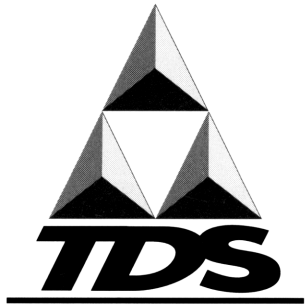

TRIPOD DATA
SYSTEMS, INC.

TDS-48GX

Survey Pro
Reference

SURVEY-PRO

Reference Manual

For use with the HP-48GX

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REFERENCE

This section of the manual presents the reference material about the SURVEY-PRO from TDS. Each screen is presented in a common and consistent format. You should read the tutorial sections (chapters 1 through 8) to learn the concepts behind the operation of the SURVEY-PRO. The reference section should be used as a refresher to understand how specific screens are used and to fill in the detailed information that was omitted from the tutorial section in the interests of brevity.

ORGANIZATION OF THE REFERENCE MANUAL

The reference section of this manual is presented in a complete and consistent format. It is assumed that you have read and understood the tutorial section of this manual. The reference section is not written to be read to learn how to use SURVEY-PRO. It is assumed that you know how the basic user concepts of the machine are organized and, specifically, that you understand the difference between Menus and Screens. (If you do not, reread Chapter 2 - Getting Started.)

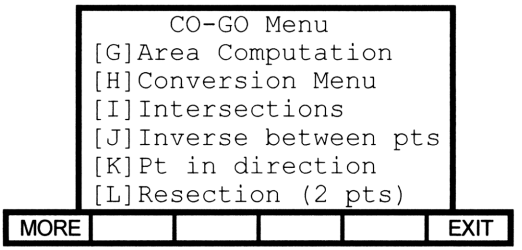
Thus, the Menus are not presented individually. They are discussed in general in the beginning of this section. Then each screen is presented. Screens are grouped by class of application from the Main Menu and by access letter within this grouping. Screens which may be accessed via multiple menu paths are cross referenced from the various starting menus.

INTRODUCTORY COMMENTS

All work in SURVEY-PRO is accomplished within the machine's Screens. Access to the various screens is accomplished via the machine's Menus. It is important to understand the difference between Menus and Screens. That material is covered in Chapter 2 - Getting Started. This section of the Reference Manual will discuss Menus and Screen in a generic way. Following sections will cover each Screen in detail. Menus will not be covered beyond the present discussion.

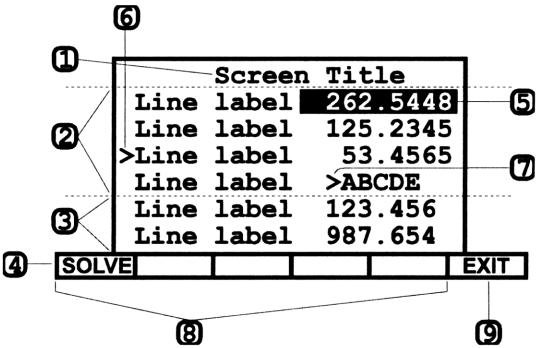
THE GENERIC MENU

The generic Menu is characterized by a sequence of choices in the display, each of which is preceded by a letter of the alphabet. A choice is made by pressing the appropriate letter-key on the keyboard. The generic menu is also characterized by the single "soft" key **[EXIT]** shown in the right hand key position in the display. Menus which have more than six or seven choices will also have a **[MORE]** softkey displayed at the left of the screen. Pressing this key will display more menu choices. A sample menu is shown below for reference:



THE GENERIC SCREEN

The figure below is of an imaginary generic screen labeled to show the various features of real screens.



None of the screens in SURVEY-PRO has all of these features. However, by understanding the nature of the generic features as shown in this screen, you will have a firm understanding of the use of the real screens that you will encounter as you use SURVEY-PRO.

Each of the features is described by reference to the feature number as shown in the figure above:

1. Screen Title: The screen's title is shown in the top line of the display. Some screens which require more lines of information will not show the title at all. If the title is shown, it will be in the top row.

2. Input Region: Some of the lines in the display are reserved for data input. The left part of the line shows the label defining the data to be input. The right side is where the data goes. The input lines will allow the screen cursor to be placed in the data field of that line. (See 5., below) Some screens that only show the results of computations will not have any input region.

3. Output region: Some of the lines in the display are reserved for data output: the results of computations based on the contents of the input region. The left part of the line shows the label defining the nature of the output. The right side shows the output itself. The output lines will not allow the screen cursor to occupy the data field of the line. (See 5., below.) Some screens that require a significant amount of data input will not have an output region. The solution will be shown on a separate output screen. Separate output screens normally follow immediately when data input is complete and the necessary function key is pressed.

4. "Soft" Key Region: Every screen will have the bottom row reserved for the definition of up to six "soft" keys which are activated by pressing the six keys in the top row of the HP-48GX. The first five keys can be any of a variety of functions dependent on the particular screen being used. (See 8., below.) The sixth key will contain the label **|EXIT|.** (See 9., below)

5. Data Entry Cursor: In any screen which has an input region, there will be a data entry screen cursor that will be positioned on the line that is active and ready to receive data from the keyboard. The cursor is recognized by the fact that it shows the data in "inverse video". The cursor may be moved to the next legal input line by pressing either of the vertical cursor keys **|↑|** , **|↓|** , or by pressing **|ENTER|**. The **|↑|** key will move the cursor to the previous data input line; the **|↓|** key will move it to the next following data input line. When the cursor is in position at a data input field, the field will only accept entries from the keyboard which are legal for the kind of data being entered. For example, it is not possible to key in alpha data into a field for which only numeric data makes sense (such as a distance). Entering *alpha data* into an input line *requires* pressing the **|α|** key *once* both before and after the entry.

Some screens will have more than one data input field contained within a single display line. For example, the Traverse / Sideshot Screen shows both the occupied point and the foresight point on the top line. It also shows the height of the instrument and the height of the rod on the same line, just above the command "soft" key line. To move the cursor from one data field to the other, you still use the vertical cursor keys, |↑| or |↓|, even though the cursor is moving "sideways". The horizontal cursor keys |→| and |←| are reserved for scrolling prompts and scrolling data.

6. Scrolling Prompt Symbol: Input lines which have a ">" character *before* the line label provide you with a choice of the kind of data which may be keyed in to solve the problem represented by the screen. For example, in many cases, angles may be keyed into SURVEY-PRO as an azimuth or as a bearing. The scrolling prompt gives you an opportunity to change the prompt (line label) of the input line to match the kind of input data that you want to use. To *"scroll"* (change the prompt), move the data entry cursor to the line in question and press either of the horizontal cursor keys |→| or |←|. Pressing one of these keys successively will allow you to review all of the prompt options which are permissible for this particular input line.

7. Scrolling Data Symbol: When the ">" character appears in *front* of an *input data* field, you know that you have a very restricted choice of inputs that you may specify for this data line. All of the choices may be reviewed by moving the data entry cursor to the line in question and pressing either one of the horizontal cursor keys |→| or |←|. Pressing one of these keys successively will allow you to review all of the data input options which are permissible for this particular input field.

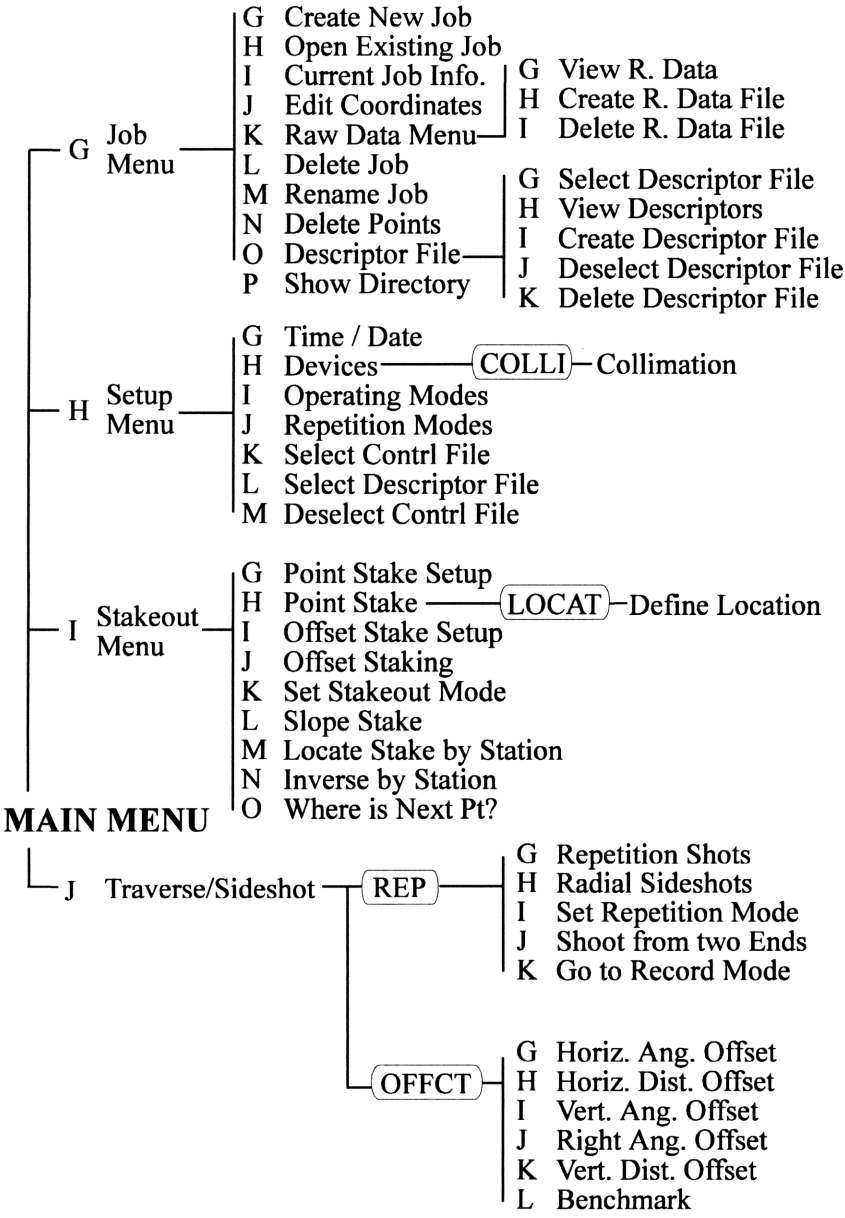
8. Command "Soft" Keys: The first five "soft" key positions are reserved for the screen commands. These are the keys that will cause SURVEY-PRO to perform some action based on the data which has been entered into the input data lines prior to invoking the command. The action may be any number of things. Some commands transfer control to another screen. Others will perform some computation and return the results to the output lines of the current screen. Still others will compute some results and transfer control to another screen. Most often, given the problem being solved and the name of the command, the action taken will be obvious. In any event, all of the commands are described in detail in this reference manual. Consult the section that describes the screen in question.

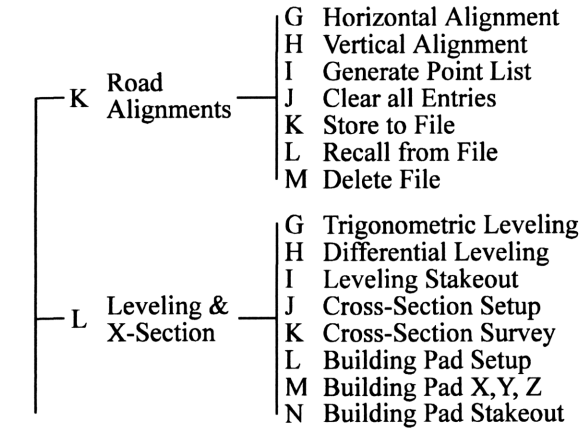
9. The **[EXIT]** Key: The right hand "soft" key position is reserved for the label **[EXIT].** The **[EXIT]** key will always return you to an immediately previous screen or menu.

SCREEN TREE MAP

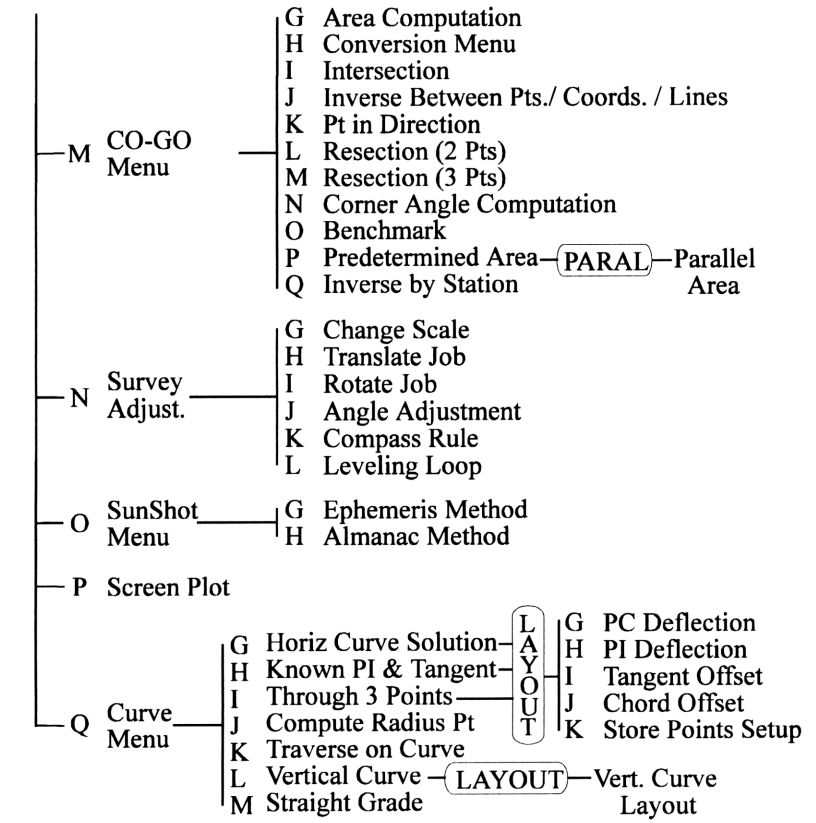
The next three figures provide a pictorial "map" of SURVEY-PRO's screen tree. Using this tree, you can determine the sequence of menus and alpha keys required to access any of the screens that you may need to use to solve surveying problems with your SURVEY-PRO.

REFERENCE

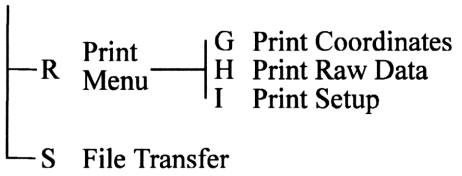

MAIN MENU
G Job Menu
G Create New Job
H Open Existing Job
I Current Job Info.
J Edit Coordinates
K Raw Data Menu
L Delete Job
M Rename Job
N Delete Points
O Descriptor File
P Show Directory
G View R. Data
H Create R. Data File
I Delete R. Data File
G Select Descriptor File
H View Descriptors
I Create Descriptor File
J Deselect Descriptor File
K Delete Descriptor File
H Setup Menu
G Time / Date
H Devices
COLLI
Collimation
I Operating Modes
J Repetition Modes
K Select Contrl File
L Select Descriptor File
M Deselect Contrl File
I Stakeout Menu
G Point Stake Setup
H Point Stake
LOCAT
Define Location
I Offset Stake Setup
J Offset Staking
K Set Stakeout Mode
L Slope Stake
M Locate Stake by Station
N Inverse by Station
O Where is Next Pt?
J Traverse/Sideshot
REP
G Repetition Shots
H Radial Sideshots
I Set Repetition Mode
J Shoot from two Ends
K Go to Record Mode
OFFCT
G Horiz. Ang. Offset
H Horiz. Dist. Offset
I Vert. Ang. Offset
J Right Ang. Offset
K Vert. Dist. Offset
L Benchmark


K Road Alignments
G Horizontal Alignment
H Vertical Alignment
I Generate Point List
J Clear all Entries
K Store to File
L Recall from File
M Delete File
L Leveling & X-Section
G Trigonometric Leveling
H Differential Leveling
I Leveling Stakeout
J Cross-Section Setup
K Cross-Section Survey
L Building Pad Setup
M Building Pad X,Y, Z
N Building Pad Stakeout

MAIN MENU

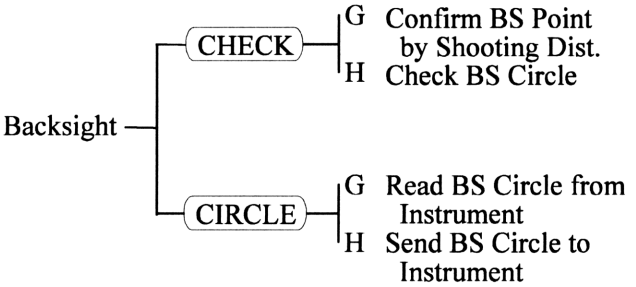

M CO-GO Menu
G Area Computation
H Conversion Menu
I Intersection
J Inverse Between Pts./ Coords. / Lines
K Pt in Direction
L Resection (2 Pts)
M Resection (3 Pts)
N Corner Angle Computation
O Benchmark
P Predetermined Area
PARAL
Parallel Area
Q Inverse by Station
N Survey Adjust.
G Change Scale
H Translate Job
I Rotate Job
J Angle Adjustment
K Compass Rule
L Leveling Loop
O SunShot Menu
G Ephemeris Method
H Almanac Method
P Screen Plot
Q Curve Menu
G Horiz Curve Solution
H Known PI & Tangent
I Through 3 Points
J Compute Radius Pt
K Traverse on Curve
L Vertical Curve
M Straight Grade
LAYOUT
G PC Deflection
H PI Deflection
I Tangent Offset
J Chord Offset
K Store Points Setup
LAYOUT
Vert. Curve Layout

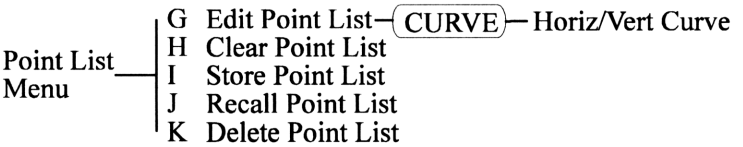
MAIN MENU



UTILITY SCREENS

These screens can be accessed from a number of locations throughout the SURVEY-PRO program by pressing the **|BACK|** or **|PTLST|** softkeys.

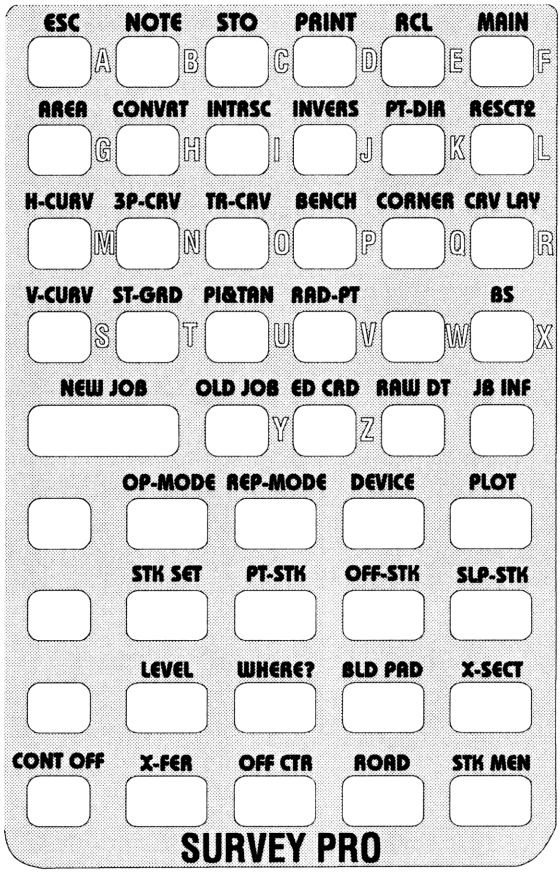




THE KEYBOARD OVERLAY

Your SURVEY-PRO Card comes with an overlay which you may install on your HP-48GX's keyboard to help you locate the alpha keys more easily and to mask the shifted functions of the 48GX which are not used by SURVEY-PRO. The overlay also displays the shifted function of each key (in purple) for direct access to many of SURVEY-PRO's most-used routines. The overlay appears as shown:

Overlay for the SURVEY-PRO



REFERENCE

Note that the alpha keys, printed in white, are positioned to the right of the associated key. The **[CONT]** and **[OFF]** functions, printed in purple and green respectively, are positioned above the **[ON]** key with which they are associated. The Global Top-Row Keyboard Functions (see above) are printed in purple. These keys perform a function and return to where you left off. The remainder of the shifted function keys send you to a screen or menu within SURVEY-PRO program's tree structure. When you **[EXIT]** from that screen, you will return to the screen from which you pressed the direct access key. With the exception of the top row keys, all direct access functions can be accessed from the menu tree in the normal manner. Below is a table listing each Global and Direct Access key used by SURVEY-PRO and a simple description of what each does:

Key	Function	Description
A	**ESC**	Escape temporarily from the SURVEY-PRO program and return to the main operating system of the HP-48GX. See the **ON** or **CONT** key to return to SURVEY-PRO
B	**NOTE**	Enter a NOTE in the Raw Data file.
C	**STORE**	Store a value to the Clipboard register.
D	**PRINT**	Print the current screen to an Infrared Printer.
E	**RECALL**	Recall a value from the Clipboard.
F	**MAIN**	Return to the Main Menu from wherever you are in SURVEY-PRO.
G	**AREA**	Compute the area of a parcel of land.
H	**CONVRT**	Convert Azimuths to Bearings or Vertical angle and Slope distance to Horiz. distance and change in elevation.
I	**INTRSC**	Find a point at the intersection of two lines.
J	**INVERS**	Compute the Inverse between two points or a point and a line.
K	**PT-DIR**	Compute the coordinates of a new point by specifying a known point, a direction and distance.
L	**RESCT2**	Determine the coordinates of an unknown occupied point by field measurements (angles and distances) to two known points.
M	**H-CURV**	Solve for the properties of a horizontal curve.
N	**3P-CRV**	Solve for a curve that will pass through three known pts.
O	**TR-CRV**	Include a horizontal curve in a traverse.

