))`

`/`
Function: Division
Example: `CALC (M(1)/M(2))`

`\`
Function: Integer Division
Example: `CALC (M(1)\M(2))`

`^`
Function: Exponent
Example: `CALC (M(1)^M(2))`

`!`
Function: Factorial
Example: `CALC (M(1)!)`

`ABS`
Function: Absolute Value
Example: `CALC ABS(M(1))`

`INT`
Function: Integer
Example: `CALC INT(M(1))`

`SQR`
Function: Square Root
Example: `CALC SQR(M(1))`

17.05 TIPS FOR WRITING & EDITING MACROS

You may use any text editor or word processor to write your macro programs, with one condition: The text editor you use, must be capable of saving your file in an unformatted ASCII text file. Any word processing format codes within your macro will cause it to fail. We suggest using the ***S4-Edit*** program that comes with Survey 4.0. Since S4-Edit may be called from within Survey 4.0, you may find this program to be the most convenient to use while writing, editing, debugging and running your macros. Please refer to Section 16 for specific instructions on the use of S4-Edit.

Case Sensitivity and Spaces

SIMPLE macros are case insensitive. There is no distinction made between lower case letters and upper case letters, with one exception. When entering a `CALC` formula, capitalization is ignored, except for the "`E`" used for scientific notation. To Survey 4.0, a lower case "`e`" represents the constant, (2.718281828...), and an upper case "`E`" represents an exponent. Capitalization is retained as entered in both `PROMPT` statements and point name entry.

Spaces within **SIMPLE** commands are optional. There is no difference between the commands `Count=1` or `Count = 1`. However, `C ou nt = 1` is not allowed, since the spaces occur within a command.

Line Numbers & Labels

SIMPLE macros do not use line numbers, but ***may*** use labels. Yet in the earlier discussions of the `PAUSE`, `TRACE` and `DEBUG` statements, this manual clearly states that line numbers are given by these statements. So what's the difference?

Labels are names that you give to sections of your code. These names may be used by `GOTO` statements for branching, or for the purpose of identifying a section of your code. However, we do not recommend that you do the latter. You will find it far less troublesome if you use comments to identify code sections instead of using labels.

Line numbers are never placed into a macro file, but instead are internally maintained when your macro is being played back. The function of a line number is to assist you in debugging your macro, by telling you in what line your error is occurring. Line numbers count every line, including comment lines and blank lines.

When you print out a macro, you will not receive line number references, so how do you see them without having to count them manually? S4-Edit to the rescue! When you use S4-Edit to write and edit your macros, look to the lower left corner of the S4-Edit window. You will see two numbers there. The first number is the line number of the cursor location and the second number is the column of the cursor location. To see a particular numbered line, use ↑ and ↓ to scroll through the file until you reach it.

Using Comments and Indentation

We strongly suggest the liberal use of comments and indentation. While your overall macro file size will be larger, the readability that these elements will add to your file may prove invaluable when you debug your macros, or when you wish to make changes at a later date. It is always easier to document what you do as you do it instead of trying to figure it all out later.

Indentation simply allows you to follow the flow of your macro a little easier. For example, look at the following un-indented code.

```
IF (M(8)>0) AND (M(6)>0)
12
CALC M(6)/M(8)
5
CALC 2*M(8)*SIN(M(12)/2)
7
CALC M(8)*TAN(M(12)/2)
END IF
IF (M(8)>0) AND (M(7)>0)
12
CALC ((ATN(M(7)/M(8)))*2)
5
CALC (2*M(8))*(SIN(M(12)/2))
6
CALC M(8)*M(12)
END IF
```

Now look at the same code punctuated with indentation and spacing.

```
IF (M(8)>0) AND (M(6)>0)
    12
    CALC M(6)/M(8)
    5
    CALC 2*M(8)*SIN(M(12)/2)
    7
    CALC M(8)*TAN(M(12)/2)
END IF

IF (M(8)>0) AND (M(7)>0)
    12
    CALC ((ATN(M(7)/M(8)))*2)
    5
    CALC (2*M(8))*(SIN(M(12)/2))
    6
    CALC M(8)*M(12)
END IF
```

In the second code section, it is much easier to see that this code actually contains two distinct pieces of the macro, and that each of these pieces is controlled by a conditional statement.

Fast Temporary Points

Often, your macros will need to use temporary points to complete their solutions. Rather than prompting for and entering point numbers, let the `SET M(n)` statement do the work for you. Using `SET M(n) = +` or `SET M(n) = -` automatically instructs Survey 4.0 to search forward or backward for the first available point number. This saves you from having to assign a number, and prevents you from accidentally assigning the number of a point that is already occupied. This is particularly important because when a macro program runs, you may not have the point overwrite protection in place and your data can be overwritten.

Using the HIDE.DISPLAY Parameter

`Hide.Display` provides a method of hiding portions of your computations during a macro playback. The command `SET Hide.Display = 1`, disables both the display and printout of anything until the macro reaches a cancelling command of `SET Hide.Display = 0`. But why would you want to do this?

Sometimes, you may want to hide intermediate calculations to clean up a printout. For example, consider **TanPC.Mac**, used to inscribe a tangent arc from the PC. The macro begins at the arc PC. To solve the problem, the macro uses the **Side Shot** routine (**SS** - Section 6.12) to set the arc's PT and center point, and then uses the **Inverse Curve** routine (**IC** - Section 7.01) to print out the curve data. To streamline the printout, `Hide.Display` is turned **On** to block out the side shot computations, and then turned **Off** to allow the curve data printout. The use of `Hide.Display` is strictly a matter of personal preference.

The CALC Statement and Stack Space

Section 17.04 stated that while you may have more than one math function on a line, we recommend that you have no more than two. The reason is ***stack space***. The stack is an area of memory that is used to hold internal program addresses and intermediate data calculations, and the `CALC` statement produces a large amount of intermediate values while computing your equations. Sometimes, if not enough stack space is available to handle a complex `CALC` statement, the stack loses or corrupts some of its contents, resulting in incorrect values being returned from your `CALC` statements.

To keep a lack of stack space from affecting your macros, limit your `CALC` statements to two math functions per line. This might mean that you have to break up equations into smaller lines, but it will also keep you from pulling out all of your hair as you try to debug your macros. For example, you can easily see that the following equation contains four math functions: `ARCSIN`, `/`, `/` and `*`. What you don't see is that internally the `ARCSIN` function has several functions of its own.

```
12
CALC ARCSIN((M(5)/2)/M(8)) * 2
```

While the equation above is certainly valid, with the result being stored in macro variable `M(12)`, limited stack space may prevent Survey 4.0 from always computing the correct value. On the other hand, if we split the equation into three parts, such as:

```
12
CALC (M(5)/2)/M(8)
12
CALC ARCSIN(M(12))
12
CALC M(12) * 2
```

we have drastically reduced the number of functions per line and the result stored in macro variable **M(12)** will be correct. Notice also how we have reused macro variable **M(12)** in the last two equations, thus preserving variable space.

If your macro doesn't correctly compute the intended solution, and you are sure that your procedures and equations are correct, use **TRACE** to view the macro variables along the way. If a value shows up as **0** when it should hold some other value, even if the value previously computed correctly, you probably have a stack space error. To resolve the error, break the equation into two or more equations. A good example of this type of programming is contained in the macro **NonTanPC.Mac**.

17.06 RUNNING A MACRO

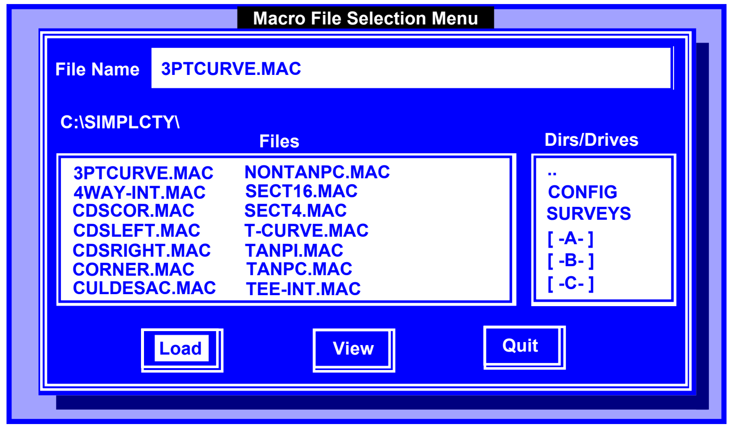
The macros included with Survey 4.0 are included within the menu structure of the program. However, the macros you write, or add to the program from a ***Simplicity Macro Pak***™, cannot be added to the menus. So how do you run a macro? Macros may be selected from a menu that is accessed from **Select Routine** by typing **RM**, the command for **Run Macro File** (Section 12.05).

The Macro Selection Menu

The selection menu speeds up the macro selection process. The macro selection screen, shown in Figure 17-1, consists of seven elements: three windows, a directory information line and three instruction keys. The windows are: the **File Name** bar; the **Files** selection window; and the **Directory/Drives** window. The three instruction keys are: **Load**; **View** and **Quit**. The directory information line is located just below the filename and is the only element of the file selection menu that is not user accessible. Use your mouse or [Tab] key to move thru the windows and keys. When inside a window, move between items and columns with your [↑], [↓], [←], and [→] arrow keys or your mouse or [Space Bar].

The File Name Bar

The **File Name** bar is a one line entry field that accepts the name of the macro you wish to run. To run a macro, type in the name of the macro, with or without the **MAC** extension and press [Enter]. The cursor will highlight the **Load** key. Press [Enter] again to load and run the macro. If you are using a mouse, move the pointer into the **Files** window. Now point to the macro that you want to run and double click the left mouse button.



The Macro Selection Menu: Figure 17-1

The Files Window

Press [Tab] until the cursor is located in the **Files** window. Using your [←], [→], [↑], [↓] or [Space Bar], move the highlight bar to the file you want to select and press [Enter]. If there are more files present in the directory than the **Files** window can show at one time, you may scroll through the files by pressing [Page Up], [Page Dn], [Home], and [End]. The **Load** button will become highlighted. Press [Enter] again to load and run the macro.

If you are using a mouse, simply point to the desired macro and click the left button twice to load the job.

The Dir./Drives Window

If you need to change disk drives or directories in order to find your macro, press [Tab] until the cursor is located in the **Dir./ Drives** window. Using your [↑], [↓] or [Space Bar], move the highlight bar to the drive or directory you want to select and press [Enter]. The new drive and directory will be displayed on the directory information line and the cursor will move to the **File Name** bar.

If you are using a mouse, simply point to the desired drive or directory and click the left button twice. The new drive and directory will be displayed on the directory information line and the cursor will move to the **File Name** bar.

Selecting the double dot entry, **. .**, at the top of the list, will allow you to back out of your current directory path, one level at a time. For example, if you are in the **C:\Simplcty\Surveys\Farms** directory, selecting **. .** takes you to **C:\Simplcty\Surveys**. Another **. .** takes you to **C:\Simplcty** and a third **. .** to **C:**.

The Load Button

Pressing Enter whenever the **Load** button is highlighted will load and start the macro shown in the **File Name** window. If you do not want to load the macro, use your mouse or Tab key to move the cursor to a new location. You can load the highlighted macro at any time by pressing Alt L.

The View Button

Pressing Enter whenever the **View** button is highlighted will load the macro file into the S4-Edit window. When you are done viewing the file, you will be returned to **Select Routine**. You can view the highlighted macro at any time by pressing Alt V.

The Quit Button

Pressing Enter whenever the **Quit** button is highlighted will exit this routine and return you to **Select Routine**. You can exit this routine at any time by pressing Alt Q. Pressing Esc at any time will also exit the routine.

17.07 WHEN IT DOESN'T WORK

So your macro doesn't quite run correctly...Now what? **SIMPLE** is not a sophisticated programming language, but it does offer some debugging help in the form of the `TRACE`, `DEBUG` and `PAUSE` routines. These routines can help you track down problems in specific lines.

TRACE

`Trace` is used in macro debugging to pause the macro after each line and wait for a keypress. The macro line, line number, variable, and variable value are displayed at the bottom of the screen during each pause, allowing you to check any calculations that occur at any particular line.

Activate `Trace` by placing the following line into your macro:

```
SET Trace = 1
```

You may deactivate `Trace` in much the same way by placing the following line into your macro:

```
SET Trace = 0
```

The **`Trace`** command may be placed anywhere within the macro in any quantity, and it affects only those lines that follow the command.

DEBUG

`Debug` is used in macro debugging to print every macro line, line number, variable, and variable value as each line is processed, allowing you to check any calculations that occur at any particular line.

Activate **`Debug`** by placing the following line into your macro:

```
SET Debug = 1
```

You may deactivate **`Debug`** in much the same way by placing the following line into your macro:

```
SET Debug = 0
```

The **`Debug`** command may be placed anywhere within the macro in any quantity, and it affects only those lines that follow the command.

PAUSE

When inserted into a macro, the **`Pause`** command temporarily stops the macro operation until you press any key to continue. Only the line number of the **`Pause`** statement is shown at the bottom of the screen while the macro is paused.

KEYSTROKE FILE NOTE
Of the three functions **`Pause`**, **`Trace`** *and* **`Debug`**, *only the* **`Pause`** *statement may be inserted into a keystroke file.* **`Trace`** *and* **`Debug`** *are* ***SIMPLE*** *macro commands only.*

The CALC Statement and Parenthesis

If your macro encounters an error while processing a **`CALC`** statement, there is a good chance that you have a mis-matched parenthesis. In other words, the number of right parenthesis do not match the number of left parenthesis. ***Matched pairs are critical.***

Stack Space (again)

If your macro still doesn't correctly compute the intended solution, and you are sure that your procedures and equations are correct, use **`Trace`** to view the macro variables along the way. If a value shows up as **`0`** when it should hold some other value, even if the value previously computed correctly, you probably have a stack space error. See **The CALC Statement and Stack Space** sub-section of Section 17.05 for more information.

We Can Help

If, no matter what you try, your macro still doesn't run, we can probably help you. First, call us. We may already be working on a similar macro, or the macro may already be contained in a Macro Pak. If your macro isn't available, we will tell you to place a copy of your macro code onto a floppy disk and place the disk into a floppy disk mailer. Place your name and address on the mailer in the **To:** area, along with sufficient postage. This mailer will be used to return your macro disk to you.

Place the mailer into a larger envelope. Include a letter telling us what the macro is designed to do, along with a copy of any supporting formulas and documentation. Make sure that your name, address and phone number appear somewhere in your letter to us, and even include a convenient time of day for us to contact you if we need to. If you have a fax number, include that as well.

Now for the important stuff, the cost. If we can't fix your macro, there is no charge. If we can fix your macro, it gets a little more complicated. If the macro you have submitted is already contained in a Simplicity Macro Pak, we will not attempt to fix it. You will be notified that the macro is available, and you may purchase the appropriate Macro Pak to obtain it.

If your macro truly does not exist, there are two possible scenarios. First, if we think the macro has Macro Pak value, we will ask (in writing) for the rights to the macro code. If you grant us those rights (in writing), we will fix the macro and send you a copy. You will also receive a free Macro Pak of your choice. Second, if you choose not to grant us the rights to the macro, we will either not fix it, or we will fix it for a fee of $50/hour (US). The choice will be yours.

17.08 A MACRO EXAMPLE

To help you better understand the steps involved in the construction of a macro, we will use this section to develop a macro program to solve the following problem:

Problem: Design a macro to break down a section of land into four quarters, and compute the coordinates of the center of the section. Include provisions for skipping the calculation of quarter-corners that are already known. Begin with the assumption that at least the four section corners, points 1, 2, 3 and 4, are known. Also assume that the section is an interior section, not lying on the northern or western tier of the township.

FIRST THINGS FIRST

Please do not attempt to work through this macro until you have become familiar with the Survey 4.0 routines.

Developing the Solution

To locate a quarter corner from two known section corners, you simply split the line lying between the two corners. Splitting a line is as easy as inversing between the two points to establish a distance and bearing, then traversing back along the same course, **0AR**), exactly one-half the original distance, (**L/2**). Of course, you could also set the point by traversing on a recalled bearing, (**Rp1,p2**), for a distance equal to one half the recalled distance, (**Rp1,p2/2**), right? ***WRONG!*** While those keystrokes will work fine from the keyboard, macro code cannot include operators on recalled values.

To find the center of the section, we must find the point of intersection of the line between the North and South 1/4 Corners and the line between the East and West 1/4 Corners.

Using a Keystroke File as a Model

Perhaps the easiest way to attack the creation of a macro is by creating a keystroke file that solves the problem. Start Survey 4.0 and open up a new data file named **SECTION** on a floppy disk in drive **A:** by typing **A:\Section** Enter at the **Filename** prompt. At **Select Routine**, type **EA** to enter and assign these points:

Point	Description	Northing	Easting	Elevation
1	NE Section Corner	10000.00000	20000.00000	0.000
2	SE Section Corner	4230.00000	20020.00000	0.000
3	SW Section Corner	4220.00000	14710.00000	0.000
4	NW Section Corner	10015.00000	14695.00000	0.000

The actual point coordinates have nothing to do with the macro we are developing. However, we need to have four defined points in memory to develop the solution.

Now, type in **SK** ↵Enter to start a new keystroke file, and solve the problem by following the keystrokes outlined below. Comments are included to assist you. Let's start at the NE corner, point 1. Names output is **On**, and we are starting at **Select Routine**.

To compute the East 1/4 Corner:

ST	Start at
1 ↵Enter	point 1
IN	Inverse to
2 ↵Enter	point 2
TR ↵Enter	Traverse to
5 ↵Enter	point 5
East 1/4 Corner ↵Enter	Name for point 5
0AR ↵Enter	0° angle right to retrace path
L/2 ↵Enter	Last distance divided by 2

To compute the South 1/4 Corner:

ST ↵Enter	Start at
2 ↵Enter	point 2
IN	Inverse to
3 ↵Enter	point 3
TR ↵Enter	Traverse to
6 ↵Enter	point 6
South 1/4 Corner ↵Enter	Name for point 6
0AR ↵Enter	0° angle right to retrace path
L/2 ↵Enter	Last distance divided by 2

To compute the West 1/4 Corner:

ST ↵Enter	Start at
3 ↵Enter	point 3
IN	Inverse to
4 ↵Enter	point 4
TR ↵Enter	Traverse to
7 ↵Enter	point 7
West 1/4 Corner ↵Enter	Name for point 7
0AR ↵Enter	0° angle right to retrace path
L/2 ↵Enter	Last distance divided by 2

To compute the North 1/4 Corner:

ST [Enter]	Start at
4 [Enter]	point 4
IN	Inverse to
1 [Enter]	point 1
TR [Enter]	Traverse to
8 [Enter]	point 8
North 1/4 Corner [Enter]	Name for point 8
0AR [Enter]	0° angle right to retrace path
L/2 [Enter]	Last distance divided by 2

To compute the Center of Section:

BB	Bng-Bng intersection from 8
9 [Enter]	thru point 9
Center of Section [Enter]	Name for point 9
5 [Enter]	to point 5 (East 1/4 cor.)
R [Enter]	Recall the bearing
8 [Enter]	from point 8 (North 1/4 cor.)
6 [Enter]	to point 6 (South 1/4 cor.)
R [Enter]	Recall the bearing
7 [Enter]	from point 7 (West 1/4 cor.)
5 [Enter]	to point 5 (East 1/4 cor.)
SK	Shut off Keystroke Recording

And the problem is complete! Now, lets use the **Dos Shell** routine (**DS** - Section 11.15) to rename the keystroke file so we don't accidentally overwrite it with another keystroke file. Type **DS** at **Select Routine**. When the **Dos Shell** prompt appears, enter the following line:

REN A:\SECTION.KEY SECTION.MAC [Enter]

The line above uses the DOS **REN**ame command to change the name of our file from one that has a **KEY**stroke extension to one that has a **MAC**ro extension. Now type **EF** for **E**dit **F**ile at **Select Routine**. When the **Filename** prompt appears, type **A:\Section.Mac** [Enter]. The S4-Edit window will open and reveal your keystroke file so that we may turn it into a macro.

