

## SURVEY PROGRAM (with COGO) for the HP-33S

### NCEES Approved Calculator

Having problems getting ready for the NCEES Surveyors Exam because your calculator is not on the NCEES approved list? Try these HP33S Surveying and COGO programs. They will give you all the computing power you need to solve the exam problems. Best of all they are available at no charge and documentation is available at my web page at [www.melbard.com](http://www.melbard.com)

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I have been writing Survey and COGO programs for my Civil Engineering Technology and Land Surveying students at Milwaukee Area Technical College since the 1980's. These programs have been written in various forms to run on the HP32S, HP32SII, TI-85 and TI-86. When the NCEES approved calculator list came out several years ago I decided to upgrade some of these programs so they would also run on the HP-33S calculator. I first provided these as a service to my students for educational purposes, but then I decided to make them available at no cost on the internet to others in the profession and to those who were preparing for the Civil Engineering and/or Land Surveying licensing exams.

If you are familiar with basic survey calculations and COGO routines you will be able to solve problems with these programs even if you are not familiar with using HP calculators or RPN. If you are more familiar with algebraic calculators you may want to take two calculators to the exam (the HP33S with the Survey and COGO programs and an approved algebraic calculator, like a TI-30X or TI-36X for general math in algebraic mode, so working in RPN is not necessary)

Even though the HP33S is both an Algebraic and an RPN mode calculator, these programs are written for RPN mode, and it is not recommended to switch between the two modes while using the programs. Again experience with RPN is not necessary to run these programs, because all you need to do is input data in the correct format and record the answers that return.

The following is a brief summary of these Survey and COGO Programs that can be loaded into the HP33S. All programs must be manually entered line by line. It will take about 1 to 2 hours to key in the entire set of programs, however not all of them need to be entered. Optional programs are identified. These optional programs can be individually added or deleted from the calculator at any time.

**XEQ W** (same as the 1 key, so it is easier to think of it as **XEQ 1**) will store the Northing and Easting of Point 1. The coordinates of Point 1 will be used in several of the following programs.

**XEQ X** (same as the 2 key, so it is easier to think of it as **XEQ 2**) will store the Northing and Easting of Point 2. The coordinates of Point 2 will be used in several of the following programs.

**XEQ Y** (same as the 3 key, so it is easier to think of it as **XEQ 3**) will inverse from Point 1 to point 2 and will return the answer as Distance and Azimuth.

**XEQ E** will do a Side-Shot by Distance and Azimuth from Point 1 and will return the answer in Northing and Easting of the new point.

**XEQ B** Bearing–Bearing Intersection This program will compute the coordinates (Northing and Easting) of the intersection of two lines with specified azimuths from Points 1 and 2.

**XEQ C** Bearing–Distance Intersection This program will compute the coordinates (Northing and Easting) of the intersections of both solutions of a line with a specified azimuth from Point 1 and a specified distance from Point 2.

**XEQ D** Distance–Distance Intersection This program will compute the coordinates (Northing and Easting) of the intersection of that is the specified distance from Point 1 and a specified distance from Point 2.

**XEQ Z** will display the coordinates that are stored in XEQ 1 and XEQ 2 and will swap the point numbers of the coordinates if desired.

The remaining programs listed are optional and the above COGO programs do not need any of the following to run.

**XEQ A** will compute the area of a boundary defined by straight lines between points with known coordinates. (the calculator limits the number of lines in the boundary to a 7 sided polygon)

**XEQ U** (same as the 5 key, so it is easier to think of it as **XEQ 5**) will Interpolate and/or Extrapolate between a data range stored in specified registers.

**XEQ V** will compute the stations and elevations of points on a Vertical Curve at a specified incremental distance like full, ½ stations or ¼ stations, etc.

**XEQ H** will compute the station and elevation of the High or Low point of a Vertical Curve.

**XEQ P** will compute the elevation of any station point specified on a Vertical Curve.

**XEQ J** will compute several Horizontal Curve components (when the Central Angle and Radius are known). Computed components include Arc Length, Tangent Length, Chord,

Degree of Curvature (arc definition), External, Mid Ordinate, Sector area, Arc to Chord area.

**XEQ K** will compute several Horizontal Curve components (when the Central Angle and Arc Length are known). Computed components include Radius, Tangent Length, Chord, Degree of Curvature (arc definition), External, Mid Ordinate, Sector area, Arc to Chord area.

**XEQ L** will compute several Horizontal Curve components (when the Radius and Arc Length are known). Computed components include Central Angle, Tangent Length, Chord, Degree of Curvature (arc definition), External, Mid Ordinate, Sector area, Arc to Chord area.

**XEQ I** will compute the angle and distance to a stake out point from a known occupied point and backsight point.

**XEQ F** will compute the station and offset of any point (defined by N and E coordinates) along any base line defined by N and E coordinates.

**XEQ O** will compute the coordinates of a side shot point defined by angle and distance from a backsight line. This program also allows you to traverse to and from the new point and keep moving up to additional new points created.

### **Installing the software into the HP-33s**

Loading the program code into the HP-33s can only be done manually by keying in each program line. It isn't too difficult to figure out with some assistance from the calculator's manual.

However if you do not feel comfortable loading the software code into the HP-33s or if you just don't want to take the time to learn how, I will be happy to do it for you (at a small fee including shipping costs). Also, I can provide a new HP-33s calculator (at a low cost) with the software loaded.

As I stated previously I have always provided my programs to my students and to the profession at no cost for the benefit of the profession and to those developing their careers by preparing for the NCEES licensing exams. I am not in the software business but I will be happy to assist you and answer your questions if you want some help.

Feel free to email me at [melbard@melbard.com](mailto:melbard@melbard.com) or call me at 414-327-0330 if you want additional information. I will reply to all questions within a few days.

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