P	**BENCH**	Compute the elevation of the occupied point given the known elevation of the foresight.
Q	**CORNER**	Compute the angle made by two lines that meet at a common (corner) point.
R	**CRV LAY**	Will bring up the Curve Layout Menu where you can select the PC & PI Deflections, Tangent & Cord Offsets.
S	**V-CURV**	Compute the elevations at various stations along a vertical curve.
T	**ST-GRD**	Solve for the elevation at various stations along a straight grade.
U	**PI&TAN**	Solve for the PC and PT with known PI, tangents and radius.
V	**RAD-PT**	Calculate the radius point of a curve with two points and one other parameter known.
W		
X	**BS**	Modify the backsight angle and circle angle setting.
Y	**OLDJOB**	Allow you to select an existing job to be opened.
Z	**ED CRD**	Provide a way to review and edit coordinate data.
ENTER	**NEW JOB**	Allow for the creation of a new job file.
DEL	**RAW DT**	Provide a mechanism for reviewing the raw data file.
←	**JB INF**	Provide for a way of reviewing many of the important parameters of the currently active job.
9	**DEVICE**	Establish manual input or communication with an electronic total station.
8	**REP-MODE**	Establish the technique to be used in acquiring angles and distances in your survey.
7	**OP-MODE**	Set the operating modes.
6	**OFF-STK**	Stakeout a right-of-way by specifying the station on the center line and offset distance from the center line.
5	**PT-STK**	Interact with your gun and your rod man to performing a radial stakeout.
4	**STK SET**	Establish the setup parameters of the offset stakeout.
3	**BLD PAD**	Will bring up the Building Pad Menu where you can Setup, Survey and Stakeout a building pad.
2	**WHERE?**	Help the rod man to find the next point relative to his own point of view during a stakeout by point number.
1	**LEVEL**	Will bring up the Leveling Menu where you can select the Trig., Differential or Stakeout leveling routines.

0	XFER	Transfer your data to or from a PC or Data Collector.
÷	PLOT	View a plot of a block of points in SURVEY-PRO's screen display.
*	SLP-STK	Slope stake a road.
-	X-SECT	Will let you setup and shoot Cross-Sections.
+	STK MEN	Will bring up the Stakeout Menu.
ON	CONT	Return to the SURVEY-PRO program after ESC to the operating system of the HP-48GX.
.	OFF CTR	Will transfer you to the Off Center Shot Menu.
SPC	ROAD	Will bring up the Road Alignment Menu.

GLOBAL TOP-ROW KEY COMMANDS

In addition to the six softkeys whose functions change depending on the screen that is active, there are six *Global Keys* that you access with the *purple* shift key and the keys in the top row. The functions they perform are **|ESC|**, **|NOTE|**, **|STORE|**, **|PRINT|**, **|RECALL|** and **|MAIN|** respectively. These functions are described in more detail below:

ESCAPE COMMAND

Purpose of command - to allow you to escape from the SURVEY-PRO program and return to the operating system of the HP-48GX in order to run some other software or to do manual calculations.

Path: From any screen, press ← **|A|**.

The **|ESC|** (Escape) function may only be executed from a SCREEN. When you are in a screen and you press **|ESC|** - (← **|A|**), control of the system is passed temporarily from SURVEY-PRO to the operating system of the 48GX.

In addition, the numerical value in the screen at the current cursor location is loaded in the operational stack of the 48GX at level 1. The word "HALT" appears in the annunciator line at the top of the screen to indicate that a running program has been halted. Thus, it is now possible for you to perform any calculations that you want in the stack, including calculations on the value that has been returned. This can be done either manually from the keyboard or via other software routines which you may have written and loaded into the system memory. When you are finished and wish to return to SURVEY-PRO, press **|CONT|** or ↩ **|ON|**. **|CONT|** is the purple shifted function above the **|ON|** key. You will return to the screen you were in before executing **|ESC|**. When you return, the value at the cursor location is replaced by the value from level 1 of the 48GX's stack.

NOTE:

If you find yourself at the HP-48GX system stack and do not know why or how you got there, you may have inadvertently pressed the **|ESC|** key. Check and see if **HALT** is displayed on the top of the screen. If it is, then press the **|CONT|** or ↩ **|ON|** keys. If **HALT** is not displayed, you must have accidentally **|EXIT**ed**|** the program; Rerun the SURVEY-PRO program.

NOTE COMMAND

Purpose of command - to allow you to key in a note of arbitrary text into your currently active raw data file.

Path:	From any screen or menu, press ↩ **[B]**.

This command will present a screen that is blank except for the message "Enter Note". You may then key in arbitrary text information which will be recorded as a note in your active raw data file. The only facility you have to edit this note is with the back space key. When you are finished keying in the note, press **[ENTER]** to place it in the raw data file and return to your previous screen or menu.

At any time during your work, if you would like to record a note, such as the date, names of your crew or any other pertinent information, press [↵] **|B|**. You will then be able to key in random text information which will be stored in the raw data file as a note.

STORE COMMAND

Purpose of command - to allow you to take any numeric value from an input field and store it to a temporary clipboard register.

Path:	From any screen or menu, press [↵] **|C|**.

To save a numeric value, first highlight the field that you want stored and then press [↵] **|C|**. The value can be moved to another field using the **|RECALL|** key (see below).

PRINT COMMAND

Purpose of command - to allow you to print any screen or menu in SURVEY-PRO with the HP-82240B Infrared Printer.

Path:	From any screen or menu, press [↵] **|D|**.

This command will output whatever is in the display of SURVEY-PRO to the HP-82240B Infrared Printer. Before issuing this command, you should be certain that the printer is properly positioned to receive the information; that the printer has an adequate supply of paper; and, that it has been turned ON. This function may be accessed from any screen or menu in SURVEY-PRO at any time that you want a hard copy of your work.

RECALL COMMAND

Purpose of command - to allow you to copy a numeric value from the clipboard register to the currently highlighted input field.

Path:	From any screen or menu, press ↵ **[E]**.

This command is used in conjunction with the **[STORE]** command. After you have stored a numeric value to the clipboard register, you can use **[RECALL]** to copy that value into a new field. To copy a numeric value, first, highlight the field that you want to move it to, then, press ↵ **[E]**.

MAIN COMMAND

Purpose of command - to allow you to return to the MAIN MENU from any other screen or menu in SURVEY-PRO.

Path:	From any screen or menu, press ↵ **[F]**.

This command will immediately return to the MAIN MENU of SURVEY-PRO. It is a shortcut method of returning to the Main Menu "home base" without pressing **[EXIT]** repeatedly.

GENERALIZED OPERATION OF A SCREEN

The generalized operation of a SURVEY-PRO screen is to enter all of the required input data by moving the cursor key to the various data fields and keying in the required information. For those data fields that are preceded by a scrolling data symbol ">", you should use the horizontal cursor keys and scroll to the data input option that you want. Data may be entered in any order. During the data entry procedure, no "action" is being taken by SURVEY-PRO. Action is initiated by pressing one of the "soft" command keys at the bottom of the screen.

In certain screens, some of the data input fields may be "filled out" by data transferred automatically from an electronic total station. Such data fields are described in the detailed screen descriptions in this reference manual. In these screens, you may trigger the data collection and transfer to SURVEY-PRO by pressing the appropriate "soft" key in the command line.

DESCRIPTION OF SCREENS

In the sections of the reference manual that follow, each screen will be described as follows:

First, the title of the screen will be in a box at the top of the page. This will be followed by the primary menu path to arrive at the screen. If there are alternative paths to the screen, they will also be given. Next, the screen itself is presented. Alternative scrolling prompts are shown to the left of the screen picture. Alternative scrolling data fields are shown to the right of the screen picture. Below the screen picture are two framed groups of information. The first framed group is reserved for a detailed description of each input and output line of the display. The second framed group is reserved for a detailed description of the command "soft" keys.

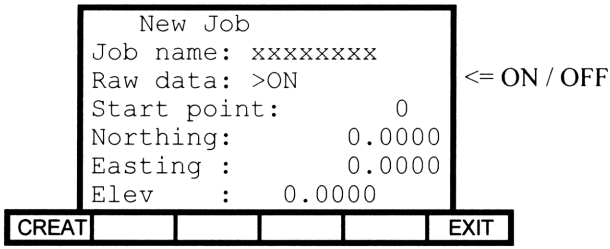
The screens are organized within this reference section by class and order of screen. At the end of the screen descriptions, there is an alphabetical reference list of screens by title.

JOBS MENU SCREENS

NEW JOB SCREEN

Purpose of screen - to allow for the creation of a new, named job file.

Path: From the Main Menu, press **[G]** Jobs Menu - **[G]**



Job name: is the name of the new job file to be created
Raw data: indicates whether or not a raw data file is to be set up and raw data stored for this particular job.
Start point: is the lowest numbered point for this job. Once this number has been selected you may *not* use a smaller point number in this job.
Northing: is the north coordinate for the start point.
Easting: is the east coordinate for the start point.
Elevation: is the elevation for the start point.

[CREAT] will establish the job file for this job with the parameters selected as shown in the screen. If the raw data line is ON, then a raw data file will also be established. The Current Job screen will then be displayed (see below). If you have set the Operating Modes field, Prompt for Setup, to yes then as you **[EXIT]** the Current Job screen you will be asked if "you wish to step through all setups?" If you select YES the Operating Mode, Device Setup, and Backsight Setup Screen will be displayed for changing any parameters including the Occupy and Backsight points and HI. When you have entered a Backsight, Occupy Pt and HI and pressed **[SOLVE]** you are ready to traverse.

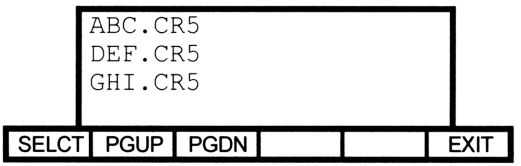
NOTE:

If your starting point for the survey is not the lowest numbered point, you should still specify the lowest numbered point in the Start point line. If you do not know the coordinates of this point at the time that you create the job, you may use any coordinates and edit (overwrite) them later. If some other point is the actual starting point with known coordinates, you may key them in the Point Data Screen.

OPEN EXISTING JOB SCREEN

Purpose of screen - to allow you to select an existing job to be opened.

Path: From the Main Menu press **[G]**, Jobs Menu - **[H]**



This screen shows the names of the jobs that have been created in SURVEY-PRO. Move the scroll bar to the job you want to open by using the vertical cursor keys **[↑]** and **[↓]**. Then press **[SELCT]**. The Current Job screen will be displayed (see below). If you have set the Operating Modes field, Prompt for Setup, to yes then as you **[EXIT]** the Current Job screen you will be asked if "you wish to step through all setups?" If you select YES the Operating Mode, Device Setup, and Backsight Setup Screen will be displayed for changing any parameters including the Occupy and Backsight points and HI. When you have entered a Backsight, Occupy Pt and HI and pressed **[SOLVE]** you are ready to traverse.

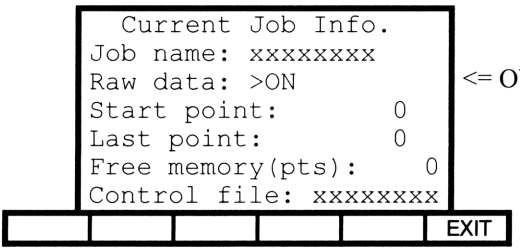
[SELCT] will chose the highlighted name as the job to open.
[PGUP] will move the display up a page.
[PGDN] will move the display down a page.

CURRENT JOB INFO SCREEN

Purpose of screen - to provide for a way of reviewing many of the important parameters of the currently active job.

Path:

→ From the Main Menu press **[G]**, Jobs Menu - **[I]**
→ From the Main Menu press **[G]**, Jobs Menu - **[H]**
Open Existing Job Screen - **[SELCT]**



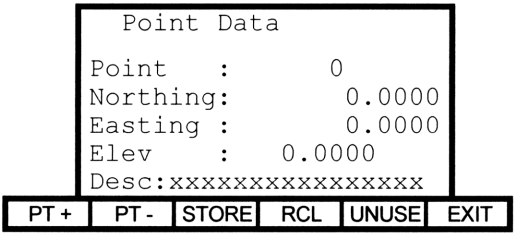
<= ON / OFF

Job: is the name of the currently opened and active job.
Raw data: indicates whether or not a raw data file has been established and is open.
Start point: is the lowest-numbered point in the job file.
Last point: is the current highest-numbered, used point in the job file.
Free mem (points): is the approximate amount of unused memory in the HP-48GX expressed in number of points.
Control file: is the name of the currently selected control file.

POINT DATA SCREEN

Purpose of screen - to provide a way to review and edit the coordinate data for the currently active job file.

Path: From the Main Menu, press **[G]** Jobs Menu - **[J]**



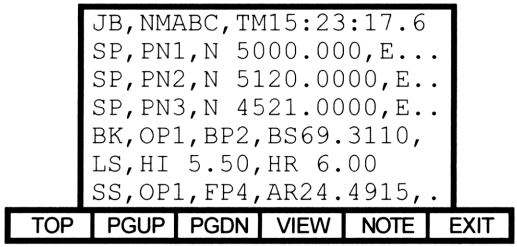
Point number: is the value of the point number for which the rest of the data in the screen applies.
Northing: is the north coordinate of the current point.
Easting: is the east coordinate of the current point.
Elevation: is the elevation of the current point.
Desc: is the point descriptor of the current point.

[PT +] will increment the point number to the next largest used point and display its coordinate information.
[PT -] will decrement the point number to the next smallest used point and display its coordinate information.
[STORE] will store the coordinate information currently shown in the display as the information in the job file at the currently displayed point number. If the current number already exists in the file, a warning screen will be displayed to confirm that the point is to be overwritten.
[RCL] will temporarily shift to a recall point number screen. You may then specify the point number to be recalled and press **[ENTER]** to return to the Point Data Screen.
[UNUSE] will display the next occurrence of an unused point with a point number greater than the current point number in the file.

VIEW RAW DATA SCREEN

Purpose of screen: to provide a mechanism for reviewing the raw data file for the current job, if such a file exists.

Path:	From the Main Menu, press **[G]** Jobs Menu - **[K]** Raw Data File Menu - **[G]**



[TOP] will display the first screen of the raw data file (including the first line).
[PGUP] will display the previous screen of the raw data file.
[PGDN] will display the next screen of the raw data file.
[VIEW] will display the entire contents of the highlighted line of the raw data file.
[NOTE] will temporarily transfer to a Note screen where you may key in an arbitrary note into the next line of the raw data file. Pressing **[EXIT]** from this screen will return to the View Raw Data Screen.

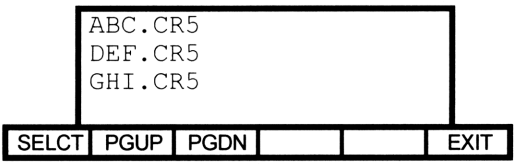
NOTE:

Other than the ability to add notes to the raw data file, it is **not** possible to edit the contents of this file from the View Raw Data Screen. In particular, it is **not possible** to delete any information from the raw data file from the HP-48GX.

CREATE RAW DATA FILE SCREEN

Purpose of screen - to provide a way of creating a Raw Data file in your SURVEY-PRO, if one does not already exist.

Path:	From the Main Menu press **[G]**, Jobs Menu - **[K]**, Raw Data File Menu - **[H]**



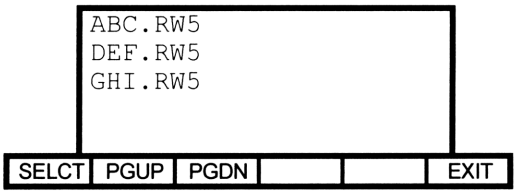
This screen shows the names of the jobs that have been created in SURVEY-PRO. Move the scroll bar to the job for which you want to create a Raw Data file by using the vertical cursor keys **[↑]** and **[↓]**. Then press **[SELCT]**.

[SELCT] will chose the highlighted name as the job to create a Raw Data file for, if one does not already exist in SURVEY-PRO. If one already exists, an error message will appear.
[PGUP] will move the display up a page.
[PGDN] will move the display down a page.

DELETE RAW DATA FILE SCREEN

Purpose of screen - provide a way of deleting a Raw Data file from SURVEY-PRO.

Path:	From the Main Menu press **[G]**, Jobs Menu - **[K]**, Raw Data File Menu- **[I]**



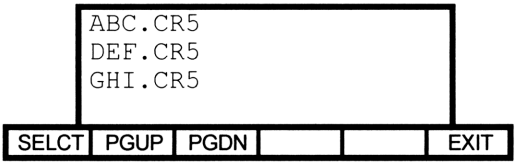
This screen shows the names of the Raw Data files that have been created in SURVEY-PRO. Move the scroll bar to the file you want to delete by using the vertical cursor keys **[↑]** and **[↓]**. Then press **[SELCT]**.

[SELCT] will chose the highlighted name as the Raw Data file to delete. Once a file is selected, you will be prompted: "Are you sure? [Y / N]. Pressing **[Y]** will delete the selected file. Pressing **[N]** will return you to the Raw Data file menu.
[PGUP] will move the display up a page.
[PGDN] will move the display down a page.

DELETE JOB SCREEN

Purpose of screen - to allow a job to be deleted from SURVEY-PRO.

Path: From the Main Menu, press **[G]** Jobs Menu - **[L]**



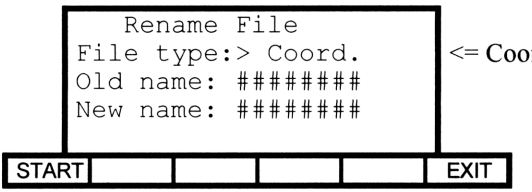
This screen shows the names of the jobs that have been created in SURVEY-PRO. Move the scroll bar to the job you want to delete by using the vertical cursor keys **[↑]** and **[↓]**. Then press **[SELECT]**.

[SELCT] will chose the highlighted name as the job to delete.
[PGUP] will move the display up a page.
[PGDN] will move the display down a page.

RENAME FILE SCREEN

Purpose of screen - to allow you to change the name of an existing file.

Path: From the Main Menu, press **[G]** Jobs Menu - **[M]**



<= Coord / PtLst / Text

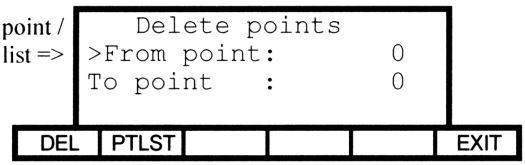
File type: is the type of file to be renamed, either coordinate, point list, or text.
Old name: is the file name before renaming.
New name: is the file name after renaming.

[START] renames the file.

DELETE POINTS SCREEN

Purpose of screen - To allow you to delete points from the currently active coordinate file.

Path: From the Main Menu, press **[G]** Jobs Menu - **[N]**



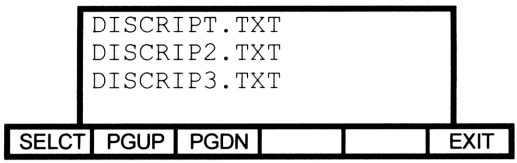
From point / To point - Using point list : allow you to specify all points which are to be deleted.

[DEL] deletes the points specified from the currently active job file.
[PTLST] will transfer to the Point List Screen.

SELECT DESCRIPTOR FILE SCREEN

Purpose of screen - to allow you to select the active descriptor table, from the available descriptor files.

Path: From the Main Menu press **[G]**, Jobs Menu - **[O]**, Raw Data File Menu - **[G]** Select Descript Files



This screen shows the names of the Descriptor files that have are stored in SURVEY-PRO. Move the scroll bar to the job you want to open by using the vertical cursor keys **[↑]** and **[↓]**. Then press **[SELCT]**. When you select a file you will be asked if "Do you intend to use codes when entering descriptions?" If you select YES, the characters up to the first space will be use a code. The remaining text is the descriptor. When one of these codes

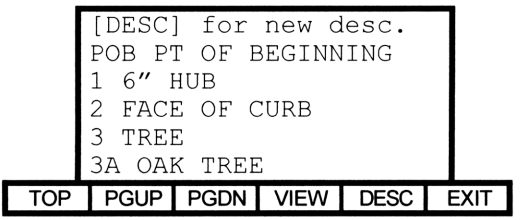
are found in a descriptor field it will be replaced with the remaining text from the line in which the code is found. If you select NO to the above question, then when prompted for a descriptor, you will be allowed to select one from a table or list.

[SELCT] will chose the highlighted file as the active descriptor file.
[PGUP] will move the display up a page.
[PGDN] will move the display down a page.

DESCRIPTOR CODE TABLE SCREEN

Purpose of screen - to provide for a way of reviewing the Descriptor Code Table and adding new descriptor codes while in the field.

Path: From the Main Menu press **[G]**, Jobs Menu - **[O]**, Raw Data File Menu - **[H]** View Descriptors



The top line is a reminder of the **[DESC]** key for adding descriptors. Each remaining line is a descriptor. The above display would be for codes and descriptor pairs separated be a single space. In this form the code may be up to seven alpha or numeric characters. The first space in each line separates the code from its descriptor. The descriptor can up to 16 characters and may include spaces or special characters. When selecting this type of descriptor file and you are asked "Do you intend to use codes when entering descriptions?", you should answer **[YES]**.

A second style of descriptor table is available. This would be a list of descriptor up to 16 characters, one to a line. It could appear as the display above except that the first few characters (up to the first space) would be removed. When selecting this type of descriptor file and you are asked "Do you intend to use codes when entering descriptions?", answer **[NO]**.

[TOP] will display the descriptor file from the top.
[PGUP] will move up to the next screen of descriptor codes
[PGDN] will move back to the previous screen of descriptor codes.
[VIEW] will display the entire descriptor at the cursor.
[DESC] will allow you to key in another code/descriptor pair. At the prompt key in CODE {space} DESCRIPTOR or just the DESCRIPTOR.