The Comment Lines

When you view the keystroke file, you will notice the initial comment lines. These can stay in our macro file just the way they are, or you may change or delete them.

The SET Lines

The next grouping of statements are the **SET** statements. These statements recorded the configuration of your computer at the time the macro was recorded. For this example, we will leave these lines just as they are.

Compacting the Code

Moving past the **SET** statements, we enter the keystroke section. This section contains several lines that are not necessary to our macro. To save some space, we can compact our code. Compacting the code simply means removing the lines that we don't need, specifically, the **'<-- NEW LEG** lines. Move the cursor to the beginning of each of these lines and press Ctrl Y to delete the line.

Substituting Variables

Macros work with variables in the form of **M(*n*)** where ***n*** is an identifying number. In the substitution process, we will replace items such as point numbers, angles, distances, etc., with variable representations. We do this because our macro must work with *any* values we want to use, and not with just the values we used to record the keystroke file.

In our example, all we need to replace are the point number values. The point numbers we entered may be identified in the keystroke file by the presence of an asterisk after each number. What we need to do is replace the numbers with variables, and the easiest way to do this is to replace all **1***'s with an **M(1)**, all **2***'s with an **M(2)**, and so on. Do that now. The first few lines of the keystroke section are shown below, in "Before Substitution" and "After Substitution" form.

Before Substitution	After Substitution
ST	ST
1*	M(1)
IN	IN
2*	M(2)
TR	TR
5*	M(5)
East 1/4 Corner	East 1/4 Corner
0AR	0AR
L/2	L/2

Adding Comments as Section Labels

To make it easier to follow our macro, we'll use comment lines to identify the various sections. Each section begins with the **Start** command, **ST**. Move your cursor down to the beginning of the first **ST** and press [Enter] [Enter] to insert two blank lines before the **ST**. Press [↑] to move up to the last blank line. Now type in **'Compute the East 1/4 Corner**. Do not press [Enter] or you will add another blank line after the comment. Repeat this procedure at each of the next three **ST** codes for the South, West and North 1/4 corners respectively.

Now move your cursor down to the beginning of the **BB** command and press [Enter] [Enter] to insert two blank lines before the **BB**. Press [↑] to move up to the last blank line. Now type in **'Compute the Center of the Section**. Do not press [Enter] or you will add another blank line after the comment.

Adding the Prompts

At this point, the computational portion of the work is complete. What we need now is a method of introducing data into the problem. This is done by adding **PROMPT** statements.

Place the cursor on the line below the **SET** statements and press [Enter] to give us some room to add the prompts. We will need prompts for all of the point numbers, known and unknown, and we need to take them in the order that they are used in the problem. The points that we need, in order, are: the Northeast Section Corner; the Southeast Section Corner; the Southwest Section Corner; the Northwest Section Corner; the East 1/4 Corner; the South 1/4 Corner; the West 1/4 Corner; the North 1/4 Corner; and the Center of the Section. So, add the following **PROMPT** statements to your macro, pressing [Enter] after each line.

```
PROMPT Enter the NE Section Corner     'M(1)
PROMPT Enter the SE Section Corner     'M(2)
PROMPT Enter the SW Section Corner     'M(3)
PROMPT Enter the NW Section Corner     'M(4)
PROMPT Enter the East 1/4 Corner       'M(5)
PROMPT Enter the South 1/4 Corner      'M(6)
PROMPT Enter the West 1/4 Corner       'M(7)
PROMPT Enter the North 1/4 Corner      'M(8)
PROMPT Enter the Center of the Section 'M(9)
```

Counting the Variables

Take a moment to notice the comments that we placed at the end of each of the prompt lines above. These comments, in the form of macro variables, serve two purposes. First and foremost, they help us keep track of what value is assigned to what variable. For this reason alone, we strongly recommend that you include comments of this type whenever you have a **PROMPT** or **CALC** statement that assigns a value to a variable. Less important is the assistance that such comments give us when we need to count the variables. *These comments **do not** assign the variable number. They are just identifying comments. The variable number is assigned by the order of the **PROMPT** statements.*

In this macro, we prompt for all of the variables that we need, since the solution does not require any temporary points. The final prompt is commented with '**M(9)**, indicating that we will need the **COUNT** statement to set aside space for 9 variables.

To add the **COUNT** statement, place the cursor on the first **SET** statement and press Enter. Now type:

COUNT = 9 Enter

A Perfect ENDing

At this point your macro is fully functional, but it still needs an **END** statement. Even though we didn't change any configuration settings this time, you may do so at some other time, and **END** is the only way to tell Survey 4.0 to reset them. Move the cursor to one line below the end of the file and type **END** Enter.

Adding Conditionals

You now have a macro that will split a section into quarters when given four known section corners. But what about those times when you may already know some of the quarter corner locations? How can you hold those values?

Conditional statements allow you to set up tests within your macros. If certain conditions are met, certain lines of macro code are processed. When conditions are not met, the lines contained within the conditional section are skipped.

To solve the problem of how to hold known quarter corner points, we would normally just check the point for coordinates. But **SIMPLE** is not sophisticated enough to extract the coordinates of a variable point and test them. So, we have to rely on the user to identify the held points. How? Perhaps if we require the numbers of held points to be preceded by a decimal point, we can make it work. Our conditional statement must test the point number to see that it is greater than 0 but less than 1. For the East 1/4 Corner, point **M(5)**, the conditional statement looks like this:

IF (M(5)>0) AND (M(5)<1)

Add similar conditional statements to each section of macro code that computes a new point. For example, place the cursor at the beginning of the line immediately under the comment **'Compute the East 1/4 Corner** and press Enter ↑. Now type:

IF (M(5)>0) AND (M(5)<1)

Because each conditional **IF** statement needs an **END IF** statement, move the cursor about ten lines down to the line immediately under the **L/2** and type:

END IF Enter

For better readability, indent the lines between the **IF** and **END IF** lines by placing the cursor at the beginning of each line and pressing Space Bar three times. Repeat the process of adding conditionals for each section, replacing the **M(5)** variables with **M(6)**, **M(7)**, **M(8)** and **M(9)** as necessary.

You're done! Except for some **SET *configuration*** statements that may differ from those shown below, your completed macro should look like this:

```
'SURVEY 4-920804-4
'WRITING FILE:  A:\SECTION.KEY
'Date: 08-07-1992     Time: 2:30 PM
'--------------------------------------------

COUNT = 9

SET Audio = 0
SET AutoNum = 0
SET CR.Correct = 0
SET Record.Keys = 2
SET Echo = 0
SET Names.Out = 0
SET Overwrite = 1
SET Printer = 0
```

```
SET SL.Correct = 0
SET Slope.Prompt = 0
SET Slope.Type = 1
SET Hide.Display = 0
SET Angle.Format = 2
SET Angle.Type = 1
SET Azimuths = 1
SET Angle.Default = 0
SET Azimuth.Type = 1
SET Metric = 1

PROMPT Enter the NE Section Corner     'M(1)
PROMPT Enter the SE Section Corner     'M(2)
PROMPT Enter the SW Section Corner     'M(3)
PROMPT Enter the NW Section Corner     'M(4)
PROMPT Enter the East 1/4 Corner       'M(5)
PROMPT Enter the South 1/4 Corner      'M(6)
PROMPT Enter the West 1/4 Corner       'M(7)
PROMPT Enter the North 1/4 Corner      'M(8)
PROMPT Enter the Center of the Section 'M(9)


'Compute the East 1/4 Corner
IF (M(5)>0) AND (M(5)<1)
   ST
   M(1)
   IN
   M(2)
   TR
   M(5)
   East 1/4 Corner
   0AR
   L/2
END IF
```

```
'Compute the South 1/4 Corner
IF (M(6)>0) AND (M(6)<1)
   ST
   M(2)
   IN
   M(3)
   TR
   M(6)
   South 1/4 Corner
   0AR
   L/2
END IF

'Compute the West 1/4 Corner
IF (M(7)>0) AND (M(7)<1)
   ST
   M(3)
   IN
   M(4)
   TR
   M(7)
   West 1/4 Corner
   0AR
   L/2
END IF

'Compute the North 1/4 Corner
IF (M(8)>0) AND (M(8)<1)
   ST
   M(4)
   IN
   M(1)
   TR
   M(8)
   North 1/4 Corner
   0AR
   L/2
END IF
```

```
'Compute the Center of the Section
IF (M(9)>0) AND (M(9)<1)
   BB
   M(9)
   Center of Section
   M(5)
   R
   M(8)
   M(6)
   R
   M(7)
   M(5)
END IF

END
```

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Section 18
Getting Support

18.01
HELP!

Simplicity Systems, Inc., provides support free of charge (but ***not*** toll-free) for 90 days from date of purchase, provided the user has returned a signed software registration form.

Experience demonstrates that well over 80% of the support calls we receive could be avoided if the caller would first look in the manual. Many long hours have gone into the preparation of this manual in an effort to provide all of the information necessary to the operation of this program. So please try the manual, especially Appendix D, before you call.

Telephone support is available **ONLY** at the following numbers:

Voice: **1-218-773-7966**
Fax: **1-218-773-3849**

Support hours are 8:00am to 5:00pm (Central time), Monday through Friday, exclusive of holidays. If all incoming support lines are busy, your call will be answered by our answering service and you will be given an option to leave your name and number, or you may wish to simply try your call again later. Messages on the answering service will be returned *collect*, in the order they are received with the exception that customers on an Unlimited Support Plan will always be given top priority.

If at all possible, please be at your computer when you call for support. This way a support technician will be able to step you through the procedure in question, which will save you the frustration of trying to remember our instructions at a later time. It will also be helpful for the technician to know the exact procedural steps you were following when you encountered the problem. Keystroke files, hard copy printouts and DOC files are especially helpful for this. Remember, keystroke and DOC files can be printed by running the ***S4-Edit*** program stand-alone from your DOS prompt. (See Section 16.07)

If your problem in any way involves a macro, please read Section 18.04 ***before*** you call for support.

If your question or problem does not require an immediate answer, please write down your problem and mail or fax it to the Simplicity technical support department including printouts, data disks, etc. Include your program serial number, your phone and fax numbers, and the hours/days you may be available. A support technician will solve your problem and provide you with the solution by mail, fax, or telephone.

You are encouraged to become as familiar with the operation of your computer as possible. When helping you, we will often ask you to perform certain DOS commands such as Directory (***DIR***), Change Directory (***CD*** \), Check Directory (***CD***), Type files (***TYPE***), Rename files (***REN***), Copy files (***COPY***), Delete files (***DEL***) and Check Disk (***CHKDSK***). It is to your advantage to be familiar with these commands before you call.

If you are having a problem such as constant input/output (I/O) errors, etc., chances are good that the problem is hardware or media related. Please contact your hardware dealer first.

18.02 SUPPORT PLANS

The subject of charging a fee for technical support is a controversial subject across the software industry. However, when you compare the initial product cost, it appears that many of the companies that do *not* charge for technical support have actually built a prepaid support charge into the price of their software package. If you are like most people, you don't want to pay for something that you may never use.

At Simplicity, we pride ourselves on dependable, practical, and perhaps best of all, *affordable* software solutions. We have not "built-in" a prepaid support charge into the price of our software. You get a great program with well-written documentation and up to 90 days of free support. We do not charge you "up front" for software support that you may never need.

After the initial 90 days of free support, users who feel they will need additional help are encouraged to subscribe to one of our support plans. A technical support order form was enclosed with the shipment of this program. Please refer to this form for prices and updated information on the following support plans.

NOTE
Customers who do not subscribe to a support plan will be automatically transferred to the Basic Service when their 90 days of free support has expired.

One Year Unlimited

The One Year Unlimited Support Plan provides ***unlimited, priority*** telephone and facsimile support on all Simplicity software for one year. Disk revisions are free and automatic during the one year subscription.

Six Month Unlimited

The Six Month Unlimited Support Plan provides ***unlimited, priority*** telephone and facsimile support on all Simplicity software for six months. Disk revisions are free and automatic during the six month subscription.

One Year Limited

The One Year Limited Support Plan provides a maximum of ***two hours*** of non-priority telephone support on all Simplicity software within one year. Disk revisions are available for a nominal fee.

Basic Service

The Basic Service Support Plan provides non-priority telephone support for all Simplicity software on a ***$1.00 per minute*** basis with a ***$15.00 minimum per call***. This plan is designed for the user who rarely needs support and can use a Visa or MasterCard for the billing. Disk revisions are available for a nominal fee with the return of your original diskettes.

Disk Revision Service

The Disk Revision Service provides you with ***automatic*** quarterly software revisions to keep you up-to-date with the latest release(s). This service only covers software that is written by Simplicity Systems, Inc. ***Software upgrades (see Section 18.03) are not included.***

18.03
UPDATES & UPGRADES

It is Simplicity's policy to regularly maintain and update our software programs. Occasionally, (approximately once each quarter), Survey 4.0 may undergo *slight* changes such as minor enhancements, bug fixes, etc. which we refer to as software ***revisions*** or ***updates***.

These changes may or may not result in a change of the internal version number of this program. For example, the first ***update/revision*** of Survey 4.0 after its initial release will most likely be referred to as Survey 4.01. The next revision/update would most likely be Survey 4.02, etc. These changes are available either for a nominal fee or at no charge by subscribing to one of the Unlimited support plans or the Disk Revision Service as explained in Section 18.02.

Much less frequently, this program may undergo *major* changes such as the addition of new routines, etc., which may or may not require the addition of a manual addendum. These changes will always result in the change of the version number. For example, the first ***upgrade*** of Survey 4.0 will most likely be referred to as Survey 4.1, or possibly Survey 4.5, depending on the magnitude of the changes. These changes are available for a fee corresponding to the changes that have been made.

Whether you choose to update and/or upgrade this program is strictly optional. Depending on the changes that have been made during each release, you may choose to purchase every update, or you may choose to "skip" any update and purchase the next one when the changes may be more substantial. Either way, the choice is *yours*.

18.04
WRITING MACROS

One of the actual macros utilized in Survey 4.0 is described in detail in Section 17. This example should help to give you a feeling for some of the things that can be accomplished with **SIMPLE**, (**S**implicity's **I**ntegrated **M**acro **P**rogramming **L**anguage **E**xtension). This example should also be used for detailed help when writing and debugging your own macros.

Technical support for **SIMPLE** will be limited to questions on the structure and usage of the available commands. Because of the many ways that macros can be used, and the amount of time possibly required to debug any problems, we require that a copy of your macro, on a floppy disk, be mailed to us along with an explanation of the problem. As time allows, and at our discretion, we *may* help to debug a macro, but only if a copy of the macro has been mailed to us (a copy sent to us on disk is required). ***Please do not expect us to support or debug a macro of which we do not have a copy***. See Section 17 for more information.

The regular technical support fees apply to the macro programming language. We cannot write your macro for you during a support call, however, at your request, we will provide a custom macro development service to write (or re-write) a macro to your specifications. (There *is* a fee required for this service, payable in advance.) If you are interested in this service, please fax or mail a detailed description of the macro you would like and we will provide a quote.

18.05 MACRO PAKS

Simplicity Macro Paks™ are collections of macro programs that run inside Survey 4.0. Macro Paks are *not* upgrades, but are additional program "mini-modules" that you may choose to add to Survey 4.0. Each pak contains six to ten macros that have been developed by Simplicity Systems or by one or more of our customers. Contact our technical support office for pricing and availability.

Get a Free One!

Users are encouraged to submit their macros for possible inclusion in a Simplicity Macro Pak. If we decide to include your macro in one of our Macro Paks, you will get your choice of one Macro Pak *free of charge*. The free offer is available only for an actual working macro that you submit, not for *ideas.* Naturally, you would not receive a free Macro Pak if the macro you submit is already included in one of our paks or if a similar macro has already been submitted by another user. There is a limit of one free Macro Pak per registered site.

To submit your macro, send it to us on a floppy disk along with a hard copy printout of the macro and a brief explanation of what the macro does. We reserve the right to modify any macro before including it in a Macro Pak.

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Survey 4.0
Simplicity Surveying Series

Section 19
Examples

19.01
PURPOSE

The three examples presented in this section will acquaint you with features of Survey 4.0 that are shared among most procedures. They are intended only to demonstrate procedures performed in Survey 4.0, and are not intended to demonstrate the most efficient means for solving surveying problems. The knowledge and familiarity you will gain by working through these examples should enable you to easily manipulate all of the Survey 4.0 routines.

Each example is accompanied by an illustration indicating the point numbering and known data used in the problem. In actual practice, you might assign point numbers and develop a drawing layout as you work, or you might have a hand drawn sketch similar to the illustration provided.

The examples illustrate the following routines: Point Names Output Toggle (NO); Enter & Assign (EA); Go To Point (GT); Start At (ST); Inverse (IN); Traverse (TR); Traverse Closure & Adjustment (TC); Enter Backsight Bearing (EB); Side Shot (SS); Measure Angle (MA); Distance-Distance Intersection (DD); Bearing-Bearing Intersection (BB); Traverse Arc (TA); Offset Intersection (OI); Offset (OS); Tee Intersection Macro (I3); Cul-de-Sac Macro (C1); Radial Stake Out (RS); Inverse Obtuse Curve (OC); Area Printout (AR); Point to Point Area Printout (PA); Define Figure (DF); List Coordinates (LC); Recall Bearing & Distance; and System Exit (SY).

19.02
THE EXAMPLES

Example 1 illustrates the closure and balancing of a ***closed traverse***, including: error correction; angle balancing; Compass Rule adjustment; original coordinate restoration; and Crandall Rule adjustment. This example sets traverse points using the Enter and Assign (EA) and Traverse (TR) routines. All distances used for the purpose of corner establishment are horizontal.

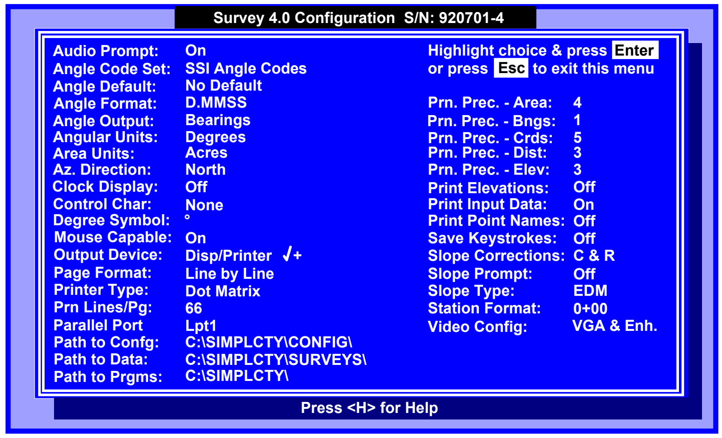
Example 2 illustrates the closure and balancing of an ***open traverse***, including angle balancing and Compass Rule adjustment. This example sets traverse points using the Enter and Assign (EA) and Traverse (TR) routines. All distances used for the purpose of corner establishment are horizontal.