Descriptors may be any length, but only the first 16 characters will be stored in the coordinate file when the code is invoked.

CREATE DESCRIPTOR FILE COMMAND

Purpose of command - to provide for a way of creating a Descriptor file in your SURVEY-PRO, if one does not already exist.

Path: From the Main Menu press **[G]**, Jobs Menu - **[O]**, Raw Data File Menu - **[I]**

This sequence of keystrokes will create an empty descriptor file, in SURVEY-PRO. You will be asked for a unique file name. If a .TXT file already exists with that name, an error message will appear.

DESELECT DESCRIPTOR FILE COMMAND

Purpose of command - to provide for a way of turning off the Descriptor table lookup in the SURVEY-PRO, if one is already selected.

Path:	From the Main Menu press **[G]**, Jobs Menu - **[O]**, Raw Data File Menu - **[J]**

This command will set the SURVEY-PRO so that there is no descriptor file selected.

DELETE DESCRIPTORS SCREEN

Purpose of screen - to provide for a way of deleting a Descriptor File from your SURVEY-PRO's memory.

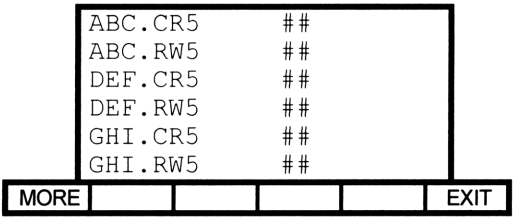
Path:	From the Main Menu press **[G]**, Jobs Menu - **[O]**, Raw Data File Menu - **[J]**

This will present you with a list of the .TXT file that exist on the RAM card of your HP-48GX. Move the scroll bar to the job you want to open by using the vertical cursor keys **[↑]** and **[↓]**. Then press **[SELCT]**. When you select a file you will be asked if "Delete: FILEMANE.TXT Are you sure?" If you select YES, the file will be deleted.

SHOW DIRECTORY SCREEN

Purpose of screen - to allow you to review the directory of files in SURVEY-PRO.

Path: From the Main Menu, press **[G]** Jobs Menu - **[P]**



This screen will prompt you to enter a file specification. The file extensions which are stored in SURVEY-PRO are:

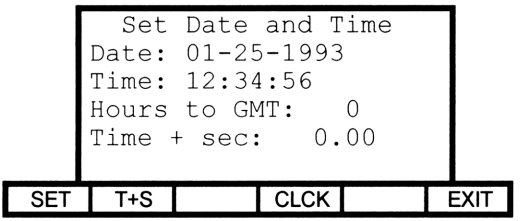
Coordinate files - .CR5
Raw Data files - .RW5
Point List files - .PL5
Road Layout files - .RD5
Text files - .TXT

SETUP MENU SCREENS

TIME / DATE SCREEN

Purpose of screen - to enable you to set the date, time, and time offset from GMT into your SURVEY-PRO.

Path: From the Main Menu, press **[H]** Setup Menu - **[G]**



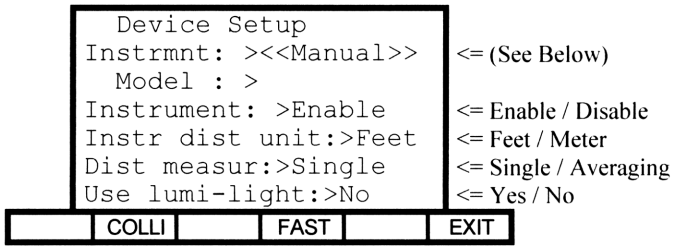
Date: is the current date as this screen is displayed.
Time: is the current time as this screen is displayed.
Hours to GMT: is the number of hours that GMT is in advance of local time.
Time + sec: is the number of seconds to be added to the current time when **[T + S]** is pressed.

[SET] will prompt for a new date and new time. After each is keyed in, press **[ENTER]**. The current displayed date and time will be adjusted accordingly. If you do not wish to change either the date or the time, press **[ENTER]** at that prompt without keying in new data.
[T + S] will adjust the current time by the number of seconds shown in the Time + sec: line of the display.
[CLOCK] will display the current time continuously.

DEVICE SETUP SCREEN

Purpose of screen - to allow you to establish manual input or communication with an electronic total station; to establish single or multiple distance readings with averaging.

Path: From the Main Menu, press **[H]** Setup Menu - **[H]**



Instrument brand and model list -
Topcon: GTSB-D & 4, ET1 / ET2, CTS1, GTS3, AP-L1, DL-100;
Lietz: SETs - SETsB - SDM3F - SDM3FR - SDM3E - SSM3ER - DT20E;
Nikon: TOPGUN, TOPGUN-D50, TOPGUN-C100;
Wild: T/TC2000, T/TC1600, TC1000, T1000, TC1610/500, NA2000;
Pentax: PTS-10, PTS II, PTS III, PCS;
Zeiss: Elta / C, Old Elta, Elta 50, DiNi 10/20;
Geodimeter: Manual Trg, Auto Trigg, w/ Servo, 4000 Robot;
Criterion:
New gun: RS232 port;

Instrmnt: is the line in which you use the horizontal cursor keys to scroll to the instrument brand name that you intend to use with SURVEY-PRO. (see list above)
Model: After the instrument brand name is selected, you may scroll to the appropriate model number on this line. (see list above)
Instrument: will select manual or instrument mode. Set to Enable turns **on** communication with the selected instrument and Disable turns it **off**. Setting the field to **Disable** is the same as scrolling the first field to <<Manual>>.
Instr dist unit: Allows you to set SURVEY-PRO to assume that the instrument is measuring distances in either feet or meters.
Dist meas: Allows you to select whether or not you intend to take single or multiple distance measurements with averaging with your gun.
Use lumi-light: turn on or off the rod direction light in applicable guns.

[COLLI] will transfer to the Collimation Screen.
[FAST] will toggle the instrument coarse mode on and off. Coarse mode is only available for certain brands of guns. If coarse mode is not available for your gun model, the computer will display: "Fast (Coarse) Mode not Applicable". The effect of coarse mode is to put the gun in a fast measurement mode. This mode may be used for topographic surveys to speed up the gathering of data or for stakeout. When used from the Stakeout Screen, however, coarse mode will not cause SURVEY-PRO to take shots continuously.

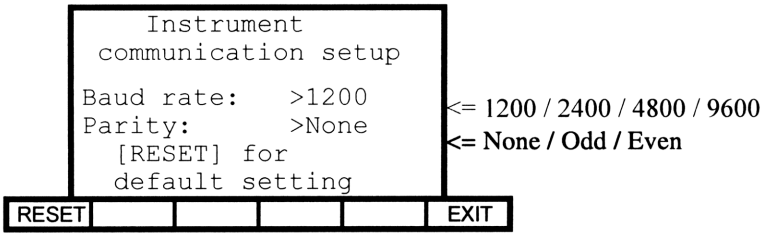
NOTE:

If you use an electronic theodolite with a top mounted EDM, you should set up your equipment so that the theodolite sights to a point on the rod below the prism at a distance equal to the distance that the EDM is offset from the optical axis of the theodolite.

NOTE:

Specific information concerning the operation of each of the brands of electronic total stations with SURVEY-PRO may be found in Appendix B.

As you **[EXIT]** the Device Setup screen, it you have selected an instrument, you will see the following screen. This screen will let you set the communication parameters for that instrument.



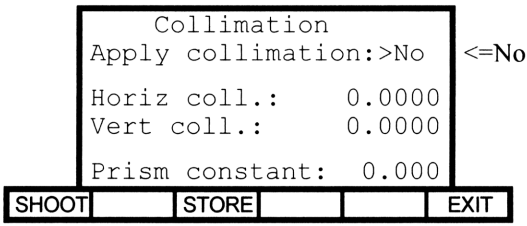
Baud rate: is the instrument communication rate expressed in baud.
Parity: is the instrument communication parity setting (even, odd, or none)

[RESET] will set the baud rate and parity to there default or factory settings These settings should work with the selected instrument unless the baud rate and/or parity have been changed in the instrument its self..

COLLIMATION SCREEN

Purpose of screen - to allow you to compute and apply collimation corrections to all measured angles, and to apply a prism constant correction to all measured distances.

Path: From the Main Menu, press **[H]** Setup Menu - **[H]** Device Setup Screen - **[COLLI]**



Apply collimation: allows you to select whether or not the corrections shown in this screen will be applied to measurements taken by SURVEY-PRO.
Horiz coll.: is the amount of angle correction that will be added to or subtracted from each measured horizontal angle.
Vert coll.: is the amount of angle correction that will be added to or subtracted from each measured zenith angle.
Prism constant: is the amount of distance correction that will be added to each slope distance measurement.

[SHOOT] can be used to shoot a target and let SURVEY-PRO compute the collimation errors automatically. You can shoot at multiple points with significant vertical separation to improve the collimation calculation. Every time **[SHOOT]** is pressed, it will prompt for a set of direct and reverse shootings. The results of the multiple sets will be averaged.
[STORE] will store the collimation values shown in this screen to your currently active raw data file.

NOTE:

Collimation is used to correct for "slack" in your gun. When collimation is applied, it will correct your angle readings using the following equations:

Corrected HA = Measured HA + Horiz collimation
Corrected ZE = Measured ZE + Vert collimation

The Prism constant is always added to the distance reading.

OPERATING MODES SCREEN

Purpose of screen - allow you to set the operating modes of SURVEY-PRO .

Path: From the Main Menu, press **[H]** Setup Menu - **[I]**

```
  Operating Modes
Azimuth: >N. azimuth     <= N. azimuth / S. azimuth
Scale factor:0.0000000
Earth curve adj.:>OFF    <= OFF / ON
Storing pause:   >OFF    <= OFF / ON
Dist unit: >Feet         <= Feet / Meter
Angle unit: >Degree      <= Degree / Grad
MORE                                  EXIT
```

```
  OP Modes (cont.)
Beeper:> ON              <= ON / OFF
Prompt for rod Ht:>Yes   <= Yes / No
Prompt for desc.: >Yes   <= Yes / No
Code is used in the
 Descriptor table:>Yes   <= Yes / No
Prompt for setup: >Yes   <= Yes / No
PREV                                  EXIT
```

Azimuth: indicates the assumed direction of a zero azimuth, either North or South.
Scale factor: is the factor by which all distances entered in the field will be multiplied before coordinate values are computed.
Earth curve adjust: when set ON, will include calculations to compensate for earth curvature and refraction in the computation of coordinates. Elevations will be adjusted according to the formula:

Vertical distance adjustment(ft) = 0.574 * horizontal distance(in miles)^2

Storing pause: when set ON, will pause and display the computed coordinates as each point is shot.
Dist unit: specifies units to be used for all distance computations. (Feet or Meters)
Angle unit: specifies units to be used for all angle computations.(Degrees or Gradians)
Beeper: will turn the sound ON or OFF in the HP-48GX.
Prompt for rod Ht: specifies whether SURVEY-PRO should ask for the height of the rod before each shot is taken.
Prompt for description: : specifies whether the SURVEY-PRO will prompt for a descriptor after each sideshot is taken.

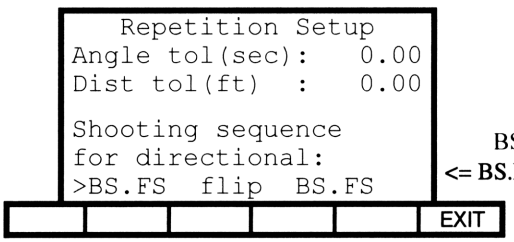
Code is used in the Descriptor table: selects between the two types of descriptor tables. When YES is selected the descriptor table should have a code, one space and then the full descriptor on each line. When NO is chosen the table should be a descriptor per line in alphabetical order. For more details see Chapter #3.
Prompt for setup: when set to YES, after a job is opened you will be prompted for a number of setup parameters that may need to be change at the beginning of a job.

[MORE] will display the next Operating Modes screen.

REPETITION MODE SCREEN

Purpose of screen - to allow you to establish the accuracy and order to be used in acquiring repetitive angles and distances in your survey.

Path:
→ From the Main Menu, press **[H]** Setup Menu - **[J]**
→ From the Main Menu, press **[J]** Traverse/Side Shot Screen - **[REP]** Repetition Modes Menu - **[I]**

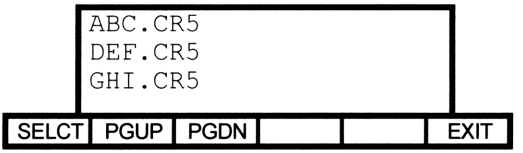


Angle tol (sec): lets you specify the error among multiple angle readings that will be tolerated before you are alerted by SURVEY-PRO that an error has occurred.
Dist. tol (ft): lets you specify the error among multiple distance readings that will be tolerated before you are alerted by SURVEY-PRO that an error has occurred. When the units are feet, the distance tolerance is in feet. When the units are meters, the distance tolerance is in centimeters.
Shooting sequence: lets you select between shooting the backsight and then the foresight or the foresight and then the backsight after you flip your scope for the reverse readings.

SELECT CONTROL FILE SCREEN

Purpose of screen - to provide a way to select a control file in your SURVEY-PRO.

Path: From the Main Menu, press **[H]** Setup Menu - **[K]**



This screen shows the names of the jobs that have been created in SURVEY-PRO. Move the scroll bar to the job you wish to select as a Control file by using the vertical cursor keys **[↑]** and **[↓]**. Then press **[SELCT]**.

[SELCT] will chose the highlighted name as the Control file for the current job.
[PGUP] will move the display up a page.
[PGDN] will move the display down a page.

SELECT DESCRIPT FILE SCREEN

Purpose of screen - to allow you to select the active descriptor table, from the available descriptor files.

Path: From the Main Menu, press [H] Setup Menu - [K] Select Descript Files

For a description of this screen see the Descriptor File Menu under the Job Menu.

DESELECT CONTROL FILE COMMAND

Purpose of command - to provide a way of deselecting a control file in the program.

Path: From the Main Menu, press **[H]** Setup Menu - **[L]**

When this command is chosen, the currently selected control file is "turned off". The Current Job Info screen is then displayed without a control file selected.

STAKEOUT MENU SCREENS

POINT STAKING SETUP SCREEN

Purpose of screen - to define a group of points to be staked.

Path - From the Main Menu, press **[I]** Stake Out Menu **[G]**

From point - To point =>
/<< Using point list >>

```
   Points Stake Setup
>From point:          0
 To point   :          0
Horiz R/L tol(ft):0.50

Define stake points.
Press [INIT] to start.
```

INIT	PTLST	BACKS			EXIT

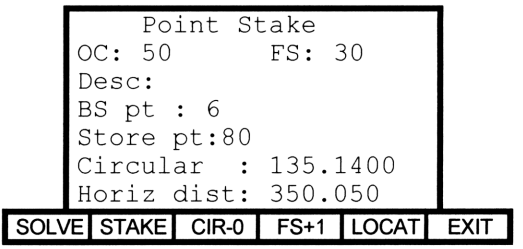
From point: / To point: - <Using point list> : are the alternative methods of specifying a sequence of points that are to be staked. *From point To point* specifies that the points are to be staked in numerical sequence. The *point list* is a technique that you may use to specify a set of points that are not in numerical sequence. See the Section of this Reference Manual that covers the Point List Screen. The stakeout point list should contain the points you wish to stake in the order that you wish to stake them. This will allow you to use the **[FS+1]** softkey in the Points Stake Screen, to step through the specified points.
Horiz R/L tol(ft): lets you specify the error, off of the horizontal angle readings, that will be tolerated before you are alerted by SURVEY-PRO that an error has occurred. When the units are feet, the distance tolerance is in feet. When the units are meters, the distance tolerance is in centimeters.

[INIT] will set the 1st point as the next foresight point of the set of points to staked and allow you to use the **[FS+1]** softkey in the Point Staking Screen..
[PTLST] will transfer you to the Point List Menu.
[BACKS] will establish the backsight for the stakeout (see Backsight Screen in the Traverse/Sideshot section).

POINTS STAKE SCREEN

Purpose of screen - allow you to stakeout coordinates stored in the current job.

Path: From the Main Menu, press **[I]** Stakeout Menu - **[H]**



Occupy pt: is the point number of the currently occupied gun position from which the stakeout will be done.
FS point: is the number of the foresight point (the point to be staked).
BS pt: specifies the backsight either by point number. To set an azimuth, or bearing use the **[BACK]** key in Points Stake Setup.
Desc: is the descriptor for the point (limited to 16 alpha, numeric, or special characters). Press the **[α]** key to put the HP-48GX into alpha mode before entering your descriptor.
Store pt: is the point number that will be used to store the actual coordinates of the point staked.
Circular: {output only} is the horizontal angle reading of the foresight.
Horiz. dist: {output only} is the horizontal distance from the occupied point to the foresight point to be staked.

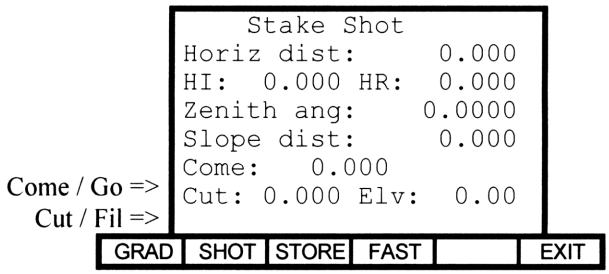
[SOLVE] will compute the circular angle and the horizontal distance from the rest of the information in the screen.
[STAKE] will transfer you to the Stake Shots Screen (see below).
[CIR-0] will set the circular angle of your gun such that, when you are sighting the foresight, the circle (horizontal) angle reading in the gun will be zero. You must be sighting the backsight and zero your gun when you press this key for the first time; and, you must be sighting the previous foresight when you press it for subsequent points.
[FS +1] if you have setup a group of points, this softkey will advance the foresight number in the screen to the next point in the group you have setup. If you have not setup a group of points to stake, this key will increment the

foresight number by one. This is useful when you have completed staking a point and you want to move on to the next one. **|FS +1|** will also perform the **|SOLVE|** command on the point after incrementing the point number. **|LOCAT|** will transfer to the Define a Location Screen (see below).

STAKE SHOTS SCREEN

Purpose of screen - to allow you to actually performing a stakeout.

Path:
- → From the Main Menu, press **|I|** Stakeout Menu - **|G|** Points Stake Screen - **|STAKE|**
- → From the Main Menu, press **|I|** Stakeout Menu - **|H|** Offset Stakeout Screen - **|STAKE|**



Horiz dist: {output only} is the horizontal distance to the foresight as computed in the previous screen (Points Stake).
HI: is the height of the instrument above the occupied point on the ground.
HR: is the height of the target on the rod above the ground.
Zenith ang: is the actual zenith angle to the rod at the proposed stake point. This data may either be entered in manual mode or it may be collected automatically from an electronic total station by pressing **|SHOT|**.
Slope dist: is the actual slope distance to the rod at the proposed stake point. This data may either be entered in manual mode or it may be collected automatically from an electronic total station by pressing **|SHOT|**.
Come - Go: {output only} is the distance that the rod man must move toward or away from the gun to locate the stake point exactly.

Cut - Fill: {output only} is the amount of earth that must be removed from or added to the ground at the stake point to bring the actual point even with the design elevation.
Elv: {output only} is the actual elevation of the stake point.

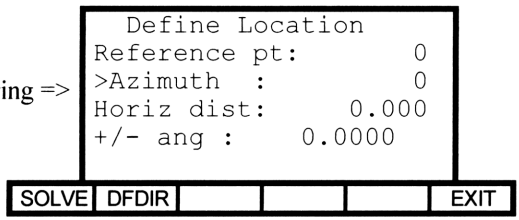
[GRADE] will prompt you for a different grade for this point; then it will recompute the "Cut/Fill" accordingly.
[SHOT] will compute the Come or Go and Cut or Fill information based on the angle and distance information which has been provided. *If you are connected to an electronic total station, it is not necessary to key in the angle and distance.* Pressing **[SHOT]** will trigger the gun to gather this information for you. After that, the Come or Go and Cut or Fill information will be computed and displayed.
[STORE] will store the actual staked coordinates at the point number specified in the previous screen (Points Stake). If **[STORE]** is pressed before a shot is taken, it will store the computed values of the coordinates. This feature may be used to generate points which may be staked later using the Points Stake Screen. This latter feature is only operative if the Stake Shots Screen is entered from the Offset Stakeout Screen.
[FAST] if your gun supports it, will put your gun in tracking mode. Thereby, you may track the movement of the rod man continuously without having to trigger the gun from SURVEY-PRO keyboard.

DEFINE A LOCATION SCREEN

Purpose of screen - allow you to stake a point that is not in the coordinate file, but whose position is known relative to a point that is in the file.

Path:	From the Main Menu, press **[I]** Stakeout Menu - **[G]** Points Stake Screen - **[LOCAT]**

Azimuth / Bearing =>



Reference pt: is the point number of the point from which the point to be staked is referenced.
Azimuth: - Bearing: is the angle from the reference point to the point to be staked (as modified by the +/- ang parameter below).
Horiz dist: is the horizontal distance from the reference point to the point to be staked.
+/- ang: is the angular deviation from the azimuth or bearing listed above from the reference point to the point to be staked. A + angle represents a clockwise deviation; a - angle represents a counter-clockwise deviation.

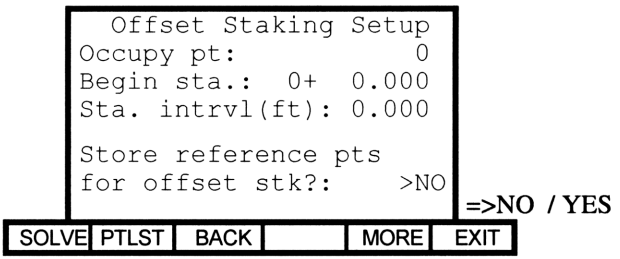
[SOLVE] will compute the angle right and the horizontal distance from the occupied point to the point to be staked. The SURVEY-PRO will return to the Points Stake Screen automatically with the foresight point reported as "0".
[DFDIR] will transfer you to the Define a Direction Screen.