Example 3 involves fitting an actual **subdivision** into an area bounded by three known points. The example is a small seven lot subdivision called Oakwoods Subdivision. Since this is strictly a coordinate geometry problem, all distances used for the purpose of corner establishment are horizontal.

If you run any of these examples using Survey Lite, the Enter & Assign routine's* Elevation *prompt will not appear.

Example 1
Adjustment and Closure of a Closed Traverse

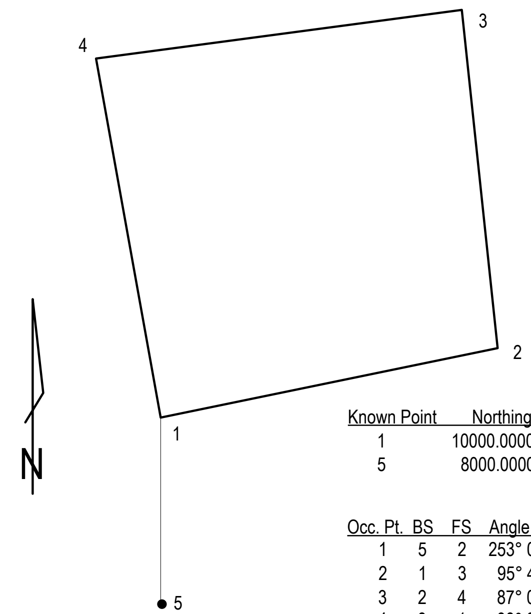
PROMPT	RESPONSE / NOTES / ETC.
	Begin by loading the Survey 4.0 program.
<Enter> to Continue <C> to Configure <Q> to Quit	When the Survey 4.0 **Title Screen** appears, press C to access the Survey 4.0 **Configuration Menu**. In order for your prompts and printed output to follow this manual, you must verify that your **Configuration Menu** options have been properly set. The following options should be set to match the setting shown in the menu screen in Figure 19-1 before running the rest of this example: **Angle Code Set**, **Angle Default**, **Angle Format**, **Angle Output**, **Angular Units**, **Area Units**, **Print Input Data**, **Print Point Names**, **Save Keystrokes** and **Slope Prompt**. *All other options should be set as they apply to your own computer system and personal preference.* Refer to Section 5 if you need help in making these changes.



Configuration Settings: Figure 19-1

PROMPT	RESPONSE / NOTES / ETC.
< L > Load Job Shown < S > Select a New Job	When the **File Selection** window appears, you may or may not receive this prompt. If the prompt does appear, press S to select a new job and the cursor will be placed at the **File Name** prompt.
File Name	Whether or not you received the above prompt, you should now type `CloseTrv` ↵Enter. The **Load** command will become highlighted at the bottom of the window; press ↵Enter to confirm your filename entry.
Cannot locate the file. Is this a new job? < Yes > < No >	Provided that you have not run this example before and you have not used that filename, this prompt will appear. Press Y to confirm that it is a new job.
By :	Enter your name at this prompt.
Dsc :	Type `Closed Traverse` and then press Esc to bypass the rest of the prompts on the job entry screen. The main Survey 4.0 work screen should now appear along with the **Select Routine** prompt.
Select Routine	Type `NO` to toggle **POINT NAMES OUTPUT** to **ON**.
Select Routine	Type `EA` to select the **ENTER & ASSIGN** routine.

PROMPT	RESPONSE / NOTES / ETC.



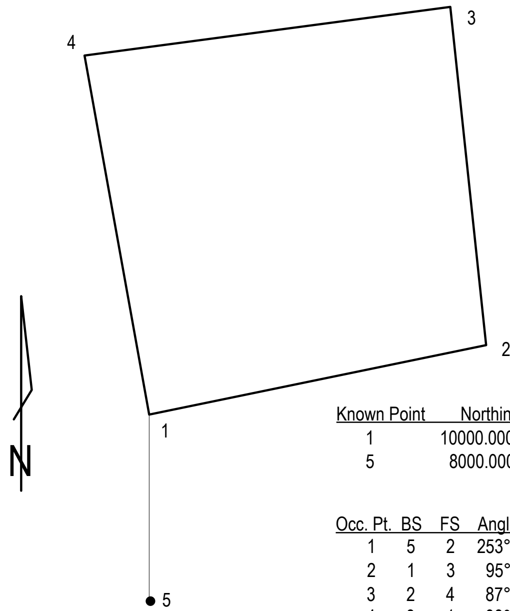
Known Point	Northing	Easting
1	10000.00000	10000.00000
5	8000.00000	9997.57399

Occ. Pt.	BS	FS	Angle Right	Distance
1	5	2	253° 00' 00"	2359.24
2	1	3	95° 47' 57"	2559.01
3	2	4	87° 09' 09"	2078.42
4	3	1	98° 35' 36"	2707.94
1	4	2	78° 27' 06"	2359.24

PROMPT	RESPONSE / NOTES / ETC.
Enter & Assign pt.	Type `5` ↵Enter to set the point number.
Coordinates for point 5 Northing	Type `8000` ↵Enter.
Easting	Type `9997.57399` ↵Enter.
Elevation	Press ↵Enter.
Enter a point ID	Type `Initial Backsight` ↵Enter.
Enter & Assign pt.	Type `1` ↵Enter to set the point number.
Coordinates for point 1 Northing	Type `10000` ↵Enter.
Easting	Type `10000` ↵Enter.
Elevation	Press ↵Enter.
Enter a point ID	Type `SW Corner` ↵Enter.

PROMPT	RESPONSE / NOTES / ETC.
Enter & Assign pt.	Type `GT` [Enter] to select the **GO TO POINT** routine.
Go To Point	Type `5` [Enter] to set the occupied point.
Select Routine	Type `IN` to select the **INVERSE** routine.
Inverse from 5 to	Type `1` [Enter] to set the reference/backsight bearing.
Inverse from 1 to	Type `ST` [Enter] to select the **START AT** routine.
Start at	Type `1` [Enter] to set the starting point.
Select Routine	Type `TR` to select the **TRAVERSE** routine.
Traverse from 1 to	Type `2` [Enter] to set the point number.
Enter a point ID	Type `SE Corner` [Enter].
Bearing	Type `253` [F6] to enter an angle right of 253° 00' 00".
Distance	Type `2359.24` [Enter] to enter the horizontal distance.
Traverse from 2 to	Type `3` [Enter] to set the point number.
Enter a point ID	Type `NE Corner` [Enter].
Bearing	Type `95.4757` [F6] to enter an angle right of 95° 47' 57".
Distance	Type `2559.01` [Enter] to enter the horizontal distance.
Traverse from 3 to	Type `4` [Enter] to set the point number.
Enter a point ID	Type `NW Corner` [Enter].
Bearing	Type `87.0909` [F6] to enter an angle right of 87° 09' 09".
Distance	Type `2078.42` [Enter] to enter the horizontal distance.
Traverse from 4 to	Type `TC` [Enter] to select the **TRAVERSE CLOSURE** routine.
Close to point	Type `1` [Enter] to set the point number.
Bearing	Type `88.3536` [F6] to enter an angle right of 88° 35' 36". *Note: We are entering an erroneous angle on purpose, in order to illustrate the traverse editing feature.*

PROMPT | **RESPONSE / NOTES / ETC.**



Known Point	Northing	Easting
1	10000.00000	10000.00000
5	8000.00000	9997.57399

Occ. Pt.	BS	FS	Angle Right	Distance
1	5	2	253° 00' 00"	2359.24
2	1	3	95° 47' 57"	2559.01
3	2	4	87° 09' 09"	2078.42
4	3	1	98° 35' 36"	2707.94
1	4	2	78° 27' 06"	2359.24

Distance

Type `2707.94` [Enter] to enter the horizontal distance.

At this point Survey 4.0 will report the Calculated Closing Point Northing and Easting, and the closure bearing and distance.

Calculated Closing Point 10084.94107 10464.53029
TC S 79°38'15.8" W 472.232

Enter angle RIGHT at Pt. 1
Backsighting Pt. 4
Foresighting Pt. 2
Press <Enter> if unknown

Type `78.2706` [Enter] to enter an angle right of 78° 27' 06".

Enter the Closing Foresight Pt.
Press <Enter> if unknown

Press [Enter] to leave this blank since we do not have a closing angle turned to an external foresight point.

PROMPT	RESPONSE / NOTES / ETC.
Enter Closing angle RIGHT at Pt. 1 Backsighting Pt. 4 To the fixed Foresight ? Press <Enter> if unknown	Press Enter to leave this blank since we do not have a closing angle turned to an external foresight point.

At this point Survey 4.0 will report the traverse statistics.

Precision Ratio	=	1: 20
Length Traversed	=	9704.610
Length To Close	=	472.232
Error in Latitude	=	84.941
Error in Departure	=	464.530
Error in Elevation	=	0.000

Area = 5148592.0085 Sq. Feet or 118.1954 Acres

Adjust this traverse? (Yes/No)

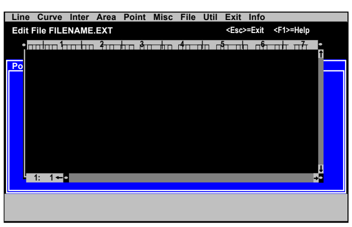
Press Y to adjust the traverse. Survey 4.0 will report the angular error and then display an **Adjustment Option** selection box.

Total Angular Error	=	10°00'12.0"
Error per Station	=	2°30'03.0"

< 1 > Balance Angles
< 2 > Adjust by Compass Rule
< 3 > Adjust by Crandall Rule
< 4 > Adjust by Transit Rule
< 5 > Edit Traverse File
< 6 > Restore Unadjusted Coordinates*
< E > EXIT to Select Routine

Select an Adjustment Option

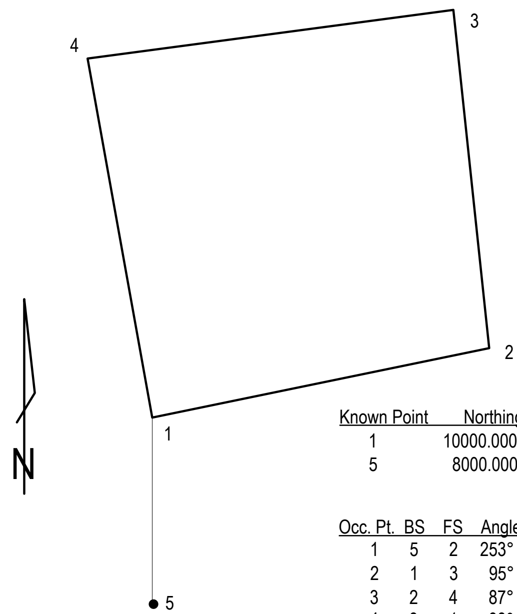
Press 5 to choose the **Edit Traverse File** option from the selection box.



Scanning the file, we see a problem on line 22. The angle entered as `88.3536` should have been `98.3536`. Press ↓ until the cursor is on line 22, which reads **88.3536000000AR**. Press 9 and Delete to change the line to read **98.3536000000AR**, then press Esc. Press Y to save the changes. Survey 4.0 will now re-run the corrected traverse data.

*Option may not be available.

PROMPT | **RESPONSE / NOTES / ETC.**



Known Point	Northing	Easting
1	10000.00000	10000.00000
5	8000.00000	9997.57399

Occ. Pt.	BS	FS	Angle Right	Distance
1	5	2	253° 00' 00"	2359.24
2	1	3	95° 47' 57"	2559.01
3	2	4	87° 09' 09"	2078.42
4	3	1	98° 35' 36"	2707.94
1	4	2	78° 27' 06"	2359.24

Calculated Closing Point 9999.84901 10000.23838
TC N 57°38'55.9" W 0.282

Enter angle RIGHT at Pt. 1
Backsighting Pt. 4
Foresighting Pt. 2
Press <Enter> if unknown

Type `78.2706` [Enter] to enter an angle right of 78° 27' 06".

Enter the Closing Foresight Pt.
Press <Enter> if unknown

Press [Enter] to leave this blank since we do not have a closing angle turned to an external foresight point.

Enter Closing angle RIGHT at Pt. 1
Backsighting Pt. 4
To the fixed Foresight ?
Press <Enter> if unknown

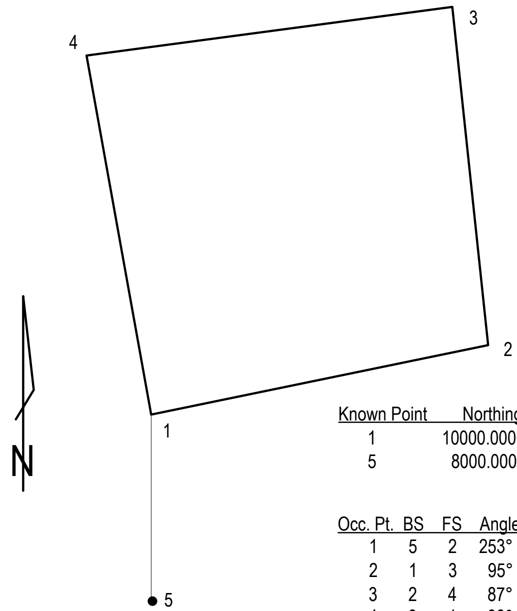
Press [Enter] to leave this blank since we do not have a closing angle turned to an external foresight point.

At this point Survey 4.0 will report the traverse statistics.

PROMPT	RESPONSE / NOTES / ETC.
	Precision Ratio = 1: 34392 Length Traversed = 9704.610 Length To Close = 0.282 Error in Latitude = 0.151 Error in Departure = 0.238 Error in Elevation = 0.000 Area = 5785222.5650 Sq. Feet or 132.8104 Acres
Adjust this traverse? (Yes/No)	Press [Y] to adjust the traverse. Survey 4.0 will report the angular error and then display an **Adjustment Option** selection box. Total Angular Error = 0°00'12.0" Error per Station = 0°00'03.0" < 1 > Balance Angles < 2 > Adjust by Compass Rule < 3 > Adjust by Crandall Rule < 4 > Adjust by Transit Rule < 5 > Edit Traverse File < 6 > Restore Unadjusted Coordinates* < E > EXIT to Select Routine
Select an Adjustment Option	Press [1] to choose the **Balance Angles** option from the selection box. Survey 4.0 will then present a **Backup File** prompt. < 1 > Save a backup coordinate file < 2 > Continue without a backup file < E > EXIT this Routine
Select an Adjustment Option	Press [1] to choose the **Save a backup coordinate file** option from the selection window. At this point Survey 4.0 will balance the angles, re-run the adjusted traverse, report the Calculated Closing Point Northing and Easting, report the closure bearing and distance and traverse statistics, and display the **Adjustment Option** selection box.

* Option may not be available.

PROMPT	RESPONSE / NOTES / ETC.



Known Point	Northing	Easting
1	10000.00000	10000.00000
5	8000.00000	9997.57399

Occ. Pt.	BS	FS	Angle Right	Distance
1	5	2	253° 00' 00"	2359.24
2	1	3	95° 47' 57"	2559.01
3	2	4	87° 09' 09"	2078.42
4	3	1	98° 35' 36"	2707.94
1	4	2	78° 27' 06"	2359.24

Calculated Closing Point   9999.90377   10000.14266
TC   N 55°59'53.8" W   0.172

Precision Ratio = 1: 56396
Length Traversed = 9704.610
Length To Close = 0.172

Error in Latitude = 0.096
Error in Departure = 0.143
Error in Elevation = 0.000

Area = 5785413.3364 Sq. Feet or 132.8148 Acres

Total Angular Error = 0°00'00.0"

PROMPT	RESPONSE / NOTES / ETC.

< 1 > Balance Angles*
< 2 > Adjust by Compass Rule
< 3 > Adjust by Crandall Rule
< 4 > Adjust by Transit Rule
< 5 > Edit Traverse File*
< 6 > Restore Unadjusted Coordinates
< E > EXIT to Select Routine

Select an Adjustment Option

Press [2] to choose the **Compass Rule Adjustment** option from the selection box. Survey 4.0 will balance the traverse and report the results. You will then be presented with the **Adjustment Option** selection box.

Adjusting traverse using Compass Rule
Re-running adjusted traverse
Start

1	SW Corner		10000.00000	10000.00000
IN	N 73°04'10.4" E	2359.214		
2	SE Corner		10687.02836	12256.96278
IN	N 11°07'49.4" W	2559.042		
3	NE Corner		13197.93604	11762.95938
IN	S 76°01'27.9" W	2078.445		
4	NW Corner		12695.97440	9746.03926
IN	S 5°22'53.0" E	2707.910		
1	SW Corner		10000.00000	10000.00000

Area = 5785731.5525 Sq. Feet or 132.8221 Acres

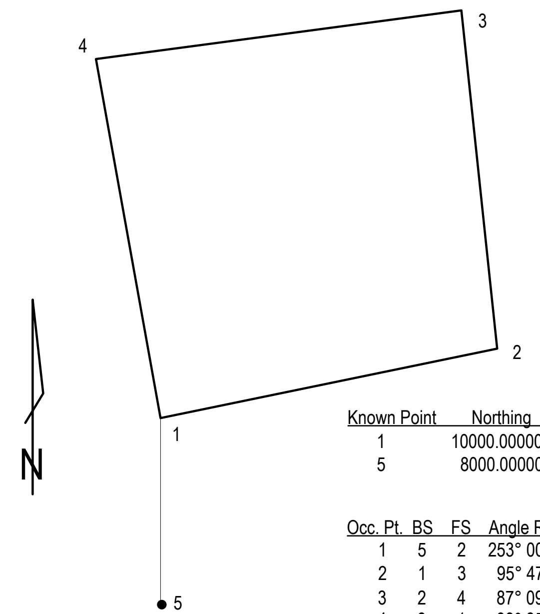
< 1 > Balance Angles*
< 2 > Adjust by Compass Rule*
< 3 > Adjust by Crandall Rule*
< 4 > Adjust by Transit Rule*
< 5 > Edit Traverse File*
< 6 > Restore Unadjusted Coordinates
< E > EXIT to Select Routine

Select an Adjustment Option

If you decide that you want to try a different adjustment method, press [6] to choose the **Restore Unadjusted Coordinates** option from the selection box.

*Option not available.

PROMPT	RESPONSE / NOTES / ETC.



Known Point	Northing	Easting
1	10000.00000	10000.00000
5	8000.00000	9997.57399

Occ. Pt.	BS	FS	Angle Right	Distance
1	5	2	253° 00' 00"	2359.24
2	1	3	95° 47' 57"	2559.01
3	2	4	87° 09' 09"	2078.42
4	3	1	98° 35' 36"	2707.94
1	4	2	78° 27' 06"	2359.24

Restore Backup File from *date* at *time* (Yes/No)

Press [Y] to restore the backup file. The ***date*** and ***time*** of the last backup file will be given in the prompt. Survey 4.0 will restore the backup file, re-print the restored traverse, report the Calculated Closing Point Northing and Easting, and report the closing bearing and distance.

Calculated Closing Point 9999.84901 10000.23838
TC N 57°38'55.9" W 0.282

Enter angle RIGHT at Pt. 1
Backsighting Pt. 4
Foresighting Pt. 2
Press <Enter> if unknown

Type `78.2706` [Enter] to enter an angle right of 78° 27' 06".

Enter the Closing Foresight Pt.
Press <Enter> if unknown

Press [Enter] to leave this blank since we do not have a closing angle turned to an external foresight point.