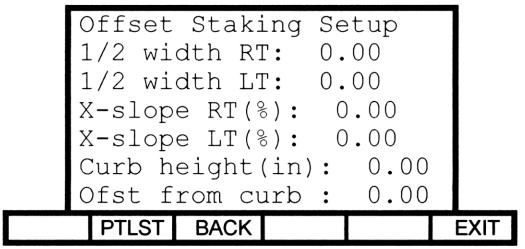
OFFSET STAKING SETUP SCREEN

Purpose of screen - to establish the setup parameters of the offset stakeout.

Path:

→ From the Main Menu, press **|I|** Stakeout Menu - **|I|**
→ From the Main Menu, press **|I|** Stakeout Menu -**|J|** Offset Staking Screen - **|SETUP|**
→ From the Main Menu, press **|I|** Stakeout Menu -**|L|** Slope Staking Screen - **|SETUP|**

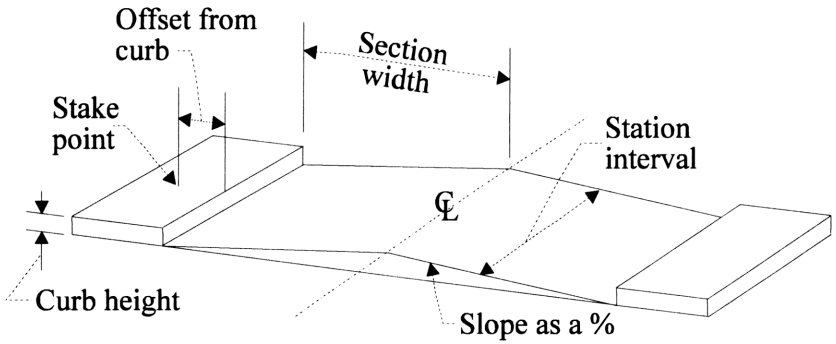




Occupy pt: is the point number of the currently occupied gun position from which the stakeout will be done.
Begin sta: is the station number of the first point in the point list.
Sta. interval (ft): is the interval between stations in feet. See figure below. When the distance units are set to meters, the station interval is in meters.
Store reference pts for offset stk?: set whether you want to set reference points for offset or slope stake points. If set to "Yes" the offset and slope staking routines will ask for an
1/2 width: is the width of the road in feet from the center line to the edge of the right-of-way or to the *inside* edge of the curb (if any). The Right and Left sides can have different 1/2 widths. (see figure)

X-slope (%): is the slope of the cross section of the road expressed as a per cent. The Right and Left sides can have different X-slopes. (see figure)
Curb height (in): is the height of the curb, if any, in inches (see figure below). When the distance units are set to meters, the curb height is in cm.
Offset from curb: is the distance of the stake point from the true location of the *inside* edge of the curb. See figure below.

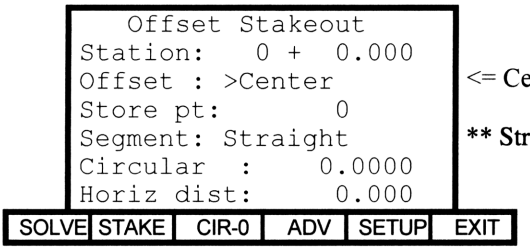
[SOLVE] will compute and store the parameters of the stakeout once all of the information has been entered in the screen. You must set the backsight and setup the Point List before using this key for the first time.
[PTLST] will transfer to the Point List Screen (see Point List Screen in Utility Screens section).
[BACKS] will establish the backsight for the stakeout (see Backsight Screen in the Traverse/Sideshot section).
[MORE] will display the second Offset Staking Setup screen.



OFFSET STAKEOUT SCREEN

Purpose of screen - to allow you to stakeout a right-of-way by specifying the station on the center line and the offset distance from the center line.

Path: From the Main Menu, press **[I]** Stakeout Menu - **[J]**



<= Center / Right / Left

** Straight / H curve / V curve / H+V curve **

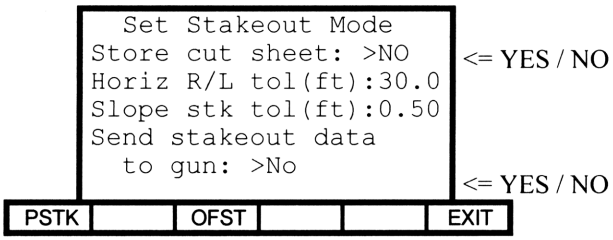
Station: is the station number currently being staked.
Offset: is the direction of the offset from the center line; either right, left, or directly on the center line.
Store pt: is the point number that will be used to store the actual coordinates of the point staked.
Segment: {output only} describes the nature of the road segment at the current station, either straight or curved.
Circular: {output only} is the horizontal angle between the backsight and foresight.
Horiz. dist: {output only} is the horizontal distance from the occupied point to the foresight point to be staked.

[SOLVE] will compute the circular angle and the horizontal distance from the rest of the information in the screen. You must execute **[SETUP]** at least once before you may press **[SOLVE]**.
[STAK] will transfer you to the Stake Shots Screen. (see Points Stake Screen).
[CIR-0] will set the circular angle of your gun so that, when you are sighting the foresight, the circle (horizontal) angle reading in the gun will be zero. You must be sighting the backsight and zero your gun when you press this key for the first time; and, you must be sighting the previous foresight when you press it for subsequent points.
[ADV] will increment the station in the screen by the distance established in the Offset Stakeout Setup Screen (see below). This is useful when you have completed staking a point and you want to move on to the next one. **[ADV]** will also execute the **[SOLVE]** command on the next station.
[SETUP] will transfer to the Offset Stakeout Setup Screen (see below).

SET STAKEOUT MODE SCREEN

Purpose of screen - allow you to set the horizontal angle error limit, the slope stake error limit, and specify whether or not you want to store a cut sheet.

Path: From the Main Menu, press **[I]** Stakeout Menu - **[K]**



Store cut sheet: may be set either ON or OFF depending on whether or not you want to store a cut sheet of the stakeout.
Horiz R/L tol(ft): is the *maximum* deviation allowed between the observed horizontal angle and the true computed horizontal angle before SURVEY-PRO will alert you of an error.
Slope stake tol (ft): is the maximum allowed deviation of the rod from the true station location before SURVEY-PRO will alert you of an error.
Send stakeout data to gun: uploads, the angle and distance to the point being stake, to the instrument, for staking controlled by the gun.

[PSTK] will transfer to the Point Staking Setup Screen (see above).
[OFST] will transfer to the Offset Stakeout Setup Screen (see above).

SLOPE STAKE SCREEN

Purpose of screen - to allow you to slope stake a road.

Path: From the Main Menu, press **[I]** Stakeout Menu - **[L]**

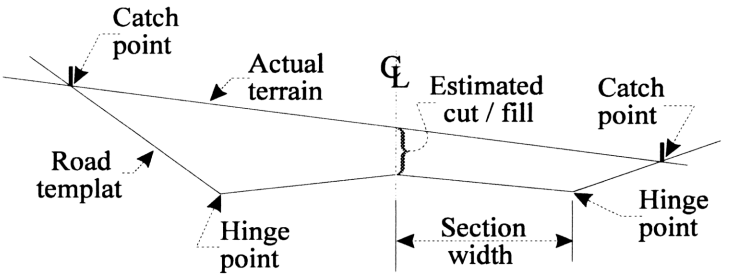
```
   Slope Staking
Station:   0 +  0.000
Segment: Straight
Slope ratio:    0.00
Estimated C/F:   0.00
Store pt:       0
```

<= Straight / H curve / V curve / H+V curve

	STAKE		ADV	SETUP	EXIT

Station: is the current station being staked.
Segment: {output only} describes the nature of the road (straight or curved) at the current station.
Slope ratio: the slope ratio of the section being staked. This is expressed as the horizontal component of the slope / vertical component of slope.
Estimated C/F: The estimated cut/fill at the catch point: - for fill; + for cut.
Store pt: the point number used to store the actual coordinates of the staked point.

[STAKE] will transfer you to the Slope Stake Shots Screen. (see below).
[ADV] will increment the station in the screen by the distance established in the Offset Stakeout Setup Screen (see above). This is useful when you have completed staking a point and you want to move on to the next one.
[SETUP] will transfer to the Offset Stakeout Setup Screen (see above). You must complete a setup before you can execute **[STAKE]**.



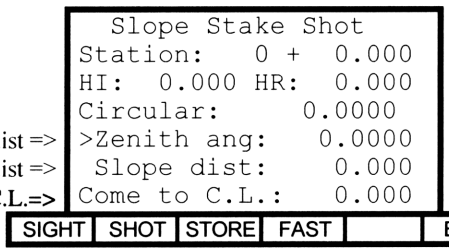
NOTE:

Since SURVEY-PRO does not know the actual terrain features during slope staking, the process of locating catch points is iterative. Therefore, it is necessary for you to provide an estimate of the amount of cut or fill that will be required at the center line of the road.

SLOPE STAKE SHOTS SCREEN

Purpose of screen - to allow you actually to take slope stake shots.

Path: From the Main Menu, press **[I]** Stakeout Menu - **[L]** Slope Stake Screen - **[STAKE]**



Zenith ang / Vert dist =>

Slope dist / Horiz dist =>

Come to C.L. / Go from C.L.=>

Station: {output only} is the current station being staked.
HI: is the height of the instrument above the occupied point on the ground.
HR: is the height of the target on the rod above the ground.
Circular: is the angle right from the backsight to the "trial" catch point.
Zenith ang: is the actual zenith angle to the rod at the proposed stake point. This data may either be entered in manual mode or it may be collected automatically from an electronic total station by pressing **[SHOT]**.
Slope dist: is the actual slope distance to the rod at the proposed stake point. This data may either be entered in manual mode or it may be collected automatically from an electronic total station by pressing **[SHOT]**.
GO (or COME) from C.L.: {output only} the distance the rod must move toward or away from the center line to establish the next "trial" catch point.

[SIGHT] will display distance and angle information related to the location of the next "trial" shot from the vantage point of the gun. It is displayed as:

Stake elev: the current elevation at the rod.
Stake to hinge: the distance from the current location of the rod to the hinge point (see figure).
Sight C.P. from gun:
Circular:
Horiz dist:
Cut:

This information is the horizontal angle and horizontal distance from the gun to the next trial point as well as the current Cut (or Fill). Press any key to return to the Slope Stake Shots Screen.

[SHOT] will compute the Come or Go and Cut or Fill information based on the angle and distance information which has been provided. *If you are connected to an electronic total station, it is not necessary to key in the angle and distance.* Pressing **[SHOT]** will trigger the gun to gather this information for you. After that, the Come or Go and Cut or Fill information will be computed and displayed.

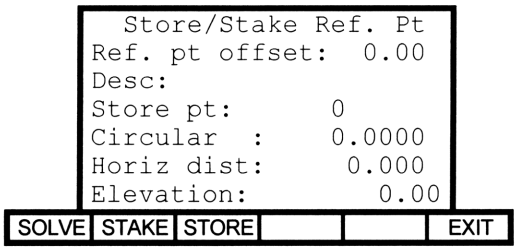
[STORE] is the key that you may use if you want to store the coordinates of the stake locations in the job file. It will first prompt for an offset distance from the catch point to a reference point where the stake is to be set. If you want to store the coordinates of the catch point itself, you should enter zero in response to this prompt. Press **[ENTER]**. The coordinates of the reference point will be stored at the point number that has been specified in the Slope Stake Screen. The offset is on a line from the catch point to the center line of the road. The unit will then prompt you with the message "Wish to store line stake? [Y/N]". If you would like to store the coordinates of another point on the line from the catch point to the center line, press **[Y]** in response to this prompt. Then you will see the prompt "Offset from ref:". Key in the offset from the previously specified reference point in response to this prompt. Then press **[ENTER]**. These coordinates will be stored at the next point number from the previous reference point.

[FAST] if your gun supports it, will put your gun in coarse mode.

STORE / STAKE REFERENCE POINT SCREEN

Purpose of screen - to allow you to store and / or stake the coordinates of the catch point while doing slope staking, and to store / stake reference points to that catch point.

Path:	From the Main Menu, press **[I]** Stakeout Menu - **[I]** Slope Stake Screen - **[STAKE]** Slope Stake Shots Screen - **[STORE]**



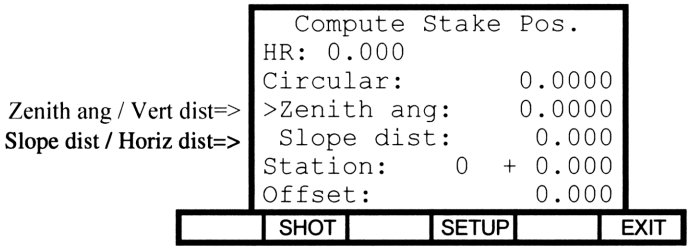
Ref. pt offset: is the offset distance from the catch point to the reference point. You enter this distance before the reference point coordinates are calculated. The reference point is calculated with the same elevation as the catch point. An offset of 0.00 indicates the catch point itself.
Desc: is the descriptor for the point (limited to 16 alpha, numeric, or special characters).
Store pt: is the point number that will be used to store the coordinates of the reference point.
Circular: {output only}is the horizontal angle right from the backsight to the catch point.
Horiz dist: {output only} is the horizontal distance to the catch point.
Elevation: {output only}is the elevation of the catch point.

[SOLVE] will compute the location of the reference point.
[STAKE] can be used to stake the reference point.
[STORE] will store the reference point.

LOCATE STAKE POSITION SCREEN

Purpose of screen - to allow you to store and / or stake the coordinates of the catch point while doing slope staking, and to store / stake reference points to that catch point.

Path: From the Main Menu, press **[I]** Stakeout Menu - **[M]**



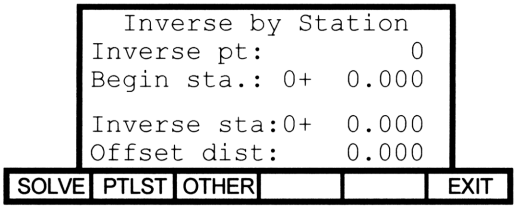
HR: is the height of the target on the rod above the ground.
Circular: is the horizontal angle reading from the backsight to the foresight. This data may either be entered in manual mode or it may be collected automatically from an electronic total station by pressing **[SHOT]**.
Zenith ang - Vert dist:
Slope dist Horiz dist: these two lines scroll together to specify the various combinations of angles and distances (or elevation changes and distances) to the rod at the proposed stake point. This data may either be entered in manual mode or it may be collected automatically from an electronic total station by pressing **[SHOT]**.
Station: {output only} is the center line station perpendicular to the point being staked.
Offset: {output only} is the distance from the center line at a perpendicular to the point being shot.

[SHOT] will compute the Station and offset information based on the angle and distance information which has been provided. If you are connected to an electronic total station, it is not necessary to key in the Curricular, zenith ang or slope distance data. Pressing **[SHOT]** will trigger the gun to gather this information for you and then display the station and offset.
[SETUP] will transfer to the Offset Stakeout Setup Screen (see above). You must describe a center line, using a point list, before you can execute **[SHOT]**.

INVERSE BY STATION SCREEN

Purpose of screen - to compute station number and offset distance from a given point to a centerline.

Path: → From the Main Menu, press **[I]** Stakeout Menu - **[N]**
→ From the Main Menu, press **[M]** CO-GO Menu - **[Q]**



Inverse point: is the point for which the inverse is to be computed.
Begin sta. : is the station number of the first point in the point list.
Inverse sta: { Output only } is the computed station number for the center line inverse.
Offset dist: { Output only } is the normal right-angle distance from the center line to the inverse point.
Offset: { Output only } the direction from the center line to the inverse point, either Left or Right.
Segment: { Output only } the type of segment , either Straight, Curve, or Spiral, to which the inverse point is computed.
Seg Begin Pt. : { Output only } is the beginning point of the center-line segment to which the inverse point is computed.
Seg End Pt. : { Output only }is the end point of the center-line segment to which the inverse point is computed.
HD frm sgmt beg: { Output only } is the horizontal distance from the segment beginning point to the inverse station point.

[SOLVE] : will compute the offset station, distance, direction, and segment begin and end points for the first segment for which an inverse can be computed. To use the SOLVE softkey, you must first describe a line with a point list.
[PTLST] : will transfer you to the Point List Menu so that you can define the center line.
[OTHER] : will compute the offset station to the next segment of the center line for which an offset may be computed and display the results on the screen. The new segment is identified by the beginning and ending point numbers.

WHERE IS NEXT POINT SCREEN

Purpose of screen - to allow the rod man to find quickly the next point relative to his own point of view during a stakeout by point number.

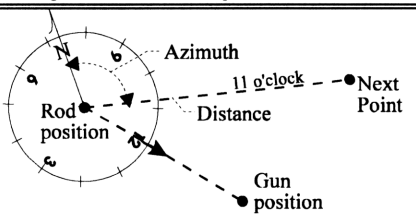
Path: From the Main Menu, press **[I]** Stake Out Menu - **[O]**

```
  Where is Next Point
Rod pt:          0
Next pt:         0
Reference pt:          0
Direction:   0 O'clock
Horiz dist:      0.000
Azimuth:         0.0000
```

SOLVE | | | ADV | | EXIT

Rod pt: is the point number of the current location of the rod.
Next pt: is the point number of the next point to be staked.
Reference pt: is any other point number in the job that is clearly visible by the rod man. For example, this point can be the point number location of the gun.
Direction: {output only} is the direction expressed as a "clock-face" direction from the rod point to the next point. If the rod man is standing at the rod point and facing the reference point and the direction, is computed as 2 o'clock, the next point is in the two o'clock direction assuming that 12 o'clock on the clock face is pointing toward the reference point.
Horiz. dist: {output only} is the computed horizontal distance from the rod point to the next point.
Azimuth: {output only} is the actual azimuth angle (based on north or south being zero azimuth) of the direction from the rod point to the next point. This value may be used in conjunction with a field compass to located the direction of the next point. This value is independent of the reference point.

[SOLVE] will compute the direction, horizontal distance, and azimuth based on the values of the input data for this screen.
[ADV] will put the next point as the rod point and increment the next point.

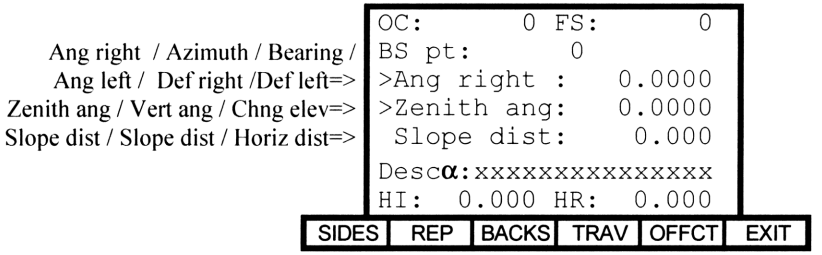


TRAVERSE/SIDESHOT SCREENS

TRAVERSE/SIDESHOT SCREEN

Purpose of screen - to organize the gathering of the data required to perform traverses and sideshots in the field.

Path: From the Main Menu, press **[J]**



OC: is the currently occupied gun position point number.

FS: is the point number of the foresight.

BS: is the point number of the backsight. If the backsight point is shown as 0, this indicates that the backsight has been specified as a known azimuth or bearing, but not by point number.

Ang. right - Azimuth - Bearing - Ang left - Def right - Def left: are the descriptions for the various ways that a horizontal angle may be entered.

Zenith ang - Vert ang - Ch elev:
Slope dist Slope dist Horiz dist: these two lines scroll together to specify the various combinations of angles and distances (or elevation changes and distances) that may be used to enter field data into SURVEY-PRO.

Desc: is the descriptor for the point (limited to 16 alpha, numeric, or special characters).

HI: is the height of the instrument above the point on the ground.

HR: is the height of the target on the rod above the ground.

[SIDES] will take the information which has been input into the screen and will compute the coordinates of the foresight point as a sideshot from the occupied point. These coordinates will be displayed depending upon whether or not the "Storing Pause" setting in the Operating Modes Screen. The coordinates will be stored in the job file at the foresight point number; and, the foresight point number will be incremented by one to prepare for the next shot. (See note below for more information.)

[REP] will transfer to the TR/SS Repetition Menu (see below).

[BACK] will transfer to the Backsight Screen.

[TRAV] will take the information which has been input into the screen and will compute the coordinates of the foresight point as a traverse from the occupied point. These coordinates will be displayed depending upon whether or not the "Storing Pause" setting in the Operating Modes Screen. The coordinates will be stored in the job file at the foresight point number; and, the foresight point, occupied point, and backsight point number will be adjusted to prepare for the next shot. (See note below for more information.)

[OFFCT] will transfer to the Off Center Shot Menu (see below).

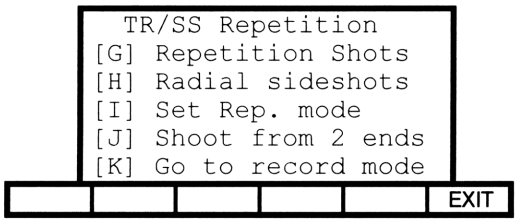
NOTE:

If you are gathering data automatically from an *electronic total station,* it is not necessary to fill in the horizontal angle, vertical angle or distance lines in the screen before pressing either **[SIDES]** or **[TRAV]**. When **[SIDES]** or **[TRAV]** are pressed, SURVEY-PRO will trigger the gun to make the appropriate measurements and transfer them to the data collector. Also, after the total station is taking the measurements and transferring them to SURVEY-PRO, the unit will display a descriptor screen for you to key in the descriptor.

TR/SS REPETITION MENU

Purpose of menu - to establish a variety of repetition (repeated readings) modes for doing field work.