PROMPT | **RESPONSE / NOTES / ETC.**

Enter Closing angle RIGHT at Pt. 1
Backsighting Pt. 4
To the fixed Foresight ?
Press <Enter> if unknown

Press Enter to leave this blank since we do not have a closing angle turned to an external foresight point.

At this point Survey 4.0 will report the traverse statistics.

Precision Ratio	=	1: 34392
Length Traversed	=	9704.610
Length To Close	=	0.282
Error in Latitude	=	0.151
Error in Departure	=	0.238
Error in Elevation	=	0.000

Area = 5785222.5650 Sq. Feet or 132.8104 Acres

Adjust this traverse? (Yes/No)

Press Y to adjust the traverse. Survey 4.0 will report the angular error and then display an **Adjustment Option** selection box.

Total Angular Error	=	0°00'12.0"
Error per Station	=	0°00'03.0"

< 1 > Balance Angles
< 2 > Adjust by Compass Rule
< 3 > Adjust by Crandall Rule
< 4 > Adjust by Transit Rule
< 5 > Edit Traverse File
< 6 > Restore Unadjusted Coordinates
< E > EXIT to Select Routine

Select an Adjustment Option

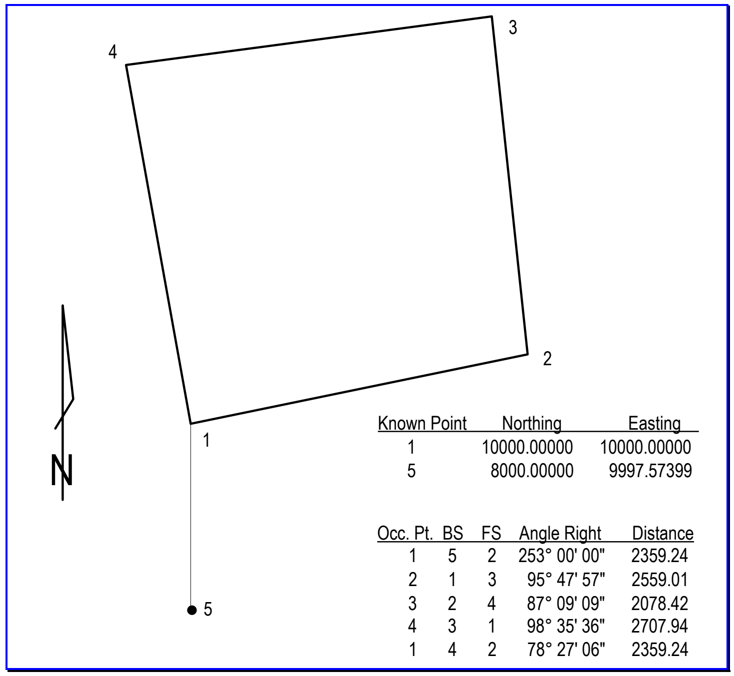
Press 1 to choose the **Balance Angles** option from the selection box. Survey 4.0 will then present a **Backup File** prompt.

< 1 > Save a backup coordinate file
< 2 > Continue without a backup file
< E > EXIT this Routine

Select an Adjustment Option

Since you already have a backup file, press 2 to choose the **Continue without a backup file** option from the selection window. At this point Survey 4.0 will balance the angles, re-run

PROMPT	**RESPONSE / NOTES / ETC.**



the adjusted traverse, report the Calculated Closing Point Northing and Easting, report the closure bearing and distance and traverse statistics, and display the **Adjustment Option** selection box.

Calculated Closing Point		**9999.90377**	**10000.14266**
TC N 55°59'53.8" W		**0.172**	
Precision Ratio	**=**	**1: 56396**	
Length Traversed	**=**	**9704.610**	
Length To Close	**=**	**0.172**	
Error in Latitude	**=**	**0.096**	
Error in Departure	**=**	**0.143**	
Error in Elevation	**=**	**0.000**	

Area = 5785413.3364 Sq. Feet or 132.8148 Acres

Total Angular Error	**=**	**0°00'00.0"**

PROMPT | **RESPONSE / NOTES / ETC.**

< 1 > Balance Angles*
< 2 > Adjust by Compass Rule
< 3 > Adjust by Crandall Rule
< 4 > Adjust by Transit Rule
< 5 > Edit Traverse File*
< 6 > Restore Unadjusted Coordinates
< E > EXIT to Select Routine

Select an Adjustment Option

Press [3] to choose the **Crandall Rule Adjustment** option from the selection box. Survey 4.0 will balance the traverse and report the results. You will then be presented with the **Adjustment Option** selection box.

Adjusting traverse using Crandall Rule
Re-running adjusted traverse
Start

	1	SW Corner		10000.00000	10000.00000
IN	N	73°04'13.2" E	2359.174		
	2	SE Corner		10686.98560	12256.93385
IN	N	11°07'46.8" W	2559.078		
	3	NE Corner		13197.93505	11762.95485
IN	S	76°01'25.2" W	2078.482		
	4	NW Corner		12695.93790	9746.00543
IN	S	5°22'55.8" E	2707.876		
	1	SW Corner		10000.00000	10000.00000

Area = 5785739.1120 Sq. Feet or 132.8223 Acres

< 1 > Balance Angles*
< 2 > Adjust by Compass Rule*
< 3 > Adjust by Crandall Rule*
< 4 > Adjust by Transit Rule*
< 5 > Edit Traverse File*
< 6 > Restore Unadjusted Coordinates
< E > EXIT to Select Routine

Select an Adjustment Option

Press [E] to **EXIT to Select Routine**

EXIT: Are you sure? (Yes/No)

Press [Y] to confirm your desire to exit the adjustment routine.

---

* Option not available.

Example 2
Adjustment and Closure of an Open Traverse

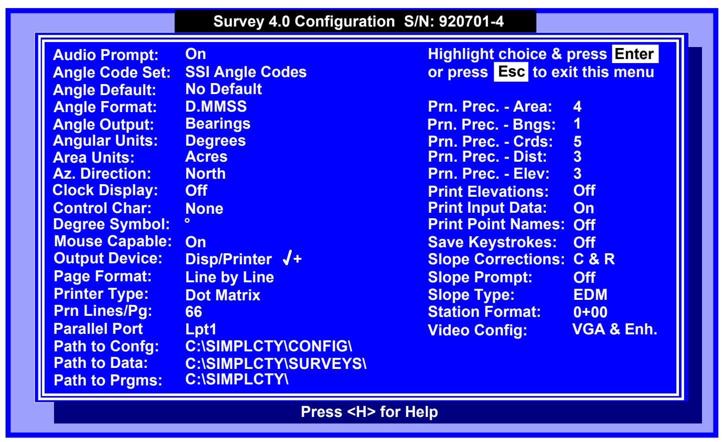
PROMPT	**RESPONSE / NOTES / ETC.**

Begin by loading the Survey 4.0 program.

<Enter> to Continue
<C> to Configure
<Q> to Quit

When the Survey 4.0 **Title Screen** appears, press C to access the Survey 4.0 **Configuration Menu**.

In order for your prompts and printed output to follow this manual, you must verify that your **Configuration Menu** options have been properly set. The following options should be set to match the setting shown in the menu screen in Figure 19-2 before running the rest of this example: **Angle Code Set**, **Angle Default**, **Angle Format**, **Angle Output**, **Angular Units**, **Area Units**, **Print Input Data**, **Print Point Names**, **Save Keystrokes** and **Slope Prompt**. *All other options should be set as they apply to your own computer system and personal preference.* Refer to Section 5 if you need help in making these changes.



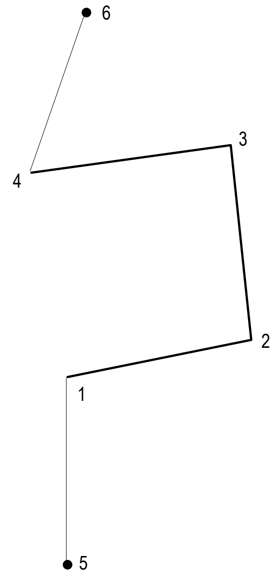
Configuration Settings: Figure 19-2

< L > Load Job Shown
< S > Select a New Job

When the **File Selection** window appears, you may or may not receive this prompt. If the prompt does appear, press S to select a new job and the cursor will be placed at the **File Name** prompt.

PROMPT	RESPONSE / NOTES / ETC.
File Name	Whether or not you received the above prompt, you should now type **OpenTrv** [Enter]. The **Load** command will become highlighted at the bottom of the window; press [Enter] to confirm your filename entry.
Cannot locate the file. Is this a new job? < Yes > < No >	Provided that you have not run this example before and you have not used that filename, this prompt will appear. Press [Y] to confirm that it is a new job.
By :	Enter your name at this prompt.
Dsc :	Type **Open Traverse** and then press [Esc] to bypass the rest of the prompts on the job entry screen. The main Survey 4.0 work screen should now appear along with the **Select Routine** prompt.
Select Routine	Type **NO** to toggle **POINT NAMES OUTPUT** to **ON**.
Select Routine	Type **EA** to select the **ENTER & ASSIGN** routine.
Enter & Assign pt.	Type **1** [Enter] to set the point number.
Coordinates for point 1	
Northing	Type **10000** [Enter].
Easting	Type **10000** [Enter].
Elevation	Press [Enter].
Enter a point ID	Type **SW Corner** [Enter].
Enter & Assign pt.	Type **4** [Enter] to set the point number.
Coordinates for point 5	
Northing	Type **12695** [Enter].
Easting	Type **9745** [Enter].
Elevation	Press [Enter].
Enter a point ID	Type **NW Corner** [Enter].

PROMPT	**RESPONSE / NOTES / ETC.**



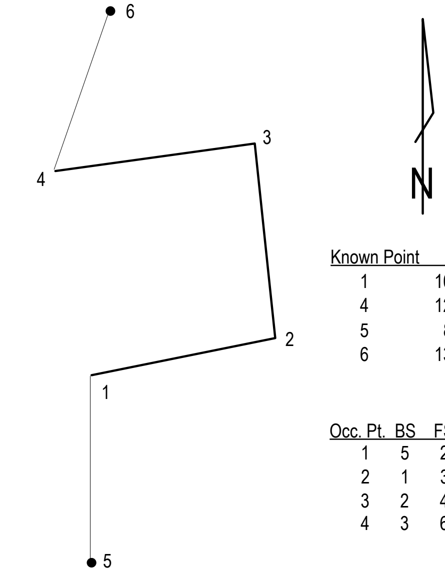
Known Point	Northing	Easting
1	10000.00000	10000.00000
4	12695.00000	9745.00000
5	8000.00000	9997.57399
6	13000.00000	10000.00000

Occ. Pt.	BS	FS	Angle Right	Distance
1	5	2	253° 00' 00"	2359.24
2	1	3	95° 47' 57"	2559.01
3	2	4	87° 09' 09"	2078.42
4	3	6	323° 53' 22"	397.56

PROMPT	RESPONSE / NOTES / ETC.
Enter & Assign pt.	Type `5` [Enter] to set the point number.
Coordinates for point 5 Northing	Type `8000` [Enter].
Easting	Type `9997.57399` [Enter].
Elevation	Press [Enter].
Enter a point ID	Type `Initial Backsight` [Enter].
Enter & Assign pt.	Type `6` [Enter] to set the point number.
Coordinates for point 6 Northing	Type `13000` [Enter].
Easting	Type `10000` [Enter].
Elevation	Press [Enter].
Enter a point ID	Type `Closing Backsight` [Enter].
Enter & Assign pt.	Type `GT` [Enter] to select the **GO TO POINT** routine.

PROMPT	RESPONSE / NOTES / ETC.
Go To Point	Type 5 Enter to set the occupied point.
Select Routine	Type IN to select the **INVERSE** routine.
Inverse from 5 to	Type 1 Enter to set the reference/backsight bearing.
Inverse from 1 to	Type ST Enter to select the **START** routine.
Start at	Type 1 Enter to set the starting point.
Select Routine	Type TR to select the **TRAVERSE** routine.
Traverse from 1 to	Type 2 Enter to set the point number.
Enter a point ID	Type SE Corner Enter.
Bearing	Type 253 F6 to enter an angle right of 253° 00' 00".
Distance	Type 2359.24 Enter to enter the horizontal distance.
Traverse from 2 to	Type 3 Enter to set the point number.
Enter a point ID	Type NE Corner Enter.
Bearing	Type 95.4757 F6 to enter an angle right of 95° 47' 57".
Distance	Type 2559.01 Enter to enter the horizontal distance.
Traverse from 3 to	Type TC Enter to select the **TRAVERSE CLOSURE** routine.
Close to point	Type 4 Enter to set the point number.
Bearing	Type 87.0909 F6 to enter an angle right of 87° 09' 09".
Distance	Type 2078.42 Enter to enter the horizontal distance.
	At this point Survey 4.0 will report the Calculated Closing Point Northing and Easting, and the closure bearing and distance. **Calculated Closing Point 12695.83548 9746.08098** **TC S 52°18'00.0" W 1.366**
Enter the Closing Foresight Pt. Press <Enter> if unknown	Type 6 Enter to set the point number.

PROMPT	RESPONSE / NOTES / ETC.



Known Point	Northing	Easting
1	10000.00000	10000.00000
4	12695.00000	9745.00000
5	8000.00000	9997.57399
6	13000.00000	10000.00000

Occ. Pt.	BS	FS	Angle Right	Distance
1	5	2	253° 00' 00"	2359.24
2	1	3	95° 47' 57"	2559.01
3	2	4	87° 09' 09"	2078.42
4	3	6	323° 53' 22"	397.56

Enter Closing angle RIGHT at Pt. 4
Backsighting Pt. 3
To the fixed Foresight ?
Press <Enter> if unknown

Type `323.5322` [Enter] to enter an angle right of 323° 53' 22" to the fixed foresight point 6.

At this point Survey 4.0 will report the traverse statistics.

Precision Ratio	**=**	**1: 5121**
Length Traversed	**=**	**6996.670**
Length To Close	**=**	**1.366**
Error in Latitude	**=**	**0.835**
Error in Departure	**=**	**1.081**
Error in Elevation	**=**	**0.000**

Open Traverse - No Area

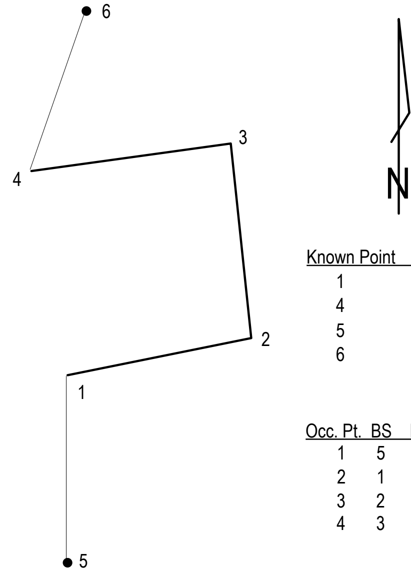
Adjust this traverse? (Yes/No)

Press [Y] to adjust the traverse. Survey 4.0 will report the angular error and then display an **Adjustment Option** selection box.

PROMPT	RESPONSE / NOTES / ETC.
	Total Angular Error = 0°00'54.5" **Error per Station = 0°00'18.2"**
	< 1 > Balance Angles **< 2 > Adjust by Compass Rule** **< 3 > Adjust by Crandall Rule** **< 4 > Adjust by Transit Rule** **< 5 > Edit Traverse File** **< 6 > Restore Unadjusted Coordinates*** **< E > EXIT to Select Routine**
Select an Adjustment Option	Press 1 to choose the **Balance Angles** option from the selection box. Survey 4.0 will then present a **Backup File** prompt.
	< 1 > Save a backup coordinate file **< 2 > Continue without a backup file** **< E > EXIT this Routine**
Select an Adjustment Option	Press 1 to choose the **Save a backup coordinate file** option from the selection window. At this point Survey 4.0 will balance the angles, re-run the adjusted traverse, report the Calculated Closing Point Northing and Easting, report the closure bearing and distance and traverse statistics, and display the **Adjustment Option** selection box.
	Calculated Closing Point 12695.41422 9745.71084 **TC S 59°46'10.4" W 0.823**
	Precision Ratio = 1: 8504 **Length Traversed = 6996.670** **Length To Close = 0.823**
	Error in Latitude = 0.414 **Error in Departure = 0.711** **Error in Elevation = 0.000**
	Open Traverse - No Area
	Total Angular Error = 0°00'00.0"

* Option may not be available.

PROMPT	**RESPONSE / NOTES / ETC.**



Known Point	Northing	Easting
1	10000.00000	10000.00000
4	12695.00000	9745.00000
5	8000.00000	9997.57399
6	13000.00000	10000.00000

Occ. Pt.	BS	FS	Angle Right	Distance
1	5	2	253° 00' 00"	2359.24
2	1	3	95° 47' 57"	2559.01
3	2	4	87° 09' 09"	2078.42
4	3	6	323° 53' 22"	397.56

< 1 > Balance Angles*
< 2 > Adjust by Compass Rule
< 3 > Adjust by Crandall Rule
< 4 > Adjust by Transit Rule
< 5 > Edit Traverse File*
< 6 > Restore Unadjusted Coordinates
< E > EXIT to Select Routine

Select an Adjustment Option

Press [2] to choose the **Compass Rule Adjustment** option from the selection box. Survey 4.0 will balance the traverse and report the results. You will then be presented with the **Adjustment Option** selection box.

---

* Option not available.

PROMPT	RESPONSE / NOTES / ETC.

Adjusting traverse using Compass Rule
Re-running adjusted traverse
Start

	1 SW Corner		10000.00000	10000.00000
IN N 73°03'57.6" E		2358.970		
	2 SE Corner		10687.09694	12256.68725
IN N 11°08'52.1" W		2558.912		
	3 NE Corner		13197.72629	11761.94606
IN S 76°00'14.9" W		2078.655		
	4 NW Corner		12695.00000	9745.00000

< 1 > Balance Angles*
< 2 > Adjust by Compass Rule*
< 3 > Adjust by Crandall Rule*
< 4 > Adjust by Transit Rule*
< 5 > Edit Traverse File*
< 6 > Restore Unadjusted Coordinates
< E > EXIT to Select Routine

Select an Adjustment Option	Press E to choose the **EXIT to Select Routine** option from the selection window.
EXIT: Are you sure? (Yes/No)	Press Y to **EXIT to Select Routine**

* Option not available.

Example 3
Computing a Small Subdivision

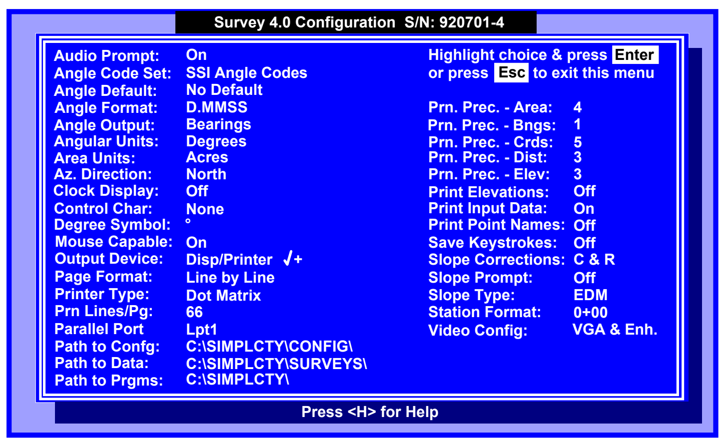
PROMPT	RESPONSE / NOTES / ETC.