Path: From the Main Menu, press **[J]** Traverse/Sideshot then, **[REP]**



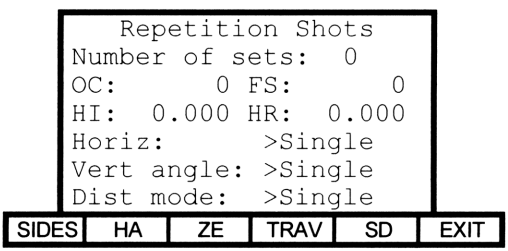
NOTE:

Pressing **[REP]** from the Traverse/Sideshot Screen will display the menu choices shown above. Selecting any of these will prompt you for input (either manual or electronic) in the proper sequence to take repeated readings and compute either the average angles or average distances (depending on which menu choice you make). Pressing **[EXIT]** from this menu will return you to the Traverse/Sideshot Screen.

REPETITION SHOT SCREEN

Purpose of screen - to allow you to establish the technique to be used in acquiring angles and distances in your survey.

Path: From the Main Menu, press **[J]** Traverse/Side Shot Screen - **[REP]** Repetition Modes Menu - **[G]**



Number of sets: is where you specify the number of readings to be taken for each multiple mode. If you choose a multiple mode, the number of sets must be entered as 1 or more.
OC: is the currently occupied gun position point number.
FS: is the point number of the foresight.
HI: is the height of the instrument above the point on the ground.
HR: is the height of the target on the rod above the ground.
Horiz. angle mode: may be set in one of four modes -
Single - a single horizontal angle shot will be taken for each point.
Directional - the sequence of shots to determine the horizontal angle for each point is as follows:

- direct to the backsight; direct to the foresight; reverse (flop) the scope; reverse to the backsight; reverse to the foresight.
- direct to the backsight; direct to the foresight; reverse (flop) the scope; reverse to the foresight; reverse to the backsight.

To select between these to shooting sequences see Shooting sequence below. The above group of shots is one set and each forward and reverse angle from all sets are then averaged to determine the horizontal angle.
Accumulation - multiple angles (windings) are taken to determine each horizontal angle. For each set, you will take a horizontal angle between your backsight and foresight then rotate your lower motion back to your backsight and take the next angle from that circle reading. The value of the circle angle from each foresight sighting is used as the circle angle for the next backsight; thus, accumulating the readings. All sets are then averaged.

Vertical angle: may be set as either a single or multiple readings to be averaged to determine the vertical or zenith angle for each point.
Dist. mode: may be set to take either a single or multiple distances to be averaged in SURVEY-PRO for each point.

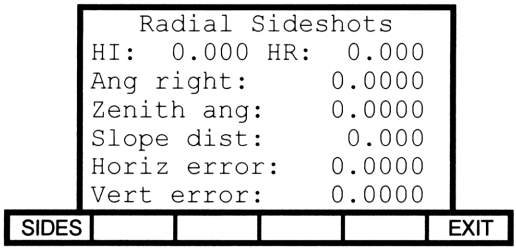
NOTE:

To use the accumulation mode for horizontal angles, you must have a gun that has a lower motion screw or some other device that will allow you to move the gun through a horizontal angle without changing the circle angle reading.

RADIAL SIDESHOTS SCREEN

Purpose of screen - to allow you to take multiple readings to a series of foresight points, using the same backsight reading for each point.

Path:	From the Main Menu, press **[J]** Traverse / Side Shot screen - **[REP]** - TR / SS Repetition Menu - **[H]**



HI: is the height of the instrument above the point on the ground.
HR: is the height of the target on the rod above the ground.
Ang right: is the angle right to the rod position.
Zenith ang: is the zenith angle to the rod position.
Slp dist: is the slope distance to the rod position.
Horiz error: is the difference between the largest and the smallest horizontal angle readings.
Vert error: is the difference between the largest and the smallest vertical angle readings.

[SIDES] will begin taking a series of shots to a foresight point. After this series, **[SIDES]** can pressed again to shoot another foresight point.

SET REPETITION MODE SCREEN

NOTE:

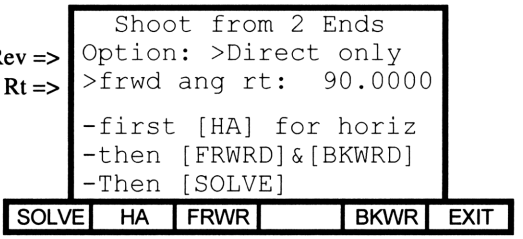
For details of this screen, see the Repetition Mode Screen under the Setup Menu Section of this Reference manual.

SHOOT FROM TWO ENDS SCREEN

Purpose of screen - to allow you to average two sets of distance and zenith angle measurements. The first set is taken from the occupied point to the foresight point, and the second set is taken in the opposite direction.

Path:	From the Main Menu, press **[J]** Traverse / Side Shot screen - **[REP]** - TR / SS Repetition Menu - **[J]**

Direct only / Direct & Rev =>
Frwd azm / Frwd ang Rt =>



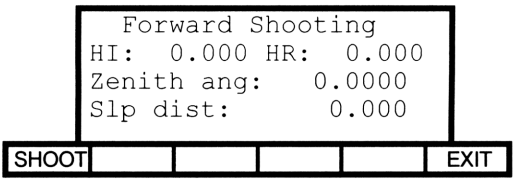
Option: allows you to choose whether to take one shot only, or two shots, flopping the scope between shots.
Frwd ang rt / Frwd azm: is the Horizontal angle or Azimuth to the foresight.

[HA] will probe your electronic total station for the Horizontal Angle.
[SOLVE] will average the readings taken from the forward and backward shots, and place the results in the Traverse / Sideshot screen.
[FRWRD] will transfer to the Forward Shooting Screen.
[BKWRD] will transfer to the Backward Shooting Screen.

FORWARD SHOOTING SCREEN

Purpose of screen - to allow you to take the distance and zenith angle measurement from the occupied point to the foresight point.

Path:	From the Main Menu, press **[J]** Traverse / Side Shot screen - **[REP]** - TR / SS Repetition Menu - **[M]** Shoot from Two Ends screen - **[FRWRD]**



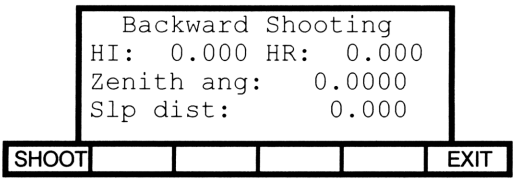
HI: is the height of the instrument above the point on the ground.
HR: is the height of the target on the rod above the ground.
Zenith ang: is the zenith angle to the rod position.
Slp dist: is the slope distance to the rod position.

[SHOOT] will collect the distance and zenith angle measurements from an electronic total station.

BACKWARD SHOOTING SCREEN

Purpose of screen - to allow you to take the distance and zenith angle measurement from the foresight point to the occupied point.

Path:	From the Main Menu, press **[J]** Traverse / Side Shot screen - **[REP]** - TR / SS Repetition Menu - **[M]** Shoot from Two Ends screen - **[BKWRD]**



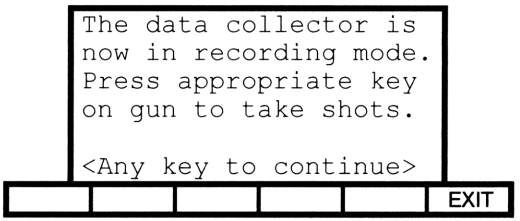
HI: is the height of the instrument above the point on the ground.
HR: is the height of the target on the rod above the ground.
Zenith ang: is the zenith angle to the rod position.
Slp dist: is the slope distance to the rod position.

[SHOOT] will collect the distance and zenith angle measurements from an electronic total station.

GO TO RECORD MODE SCREEN

Purpose of screen - to allow you to put SURVEY-PRO into a mode where you control the total station from its own keypad. The data collector will then simply log points as they are received.

Path: From the Main Menu, press **[J]** - Traverse/Sideshot Screen - **[REP]** - TR/SS Repetition Menu - **[N]**



Press a key on SURVEY-PRO and you will be prompted to Enter a descriptor for all of the shots to follow. Enter a descriptor that will be stored with all shots recorded in this mode. After pressing **[ENTER],** you will see one or two more prompts telling you how to control your particular gun. Follow the prompts, collecting shots until you are finished.

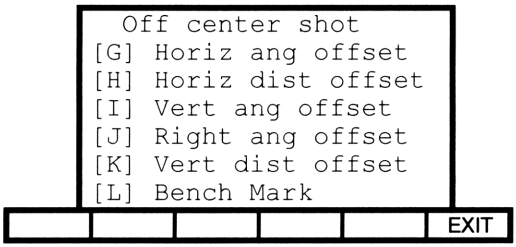
NOTE:

The Record mode routine only supports certain instruments. If you receive the prompt: "**Record mode not supported.**" after pressing the **[N] Go to Record mode** key, you are either in the Manual mode or your instrument is not supported.

OFF CENTER SHOT MENU

Purpose of menu - to allow you to shoot points for which you cannot place the rod target exactly on the point.

Path:	From the Main Menu, press **[J]** Traverse/Sideshot Screen - **[OFFCT]**



The Off Center Shot Menu covers six common situations that are encountered in the field when it is not possible for the rod to occupy the point that is to be shot. Those six situations are specified in the menu and illustrated in the screens shown below. If you are taking the data *manually*, you should fill out the Traverse/Sideshot Screen with the data as obtained from the shot to the prism in each of the four cases. Then press **[OFFCT]**. You will be prompted to key in the missing data for each situation as required. After following the prompts, you will be returned to the Traverse/Sideshot Screen where the input data will have been modified to reflect the actual point to be shot. Then you should press **[SIDES]** to complete the shot.

If you are collecting your data *electronically*, pressing **[OFFCT]** will take the appropriate shots and prompt you to move the rod or key in the data to the actual point as required. After the final prompt, the sideshot to the unknown point will be completed and you will be returned to the Traverse/Sideshot Screen for the next shot.

HORIZONTAL ANGLE OFFSET SCREEN

Purpose of screen - To allow you to shoot the center of a large object, such as a big tree.

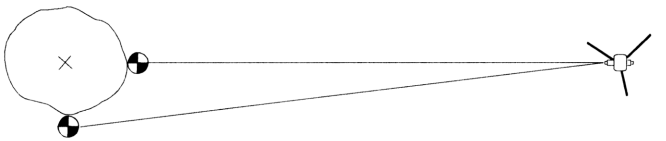
Path:	From the Main Menu, press **[J]** Traverse / side shot screen - **[OFFCT]** Off Center Shot Menu - **[G]**

```
  Horiz Ang Offset
FS point:  0
HI:0.000     HR:0.000
Side HA:     0.0000
Zenith:      0.0000
Slp dist:    0.000
Center HA:   0.0000
```

CNTR	SIDE	STORE		HELP	EXIT

FS point: is the number of the foresight point.
HI: is the height of the instrument above the point on the ground.
HR: is the height of the target on the rod above the ground.
Side HA: is the horizontal angle to the side of the object.
Zenith: is the zenith angle to the side of the object.
Slp dist: is the slope distance to the side of the object.
Center HA: is the horizontal angle to the center of the object.

[CNTR] takes a shot to the center of the object.
[SIDE] takes a shot to the side of the object.
[STORE] calculates and stores the coordinates of the actual point.



HORIZONTAL DISTANCE OFFSET SCREEN

Purpose of screen - To allow you to shoot a point beyond the rod point, such as the middle of a river.

Path:	From the Main Menu, press **[J]** Traverse / side shot screen - **[OFFCT]** Off Center Shot Menu - **[H]**

```
  Horiz Dist Offset
FS point: 0
HI:0.000    HR:0.000
Ang Rt:     0.0000
Zenith:     0.0000
Slp dist:   0.000
HD +/-:     0.000
CNTR | | STORE | | HELP | EXIT
```

FS point: is the number of the foresight point.
HI: is the height of the instrument above the point on the ground.
HR: is the height of the target on the rod above the ground.
Ang Rt: is the angle right to the rod position.
Zenith: is the zenith angle to the rod position.
Slp dist: is the slope distance to the rod position.
HD +/-: is the amount to be added or subtracted from the distance measured to the rod.

[CNTR] takes a shot to the rod position.
[STORE] calculates and stores the coordinates of the actual point.

VERTICAL ANGLE OFFSET SCREEN

Purpose of screen - To allow you to shoot a point that is too high to reach, such as the top of a power pole.

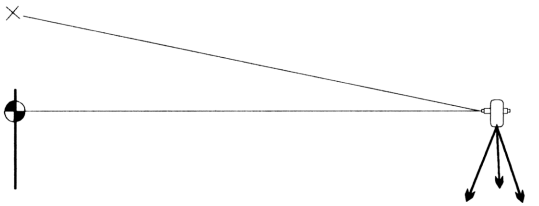
Path:	From the Main Menu, press **[J]** Traverse / side shot screen - **[OFFCT]** Off Center Shot Menu - **[I]**

```
   Vert Ang Offset
FS point: 0
HI:0.000    HR:0.000
Ang Rt:     0.0000
Zenith:     0.0000
Slp dist:   0.000
True zen:   0.0000
```

CNTR	ZEN	STORE		HELP	EXIT

FS point: is the number of the foresight point.
HI: is the height of the instrument above the point on the ground.
HR: is the height of the target on the rod above the ground.
Ang Rt: is the angle right to the rod position.
Zenith: is the zenith angle to the rod position.
Slp dist: is the slope distance to the rod position.
True zen: is the zenith angle to the actual point.

[CNTR] takes a shot to the rod position.
[ZEN] shoots the zenith angle to the actual point.
[STORE] calculates and stores the coordinates of the actual point.



RIGHT ANGLE OFFSET SCREEN

Purpose of screen - To allow you to shoot a point that is at a right angle to your rod position, such as around the corner of a building.

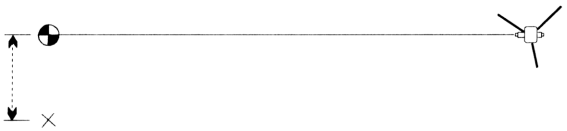
Path:	From the Main Menu, press **[J]** Traverse / side shot screen - **[OFFCT]** Off Center Shot Menu - **[J]**

```
  Right Ang Offset
FS point: 0
HI:0.000    HR:0.000
Ang Rt:     0.0000
Zenith:     0.0000
Slp dist:   0.000
Offset dist0.000
```

SHOOT		STORE		HELP	EXIT

FS point: is the number of the foresight point.
HI: is the height of the instrument above the point on the ground.
HR: is the height of the target on the rod above the ground.
Ang Rt: is the angle right to the rod position.
Zenith: is the zenith angle to the rod position.
Slp dist: is the slope distance to the rod position.
Offset dist: is the right angle distance from the rod position to the actual point.

[SHOOT] takes a shot to the rod position.
[STORE] calculates and stores the coordinates of the actual point.



VERTICAL DISTANCE OFFSET SCREEN

Purpose of screen - To allow you to shoot a point which you cannot occupy, but can find the vertical distance to, such as down a manhole.

Path:	From the Main Menu, press **[J]** Traverse / side shot screen - **[OFFCT]** Off Center Shot Menu - **[K]**

```
  Vert Dist Offset
FS point: 0
HI:0.000    HR:0.000
Ang Rt:     0.0000
Zenith:     0.0000
Slp dist:   0.000
VD +/-:     0.000
```

SHOOT		STORE		HELP	EXIT

FS point: is the number of the foresight point.
HI: is the height of the instrument above the point on the ground.
HR: is the height of the target on the rod above the ground.
Ang Rt: is the angle right to the rod position.
Zenith: is the zenith angle to the rod position.
Slp dist: is the slope distance to the rod position.
VD +/-: is the vertical distance from the rod point to the actual point.

[SHOOT] takes a shot to the rod position.
[STORE] calculates and stores the coordinates of the actual point.

SHOOT BENCH MARK SCREEN

NOTE:

This screen is detailed under the CO-GO Menu Section of this Reference manual.

ROAD LAYOUT MENU

Purpose of menu - to allow you to describe a road, store the description to a file, recall a stored road description, and change the road description. The following commands are available from the **Road Layout Menu :**

HORIZONTAL ALIGNMENT SCREEN

Purpose of screen - to allow you to edit the description of the horizontal alignment of a road.

Path: From the Main Menu, press **[K]** Road Alignment Menu - **[G]**

This screen is a list of the horizontal alignment segments you have entered in this Road Layout. Each segment is entered by pressing the **[CURVE]** or **[LINE]** keys. After all the horizontal, vertical and profile data has been entered the Generate A Point List screen is used to convert these lists into a point list that describes the road layout. The **[↑] [↓]** keys can be used to highlight each line for editing or deleting.

[END] will move the highlight to the bottom of the list ready to append the next segment to the list.

[EDIT] transfers you to the appropriate screen to edit the current segment.

[DEL] deletes the currently highlighted segment.

[CURVE] transfers you to the Enter Horiz Curve Screen.

[LINE] transfers you to the Enter Straight Line Screen.

ENTER HORIZ CURVE SCREEN

Purpose of screen - to allow you to edit the description of a curved segment of a road

Path: From the Main Menu, press **[K]** Road Alignment Menu - **[G]** - Horizontal Alignment Screen - **[CURVE]**

```
Enter Horiz Curve
>Tangent azm:   0.0000
Radius:           0.000
Length:           0.000
Curve turn:     >Right
Curr. sta.: 0+   0.000
Azimuth:     0.0000
```

=>Tangent azm / Tangent brg / << Tangent continuing >

=>Right / Left

ENTER		SOLVE			EXIT

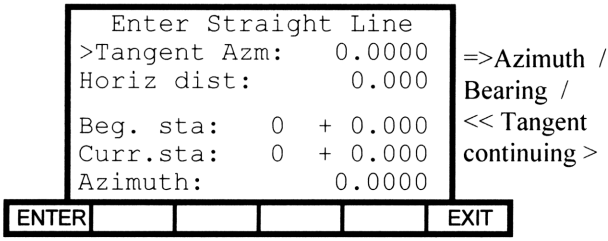
Tangent azm: - Tangent brg: - Tangent continuing: are three ways of specifying the ending point of the curve.
Radius: is the radius of the circular curve.
Length: the length of the curve.
Curve turn: the direction the curve turns.
Current sta: {output only} is the station currently being entered.
Azimuth: {output only} the direction of the previous segment.

[ENTER] will place the straight line in the description.
[SOLVE] will transfer you to the Horiz Curve Solution Screen.

ENTER STRAIGHT LINE SCREEN

Purpose of screen - to allow you to edit the description of a straight-line segment of a road.

Path:	From the Main Menu, press **[K]** Road Alignment Menu - **[G]** -Horizontal Alignment Screen - **[LINE]**



Azimuth: - Bearing: - Tangent continuing: are three ways of specifying the direction of the line.

Horiz dist: is the length of the line.

Beg. sta: is the assumed begin station with which the computation of the current station will base upon.

Curr. sta: {output only} is the station currently being entered.

Azimuth: {output only} the direction of the previous segment.

[ENTER] will place the straight line in the description.

VERTICAL ALIGNMENT SCREEN

Purpose of screen - to allow you to edit the description of the vertical alignment of a road.

Path: From the Main Menu, press **[K]** Road Alignment Menu - **[H]**

This screen is a list of the Vertical Alignment segments you have entered in this Road Layout. Each segment is entered by pressing the **[PARAB]** or **[GRAD]** keys. After all the horizontal, vertical and profile data has been entered the Generate A Point List screen is used to convert these lists into a point list that describes the road layout. The **[↑]** **[↓]** keys can be used to highlight each line for editing or deleting.

[EDIT]: transfers you to the appropriate screen to edit the current segment.

[DEL]: deletes the current segment.

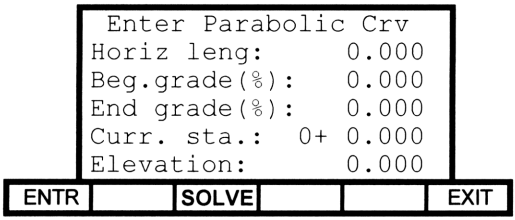
[PARAB]: transfers you to the Enter Parabolic Curve Screen.

[GRADE]: transfers you to the Enter Straight Grade Screen.

ENTER PARABOLIC CURVE SCREEN

Purpose of screen - to allow you to edit the description of a curved segment of a road.

Path:	From the Main Menu, press **[K]** Road Alignment Menu - **[H]** -Vertical Alignment Screen - **[PARAB]**



Horiz Length: the horizontal distance from the beginning of the vertical curve to the end of the vertical curve.

Beg. grade (%): is the beginning grade of the vertical curve expressed as a % (+ for uphill; - for downhill).

End grade (%): is the ending grade of the vertical curve expressed as a % (+ for uphill; - for downhill).

Beg. sta: is the station where the Road Design begins.

Curr. sta: {output only} is the station currently being entered.

Elevation: {output only} is the elevation of the point currently being entered.

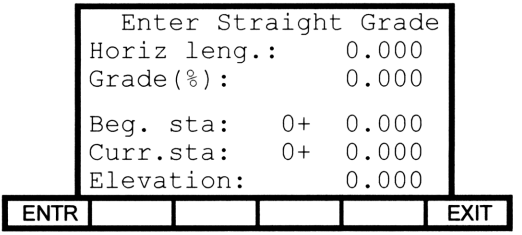
[ENTR] will place the vertical curve in the description.

[SOLVE] will transfer you to the Vertical Parabolic Curve Solution Screen.

ENTER STRAIGHT GRADE SCREEN

Purpose of screen - to allow you to edit the description of a segment of a road.

Path:	From the Main Menu, press **[K]** Road Alignment Menu - **[H]** -Vertical Alignment Screen - **[GRADE]**



Horiz length: is the length of the section in the horizontal axis.

Grade (%): is the grade of the section (+ for uphill; - for downhill).

Beg. sta: is the station where the Road Design begins.

Curr. sta: {output only} is the station currently being entered.

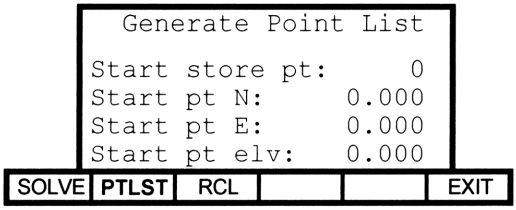
Elevation: {output only} is the current elevation being entered.