Begin by loading the Survey 4.0 program.

<Enter> to Continue
<C> to Configure
<Q> to Quit

When the Survey 4.0 **Title Screen** appears, press C to access the Survey 4.0 **Configuration Menu**.

In order for your prompts and printed output to follow this manual, you must verify that your **Configuration Menu** options have been properly set. The following options should be set to match the setting shown in the menu screen in Figure 19-3 before running the rest of this example: **Angle Code Set**, **Angle Default**, **Angle Format**, **Angle Output**, **Angular Units**, **Area Units**, **Print Input Data**, **Print Point Names**, **Save Keystrokes** and **Slope Prompt**. *All other options should be set as they apply to your own computer system and personal preference.* Refer to Section 5 if you need help in making these changes.

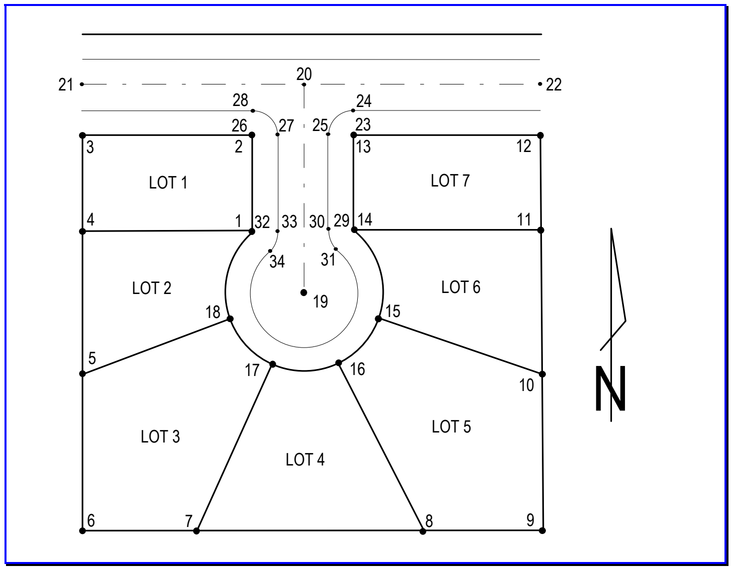


Configuration Settings: Figure 19-3

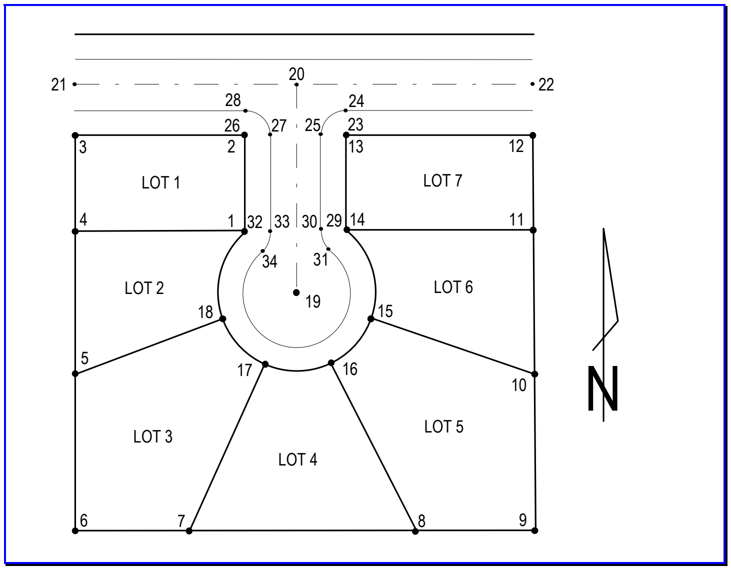
< L > Load Job Shown
< S > Select a New Job

When the **File Selection** window appears, you may or may not receive this prompt. If the prompt does appear, press S to select a new job and the cursor will be placed at the **File Name** prompt.

PROMPT	RESPONSE / NOTES / ETC.
File Name	Whether or not you received the above prompt, you should now type **Oakwoods** [Enter]. The **Load** command will become high-lighted at the bottom of the window; press [Enter] to confirm your filename entry.
Cannot locate the file. **Is this a new job?** **< Yes > < No >**	Provided that you have not run this example before and you have not used that filename, this prompt will appear. Press [Y] to confirm that it is a new job.
By : **Dsc :**	Enter your name at this prompt. Type **Oakwoods Subdivision Example** and then press [Esc] to bypass the rest of the prompts on the job entry screen. The main Survey 4.0 work screen should now appear along with the **Select Routine** prompt.
Select Routine	Type **NO** to toggle **POINT NAMES OUTPUT** to **ON**.
Select Routine	Type **EA** to select the **ENTER & ASSIGN** routine.
Enter & Assign pt.	Type **3** [Enter] to set the point number.
Coordinates for point 3	
Northing	Type **10126.2344** [Enter].
Easting	Type **19824.4965** [Enter].
Elevation	Press [Enter].
Enter a point ID	Type **NW Corner Lot 1** [Enter].
Enter & Assign pt.	Type **9** [Enter] to set the point number.
Coordinates for point 9	
Northing	Type **9811.7544** [Enter].
Easting	Type **20190.0472** [Enter].
Elevation	Press [Enter].
Enter a point ID	Type **SE Corner Lot 5** [Enter].

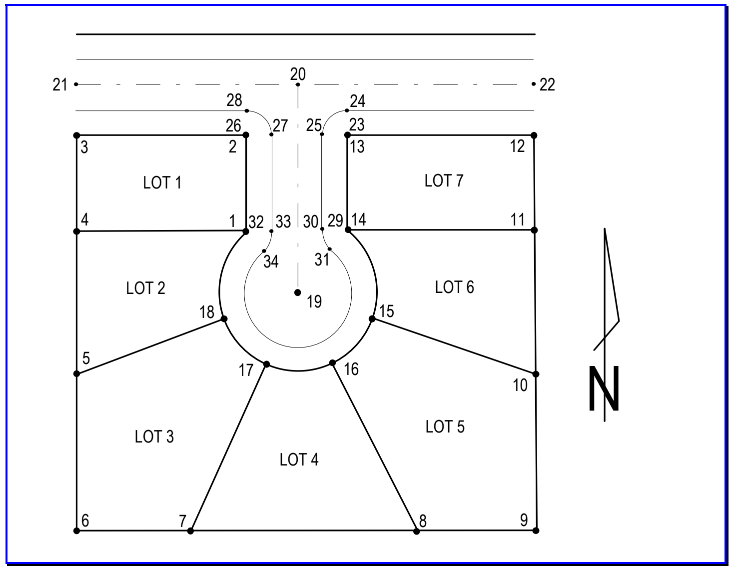
PROMPT	**RESPONSE / NOTES / ETC.**
	
Enter & Assign pt.	Type `12` ↵Enter to set the point number.
Coordinates for point 12 Northing	Type `10126.2344` ↵Enter.
Easting	Type `20186.4565` ↵Enter.
Elevation	Press ↵Enter.
Enter a point ID	Type `NE Corner Lot 7` ↵Enter.
Enter & Assign pt.	Type `ST` ↵Enter to select the **START AT** routine.
Start at	Type `3` ↵Enter to set the starting point.
Select Routine	Type `EB` to select the **ENTER BACKSIGHT** routine.
Enter backsight bearing	Type `*3-12` ↵Enter to recall the bearing from point 3 to point 12 and set it as the reference/backsight bearing.
Select Routine	Type `TR` to select the **TRAVERSE** routine.

PROMPT	RESPONSE / NOTES / ETC.
Traverse from 3 to	Type `2` [Enter] to set the point number.
Enter a point ID	Type `NE Corner Lot 1` [Enter].
Bearing	Type `0` [F6] to enter an angle right of zero degrees.
Distance	Type `135.5` [Enter] to enter the horizontal distance.
Traverse from 2 to	Type `SS` [Enter] to select the **SIDE SHOT** routine.
Side Shot from 2 to	Type `1` [Enter] to set the point number.
Enter a point ID	Type `SE Corner Lot 1` [Enter].
Bearing	Press [F9] to enter an angle left of 90 degrees.
Distance	Type `75` [Enter] to enter the horizontal distance.
Side Shot from 2 to	Type `TR` [Enter] to select the **TRAVERSE** routine.
Traverse from 2 to	Type `13` [Enter] to set the point number.
Enter a point ID	Type `NW Corner Lot 7` [Enter].
Bearing	Type `90` [F1] to enter a bearing of 90° Northeast.
Distance	Type `80` [Enter] to enter the horizontal distance.
Traverse from 13 to	Type `14` [Enter] to set the point number.
Enter a point ID	Type `SW Corner Lot 7` [Enter].
Bearing	Type `MA` [Enter] to **MEASURE** an existing **ANGLE**.
Instrument at	Type `2` [Enter] to enter the instrument location.
Backsight to	Type `3` [Enter] to enter the backsight point.
Sight Point	Type `1` [Enter] to enter the foresight point.
Distance	Type `75` [Enter] to enter the horizontal distance.
Traverse from 14 to	Type `DD` [Enter] to select the **DIST-DIST** routine.

PROMPT	RESPONSE / NOTES / ETC.
	
Dist.-Dist. FROM Point 14 THRU Point	Type `19` ↵Enter to set the intersection point number.
Enter a point ID	Type `Center of Cul-de-Sac` ↵Enter.
Dist.-Dist. FROM Point 14 THRU Point 19 TO Point	Type `1` ↵Enter to set the point number of the closing point.
Distance from 14 to 19	Type `65` ↵Enter to set the radius length.
Distance from 19 to 1	Type `65` ↵Enter to set the radius length.
Select Routine	Type `BB` to select the **BEARING-BEARING** routine.
Bng.-Bng. FROM Point 1 THRU Point	Type `4` ↵Enter to set the intersection point number.
Enter a point ID	Type `SW Corner Lot 1` ↵Enter.
Bng.-Bng. FROM Point 1 THRU Point 4 TO Point	Type `3` ↵Enter to set the point number of the closing point.
Bearing from 1 to 4	Type `90` F4 to enter a bearing of 90° Northwest.

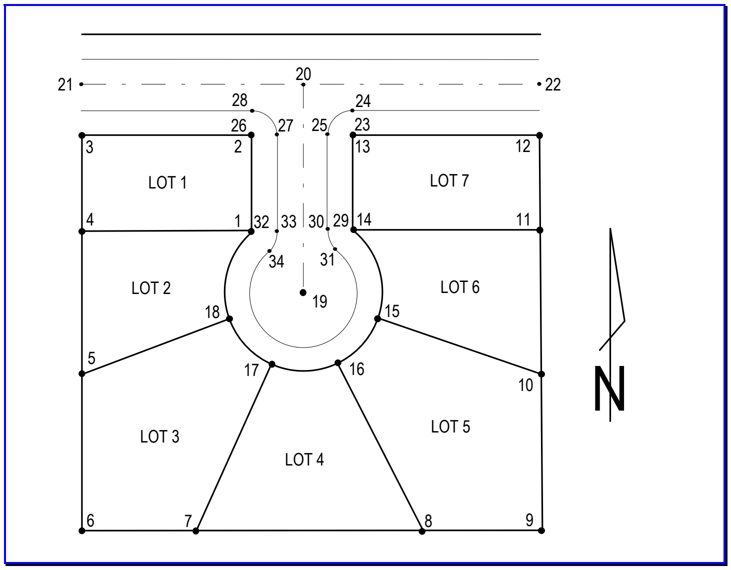
PROMPT	RESPONSE / NOTES / ETC.
Bearing from 4 to 3	Type `0` [F4] to enter a bearing of zero degrees Northwest.
Select Routine	Type `NO` to toggle **POINT NAMES OUTPUT** to **OFF**.
Select Routine	Type `GT` to select the **GO TO POINT** routine.
Go To Point	Type `1` [Enter] to set the new starting point.
Select Routine	Type `TA` to select the **TRAVERSE ARC** routine.
Center point	Type `19` [Enter] to set the known center point.
Traverse Arc from 1 to	Type `18` [Enter] to set the point number for the end of arc.
Arc, Chord, Tangent Or Delta	Type `-80A` [Enter] to enter a counterclockwise 80 foot arc.
Save the PI as a COGO point? (Yes/No)	Press [N] since we do not wish to save this point.
Print coordinates of an existing PI? (Yes/No)	Press [N] since we do not have a known PI point.
Traverse Arc from 18 to	Type `BB` [Enter] to select the **BNG-BNG** routine.
Bng.-Bng. FROM Point 18 THRU Point	Type `5` [Enter] to set the intersection point number.
Bng.-Bng. FROM Point 18 THRU Point 5 TO Point	Type `4` [Enter] to set the point number of the closing point.
Bearing from 18 to 5	Type `*19-18` [Enter] to recall bearing from point 19 to point 18.
Bearing from 5 to 4	Type `0` [F4] to enter a bearing of zero degrees Northwest.
	At this point the Traverse Arc routine has computed a distance of 109.95 feet from point 5 to point 4. For some reason however, we decide that we need at least 115 feet between those points. We can reset point 5 using the Traverse routine.
Select Routine	Type `TR` to select the **TRAVERSE** routine.

PROMPT	RESPONSE / NOTES / ETC.



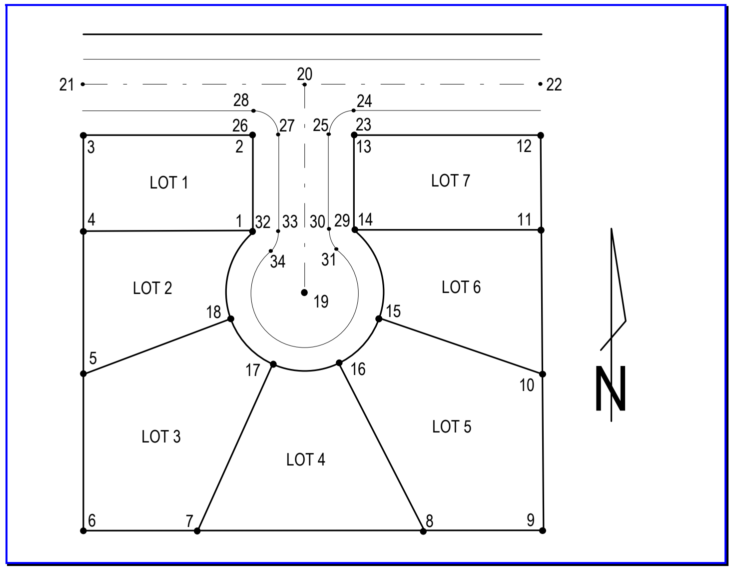
Traverse from 4 to	Type `5*` [Enter] to override the point overwrite protection.
Bearing	Type `0` [F2] to enter a bearing of zero Southeast.
Distance	Type `115` [Enter] to enter the horizontal distance.
Traverse from 5 to	Type `BB` [Enter] to select the **BNG-BNG** routine.
Bng.-Bng. FROM Point 5 THRU Point	Type `6N` [Enter] to set the intersection point number and add a point name to it.
Enter a point ID	Type `SW Corner Lot 3` [Enter].
Bng.-Bng. FROM Point 5 THRU Point 6 TO Point	Type `9` [Enter] to set the point number of the closing point.
Bearing from 5 to 6	Press [Enter] to recall the last used bearing.
Bearing from 6 to 9	Type `N90E` [Enter] to enter a bearing of 90° Northeast.
Select Routine	Type `IN` to select the **INVERSE** routine.
Inverse from 9 to	Type `12` [Enter] to set the reference/backsight bearing.

PROMPT	RESPONSE / NOTES / ETC.
Inverse from 12 to	Type BB [Enter] to select the **BNG-BNG** routine.
Bng.-Bng. FROM Point 12 THRU Point	Type 11N [Enter] to set the intersection point number and add a point name to it.
Enter a point ID	Type SE Corner Lot 7 [Enter].
Bng.-Bng. FROM Point 12 THRU Point 11 TO Point	Type 14 [Enter] to set the point number of the closing point.
Bearing from 12 to 11	Type *12-9 [Enter] to recall the bearing from point 12 to point 9.
Bearing from 11 to 14	Type 90NW [Enter] to enter a bearing of 90° Northwest.
Select Routine	Type GT to select the **GO TO POINT** routine.
Go To Point	Type 11 [Enter] to set the new starting point.
Select Routine	Type TR to select the **TRAVERSE** routine.
Traverse from 11 to	Type 10 [Enter] to set the point number.
Bearing	Type *12-9 [Enter] to recall bearing from pt 12 to pt 9.
Distance	Type *4-5 [Enter] to recall distance from pt 4 to pt 5.
Traverse from 10 to	Type GT [Enter] to select the **GO TO POINT** routine.
Go To Point	Type 6 [Enter] to set the new starting point.
Select Routine	Type EB to select the **ENTER BACKSIGHT** routine.
Enter backsight bearing	Type *6-9 [Enter] to recall the bearing from point 6 to point 9 and set it as the reference/backsight bearing.
Select Routine	Type TR to select the **TRAVERSE** routine.
Traverse from 6 to	Type 7 [Enter] to set the point number.
Bearing	Type 0 [F6] to enter an angle right of zero degrees.
Distance	Type 90 [Enter] to enter the horizontal distance.

PROMPT	RESPONSE / NOTES / ETC.
	
Traverse from 7 to	Type **8** [Enter] to set the point number.
Bearing	Press [Enter] to recall the last used bearing.
Distance	Type **181** [Enter] to enter the horizontal distance.
Traverse from 8 to	Type **GT** [Enter] to select the **GO TO POINT** routine.
Go To Point	Type **10** [Enter] to set the new starting point.
	NOTE *We will now set the four intermediate curve points, (15, 16, 17 & 18) via four different procedures. In actual practice, you would probably use only the procedure you find most convenient.*
Select Routine	Type **IN** to select the **INVERSE** routine.
Inverse from 10 to	Type **19** [Enter] to set the reference/backsight bearing.

PROMPT	RESPONSE / NOTES / ETC.
Inverse from 19 to	Type TR [Enter] to select the TRAVERSE routine.
Traverse from 19 to	Type 15 [Enter] to set the point number.
Bearing	Type 0 [F6] to enter an angle right of zero degrees.
Distance	Type 65 [Enter] to set the radius length..
Traverse from 15 to	Type GT [Enter] to select the GO TO POINT routine.
Go To Point	Type 19 [Enter] to set the new starting point.
Select Routine	Type TR to select the TRAVERSE routine.
Traverse from 19 to	Type 16 [Enter] to set the point number.
Bearing	Type *19-8 [Enter] to recall bearing from point 19 to point 8.
Distance	Type 65 [Enter] to set the radius length.
Traverse from 16 to	Type GT [Enter] to select the GO TO POINT routine.
Go To Point	Type 19 [Enter] to set the new starting point.
Select Routine	Type SS to select the SIDE SHOT routine.
Side Shot from 19 to	Type 17 [Enter] to set the point number.
Bearing	Type *19-7 [Enter] to recall bearing from point 19 to point 7.
Distance	Press [Enter] to recall the last used (radius) distance.
Side Shot from 19 to	Type IN [Enter] to select the INVERSE routine.
Inverse from 19 to	Type 5 [Enter] to set the reference/backsight bearing.
Inverse from 5 to	Type TR [Enter] to select the TRAVERSE routine.
Traverse from 5 to	Type 18* [Enter] to override the point overwrite protection.
Bearing	Type 0 [Enter] to enter an angle of zero degrees.