[ENTR] will place the straight grade in the description.

GENERATE POINT LIST SCREEN

Purpose of screen - to allow you to generate a point list from the description of the alignment of a road.

Path: From the Main Menu, press **[K]** Road Alignment Menu - **[I]**



Start store pt: the first point number to use for the point list to be generated from the current road description.
Start pt N: the starting point's Northing coordinate.
Start pt E: the starting point's Easting coordinate.
Start pt elev: the starting point's elevation.

[SOLVE] will produce a point list from the current road description and will save it under the current point list name in the current path.
[PTLST] will transfer you to the Point List Menu.
[RCL] will recall the starting point's coordinates from an existing point.

CLEAR ALL ENTRIES SCREEN

Purpose of screen - to allow you to edit the description of the vertical alignment of a road.

Path: From the Main Menu, press **[K]** Road Alignment Menu - **[J]**

This command, which is executed from the Road Layout Menu, allows you to delete the current layout so that you can enter a new one.

STORE TO FILE SCREEN

Purpose of screen - to allow you to store the current description of the alignment of a road to a file.

Path: From the Main Menu, press **[K]** Road Alignment Menu - **[K]**

This command, which is executed from the Road Layout Menu, allows you to store the current alignment to a file.

RECALL FROM FILE SCREEN

Purpose of screen - to allow you to recall a stored description of the alignment of a road.

Path: From the Main Menu, press **[K]** Road Alignment Menu - **[L]**

This command, which is executed from the Road Layout Menu, allows you to recall a saved alignment and make it the current alignment.

DELETE FILE SCREEN

Purpose of screen - to allow you to delete a saved description of the alignment of a road.

Path: From the Main Menu, press **[K]** Road Alignment Menu - **[M]**

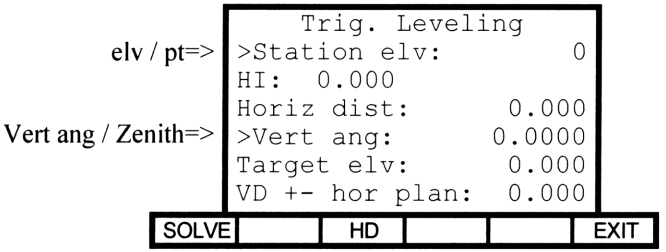
This command, which is executed from the Road Layout Menu, allows you to delete a saved alignment file.

TRIG. LEVELING MENU SCREENS

TRIGONOMETRIC LEVELING SCREEN

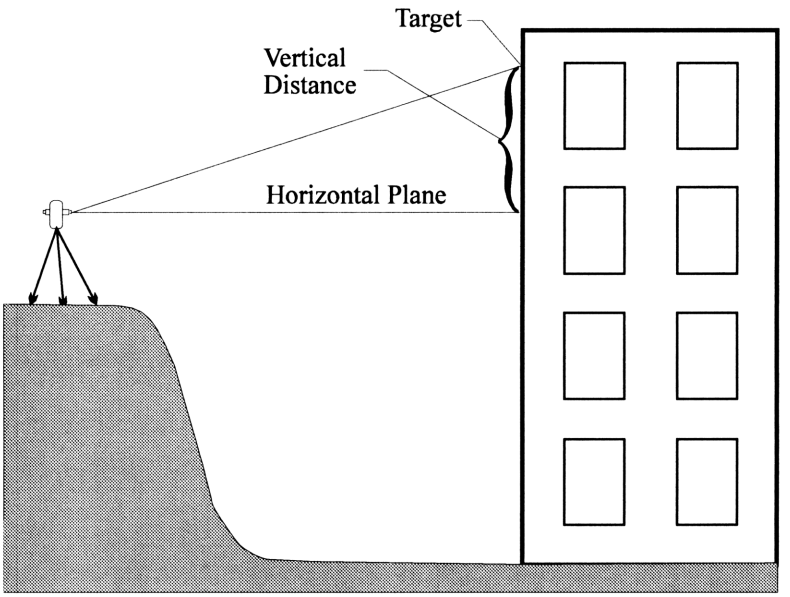
Purpose of screen - to compute the elevation of a point based on the elevation of another point in the same vertical plane, given the vertical angle between the two points, and the horizontal distance to the vertical plane.

Path:	From the Main Menu, press **[L]** Trig. Leveling Menu - **[G]**



Station elv - Station point: allows you to specify the elevation of the instrument point either as an elevation or a point number which has a known elevation.
HI: the height of the instrument above the ground.
Horiz dist: the horizontal distance from the instrument point to the vertical plane containing the two points.
Vert ang - Zenith: allows you to specify the angle between the horizontal plane and the target point.
Target elv: {output only} the elevation of the target.
VD +- hor plan: {output only} the vertical distance from the target to the horizontal plane of the instrument.

[SOLVE] will solve for the output values based on the input information in the screen and will display the computed values on the screen.
[HD] : will trigger an electronic total station to read the horizontal distance from the instrument to a prism in the vertical plane.



DIFFERENTIAL LEVELING SCREEN

Purpose of screen - to allow you to compute the elevation of a point based on the elevation of another point.

Path:	From the Main Menu, press **[L]** Trig. Leveling Menu - **[H]**

elv / pt=>

```
Differential Leveling
>BS elv:                0
BS rod reading:   0.000
FS rod reading:   0.000
FS pt:     0    :>B Mark
FS elev:          0.000
B.ds:0.000   F.ds:0.000
```

SOLVE	FS	FS2BS	BS		EXIT

BS elv - BS pt: allows you to specify the back sight elevation either as an elevation or a point number which has a known elevation.

BS rod reading: is the height of the target on the rod at the backsight point.

FS rod reading: is the height of the target on the rod at the foresight point.

FS pt: is the point number where the resulting elevation will be stored. If this point exists only the elevation will be changed. If it does not exist then the northing and eastings will be stored as 0.000.

B Mark - Side P - Turn P: this scrolling field selects the kind of shot you will be making:

Bench Mark: will store the resulting elevation and be used in calculating the closure. When using the compass rule to adjust elevations this point will be a part of the traverse.

Side Point: will store the resulting elevation but will not be used in calculating the closure. It will be adjusted with the bench mark it was shot from.

Turning Point: will not be stored.

FS elev: {output only} is the elevation at the foresight point.

B.ds: {output only} is the distance to the backsight point.

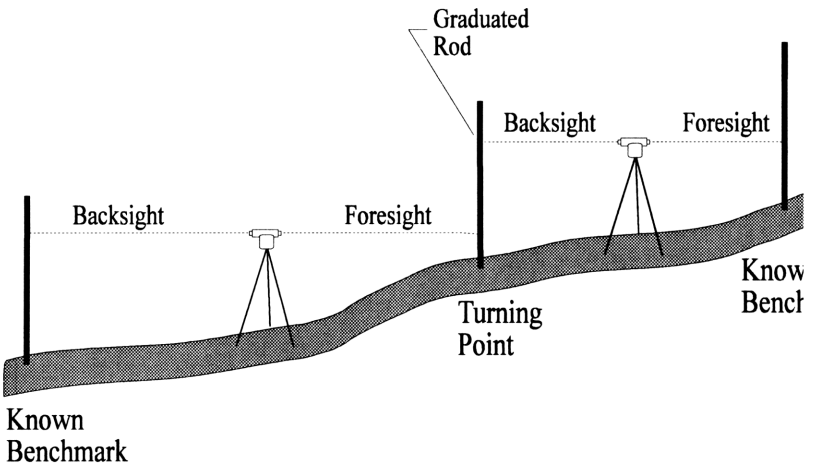
F.ds: {output only} is the distance to the foresight point.

[SOLVE] will compute the foresight elevation based on the BS elev, BS rod reading, and FS rod readings. Except for Turning point, the elevation will be stored into the FS point number. If this point exists, only the elevation will be changed. If the FS point does not exist the northing and easting will be set to 0.000. You will also be asked if you want to transfer the foresight elevation computed to the backsight elevation field

[FS] if you are in the manual input mode, this key will transfer you to the 3-Wire Data Input Screen (see below). If you are connected to an electronic total station, this key will read the road and enter the foresight elevation.

[FS->B] will transfer the foresight elevation computed to the backsight elevation field for your next occupy point.

[BS] if you are in the manual input mode, this key will transfer you to the 3-Wire Data Input Screen (see below). If you are connected to an electronic total station, this key will read the road and enter the backsight elevation.



3-WIRE DATA INPUT SCREEN

Purpose of screen - to allow you to enter the Differential Leveling rod readings using the 3-wire technique. This method helps to catch errors in reading the rod.

Path:	From the Main Menu, press **[L]** Trig. Leveling Menu - **[H]** Differential Leveling - **[FS]** or **[BS]**

```
 3-Wire Data Input
Upper stadia:     0.000
Middle X-hair:    0.000
Lower stadia:     0.000
    <FS reading>
Distance:         0.000
Tolerance:        0.000
SOLVE                   EXIT
```

Upper stadia: the elevation reading at the upper cross-mark or stadia.
Middle X-hair: the elevation reading at the cross-hairs or the center of the scope.
Lower stadia: the elevation reading at the lower cross-mark or stadia.
Distance: is the distance from the occupy point to the point being entered, either backsight or foresight.
Tolerance: Is the error tolerance the will be accepted without displaying an error message. The stadia readings are used to detect errors in reading the rod scale. The distance from upper stadia reading to the middle cross hair and the distance from lower stadia to middle cross hair should be fairly close. The "Tolerance" can be used to specify the maximum allowable limit of this error. If the difference. The error is calculated as:

Error = (upper stadia - middle x-hair) - (middle x-hair - lower stadia)

If the Error is greater than the tolerance, you will be asked to decide if you want to reject the readings.

The average of scale reading is computed as:

Average = { (middle x-hair) + ((upper stadia + lower stadia) / 2) } / 2

The distance from the level to the rod is computed as:

Distance = (upper stadia - lower stadia) * 100

[SOLVE] will compute the errors in the elevation fields and compare the differences to the value in the tolerance field. If it is greater than the error tolerance it will prompt "Data exceed tolerance Accept?" with **[YES]** and **[NO]** softkeys. When the **[EXIT]** key is pressed the Average of the three elevations is returned to the Differential Leveling screen only if the **[SOLVE]** key has been press first.

LEVELING STAKEOUT SCREEN

Purpose of screen - to compute the cut or fill from a design elevation of one point based on the elevation of another point.

Path: From the Main Menu, press **[L]** Trig. Leveling Menu - **[I]**

BS pt / BS elv =>

FS stk pt / FS elev =>

```
  Leveling Stakeout
>BS pt:              0
BS rod reading: 0.000
>FS stk pt :    0.000
FS rod reading: 0.000
FS elev:        0.000
Cut:  0.000
```

SOLVE	FS	STORE	BS	FP+1	EXIT

BS elv - BS pt: allows you to specify the back sight elevation either as an elevation or a point number which has a known elevation.
BS rod reading: is the height of the target on the rod at the backsight point.
FS stk pt - FS elev: is the design elevation for the Foresight. This elevation or the elevation of this point will be compared to the elevation calculated from the BS elev, BS rod reading and FS rod reading. The resulting difference is the cut or fill displayed below.
FS rod reading: is the height of the target on the rod at the foresight point.
FS elev: {output only} is the elevation at the foresight point.
Cut - Fill: is the difference between the design elevation entered in the FS stk pt or FS elev, and the elevation calculated from the BS elev, BS rod reading and FS rod reading, expressed as a cut or fill.

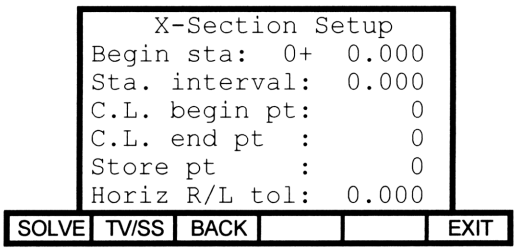
[SOLVE] will compute the foresight elevation based on the BS elev, BS rod reading, and FS rod readings. This is compared with the Foresight elevation and the difference is displayed as a cut or fill.
[FS] if you are in the manual input mode, this key will transfer you to the 3-Wire Data Input Screen (see below). If you are connected to an electronic total station, this key will read the road and enter the foresight elevation.
[STORE] will store the elevation. The point number that will be use is the last point stored + 1. You can set it to a new point number in the X-section Setup Screen store pt field or any other store point field. If this point exists, only the elevation will be changed. If the point does not exist the northing and easting will be set to 0.000.

[BS] if you are in the manual input mode, this key will transfer you to the 3-Wire Data Input Screen (see below). If you are connected to an electronic total station, this key will read the road and enter the backsight elevation.
[FP+1] will increment the FS point by one, ready for you next shot.

X-SECTION SETUP SCREEN

Purpose of screen - to set parameters for the X-section screen.

Path: From the Main Menu, press **[L]** Trig. Leveling Menu - **[J]**



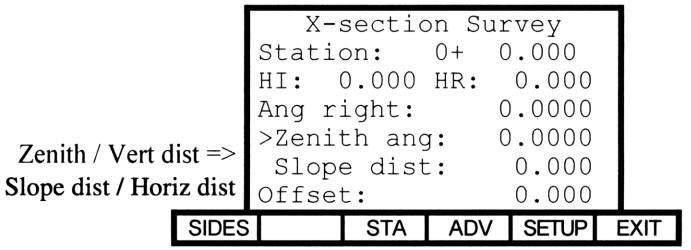
Begin sta: is the station number (chainage) to the center line begin point. With this reference, the station and offset of each subsequent shot can be recorded and later used to group cross section points together.
Sta. interval: is the interval between cross-section.
C.L. begin pt: is the point number that defines the beginning of the center line.
C.L. end pt: is the point number that defines the end of the center line.
Store pt: is the starting point number that will be used to store the coordinates of the cross-section points.
Horiz R/L tol: lets you specify the distance from the perpendicular that will be tolerated before you are alerted by SURVEY-PRO.

[SOLVE] will set all parameters for the cross-section routine according to the data entered in the above fields.
[TV/SS] will transfer to the Traverse Sideshot Screen.
[BACK] will transfer to the Backsight Setup Screen

CROSS-SECTION SURVEY SCREEN

Purpose of screen - to gather cross-section data in a form that can be used to perform Average End Area Volume calculations.

Path: From the Main Menu, press **[L]** Trig. Leveling Menu - **[K]**



Station: specifies the stationing of the cross-section you are now shooting offsets for.
HI: the height of the instrument above the ground.
HR: is the height of the target on the rod above the ground.
Ang. right: is where the horizontal angle is entered.
Zenith ang - Vert Dist:
Slope dist - Horiz dist: these two lines scroll together to select between zenith angles and slope distances or elevation changes and horizontal distances that may be used to enter field data into the X-section routine.
Offset: is the distance from the center line to the point being shot along a line perpendicular to the center line.

[SIDES] will take the information which has been input into the screen and will compute the coordinates of the foresight point with offset information in the descriptor field. If connected to an electronic total station the Ang right, Zenith ang and Slope dist will be electronically entered.
[STA] will take the a shot at a rod on the center line and compute the station for the next cross-section.
[ADV] will increment the station in the screen by the distance established in the X-section Setup Screen (see above). This is useful when you have completed a cross-section and you want to move on to the next one.
[SETUP] will transfer to the X-section Setup screen (see above).

BUILDING PAD SETUP COMMAND

Purpose of screen - to establish a X, Y, Z grid for use by the following building pad routines.

Path:	From the Main Menu, press **[L]** Trig. Leveling Menu - **[L]**

Displays the following sequence of prompts used to establish the origin and the Y-axis for an arbitrary grid use for the building pad routines:

Enter Height of Instrument

Height of rod

Aim at (0,0) point of the x-y axes
Hit a key when ready

Set HA of gun to zero
Hit a key when ready

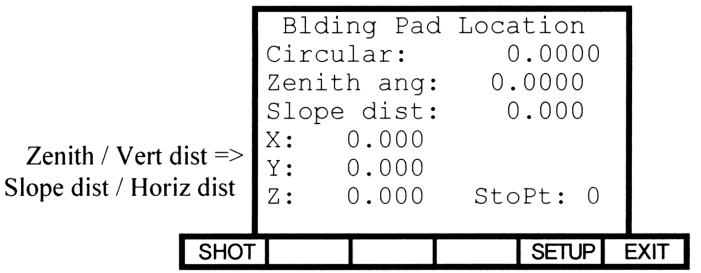
Aim at another point on the Y-axis
Hit a key when ready

Enter point number for storing origin pt:

BUILDING PAD X, Y, Z SCREEN

Purpose of screen - using the X and Y axis established in the Building Pad Setup determine the (x, y) coordinates of the any rod location.

Path: From the Main Menu, press **[L]** Trig. Leveling Menu - **[M]**



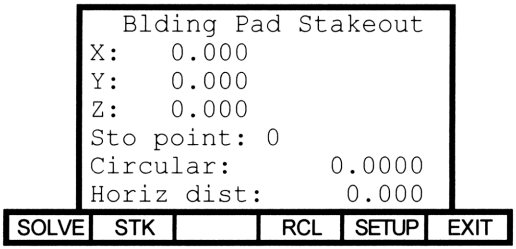
Circular: is the horizontal angle reading from the origin to the line of sight of the foresight point. The first three fields may either be entered in manually or it may be collected automatically from an electronic total station by pressing **[SHOT]**.
Zenith ang: is the zenith angle to the rod position.
Slope dist: is the slope distance to the rod position.
X: {output only}the distance from the origin in the x direction to the foresight point.
Y: {output only} the distance from the origin in the y direction to the foresight point.
Z: {output only}the vertical distance from the origin to the foresight point.
StoPt: is the point number where the coordinates are store. If set to "0" then the building pad location routine will not store coordinates.

[SIDES] will take the a shot at a rod or take the information which has been input into the screen and will compute the coordinates of the foresight point with offset information in the descriptor field. If connected to an electronic total station the Ang right, Zenith ang and Slope dist will be electronically entered. The coordinates calculated will be store at the point number entered in the StoPt field. If this value is "0" then the coordinates are not stored.
[SETUP] will transfer to the Building Pad Setup Routine (see above).

BUILDING PAD STAKEOUT SCREEN

Purpose of screen - using the X and Y axis established in the Building Pad Setup stake the location of any (x, y) coordinate.

Path: From the Main Menu, press **[L]** Trig. Leveling Menu - **[N]**



X: the distance from the origin in the x direction to the point to be staked.
Y: the distance from the origin in the y direction to the point to be staked.
Z: the vertical distance from the origin to the point to be staked.
Circular: {output only} is the horizontal angle reading from the origin to line of sight of the point to be staked.
Horiz dist: {output only} is the horizontal distance from the occupied point to the point to be staked.
Sto Point: is the point number where the *as built* coordinates are store.

[SOLVE] will take the coordinates which have been input into the X, Y, and Z fields and will compute the Curricular and Horizontal distance. This should be done before pressing the **[STK]** key.
[STK] will transfer you to the Stake Shots Screen (see the screen following Point Stake).
[RCL] will temporarily shift to a recall point number screen. You may then specify the point number to be recalled and press **[ENTER]** to return to the Blding Pad Stakeout Screen.
[SETUP] will transfer to the Building Pad Setup Routine (see above).

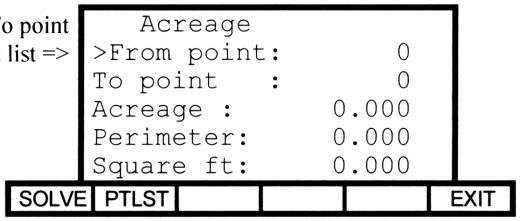
CO-GO MENU SCREENS

ACREAGE SCREEN

Purpose of screen - To allow the computation of the area of a parcel of land defined by a series of points stored in SURVEY-PRO.

Path: From the Main Menu, press **[M]** CO-GO Menu - **[G]**

From point - To point /Using point list =>



NOTE:

When the units are feet, the area is reported in both acres and square feet and the perimeter is in feet.
When the units are meters, the screen is called the Area Screen, the area is in square meters and the perimeter is in meters.

From point: - <Using point list>
To point: These are the alternative methods of specifying a sequence of points that are to make up the boundary of the parcel. From point To point specifies that the points are to be connected in numerical sequence. Also, the last point is connected to the first to complete the closed area. The point list is a technique that you may use to specify a boundary that is made up of points that are not in numerical sequence. (See the Section of this Reference Manual that covers the Point List Screen.)
Acreage: {output only} is the computed area in acres.
Perimeter: {output only} is the computed perimeter of the parcel in feet.
Sq feet: {output only} is the computed area in square feet.

[SOLVE] will compute the output lines based on the input points specified at the top of the display.
[PTLST] will transfer to the Point List Screen.

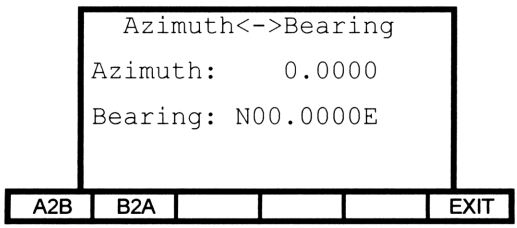
NOTE:

If the boundary of the area to be computed includes sections of horizontal curves, they may be included in the point list. Point lists that have curves included will compute the area **within** the curved boundaries.

AZIMUTH <---> BEARING SCREEN

Purpose of screen - to allow you to convert azimuths to bearings or bearings to azimuths.

Path: From the Main Menu, press **[M]** CO-GO Menu - **[H]** Conversion Menu - **[G]**



Azimuth: is the angle of a line expressed as an azimuth.
Bearing: is the angle of the same line expressed as a bearing.

[A 2 B] (read azimuth to bearing) will compute the bearing based on the value of the azimuth line in the screen.
[B 2 A] (read bearing to azimuth) will compute the azimuth based on the value of the bearing line in the screen.