PROMPT	RESPONSE / NOTES / ETC.



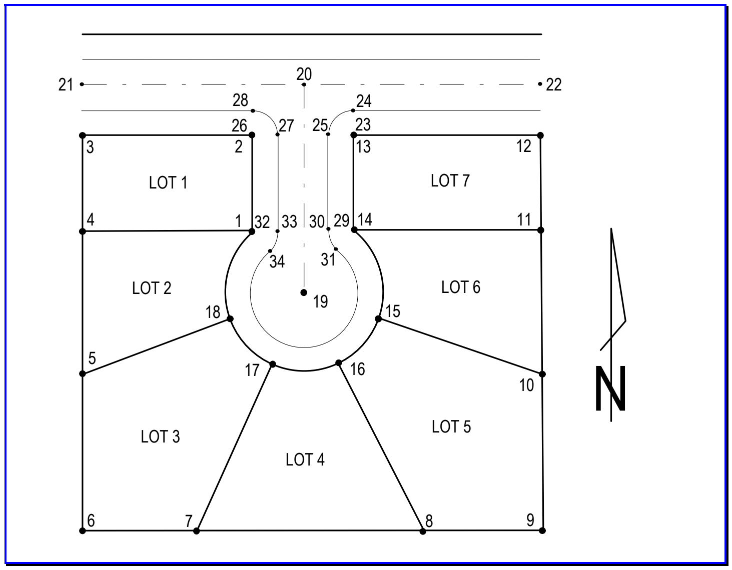
Quad Code	Type **6** Enter to specify an angle right.
Distance	Type **L-65** Enter to recall the last used distance and subtract the 65 foot radius length from it.

NOTE
At this point, all of the property corners for the Oakwoods Subdivision have been computed. However, we will now place some control points to mark the back-of-curb for our pavement section. To computed these points, we will use the Tee-Intersection and Cul-de-Sac macro programs.

Traverse from 18 to	Type **NO** Enter to toggle **POINT NAMES OUTPUT** to **ON**.
Select Routine	Type **GT** to select the **GO TO POINT** routine.
Go To Point	Type **13** Enter to set the new starting point.
Select Routine	Type **OI** to select the **OFFSET INTERSECTION** routine.

PROMPT	RESPONSE / NOTES / ETC.
Offset Intersection Point	Type 20 Enter to set the intersection point number.
Enter a point ID	Type Centerline Intersection Pt Enter.
1st Bearing from 13	Type *13-14 Enter to recall the parallel bearing.
1st Offset Distance	Type 40 Enter to set the distance. (This is entered as a positive value because it lies to the right of the base line bearing from point 13 to point 14.)
2nd Bearing from 13	Type *13-12 Enter to recall the parallel bearing.
Offset Intersection Point	Type -40 Enter. (This is entered as negative value because it lies to the left of the base line bearing from point 13 to point 12.)
Select Routine	Type GT to select the **GO TO POINT** routine.
Go To Point	Type 19 Enter to set the new starting point.
Select Routine	Type IN to select the **INVERSE** routine.
Inverse from 19 to	Type 20 Enter to set the reference/backsight bearing.
Inverse from 20 to	Type OS Enter to select the **OFFSET** routine.
Offset from 20 to	Type 21 Enter to set the offset point number.
Offset Distance	Type -185.5 Enter to set a left offset.
Offset from 20 to	Type 22 Enter to set the offset point number.
Offset Distance	Type 186.5 Enter to set a right offset.
Offset from 20 to	Press Enter to exit the **OFFSET** routine.

PROMPT	RESPONSE / NOTES / ETC.

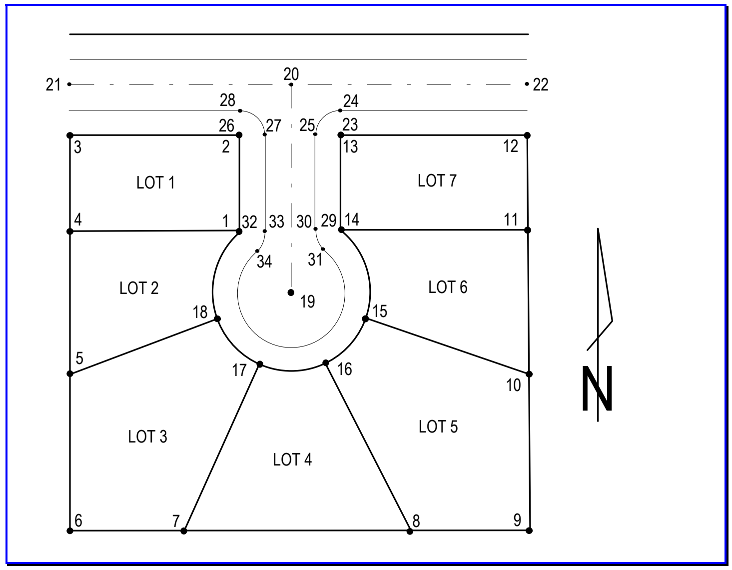


NOTE

If you are running this example in the Survey 4.0 DEMO or in Survey Lite, you will be unable to complete the TEE INTERSECTION and CUL-DE-SAC portions of this example. (The DEMO version will run out of available point numbers and the LITE version does not have access to these routines.) If you are running either of these two programs, skip to page 503 and continue with the RADIAL STAKE OUT section.

PROMPT	RESPONSE / NOTES / ETC.
Select Routine	Type `I3` to select the **TEE INTERSECTION** macro.
Select the Primary R/W Type	Press 2 to indicate a Straight Primary Right of Way.
Enter Intersection Center Point	Type `20` Enter to set the known intersection point.
Enter 1st point on Primary Centerline	Type `21` Enter to set the 1st known centerline point.

PROMPT	RESPONSE / NOTES / ETC.
Enter 2nd point on Primary Centerline	Type `22` Enter to set the 2nd known centerline point.
Enter a point on the Secondary Centerline	Type `19` Enter to set the known centerline point.
Enter 1st Corner Curve Center Point	Type `26` Enter to set the center point number.
Enter 1st Corner Curve P.C.	Type `28` Enter to set the P.C. point number.
Enter 1st Corner Curve P.T.	Type `27` Enter to set the P.T. point number.
Enter 2nd Corner Curve Center Point	Type `23` Enter to set the center point number.
Enter 2nd Corner Curve P.C.	Type `25` Enter to set the P.C. point number.
Enter 2nd Corner Curve P.T.	Type `24` Enter to set the P.T. point number.
Enter the Corner Curve Radius	Type `20` Enter to set the corner curve radius.
Enter 1/2 of the Primary Road R/W	Type `20` Enter. (When setting a curb line instead of a property line, enter ½ of the *roadway width*, not ½ of the right of way.)
Enter 1/2 of the Secondary Road R/W	Type `20` Enter. (When setting a curb line instead of a property line, enter ½ of the *roadway width*, not ½ of the right of way.)
	NOTE *Survey 4.0 will require a short time to compute the results. You will regain control at the* **Select Routine** *prompt.*
Select Routine	Type `C1` to select the **CUL-DE-SAC** macro.
Enter Cul-de-Sac Center Pt	Type `19` Enter to set the known center point.
Enter Centerline Point	Type `20` Enter to set the known centerline point.
Enter Entrance Curve Center Point	Type `29` Enter to set the point number.
Enter Entrance Curve P.C.	Type `30` Enter to set the point number.
P.R.C. to Cul-de-Sac	Type `31` Enter to set the point number.

PROMPT	RESPONSE / NOTES / ETC.
	
Enter Exit Curve Center Point	Type 32 Enter to set the point number.
Enter Exit Curve Ending Point	Type 33 Enter to set the point number.
Enter Cul-de-Sac P.R.C. to Exit Curve	Type 34 Enter to set the point number.
Enter the Entrance/Exit Curve Radius	Type 20 Enter to set the curve radius.
Enter the Cul-de-Sac Radius	Type 45 Enter to set the cul-de-sac radius. (Enter the distance from the cul-de-sac center point to the back of curb.)
Enter 1/2 of the Road R/W	Type 20 Enter. (When setting a curb line instead of a property line, enter ½ of the *roadway width*, not ½ of the right of way.)

NOTE

Survey 4.0 will require a short time to compute the results. You will regain control at the* Select Routine *prompt.

PROMPT	RESPONSE / NOTES / ETC.
	The next portion of this example illustrates a typical staking procedure for the field placement of monuments, as set from the known points, 9 & 12.
Select Routine	Type `RS` to select the **RADIAL STAKE OUT** routine.
Instrument at	Type `12` [Enter] to set the instrument location point.
Backsight to	Type `9` [Enter] to set the backsight point number.
Max. Foresight Distance (<Enter> for none)	Press [Enter] to signify no foresight limit.
Sight Points	Type `19` [Enter] to set the foresight point.
Sight Points	Type `RS` [Enter] to re-select the **RADIAL STAKE OUT** routine to enter new setup information.
Instrument at	Type `19` [Enter] to set the instrument location point.
Backsight to	Type `12` [Enter] to set the backsight point number.
Max. Foresight Distance (<Enter> for none)	Type `300` [Enter] to set a foresight limit of 300 feet.
Sight Points	Type `1-34` [Enter] to set foresight points 1 through 34.

NOTE

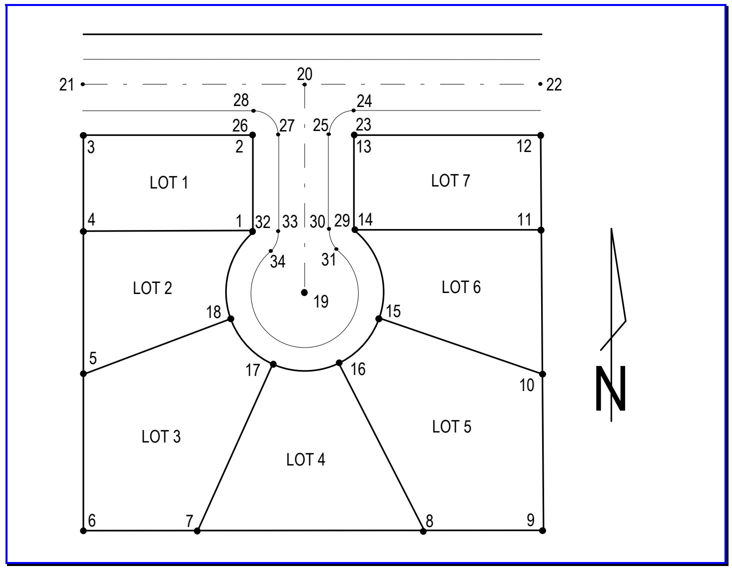
The foresight points can be entered individually such as `1` [Enter], `2` [Enter], `3` [Enter]*, etc., or as a point string such as* `1,3,4-6` [Enter].

By carefully inspecting the point locations, you could key in a point string designed to give you all of the turned angles in an ascending fashion. In the case of Oakwoods, that string would be entered like this: `11,15,10,9,16,8,17,7,6,18,5,4,3,21,34,32,1,33,23-25,2,20,13,27,28,26,30,14,31,29,22,12` [Enter].

To stake out all of the assigned points in a file in numerical order, simply press [A] [Enter] *at the* **Sight Points** *prompt.*

The next portion of this example illustrates the area and defined figure routines.

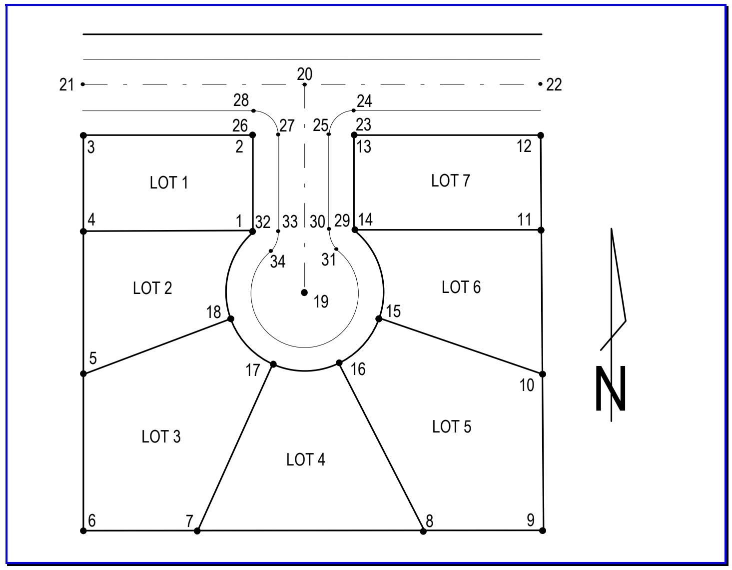
PROMPT	**RESPONSE / NOTES / ETC.**



Sight Points	Type `ST` Enter to select the **START AT** routine.
Start at	Type `1` Enter to set the starting point and clear the Area Sum and Traverse Length Accumulators.
Select Routine	Type `IN` to select the **INVERSE** routine.
Inverse from 1 to	Type `-14` Enter to inverse all straight segments between points 1 and 14, inclusive.
Inverse from 14 to	Type `OC` Enter to select the **INVERSE OBTUSE CURVE** routine.
Inverse Obtuse Curve from PC pt. 14 thru Center point	Type `19` Enter to set the curve center point.
Inverse Obtuse Curve from PC pt 14 thru Center point 19 to point	Type `1` Enter to inverse the cul-de-sac from point 14 through through point 1, inclusive.

PROMPT	RESPONSE / NOTES / ETC.
Inverse Obtuse Curve from PC point 1 thru Center point 19 to point	Type **`AR`** ↵Enter to print the **AREA** of the subdivision.
	NOTES ***1. Although we have already calculated the area of the subdivision by inversing through all the points, the next section shows how to get the area of a figure without having the inversed bearings & distances printed.*** ***2. The cul-de-sac, despite being made up of 5 segments, may be broken down into fewer segments provided that each segment spans less than 180°. The following point to point area calculation has the cul-de-sac split into two parts, the first arc spans from point 14 to point 17 and the second arc spans from point 17 to point 1.***
Select Routine	Type **`PA`** to select the **POINT TO POINT AREA** routine.
Enter Point to Point Area string	Type **`1-14*19,17*19,1`** ↵Enter to print the **AREA**.
	NOTE ***Instead of breaking the cul-de-sac into two curves, you can also use the greater than (>) sign to indicate that you want to get the area around the obtuse curve, as shown in the following entry:***
Enter Point to Point Area string	Type **`1-14>19,1`** ↵Enter to print the **AREA**.
	NOTE ***The following section of the example will show you how to set up point strings using the Define Figure routine. The figure names will then be used to compute the area of the seven lots of the Oakwoods subdivision.***
Enter Point to Point Area string	Type **`DF`** ↵Enter to select the **DEFINE FIGURE** routine.

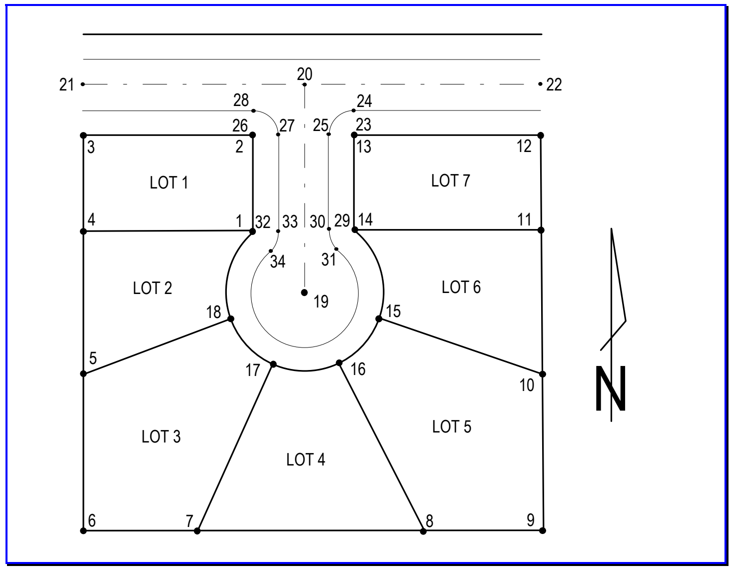
PROMPT	RESPONSE / NOTES / ETC.



SELECT: **< D > Define/Edit a figure** **< C > Clear a figure** **< V > View a figure** **< L > List all figures** **< E > EXIT this Routine**	Press D to select the **Define/Edit a figure** option.
Define/Edit **Figure Name:**	Type `Lot 1` Enter.
Points:	Type `1-4,1` Enter.
Figure Name:	Type `Lot 2` Enter.
Points:	Type `1,4,5,18*19,1` Enter.
Figure Name:	Type `Lot 3` Enter.
Points:	Type `18,5-7,17*19,18` Enter.
Figure Name:	Type `Lot 4` Enter.
Points:	Type `17,7,8,16*19,17` Enter.

PROMPT	RESPONSE / NOTES / ETC.
Figure Name:	Type `Lot 5` [Enter].
Points:	Type `16,8-10,15*19,16` [Enter].
Figure Name:	Type `Lot 6` [Enter].
Points:	Type `15,10,11,14*19,15` [Enter].
Figure Name:	Type `Lot 7` [Enter].
Points:	Type `11-14,11` [Enter].
Figure Name:	Press [Enter] to return to the Define Figure menu and then press [E] to exit the Define Figure menu.
Select Routine	Type `PA` to select the **POINT TO POINT AREA** routine.
Enter Point to Point Area string	Type `F:Lot 1` [Enter] to print the **AREA** of lot one.
Enter Point to Point Area string	Type `F:Lot 2` [Enter] to print the **AREA** of lot two.
Enter Point to Point Area string	Type `F:Lot 3` [Enter] to print the **AREA** of lot three.
Enter Point to Point Area string	Type `F:Lot 4` [Enter] to print the **AREA** of lot four.
Enter Point to Point Area string	Type `F:Lot 5` [Enter] to print the **AREA** of lot five.
Enter Point to Point Area string	Type `F:Lot 6` [Enter] to print the **AREA** of lot six.
Enter Point to Point Area string	Type `F:Lot 7` [Enter] to print the **AREA** of lot seven.
Enter Point to Point Area string	Type `LC` [Enter] to select the **LIST COORDINATES** routine.
List Point(s)	Press [A] [Enter] to list all points in the file.
List Point(s)	Press [Enter] to return to the Select Routine prompt.

PROMPT	RESPONSE / NOTES / ETC.



Select Routine

Type **SY** to select the **EXIT to DOS SYSTEM** routine.

You have chosen to EXIT to DOS. Are you sure? (Yes/No)

Press Y to confirm your intention to exit.