VERT/ZENITH & SLOPE SCREEN

Purpose of screen - to allow you to convert a vertical angle, or a zenith angle and slope distance to a horizontal distance and a change in elevation.

Path:	From the Main Menu, press **[M]** CO-GO Menu - **[H]** Conversion Menu - **[H]**

Zenith / Vert ang=>

```
  Zenith & Slope Dst

>Zenith    :     0.0000
Slope dist:      0.000

Horiz dist:      0.000
Vert. dist:      0.000
```

SOLVE					EXIT

Zenith - Vert ang: is the specification of a vertical angle that is to be used in the conversion.

Slope dist: is the specification of the slope distance to be used in the conversion.

Horiz dist: {output only} is the computation of the horizontal distance from the data which has been entered into the screen.

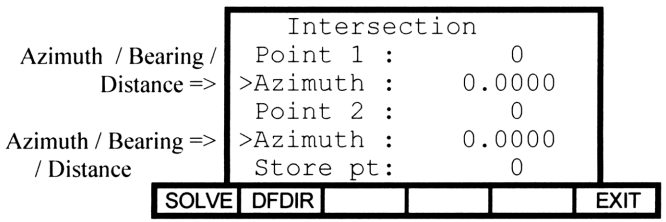
Vert dist: {output only} is the vertical distance (change in elevation) which has been computed from the data which has been entered into the screen.

[SOLVE] will compute the output values of horizontal and vertical distance from the data which has been entered into the input lines of the screen.

INTERSECTION SCREEN

Purpose of screen - to find a point at the intersection of two lines emanating from two known points. The intersection may be specified as two directions, a direction and a distance, or two distances.

Path: From the Main Menu, press **[M]** CO-GO Menu - **[I]**



Point 1: is the point number of the first point from which the intersection line is to be defined.
Azimuth - Bearing - Distance: is the known parameter from point 1, either an azimuth, bearing, or distance.
Point 2: is the point number of the second point from which the intersection line is to be defined.
Azimuth - Bearing - Distance: is the known parameter from point 2, either an azimuth, bearing, or distance.
Store pt: is the point number of the intersection point at which the coordinates should be stored.

[SOLVE] will compute the coordinates of the intersection point from the data provided in the screen and store these coordinates at the specified point number in the job coordinate file. After **[SOLVE]** has been pressed, the **[←]** and **[→]** may be used on the appropriate lines of this screen to see the other quantities to the intersection point. For example if you have solved for a bearing-bearing intersection, you may display the distances from the two points to the intersection point.
[DFDIR] will transfer to the Define A Direction Screen, where the azimuth required for a direction specification for this screen may be computed from other point information (see below).

DEFINE A DIRECTION SCREEN

Path:

→ From the Main Menu, press **[M]** CO-GO Menu:
- **[I]** Intersection Screen - **[DFDIR]**
- **[P]** Pre-Determined Area Screen **[DFDIR]**

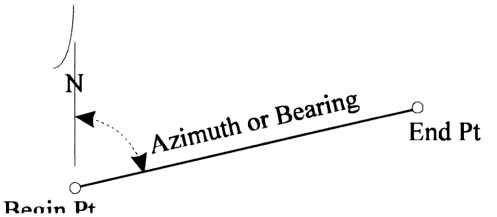
→ From the Main Menu, press **[N]** Survey Adjustment Menu - **[I]** Rotate Job **[DFDIR]**

```
  Define a Direction
Begin pt:        0
End pt  :        0
+/- ang :     0.0000
Bearing : N00.0000E
Azimuth :     0.0000
Distance:      0.000
```

SOLVE					EXIT

Begin point: is the first point on the line to define a direction.
End point: is the second point on a line to define a direction.
+/- ang: is the deviation from the computed azimuth or bearing from the first point to the second point on the line that is to be returned as the azimuth or bearing to be used in subsequent calculations. A + angle is in the clockwise direction from the first point to the second point; a - angle is in the counter-clockwise direction.
Bearing: {output only} the bearing from the beginning point to the end point.
Azimuth: {output only} the azimuth of the line from the beginning point to the end point.
Horiz dist: {output only} the horizontal distance between the two lines.

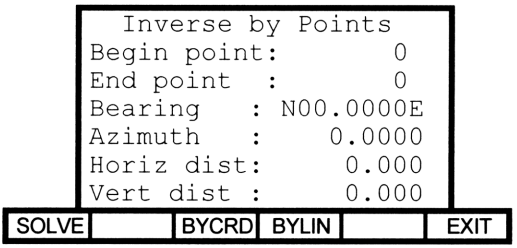
[SOLVE] will compute the output bearing and azimuth from the point numbers of the two points on the line as specified in the screen.
[EXIT] will first prompt for the azimuth or bearing that is required in the intersection being solved and then return to the Intersection Screen.



INVERSE BY POINT SCREEN

Purpose of screen - to compute the inverse (bearing and distance) between two points expressed as point numbers.

Path:	From the Main Menu, press **[M]** CO-GO Menu - **[J]**



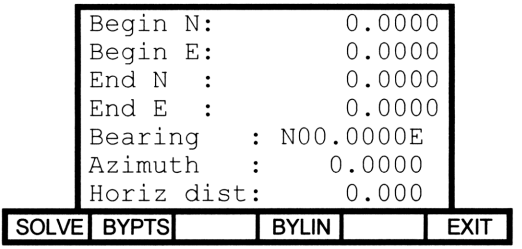
Begin point: is the first point on the line for which the inverse is to be computed.
End point: is the second point on the line for which the inverse is to be computed.
Bearing: {output only} is the bearing of the line from the first point to the second point.
Azimuth: {output only} is the azimuth of the line from the first point to the second point.
Horiz dist: {output only} is the horizontal distance between the two inputs in this screen.
Vert dist: {output only} is the vertical distance between the two points in this screen.

[SOLVE] will compute the azimuth, bearing and distance between the points specified in the screen.
[BYCRD] will transfer to an alternate Inverse Screen that will compute the inverse between points specified by coordinates (see below).
[BYLIN] will transfer to an alternate Inverse Screen that will compute the perpendicular bearing and distance from a point to a line (see below).

INVERSE BY COORDINATES SCREEN

Purpose of screen - to compute the inverse (bearing and distance) between two points expressed as coordinates.

Path:	From the Main Menu, press **[M]** CO-GO Menu - **[J]** Inverse By Points Screen - **[BYCRD]**



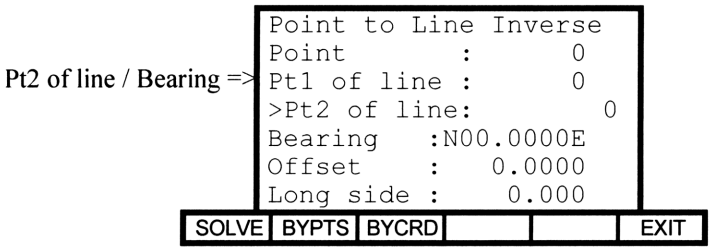
Begin N: is the north coordinate of the first point on the line for which the inverse is to be computed.
Begin E: is the east coordinate of the first point on the line for which the inverse is to be computed.
End N: is the north coordinate of the second point on the line for which the inverse is to be computed.
End E: is the east coordinate of the second point on the line for which the inverse is to be computed.
Azimuth: {output only} is the azimuth of the line from the first point to the second point.
Bearing: {output only} is the bearing of the line from the first point to the second point.
Horiz dist: {output only} is the horizontal distance between the two points in this screen.

[SOLVE] will compute the azimuth, bearing and distance between the points specified in the screen.
[BYPTS] will transfer to an alternate Inverse Screen that will compute the inverse between points specified by point numbers (see above).
[BYLIN] will transfer to an alternate Inverse Screen that will compute the perpendicular bearing and distance from a point to a line (see below).

POINT TO LINE INVERSE SCREEN

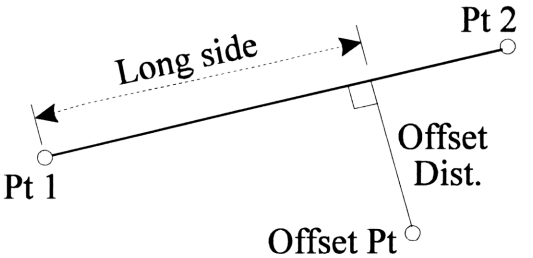
Purpose of screen - to compute the inverse (bearing and distance) between a point and a line defined by two other points.

Path:	From the Main Menu, press **[M]** CO-GO Menu - **[J]** Inverse By Points Screen - **[BYLIN]**



Point: is the point from which the inverse is to be computed.
Pt 1 of line: is the first point that defines the line to which the inverse is to be computed.
Pt 2 of line - Bearing: is the method that you use to define the line to which the inverse is to be computed.
Bearing: {output only} is the bearing of the line from the first point to the second point.
Offset: {output only} is the perpendicular distance from the offset point to the line from Point 1 to Point 2. If this distance is positive, the offset is to the right of the line from Point 1 to Point 2. If this distance is negative, the offset is to the left of the line from Point 1 to Point 2.
Long side: {output only} is the distance from Point 1 to the projection of the offset point to the line from Point 1 to Point 2. If this distance is positive, the distance is from Point 1 in the direction of Point 2. If this distance is negative, the distance is from Point 1 away from Point 2.

[SOLVE] will compute the bearing and distances and display the results in the Results Screen as shown above.
[BYPTS] will transfer to an alternate Inverse Screen that will compute the inverse between points specified by point numbers (see above).
[BYCRD] will transfer to an alternate Inverse Screen that will compute the inverse between points specified by coordinates (see above).


Pt 2
Long side
Offset
Dist.
Pt 1
Offset Pt

POINT IN DIRECTION SCREEN

Purpose of screen - to allow you to compute the coordinates of a new point by specifying a known point and a direction and distance from the known point.

Path: From the Main Menu, press **[M]** CO-GO Menu - **[K]**

Azimuth / Bearing =>

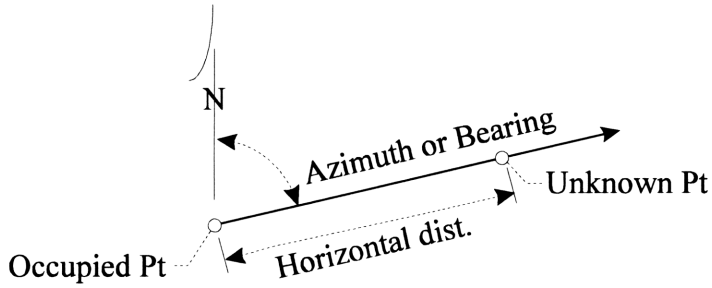
```
  Point in Direction
Occupy pt:        0
>Azimuth  :         0
Horiz dist:     0.000
+/- ang :     0.0000
Store pt:         0
```

SOLVE | DFDIR | | | | EXIT

Occupy point: is the point number of the known point.
Azimuth: - Bearing: is the direction from the known point to the unknown point.
Horizontal dist: is the distance from the known point to the unknown point.
+ / - ang: is the angle that will be added to or subtracted from the azimuth.
Store pt: is the point number of the unknown point whose coordinates are to be computed.

[SOLVE] will solve for the unknown point coordinates based on the input information in the screen and will store these coordinates into the current job file at the specified point number.

[DFDIR] will transfer to the Define A Direction Screen.



RESECTION FROM TWO POINTS SCREEN

Purpose of screen - to allow you to determine the coordinates of an occupied point by field measurements (angles and distances) to two known points.

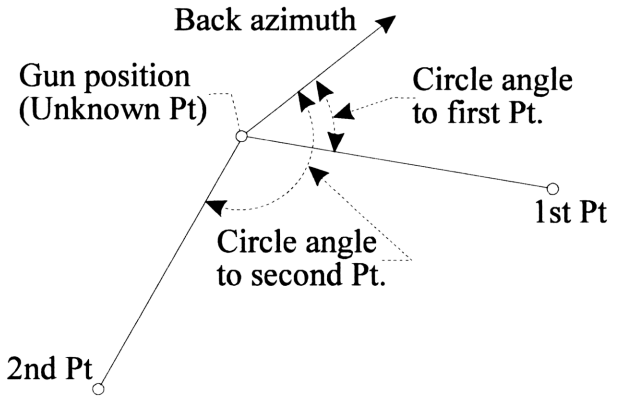
Path: From the Main Menu, press **[M]** CO-GO Menu - **[L]**

```
  Resection from 2 Pts
Option: >Direct & Rev
First pt:          0
HI:  0.000 HR:  0.000
Circular:       0.0000
Zenith ang:     0.0000
Slope dist:      0.000
SOLVE                                   EXIT
```

<= Direct & Rev / Direct only

Option: lets you select between a direct foresight shot only and shooting one direct and one reversed shot at each foresight.
First point: is the number of the first known point.
Circular: is the horizontal angle reading when sighting the first point.
Zenith ang: is the zenith angle to the first point.
Slope dist: is the slope distance to the first point.
HI: is the height of the instrument above the unknown point on the ground
HR: is the height of the target on the rod above the ground.

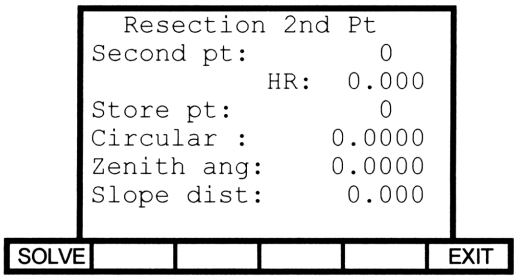
[SOLVE] will transfer to the Second Point Screen for this two point resection.



SECOND POINT SCREEN

Purpose of screen - to complete the two point resection begun in the previous screen.

Path:	From the Main Menu, press **[M]** CO-GO Menu - **[L]** Resection From Two Points Screen - **[SOLVE]**



Second point: is the number of the second known point.
HR: is the height of the target on the rod above the ground.
Circular: is the horizontal angle reading when sighting the second point.
Zenith ang: is the zenith angle to the 2nd point.
Slope dist: is the slope distance to the 2nd point.
Store pt: is the number of the occupied point whose coordinates are to be determined.

[SOLVE] will solve for the coordinates of the unknown occupied point based on the contents of this and the previous screen. It will also store these coordinates in the job file at the specified point number.

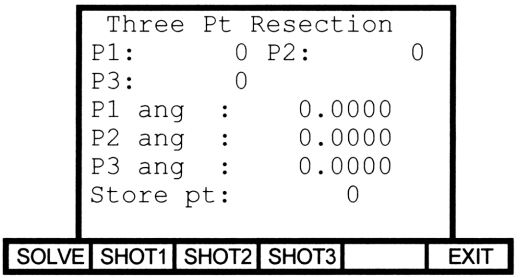
NOTE:

In both this and the previous screen, if you are in the field and connected to an *electronic total station*, pressing **[SOLVE]** will trigger the gun to collect the data for each point of the resection.

RESECTION FROM THREE POINTS SCREEN

Purpose of screen - to allow you to determine the coordinates of an occupied point by field measurements (angles) to three known points.

Path:	From the Main Menu, press **[M]** CO-GO Menu - **[M]**



P1: is the point number of the first known point.

P2: is the point number of the second known point.

P3: is the point number of the third known point.

P1 ang: is the circular (horizontal) angle reading when sighting the first known point.

P2 ang: is the circular (horizontal) angle reading when sighting the second known point.

P3 ang: is the circular (horizontal) angle reading when sighting the third known point.

Store pt: is the point number of the unknown occupied point.

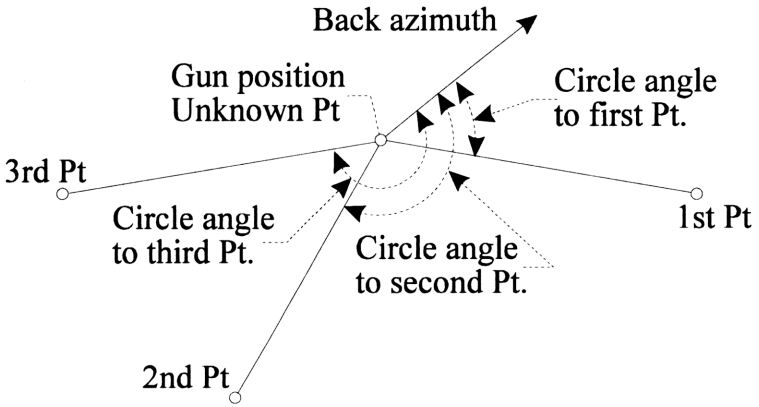
[SOLVE] will compute the coordinates (northing and easting) of the unknown occupied point and store them in the job file at the specified point number.

[SHOT1] will trigger an electronic total station to read the horizontal angle from the first point automatically.

[SHOT2] will trigger an electronic total station to read the horizontal angle from the second point automatically.

[SHOT3] will trigger an electronic total station to read the horizontal angle from the third point automatically.

NOTE: P1, P2, and P3 are required to be in *clockwise* order as viewed from above the gun position.



NOTE: Since a three point resection only requires horizontal angles to be measured, it is *not* possible to use this method to determine the elevation of the unknown point. Only the north and east coordinates are solved.

COMPUTE CORNER ANGLE SCREEN

Purpose of screen - to allow you to compute the angle made by two lines that meet at a common (corner) point.

Path: From the Main Menu, press **[M]** CO-GO Menu - **[N]**

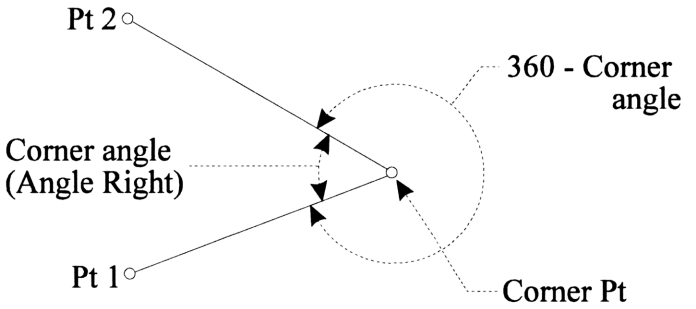
```
  Compute Corner Angle
Point 1:          0
Corner pt:        0
Point 3:          0

Corner ang:    0.0000
360 -:     0.0000
```

SOLVE | | | | | EXIT

Pt 1: is a point on the first line.
Corner pt: is the common point (corner) of the two lines.
Pt 3: is a point on the second line.
Corner angle: {output only} is the *internal* corner angle determined at the intersection of the two lines.
360 - : {output only} is 360_ minus the corner angle computed above.

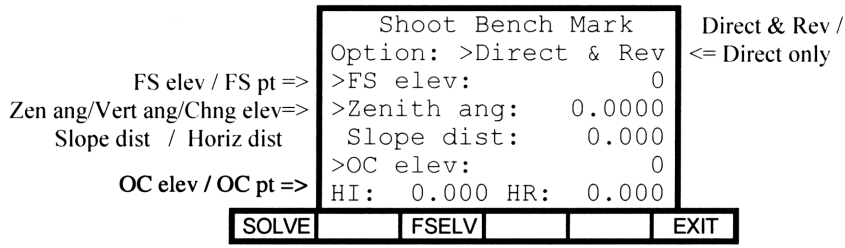
[SOLVE] will compute the *internal* corner angle determined by the two lines defined by points 1 and 3 and the corner point.



SHOOT BENCHMARK SCREEN

Purpose of screen - to allow you to compute the elevation of the occupied point given the known elevation of the foresight.

Path:
- → From the Main Menu, press **[J]** Traverse / Sideshot Screen - **[OFFCT]** Off Center Shot Menu - **[L]**
- → From the Main Menu, press **[M]** CO-GO Menu - **[O]**



Option: lets you select between a direct foresight shot only and shooting one direct and one reversed shot at the foresight.
FS elev: - FS point: is the specification of the remote foresight elevation either by elevation or by the point number of the foresight.
Zenith ang: is the zenith angle from the occupied point to the foresight.
Slope Dst: is the slope distance from the occupied point to the foresight.
OC elev: is the computed elevation of the occupied point. If this prompt is set at OC point, the computed elevation will be stored in the coordinate file of the designated point. The northing and easting values will not be changed.
HI: is the height of the instrument.
HR: is the height of the rod.

[FSELV] This key will calculate the foresight elevation from the occupied elevation and the data entered into the screen.
[SOLVE] if SURVEY-PRO is connected to an electronic station, this key will trigger the gun to take a shot. If SURVEY-PRO is in manual mode, the elevation of the occupied point will be computed from the values of zenith angle and slope distance that have been keyed in the screen.

PRE-DETERMINED AREA SCREEN

Purpose of screen - To enable you to find the coordinates of the missing boundary line of a parcel that will result in a pre-determined area for that parcel. The primary screen will assume that the unknown boundary is hinged at the last point in the point list and intersects the first line at an unknown point whose coordinates are to be determined.

Path:	From the Main Menu, press **[M]** CO-GO Menu - **[P]**

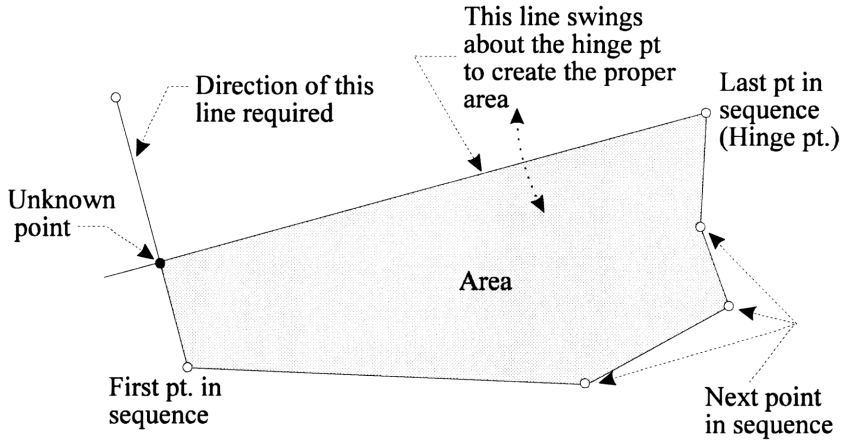
Acre / Square ft =>
From point-To point =>
/ Using point list
Pt on line / Bearing =>

```
>Acre       :        0.00
>From point:          0
To point    :          0
>Pt on line:      0.0000
 Store pt   :          0
 Line brg   : N00.0000E
 Line dist  :      0.000
```

SOLVE | PTLST | DFDIR | PARAL | | EXIT

Acre: - Square ft: is the predetermined area expressed as acres or square feet.
From point: - <Using point list>
To point: These are the alternative methods of specifying a sequence of points that are to make up the boundary of the parcel.
Bearing: - Pt on line: is the technique for describing the direction of the first side of the parcel.
Store pt: - is the point number of the unknown boundary point whose coordinates are to be determined.
Line brg: {output only} is the bearing of the missing last boundary line of the parcel.
Line dist: {output only} is the length of the first line segment of the parcel.