A listing of computed coordinates is shown below:

Pt.	Description	Northing	Easting
1	SE Corner Lot 1	10051.23440	19959.99650
2	NE Corner Lot 1	10126.23440	19959.99650
3	NW Corner Lot 1	10126.23440	19824.49650
4	SW Corner Lot 1	10051.23440	19824.49650
5	SW Corner Lot 2	9936.23440	19824.49650
6	SW Corner Lot 3	9811.75440	19824.49650
7	SE Corner Lot 3	9811.75440	19914.49650
8	SE Corner Lot 4	9811.75440	20095.49650
9	SE Corner Lot 5	9811.75440	20190.04720
Pt.	Description	Northing	Easting

10	NE Corner Lot 5	9936.24190	20188.62581
11	SE Corner Lot 7	10051.23440	20187.31284
12	NE Corner Lot 7	10126.23440	20186.45650
13	NW Corner Lot 7	10126.23440	20039.99650
14	SW Corner Lot 7	10051.23440	20039.99650
15	SW Corner Lot 6	9979.18609	20061.57406
16	NE Corner Lot 4	9942.03253	20029.40420
17	NW Corner Lot 4	9940.81801	19973.11651
18	SE Corner Lot 2	9977.80262	19938.90401
19	Center of Cul-de-Sac	9999.99965	19999.99650
20	Centerline Intersection Pnt	10166.23440	19999.99650
21	OS 185.500 L. @ Pt. 20	10166.23440	19814.49650
22	OS 186.500 R. @ Pt. 20	10166.23440	20186.49650
23	2nd Curve Center Point	10126.23440	20039.99650
24	2nd Curve P.T.	10146.23440	20039.99650
25	2nd Curve P.C.	10126.23440	20019.99650
26	1st Curve Center Point	10126.23440	19959.99650
27	1st Curve P.T.	10126.23440	19979.99650
28	1st Curve P.C.	10146.23440	19959.99650
29	Entrance Curve Center Point	10051.23440	20039.99650
30	P.C. Entrance Curve	10051.23440	20019.99650
31	P.R.C. into Cul-de-Sac	10035.46986	20027.68881
32	Exit Curve Center Point	10051.23440	19959.99650
33	Exit Curve Ending Point	10051.23440	19979.99650
34	P.R.C. out of Cul-de-Sac	10035.46986	19972.30419

Note: Not all points were assigned names during the example. However, all points are named here to assist you in rapidly identifying them.

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Survey 4.0
Simplicity Surveying Series

Appendix A
Survey 4.0 File Structures

Project Files

EXTENSION: DAT

CONTENTS: Coordinate data and descriptions
TYPE: Random Access
RECORD SIZE: 50 bytes
FIELDING: 2 as Point$, 8 as North$, 8 as East$, 4 as Elev$, 28 as Name$
RECORD NUMBER: Sequentially assigned.

*NOTE: **North$** & **East$** are double precision values converted to strings, and represent the Northing and Easting coordinates. **Elev$** is a single precision value converted to a string, and represents the elevation coordinate. **Point$** is an integer value converted to a string, and represents the point number. **Name$** is a 28 character point description.*

EXTENSION: DOC

CONTENTS: Survey 4.0 Printer Output
TYPE: ASCII
RECORD SIZE: Variable
FIELDING: 80 bytes per line.

NOTE: This file may contain any number of lines, and each line is terminated by a carriage return and line feed.

EXTENSION: FIG

CONTENTS: Defined figures
TYPE: Random Access
RECORD SIZE: 128 bytes
FIELDING: 128 as Figure$
RECORD NUMBER: Sequentially assigned.

*NOTE: **Figure$** is a 128 character (max.) point number string. The figure name and the figure points are separated by the character* **»**.

EXTENSION: JOB

CONTENTS: Job description
TYPE: ASCII
RECORD SIZE: Variable, up to 512 bytes.
FIELDING: Data.File.Type$
Date$
Time$
By$
Description$ (up to 4 lines)

NOTE: Each data line is in quotes. Each line may contain commas, but must end with a carriage return/line feed combination. All data is read in with a Line Input command that reads data until a carriage return/line feed combination is encountered. The ***Data.File.Type$*** *is either* ***S4*** *for Survey 4.0 or* ***SL*** *for Survey Lite.*

EXTENSION: KEY

CONTENTS: Survey 4.0 Keystroke Recording
TYPE: ASCII
RECORD SIZE: Variable
FIELDING: Variable, maximum 255 bytes per line.

NOTE: This file may contain any number of lines, and each line is terminated by a carriage return and line feed.

EXTENSION: OFF

CONTENTS: Offset table values
TYPE: ASCII Sequential
RECORD SIZE: 80 bytes
FIELDING: 8 as Value, up to 10 entries.

NOTE: ***Value*** *is a double precision offset value. Up to 10 lines of values may exist in this file.*

Drawing Files

EXTENSION: S4D

CONTENTS:	Drawing file parameters
TYPE:	ASCII
RECORD SIZE:	117 bytes
FIELDING:	S%, W%, N.High, N.Low, N.Old, E.High, E.Low

*NOTE: **S%** and **W%** are integers representing the screen mode and line setting. **N.High**, **N.Low**, **N.Old**, **E.High** and **E.Low** are values used to set the view window borders.*

EXTENSION: CGA or GRN

CONTENTS:	A screen image
TYPE:	Binary array
RECORD SIZE:	CGA - 16,384 bytes GRN (EGA) - 28,007 bytes GRN (VGA) - 38,407 bytes

Macro Files

EXTENSION: MAC

CONTENTS:	Macro Programming Lines
TYPE:	ASCII
RECORD SIZE:	Variable
FIELDING:	Variable number of bytes per line. Each line terminated with a carriage return and line feed.

Other Reserved Files

NAME: ASCII.FMT

CONTENTS:	ASCII File Formats
TYPE:	ASCII
RECORD SIZE:	Variable, generally less than 50 bytes
FIELDING:	Up to six lines. Each line terminated with a carriage return and line feed.
LOCATION:	Survey 4.0 Configuration Directory

NOTE: The first line contains a comma delimited format. Lines 2 through 6 contain the fielded variable format. *See Section 12.01.*

NAME: Memory.CLC

CONTENTS: Calculator memory for S4-Calc
TYPE: ASCII
RECORD SIZE: Variable, generally less than 200 bytes
FIELDING: The first 10 lines contain memory registers 0 - 9. The next line is unused, followed by six lines containing memory registers Alt 1 - Alt 6, (triangle data). The next line contains the number of displayed decimal places in the calculator display. The last four lines contain the values of the T, Z, Y and X registers. Each line is terminated with a carriage return and line feed.
LOCATION: Survey 4.0 Configuration Directory

NOTE: See Sections 15.07 through 15.10.

NAME: Survey-4.CFG

CONTENTS: Survey 4.0 configuration settings
TYPE: ASCII
RECORD SIZE: Variable, generally less than 500 bytes
FIELDING: Listed in the file
LOCATION: Survey 4.0 Configuration Directory

NOTE: See Sections 5.02 and 5.03.

NAME: Survey-4.NME

CONTENTS: Point name table
TYPE: ASCII Sequential
RECORD SIZE: Up to 300 bytes
FIELDING: Up to 10 entries, with each entry containing up to 28 characters
LOCATION: Survey 4.0 Configuration Directory

NOTE: See Section 10.19.

Appendix B
Running in Windows

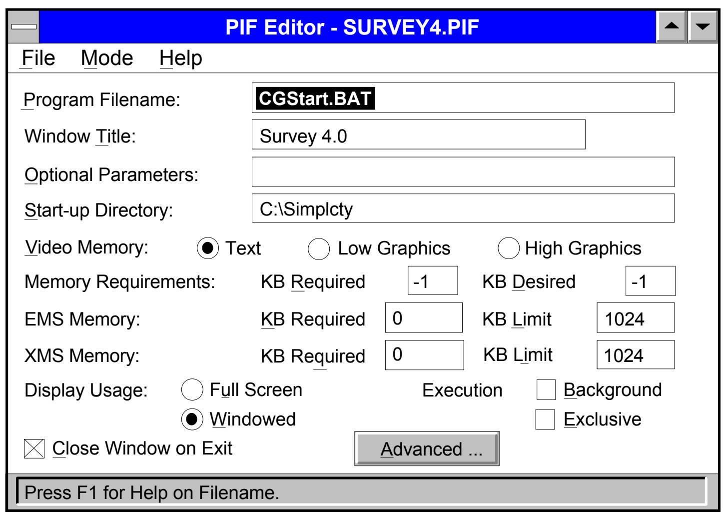
While Survey 4.0 is not designed to be compatible with Microsoft Windows, it can run in that environment. This section is here to help you with the operation of Survey 4.0 in Windows, ***but no attempt will be made to teach you how to run Windows.***

Windows Version

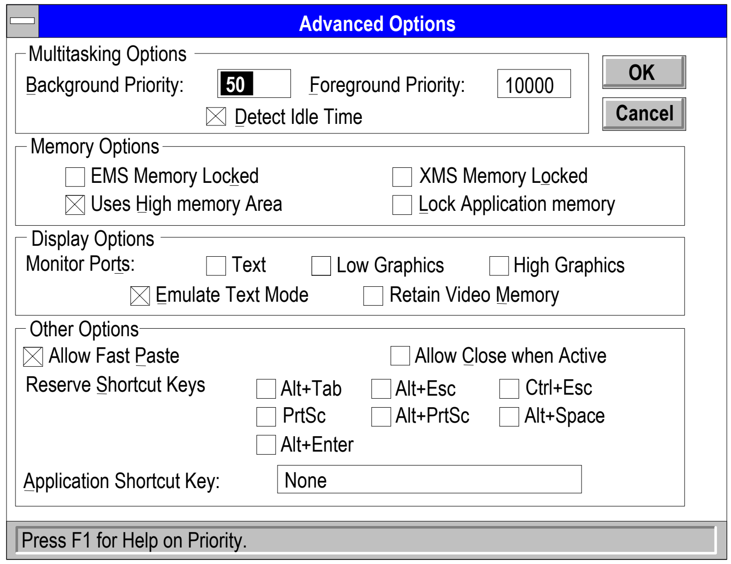
Your Microsoft Windows version must be 3.0 or higher.

The PIF File

Using the Windows **PIF Editor**, construct a **Survey4.PIF** file to match the following screens. Adjust the **Start-up Directory** to match your system. Also, set the **Display Usage** to `Full Screen` if you are running at or below the VGA standard resolution of 640 x 480.



The first screen of the Windows PIF Editor



The Advanced Options screen of the Windows PIF Editor

CGStart.BAT

The Survey 4.0 **CGStart.BAT** program will check for the presence of Windows. If Windows is found to be active, Survey 4.0 will be started with the command **S4-Title /w**, with the **/w** telling Survey 4.0 that it was started in Windows. The **/w** switch alters the color scheme of the menu bar and triggers certain Windows specific operational messages throughout the program.

Runtime Considerations

If you start Survey 4.0 inside a window, the program may appear to hang after loading the data file. This can always be corrected by switching into and then out of full screen mode. Press Alt ↵Enter once to shift to a full screen mode, then press Alt ↵Enter again to shift back into a window. Sometimes, you can also correct the problem with a rapid double click of the mouse anywhere in the top ¼ of the window.

If you attempt to run the **View Coordinate Screen** (**VS** - Section 11.14) within a window, you will seldom have any luck. To use this routine, shift to a full screen mode (Alt ↵Enter) when you are prompted to do so. You can shift back into a window (Alt ↵Enter) upon completion of the routine.

S4-Calc

You may find it useful to run **S4-Calc** in a separate window that can remain on your screen while you are working inside the Survey 4.0 window. To accomplish this, create an **S4-Calc.PIF** file. First, use the **PIF Editor** to open the PIF file **Survey4.PIF**. Then click on **File**, **Save As**, and save a copy of the file under the name `S4-Calc.PIF`.

Now change the file for the correct S4-Calc settings. In the **Program Filename** window, type in `S4-Calc.Exe`. In the **Window Title** window, type in `S4-Calc`. Finally, in the **Optional Parameters** window, type in `/w`. Now click on **File, Save** to save your PIF file.

To run Survey 4.0 and/or S4-Calc, you have two options. First, you can pull down the **Program Manager's File** menu and click on **Run**. Then enter the name of the PIF file that you want to run. Second, you can create a **Simplicity Program Group** and place program icons into the group. To run a program, simply double click on the program icon. Please consult your Windows manual for instructions on creating a Program Group.

Disclaimer

Survey 4.0 is not designed to run in Windows, and we do not guarantee that you will not experience problems running in Windows. Windows has proven itself to be unstable in running certain DOS based programs. Simplicity Systems, Inc. will not be held liable for data loss experienced from the operation of this software either inside or outside of Windows. Use this program within Windows at your own risk.

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Survey 4.0
Simplicity Surveying Series

Appendix C
Optimizing Survey 4.0

Introduction

This section contains information that may prove to be helpful when setting up Survey 4.0 on your computer. We have included a copy of our **Config.Sys** and **Autoexec.Bat** files for your information only. Using the configuration shown, we are able to free approximately 615Kb of RAM (631,000 bytes) for DOS applications. Your specific file structure may be very different from ours. ***Before proceeding, make sure that you have a backup copy of your Config.Sys and Autoexec.Bat files.***

What DOS Version?

To maximize your available RAM, we suggest that you use MS-DOS 5.0 or higher from Microsoft, PC-DOS 5.0 or higher from IBM, or DR-DOS 6.0 or higher from Digital Research. (For your information, we use MS-DOS 5.0.)

Using a Memory Manager

To maximize your available RAM, we suggest that you use QEMM from Quarterdeck, or 386 Max from Qualitas Software. If your computer setup relies on memory resident programs, load as many as possible into high ram. (For your information, we use QEMM 6.0.)

Our Config.Sys File

SHELL=C:\DOS\Command.Com C:\DOS\ /E:1024 /P 'Establishes the environment and sets aside a 1Kb environment area. See your DOS manual.

DEVICE=C:\QEMM\QEMM386.SYS X=B000-C7FF RAM ROM 'Loads QEMM and excludes the memory area B000-C7FF. RAM allows QEMM to use areas between 640Kb and 1024Kb for programs "loaded high". ROM maps all ROM memory to faster RAM memory for increased performance. See the QEMM manual for specifics.

DEVICE=C:\QEMM\LoadHi.Sys /R:1 C:\Windows\Ramdrive.Sys 2048 /E 'Loads a 2Mb ram drive into high memory. See your DOS and Windows manuals.

DEVICE=C:\QEMM\LoadHi.Sys /R:1 C:\DOS\SetVer.Exe 'Loads the DOS SetVer program. See your DOS manual.

DOS=High 'Loads DOS into a high memory area. See your DOS manual.

Files=20 'Allows DOS to open up to 20 files. See your DOS manual.

Buffers=10 'Loads 10 file access buffers. See your DOS manual.

Our Autoexec.Bat File

PATH = C:\; C:\Qemm;C:\DOS;C:\Windows;C:\Windows\System;...
'Sets up the DOS path. See your DOS manual.

LoadHi /R:1 Buffers +20 'Add another 20 DOS buffers, but places them in high memory. See your DOS manual.

LoadHi /R:1 Mouse 'Loads the mouse driver into high memory.

LoadHi /R:1 Files +20 'Add another 20 DOS files, but places them in high memory. See your DOS manual.

LoadHi /R:1 SmartDrv.Exe /l 'Installs Windows SmartDrive disk cache using default parameters as determined from available RAM. See your Windows manual.

LoadHi /Link 'Allow QEMM to link any available free RAM in high memory to DOS. See your QEMM manual.

PROMPT $p $g 'Set prompt to show the drive and directory. See your DOS manual.

Using a RAM Disk

Survey 4.0 is a very disk-intensive program, meaning that it accesses the disk to read and write data quite often. Some data, such as coordinate values, is held in RAM at all times, thus speeding its access. However, other data, such as point names, figures, etc., is strictly disk based. Every time you access disk based data, you slow down the program. Since most users prefer to operate Survey 4.0 with **Names Output** set to **On**, most users will experience a program slowdown.

To alleviate the drag on the program caused by frequent disk accesses, you might want to try using a ***RAM disk***. This can be dangerous however, particularly if you do not use a UPS (uninterruptable power supply). If you ever lose power while running with a RAM disk, the information contained on the RAM disk is lost. Of course, you can guard against data loss by frequently backing up your data files using the **Store Coordinates** command (**SC** - Section 10.21), since the backup files are physically placed on the hard drive.

To set up a RAM drive, you need to place certain commands into your Config.Sys file. Our RAM drive command is the third line of our Config.Sys file as shown on the previous page.

Once your ram drive is set up, you must copy your data files to it using a standard DOS Copy command. For example, suppose your job is named **Jones**, and it resides in the directory

C:\Simplcty\Surveys. Assuming that your RAM drive is designated **D:**, entering the command:

```
Copy C:\Simplcty\Surveys\Jones.* D: Enter
```

will copy all of the job files to the RAM drive D:. Remember: When you have finished working, copy the files back into their hard disk location before turning off the computer or you will lose your data. For the example above, you would enter the command:

```
Copy D:Jones.* C:\Simplcty\Surveys Enter
```

Utilizing DOC Files

Two other options that significantly slow the program are the use of DOC files and the use of the printer. However, even this loss of speed can be overcome by following these steps.

1. If you insist on using a printer and your printer has an adjustable buffer, set your buffer as large as you can. If your printer does not have an adjustable buffer, consider installing printer spooling software.

2. If you know that you are going to want a printout, but you don't necessarily need it right away, send your printout data to a DOC file and leave your printer shut off.

3. For the best performance, do not use your printer and use a RAM disk to hold your data files, including your DOC file. ***Just remember to download the data from the RAM drive to the hard drive before shutting down.***

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Survey 4.0
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Appendix D
Operational and Error Messages

Computational

Base side is not radial.
You have specified base points in the **Predetermined Area: Radial Sides** routine (**P3** - Section 9.05) that do not identify a radial side.

Equation is incorrect! Press H for Help, or <Enter> to continue.
You have entered an incorrect **CALC** statement into the command line calculator. See Section 3.10.

No Solution.
Survey 4.0 is unable to generate a solution from the given parameters. Check and change them as necessary and re-run the problem.

Not enough records to compile.
You have fewer than three records to assemble into a **RoadRunner** file. See Section 12.09.

Radii do not match!
The distance from the PC to the arc center point does not match (within 0.02) the distance from the curve end point to the center point. Usually caused by an incorrect point number.

Data Entry

CAUTION: You have entered a large stadia interval value. Please verify that your entry is correct, or enter a new value now. Press <Enter> to accept a value of ####.###
You have entered a stadia value greater than 9. Verify and/or change the value. See Section 3.11.

INCORRECT RESPONSE: You have entered an invalid Minutes/Seconds/Quadrant/Angle entry.
You have entered the specified data incorrectly. Correct and re-enter the data. See Section 3.06.
Small Value! Are you sure? (Yes/No)

You have entered a small value for your maximum foresight distance in the **Radial Stake Out** routine (**RS** - Section 6.11). Verify and/or change your entry.

Disk/File - Not Found

DATA FILES NOT FOUND! Insert data disk and press <C> to continue or <S> for Select Routine.
Survey 4.0 cannot locate a **DAT** file. Please insert the correct disk.

File does not exist! Try again? (Yes/No)
Survey 4.0 cannot locate the specified file. If the file exists, you have specified an incorrect drive, path or filename, and you must correct it.

File not found. Is this a new file? (Yes/No)
Survey 4.0 cannot locate the specified file to load. This may be either a data file or an edit file. If the file exists, you have specified an incorrect drive, path or filename, and you must correct it. Otherwise, Survey 4.0 will assume you are attempting to create a new file.

That is an invalid filename!
You have specified invalid characters within the filename. Correct your entry. See Section 5.05.

Disk/File - Access

The directory selected does not exist!
You specified a directory that does not exist. Check and correct your entry. See Sections 5.03 and 5.05.

The disk drive selected does not exist!
You specified a drive that does not exist within your system. Check and correct your entry.

The disk drive selected is not ready for input!
You specified a drive that is not ready. Check and correct your entry. If you specified drive `A:` or `B:`, check for the presence of a disk, and also to be certain that the drive door is closed.

Unrecoverable Error!

You have attempted to load a non-supported file type into S4-Edit. S4-Edit supports only pure, unformatted ASCII files. The S4-Edit program will be exited.

Memory - RAM and Disk Space

File is too large. Loading halted at line *xxxx*.
The file you have attempted to load into S4-Edit is too large. You may continue with the loaded portion of the file, or exit the routine.

Insufficient space to save a backup file!
Your hard drive is filling up. Use the **DOS Shell** routine (**DS** - Section 11.15) to delete old files or copy some files to a new disk, and then try again.

Insufficient disk space. Replace the disk in drive and press the SPACE BAR when ready, or press <E> to exit Save routine.
Your data disk is filling up. Use the **DOS Shell** routine (**DS** - Section 11.15) to delete old files or copy some files to a new disk, and then try again.

WARNING! Remaining disk space is less than # bytes! Quit now and copy your data files to a disk with more free space or data loss WILL occur!
Your hard drive is filling up. Use the **DOS Shell** routine (**DS** - Section 11.15) to delete old files or copy some files to a new disk.

You are running low on data memory space. It is suggested that you store your data to avoid possible data loss. Re-starting the program will restore memory.
The free RAM area of your computer is full of information, some of which is no longer needed but still exists. Use the **Start a New Job** routine (**NJ** - Section 14.03) to re-start your job and clear this area.

Points - Capacity

Copy Block routine will exceed the allowable point capacity!
You are attempting to copy a block of points which will result in the highest point number being greater than the maximum allowable point number. Change your parameters. See Section 10.13.

Point Renumbering will exceed the allowable point capacity!

You are attempting to renumber a block of points which will result in the highest point number being greater than the maximum allowable point number. Change your parameters. See Section 10.05.

Points - Not Found

Point match not successful!
Survey 4.0 cannot find a partial or full match to the specified point name. Correct the name and try again. See Sections 3.03 and 3.04.

Cannot find a figure by that name!
Survey 4.0 cannot find a figure matching the specified figure name. Correct the name and try again. See Sections 3.05 and 10.14.

Unable to find a matching point name!
Survey 4.0 cannot find a partial or full match to the specified point name. Correct the name and try again. See Sections 3.03 and 3.04.

Points - Not Valid

 # is not a valid point number!
The point number you entered does not exist. Re-enter the correct number.

You have selected an Invalid or blank starting point.
The point number you entered does not exist. Re-enter the correct number.

No coordinates available!
The point number you entered does not exist. Re-enter the correct number.

Pt. number can't be greater than #####.
The point number you entered exceeds the maximum allowable point capacity. Re-enter a valid number.

Points - Used

Points cannot be the same!
You have specified a PC and/or PT number that either match each other, or the arc center point number. Correct your point numbers and try again.

Point is in use. Enter a new number or enter the same number to re-use.
You have specified a used point number. Verify that you want to re-use the number, or enter a new number.

Point Range Entry: Cannot use +, - or names.
Enter a correct point range by specifying the beginning and ending point, separated by a comma.

Point Re-Entry: Cannot use +, - or name.
You entered an invalid point number and must re-enter a correct number. You cannot use the + or - keys or enter a name.

Printer

Cannot print from the Demo Version!
The Survey 4.0 Demo version cannot print anything. Upgrade your program to Survey 4.0 (or Survey Lite).

(Named) Routine is not available when printer options are disabled.
You have selected a routine that requires the printer. Use the **Printer On/Off** routine (**PR** - Section 11.10) to select a printer output option.

Printer is not ready to receive a listing!
Check to see that your printer is On and On Line.

Printer is not ready! Press any key to resume or <Esc> to quit.
Check to see that your printer is On and On Line.

Printer not ready for form feed!
Check to see that your printer is On and On Line.

Routines

Sorry. Routine XX is an incorrect code! Please re-enter a valid routine code.
Check and re-enter the correct routine code, or select a routine from the pull down menus.

Sorry. Routine XX is not available in the Survey Demo/Lite version.
Some routines are not available in the Survey 4.0 Demo and/or Lite versions. Upgrade your program to Survey 4.0 (or Survey Lite).

Unavailable Features

Can't save Hercules Video screens.
Sorry. Survey 4.0 cannot save a Hercules based video screen.

Program is not available!
Your program, or the calling batch file, does not exist. See Sections 14.04 through 14.12.

This routine is not available. No Graphics Adapter present in system.
Sorry. Survey 4.0 requires a graphics adapter for the **View Coordinate Screen** routine (**VS** - Section 11.14).

System Errors

System errors may be either Operator Errors or Program Errors. Operator errors can be corrected by the program operator. Program errors, marked in the error message by the word "Call", are more serious and must be reported to Simplicity Systems. The general error message is:

ERROR: (named error)

Refer to the HELP section of the reference manual for additional information about this error. If you are unable to correct this problem, contact Simplicity Systems' Technical Support office.

Press: < 1 > to resume program operations.
< 2 > to re-start the program.
< 3 > to EXIT to the DOS operating system.

Operator Errors

Device fault, **Device I/O error**, **Device timeout**, **Device unavailable**, and **Out of paper**
Generally caused when the printer is **Off** or **Off Line**, or otherwise not ready to print. Correct the condition and continue.

Disk full
Your disk is full. Delete unused files or move them to another disk.

Rename across disks
You attempted to rename a file with a new drive designation. This is not allowed.

Disk media error
The disk is bad or unformatted. If this is reporting a bad hard disk, call Simplicity Systems at 1-218-773-7966 before doing anything!

Disk not ready
A disk is not in the disk drive, or the drive door is open.

Input past end of file
Your data file may be corrupted but can probably be saved by adding an end of file character. To do this, use the File Manager to create a new Survey 4.0 file containing the same points but having a different name. Then delete the corrupted DAT file and rename the new DAT file to the old name.

Out of memory
Restart your job, and heed Survey 4.0's warnings about decreasing RAM the next time you see them. You probably lost some data, but no more than the last 25 points computed.

File already exists, File not found, Path not found, or Path/File access error
Check and/or change the file name and path and try again.

Permission denied
You attempted to write to a write protected disk. Close the disk's write protect window on a 3½" disk or uncover the write protect notch on a 5¼" disk and try again.

Too many files
Increase the **FILES =** setting in your **Config.Sys** to at least 20. See Section 2.04. Sometimes this error is caused by the presence of too many files on the disk or in a directory. Consult your DOS manual for file limits.

Program Errors

Argument-count mismatch
Array not defined
Bad file mode
Bad filename
index
Bad filename or number
Bad record length
Bad record number
Cannot continue
Communication buffer overflow
Database needs repair
Division by zero
Duplicate label
Duplicate value for unique index
Feature removed
Feature unavailable
FIELD error
FIELD statement active
File already open
FOR without NEXT
Function not defined
Illegal function call
Illegal in direct mode
Index not found
Input past end of file
Internal error
Invalid column
Invalid name
Invalid operation on null
Label not defined
NEXT without FOR
No current record
No RESUME
Not Defined
Out of data
Out of string space
Overflow
Redimensioned array
RESUME without error
RETURN without GOSUB
String formula too complex
Subprogram not defined
Subscript out of range
Syntax error
Table not found
Type mismatch
Variable required
WEND without WHILE
WHILE without WEND

If you receive a program error, call Simplicity Systems, Inc. at 1-218-773-7966 and report the error and your procedure.

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Appendix E
Un-menued Codes

Survey 4.0 contains several routine codes that are not contained on any pull down menus. These commands are:

A*n* - Advance Printer

Used to advance the printer from 1 to 9 lines. Replace the ***n*** with any numeral 1-9, such as **A3** to advance the printer three lines.

CJ - Clear Junk

Used to erase old backup files. Survey 4.0 will present a list of existing backup files for the current active job and allow you to select those files that you would like to delete.

EM - End Macro

Used to terminate a macro operation that did not correctly terminate. This option should be used when the macro you are attempting to run does not correctly restore the original configuration settings.

FR - Free RAM

Used to report the available RAM memory.

KS - Keystroke Save

Works just like **Save Keystrokes** (**SK** - Section 12.03). Just in case you get confused.

PB - Previous Backup

Used to restore the backup file that you thought was overwritten by your last backup operation. Aren't we thoughtful?

PI - Print Input Data

Works just like **PD** to toggle your print input data **On** and **Off** (**PD** - Section 11.13). Provided as a convenience for those who prefer to think of **Print Inputs** instead of **Print Data**.

SA - Slope Angle Prompting

Used to toggle slope angle prompting **On** and **Off**. See **Slope Prompt** in Section 5.03 for more information.

TF - Traverse Fix

Used to call up the Traverse Adjustment menu when you change your mind after telling Survey 4.0 that you didn't want to adjust the traverse.

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Appendix F
Direct and Reverse Angles

In the collection of field data, many surveyors measure angles in both direct and reverse modes. Survey 4.0 has been set up to accommodate these types of measurements in both the horizontal and vertical planes.

The field procedure supported by Survey 4.0 is as follows:

1. Sight the backsight and set the transit to 0°;
2. Turn the angle **RIGHT** to the foresight;
3. Record the Direct Angle reading;
4. Plunge the scope of the transit;
5. Lock in the angle scale (vernier), loosen the plate and turn the transit to re-sight the backsight. The angle reading should not change;
6. Unlock the angle scale and turn the angle **RIGHT** to the foresight once again;
7. Record the Reverse Angle reading.

Bearing

To enter a direct and reverse angle pair, type in the direct and reverse angles separated by a (forward or backward) slash and press ↵Enter. For example (in the D.MMSS mode), if your direct reading is 78°26'47" and your reverse reading is 156°53'29", you would type:

`78.2647/156.5329` ↵Enter

Notice that we did not add an angle (quad) code to the above entry. When you are entering direct and reverse angles, any angle code entered is ignored. After Survey 4.0 accepts the actual (horizontal) angle entry, you will be asked for the angle code.

Select:
< 1 > Direct 78°26'47.0"
< 2 > Reverse 78°26'42.0"
< 3 > Mean 78°26'44.5"
< 4 > Re-Enter
Error: 0°00'05.0"

Survey 4.0 will analyze your entry and report back with a selection box containing the direct angle, the reverse angle, the mean angle, and the error between the two readings. (Note that the reverse angle is the difference between the reverse reading and the direct reading.) You will also be alerted to any errors over 20 seconds (0.0062 grads) through the use of a flashing warning. Select the angular value that you would like to use by pressing or clicking your mouse on the corresponding number. If you don't want any of the values shown, perhaps due to an entry error, select option 4 to re-enter the angle(s).

Angle code

If you are entering a horizontal angle, you will be prompted for the angle code. Type in the angle code and press ↵Enter, or select the angle code by pressing a corresponding function key. If you are entering a vertical angle, this prompt will not appear.

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Glossary

Acute Curve
A curve having a **Central Angle** of less than 180° (200 grads). See also **Obtuse Curve**.

Acute Triangle
A triangle in which all three angles are less than 90° (100 grads). See also **Obtuse Triangle**.

Alphanumeric
Any combination of letters and numbers, such as **Ab123C4de5**.

Alt
The **Alt**ernate key on your computer keyboard. See also **Re-Boot**.

ASCII
American **S**tandard **C**ode for **I**nformation **I**nterchange. A type of code used by most computers to represent letters and numbers.

Aspect Ratio
The ratio of width to height (in pixels) of a computer monitor.

Azimuth
The direction of one point or object with respect to another, expressed in terms of degrees turned to the right from a line of 0 (zero) degrees orientation. North azimuths are referenced to a 0 (zero) degree line running true North while South azimuths are referenced to a 0 (zero) degree line running true South.

Batch File
A text file containing DOS commands, and having a .BAT filename extension. When you enter the name of a batch file, DOS sequentially executes the commands contained within the file.

Boot
To start your computer, or to load and run a computer program. See also **Re-Boot**.

Bowditch Rule
See **Compass Rule**.

Buffer
An area of memory used as an intermediate storage area during disk read/write operations.

Ctrl
The **Contr**o**l** key on your computer keyboard. See also **Re-Boot**.

CD — A DOS command used to check or **C**hange **D**irectories.

Center Point — The point at the center of a circle at which all radii meet.

Central Angle — The angle at the center of radius of a circular arc. This angle is measured between the radial which intersect the arc to define the P.C. (point of curve) and the P.T. (point of tangent) of the arc.

COM1, COM2 — Communications ports. See **Serial Port**.

Compass Rule — A traverse adjustment method whereby corrections applied to the latitudes and departures of the courses are proportional to the length of each course divided by the total length of all courses.

Constant Factor — See **Grid Factor**.

Crandall Rule — A traverse adjustment method in which the angular error is first equally distributed among all measured angles. The angles are then held fixed while linear measurements are adjusted through a weighted least squares procedure.

Cuerda — A unit of area measurement which equals 3,930.3956 square meters.

Curvature — Refers to the offset from the tangent to the curve resulting from the curvature of the earth.

Default — A value that will be accepted as the data entry when no other value is entered.

Degree — $^{1}/_{360}$ th of a circle. See also **Grad** and **Radian**.

Delete — The **Del**ete key on your computer. See also **Re-Boot**.

Delta Angle — See **Central Angle**.

Directory — A DOS maintained index of disk program files and/or sub-directories. Similar to a chapter index.

Disk I/O Error — An **I**nput/**O**utput error. Commonly caused by disk drive mechanical or interface problems and/or by attempting to utilize bad or unformatted media for data storage.

DOS	**D**isk **O**perating **S**ystem. The instruction set used by your computer in basic operations.
DOS Prompt	Usually seen as **A>**, **B>** or **C>**. A request by the computer for you to provide information or commands.
Drive Designation	A letter that identifies a disk drive.
↵Enter	The carriage return, or enter key on your computer keyboard.
EDM	**E**lectronic **D**istance **M**easurement. Sometimes also used to refer to electronic distance (measuring) meters.
Endless Loop	See **Loop, Endless**.
Esc	The **Esc**ape key on your computer.
External	The distance from the intersection of the tangents to a curve (the P.I.) to the curve itself.
Fixed Disk	See **Hard Disk**.
Floppy Disk	A 5.25" or 3.5" removable disk for storing files. Sometimes referred to as **Media**.
Grad	$^{1}/_{400}$ th of a circle. See also **Degree** and **Radian**.
Grid Factor	A factor used to scale the coordinates from one coordinate system to match another. Used frequently in the transformation of a local datum coordinate system to state plane coordinate system.
Hard Disk	A large capacity disk that cannot be removed from its drive.
International Foot	A unit of linear measurement based on the definition of 0.3048 meters (International) = 0.304800609601219 meters (US). 1 International Foot = 0.999998012358944 foot US. See also **Survey Foot**.
Inverse	The computation of the length and azimuth of a line from the coordinates of its endpoints.

Keystroke File — A disk file containing the operator's key presses from a computing session. Keystroke files may be edited and re-run. See Section 3.13.

Loop, Endless — See **Endless Loop**.

LPT1, LPT2 — Line printer ports. See **Parallel Port**.

Macro — A user-created file containing configuration statements, prompts, equations, conditional statements, and keystrokes. Macros are essentially small programs designed to solve repetitious problems. See Section 17.

Media — See **Floppy Disk**.

Mid-Ordinate — The radial distance from the middle of a chord to the arc.

Non-Tangent Curve — A curve whose tangent line from the P.C. (Point of Curvature) travels along a bearing different than that of the boundary line coming into the P.C. See also **Tangent Curve**.

Obtuse Curve — A curve having a **Central Angle** of greater than or equal to 180° (200 grads). See also **Acute Curve**.

Obtuse Triangle — A triangle in which one angle is greater than 90° (100 grads). See also **Acute Triangle**.

Osculating Circle — The circle with its center on the normal to the concave side of a curve at a given point on the curve and with its radius equal to the radius of curvature at that point.

Parallel Port — The communications port to which a printer is usually attached.

Path — A list of directory names that identifies the location of a directory on a disk. Think of it as a family tree.

Path Name — That portion of a filename specification that defines the path to a file.

Point String — A group of point numbers separated by commas and/or dashes. Point strings are used in Defined Figures and many other routines. See Sections 3.05 and 10.14.

Precision Ratio — A ratio reflecting the error of a traverse expressed as the total length of the traverse divided by the total length of the error.

Radian — A unit of angular measurement equal to 180/π, approximately 57.29578°. See also **Grad** and **Degree**.

Radius Point — See **Center Point**.

RAM Disk — An area of memory that behaves like a disk drive. Contents of a RAM disk are lost when the computer loses power.

RAM Memory — Random Access Memory. The memory that a computer uses for programs and data. The contents of RAM change often and are lost when the computer loses power.

Re-Boot — Pressing the [Ctrl] [Alt] [Delete] simultaneously causes your computer to restart itself.

Refraction — The bending effect that the earth's atmosphere introduces on visual observations.

Root Directory — The main directory listing of a disk. Similar to the table of contents of a book. See also **Directory** and **Sub-Directory**.

Serial Port — A communications port to which a modem, a plotter, a digitizer, a mouse and sometimes a printer may be connected.

Stack — A five register memory area (X, Y, Z, T, and Last X) used by the S4-Calc program. See Section 15.04.

Stack Space — An area of RAM that holds values of intermediate calculations, miscellaneous variables, and program line addresses. See Sections 17.05 and 17.07.

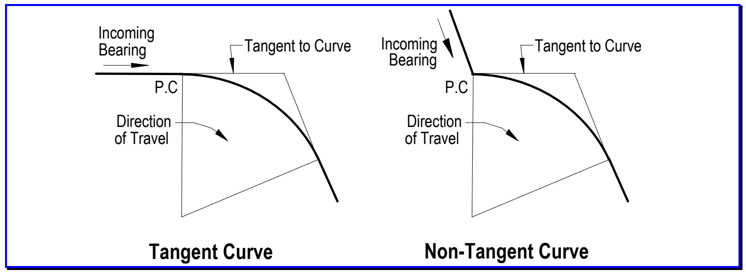
Sub-Directory — A directory containing files that is located under a parent directory. May be used to refer to a portion of a disk set aside to contain files common to an application. Think of a sub-directory as being like a folder in a file cabinet (the disk), where each folder contains several files.

Survey Foot, US — A unit of linear measurement based on the definition of 0.304800609601219 meters (US) = 0.3048 meters (International).

1 US Survey Foot = 1.000002000004 International Foot. See also **International Foot**.

Tangent Curve

A curve whose tangent line continues from the P.C. (Point of Curvature) along the same bearing as the boundary line coming into the P.C. See also **Non-Tangent Curve**.



Transit Rule

A traverse adjustment method in which the correction to the latitude (or departure) of a line is to the latitude (or departure) of that line as the closure in latitude (or departure) is to the sum of all latitudes (or departures), regardless of sign.

Traverse, Closed

A traverse that begins and ends at the same fixed point.

Traverse, Open

A traverse that begins and ends at different fixed points.

Traverse

1. A method of surveying in which the lengths and directions of lines are obtained by field measurements which are then used to determine the relative positions of the points. **2.** A series of connected courses of known bearing and distance.

Vertical Angle

An angle turned in the vertical plane with respect to a horizontal plane lying at 0 (zero) degrees.

Write Protected

A disk overwrite protection feature activated by placing a tape over the write protect notch on a 5.25" disk, or by opening the write protect door on a 3.5" disk. To write to a disk, the notch must be uncovered (5.25"), or the door must be shut (3.5").

Zenith Angle

An angle turned in the vertical plane with respect to a horizontal plane lying at 90 degrees.

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