[SOLVE] will solve for the unknown point coordinates based on the input information in the screen and will store these coordinates into the current job file at the specified point number.
[PTLST] will transfer to the Point List Screen.
[DFDIR] will transfer to the Define a Direction Screen. In this way, the bearing of the first line may be computed from two points on the line.
[PARAL] will transfer to the Parallel Pre-determined Area Screen, an alternative technique for bounding a pre-determined area. (see below).



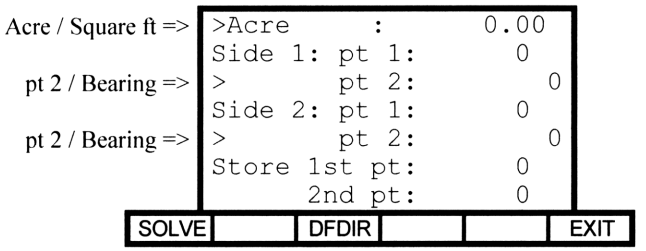
NOTE:

If the distance units setting has been specified as meters in the Operating Modes Screen, the area specification in this screen must be input as square meters. All output distances will be in meters.

PARALLEL PRE-DETERMINED AREA SCREEN

Purpose of screen - To allow a pre-determined area to be bounded by a sequence of boundary points and an unknown line that is parallel to a known line.

Path:	From the Main Menu, press **[M]** CO-GO Menu - **[P]** Pre-determined Area Screen - **[PARAL]**



Acre: - Square ft: is the predetermined area expressed as acres or square feet.

Side 1: Pt 1: is the first point that defines the first side of the parcel.

Pt 2: - Bearing: is the second point (or bearing) that defines the first side of the parcel.

Side 2: Pt 1: is the first point that defines the second side of the parcel.

Pt 2: - Bearing: is the second point (or bearing) that defines the second side of the parcel.

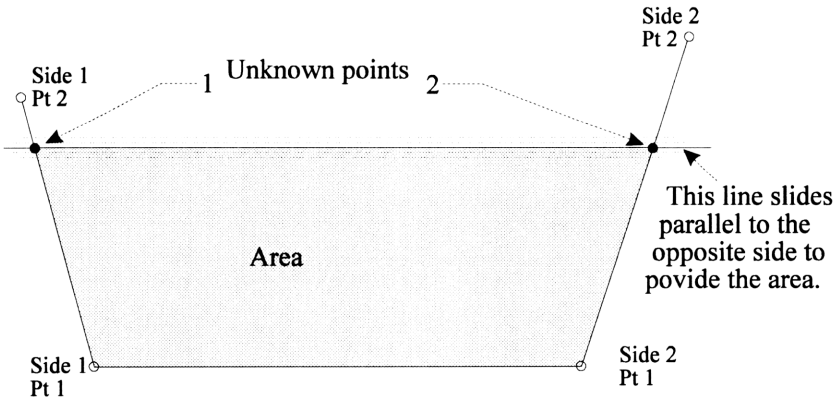
[Note: The line that defines the bearing of the unknown line is the line that connects the two Pt 1's above.]

Store 1st pt: is the point number of the intersection of the unknown boundary line with line 1.

Store 2nd pt: is the point number of the intersection of the unknown boundary line with line 2.

[SOLVE] will solve for the unknown point coordinates based on the input information in the screen and will store these coordinates into the current job file at the specified point numbers.

[DFDIR] will transfer to the Define a Direction Screen. In this way, the bearing of the first line may be computed from two points on the line.



NOTE:

If the distance units setting has been specified as meters in the Operating Modes Screen, the area specification in this screen must be input as square meters. All output distances will be in meters.

INVERSE BY STATION SCREEN

Purpose of screen - to compute station number and offset distance from a given point to a centerline.

Path:	→ From the Main Menu, press **[I]** Stakeout Menu - **[N]** → From the Main Menu, press **[M]** CO-GO Menu - **[Q]**

REFERENCE

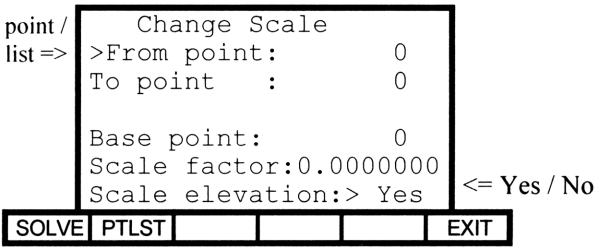
For a description of this screen see the Inverse by Station Screen under the Stakeout menu.

SURVEY ADJUSTMENT MENU SCREENS

CHANGE SCALE SCREEN

Purpose of screen - to allow you to change the coordinates of a block of points to reflect a change in the relative distances between them.

Path:	From the Main Menu, press **[N]** Survey Adjustment Menu - **[G]**



From point / To point - Using point list: allows you to specify all points which are to be included in the scale factor adjustment.

Base point: the "Origin" point for the scale factor adjustment. The coordinates of the base-point will not change.

Scale factor: the amount of change of the relative linear distance between the points as defined in the screen.

Scale elevation: specifies whether or not vertical distances should be scaled.

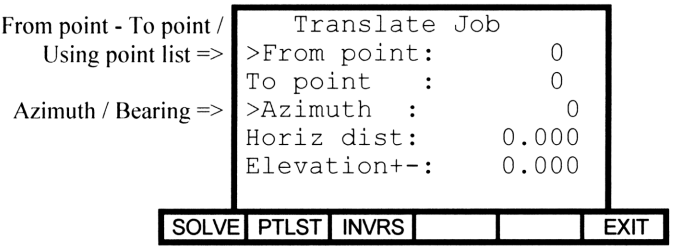
[SOLVE] will compute the new coordinates for all of the points selected, except the base-point, so that the relative distance between them will be changed by multiplying the existing distances by the .

[PTLST] will transfer to the Point List Screen.

TRANSLATE JOB SCREEN

Purpose of screen - to move all of the coordinates in a block of points to the north and/or east and/or change in elevation by a constant distance.

Path:	From the Main Menu, press **[N]** Survey Adjustment Menu - **[H]**



From pt: - <Using point list>
To point: are the alternative methods of specifying the points that are to be included in the translation.

Azimuth: - Bearing: is the *direction* in which the specified points in this job are to be translated. This screen *does not rotate* the job.

Horiz dist: is the horizontal distance through which the specified points in this job are to be translated in the direction noted by the azimuth or bearing in this screen.

Elevation +-: is the amount of change in the elevation of the specified points in this job.

[SOLVE] will compute new coordinates for all of the points identified in the top of the screen by the amounts specified in the +/- lines of the screen.

[PTLST] will transfer to the Point List Screen.

[INVRS] will transfer to the Inverse between Points Screen and then return the results to this screen.

ROTATE JOB SCREEN

Purpose of screen - to allow you to rotate a block of points about a central point and change the northings and eastings accordingly.

Path:	From the Main Menu, press **[N]** Survey Adjustment Menu - **[I]**

From point - To point / Using point list =>

```
   Rotate Job
>From point:        0
To point   :        0

Rotation pt:        0
Old bearing: N00.0000E
New bearing: N00.0000E
```

SOLVE | PTLST | DFDIR | | | EXIT

From point: - <Using point list>
To point: are the alternative methods of specifying the points that are to be included in the rotation.

Rotation pt: is the point about which the rotation is to be taken.

Old bearing: is the bearing of a line on the survey *before* the rotation.
New bearing: is the bearing of the same line on the survey *after* the rotation.

[SOLVE] will rotate all of the points specified in the top of the screen about the rotation point and at the rotation angle specified in the screen. New northings and eastings for these points will be computed.

[PTLST] will transfer to the Point List Screen.

[DFDIR] will transfer to the Define A Direction Screen, where the azimuth required for a direction specification for this screen may be computed from other point information

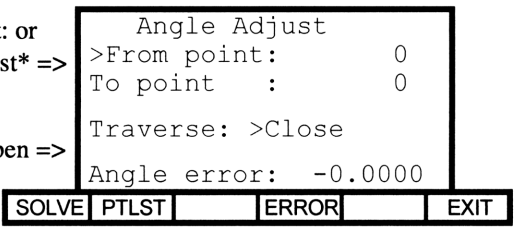
ANGLE ADJUSTMENT SCREEN

Purpose of screen - to allow you to adjust a traverse for angular error.

Path: From the Main Menu, press **[N]** Survey Adjustments Menu - **[J]**

From pt: - To pt: or
Using point list =>

Close / Open =>

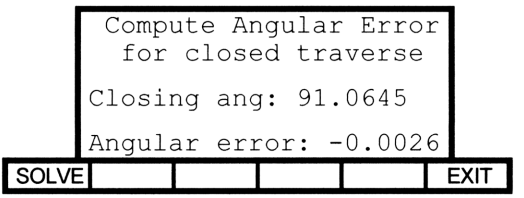


From point / To point - Using point list: allow you to specify all points which are to be included in the angle adjustment.
Traverse: selects between an open and closed traverse
Angle error: is the angular error that is to be "adjusted out" of the survey.

[SOLVE] will divide the angular error equally among all of the angles of the closed traverse and adjust the coordinates of all but the first two points.
[PTLST] will transfer you to the Point List Screen.
[ERROR] will transfer you to one of the Compute Angular Error Screens.

COMPUTE ANGULAR ERROR For Closed Traverse

Purpose of screen - to allow you to compute the angular error using the polygon rule. You may either enter a closing angle or let SURVEY-PRO compute the closing angle. (see below) The error will be displayed in the Angle error field.



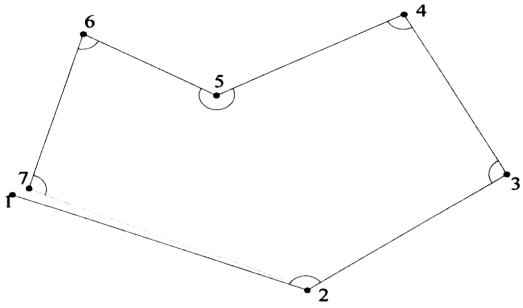
Closing Ang: this is the angle between the next to the last traverse point through the closing point to the second point of the traverse. If you shot this angle in the field you should enter the result as the Closing ang. If you do not have the closing angle set this field to zero and SURVEY-PRO will calculate it for you.
Angle error: is the angular error that is to be "adjusted out" of the survey.

[SOLVE] will compute the angular error using the polygon rule. You may either enter a closing angle or let the TDS-COGO48 compute the closing angle. (see below)
Angular error will be calculated by using the rule that the sum of all internal angles of a polygon will be equal to the number of sides minus two multiplied by 180 degrees. If the Closing angle is zero, the angle between the next to the last, the last and the second points will be used. See the example below.

Polygon Rule: Angular error will be calculated by using the rule that the sum of all internal angles of a polygon will be equal to the number of sides minus two multiplied by 180 degrees. If the Closing angle is zero, the angle between the next to the last, the last and the second points will be used. See the example below:

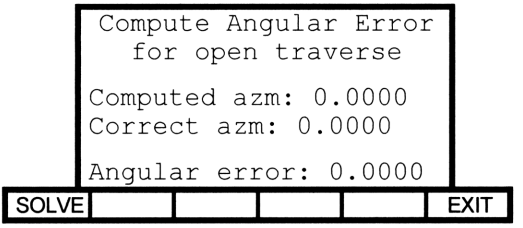
The angular Error is computed by adding:
1-2-3
2-3-4
3-4-5
4-5-6
5-6-7
Closing ang value or 6-7-2

The result is then compared to (6-2)*180 and the difference is the error



COMPUTE ANGULAR ERROR For Opened Traverse

Purpose of screen - to allow you to compute the angular error of a OPEN traverse The difference between the two azimuths is the angular error and will be displayed in the Angle error field.



Computed azm: the ending observed azimuth of the traverse
Correct azm: the desired ending azimuth This will be the ending azimuth after the traverse has been angle adjusted.
Angle error: {output only}is the angular error that is to be "adjusted out" of the survey.

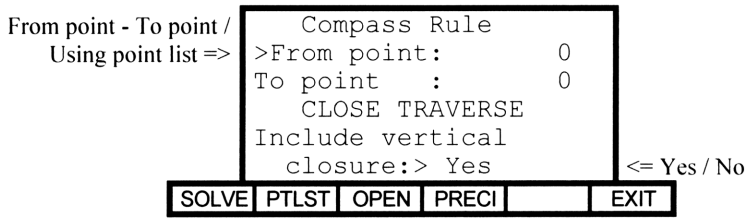
[SOLVE] will compute the angular simply by taking the difference between the computed and the correct azimuths.

COMPASS RULE SCREENS

CLOSED TRAVERSE

Purpose of screen - to allow you to adjust a *closed* traverse by the Compass Rule.

Path: From the Main Menu, press **[N]** Survey Adjustment Menu - **[K]**



From pt-To point: - <Using point list>: are the alternative methods of specifying the points that are to be included in the angular adjustment.
Include vertical closure: specifies whether elevations will be included in the adjustment.

[SOLVE] will apply the Compass Rule to the points specified in the closed traverse in the screen. It will compute new coordinates for all points *but the first point* and store these new coordinates in the job file.
[PTLST] will transfer to the Point List Screen.
[OPEN] will transfer to the Compass Rule Screen for open traverses (see below).
[PRECI] will compute the precision of the closed traverse based on the original data. The **[PRECI]** key should be used to check the precision *before* **[SOLVE]** is used. After pressing **[SOLVE]** the precision will be near perfect.

REFERENCE

OPEN TRAVERSE

Purpose of screen - to allow you to adjust an *open* traverse by the Compass Rule.

Path:	From the Main Menu press **[N]** Survey Adjustment Menu - **[K]** Compass Rule - **[OPEN]**

From point - To point / Using point list =>

```
   Compass Rule
>From point:        0
To point   :        0
   OPEN TRAVERSE
Correct N:    0.000
Correct E:    0.000
Correct EL:   0.0000
```

SOLVE	PTLST	CLOSE	PRECI	RCL	EXIT

From pt: - <Using point list>
To point: are the alternative methods of specifying the points that are to be included in the angular adjustment.
Correct N: is the true northing of the last point.
Correct E: is the true easting of the last point.
Correct EL: is the true elevation of the last point.

[SOLVE] will apply the Compass Rule to the points specified in the open traverse in the screen. It will compute new coordinates for all points *but the first point* and store these new coordinates in the job file.
[PTLST] will transfer to the Point List Screen.
[CLOSE] will transfer to the Compass Rule Screen for closed traverses (see above).
[PRECI] will compute the precision of the open traverse based on the original data. The **[PRECI]** key should be used to check the precision *before* **[SOLVE]** is used.
[RCL] will temporarily shift to a recall point number screen. You may then specify the point number whose coordinates will be used as the correct northing, easting, and elevation. Press **[ENTER]** to return to the Compass Rule Screen.

LEVELING LOOP SCREENS

CLOSED LOOP

Purpose of screen - to allow you to adjust a *closed* leveling traverse.

Path:	From the Main Menu, press **|O|** Adjustment Menu - **|J|** Leveling Loop Screen - Then press **|CLOSE|**

From point - To point / Using point list =>

```
   Leveling Loop
>From point:        0
To point   :        0

      CLOSE LOOP
```

SOLVE	PTLST	OPEN	PRECI		EXIT

From pt-To point: - <Using point list>: are the alternative methods of specifying the points that are to be included in the level adjustment.

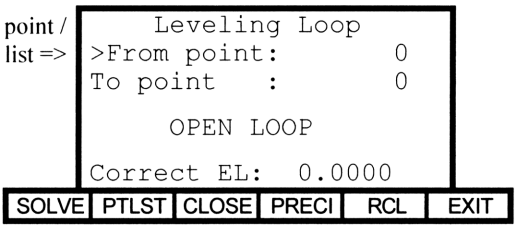
|SOLVE| will adjust the Closed Loop. It will compute new coordinates for all points *but the first point* and store these new coordinates in the job file.
|PTLST| will transfer to the Point List Screen.
|OPEN| will transfer to the Leveling Loop Screen for open traverses (see below).
|PRECI| will compute the precision of the loop based on the current data. The **|PRECI|** key should be used to check the precision *before* **|SOLVE|** is used. After pressing **|SOLVE|** the precision will be near perfect.

OPEN LOOP

Purpose of screen - to allow you to adjust an *open* Leveling traverse.

Path:	From the Main Menu press **[O]** Adjustment Menu - **[J]** Leveling Loop Screen - Then press **[OPEN]**

From point - To point / Using point list =>



From pt: - <Using point list>
To point: are the alternative methods of specifying the points that are to be included in the angular adjustment.
Correct EL: is the true elevation of the last point.

[SOLVE] will adjust the Open Loop. It will compute new coordinates for all points *but the first point* and store these new coordinates in the job file.
[PTLST] will transfer to the Point List Screen.
[CLOSE] will transfer to the Leveling Loop Screen for closed traverses (see above).
[PRECI] will compute the precision of the loop based on the current data. The **[PRECI]** key should be used to check the precision *before* **[SOLVE]** is used. After pressing **[SOLVE]** the precision will be near perfect.
[RCL] will temporarily shift to a recall point number screen. You may then specify the point number whose elevation will be used as the correct elevation. Press **[ENTER]** to return to the Leveling Loop Screen.

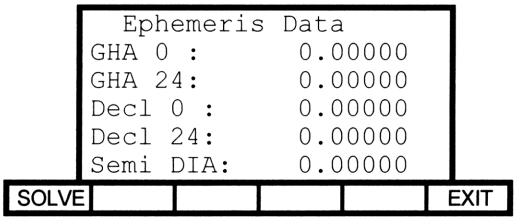
SUNSHOT MENU SCREENS

NOTE: **Direct viewing of the sun without a solar filter can cause serious and permanent eye damage. Also, sighting your electronic total station toward the sun without an objective lens filter can cause damage to your EDM.**

EPHEMERIS DATA SCREEN

Purpose of screen - to allow you to key in data from an ephemeris in preparation for performing sunshots in the field.

Path:	From the Main Menu, press **[O]** Sunshot Menu - **[G]** Ephemeris method



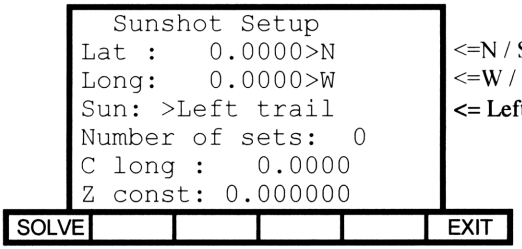
GHA 0: is the Greenwich Hour Angle of the sun at zero hour Universal Time, Greenwich on the current date.
GHA 24: is the Greenwich Hour Angle of the sun at zero hour Universal Time, Greenwich on the next date (24 hours later).
Decl 0: is the declination of the sun on the current date.
Decl 24: is the declination of the sun on the next date (24 hours later).
Semi Dia: is the semidiameter of the sun expressed in minutes and seconds.

[SOLVE] will transfer to the Sun Shot Setup Screen in preparation for taking the sunshots.

SUNSHOT SETUP SCREEN

Purpose of screen - to set the proper local constants into SURVEY-PRO in preparation for taking sunshots.

Path:
- → From the Main Menu, press **|O|** Sunshot Menu - **|G|** Ephemeris Data Screen - **|SOLVE|**
- → From the Main Menu, press **|O|** Sunshot Menu - **|H|** Almanac method

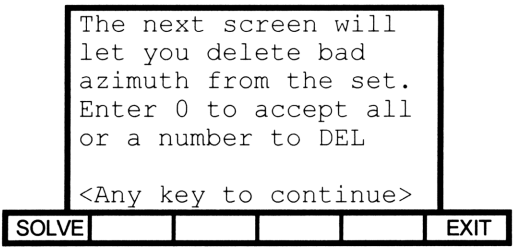


<=N / S
<=W / E
<= Left trail / Right trail / Center

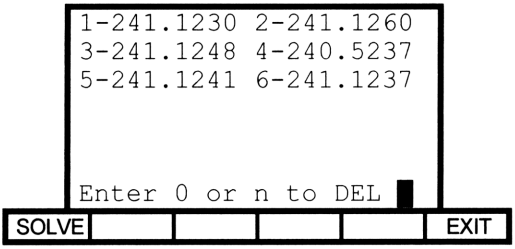
Lat: is the latitude of the *observer.*
Long: is the longitude of the *observer.*
Sun: indicates the location of the cross hair of the gun with respect to the sun at the time of the sunshot: left trailing edge, right trailing edge, or center.
Number of sets: is the number of sets of sunshots (direct and reverse) that are to be taken.
C long: is the central meridian longitude.
Z const: is the zone latitudinal constant for your region.

|SOLVE| will prompt you for the proper positioning of the gun and the sequence of readings to be taken. The procedure is to take a direct sighting on the backsight; then the direct sightings on the sun. Then, reverse (flop) your scope and take the reverse readings on the sun. The number of direct and reversed sightings on the sun are the sets specified in the Setup Screen. For each sighting of the sun, you must record the time of the reading. If you are connected to an electronic total station, the TDS-48 will take all readings automatically, including the time, as you trigger the machine. After the last shot has been collected, SURVEY-PRO will compute and display the individual back azimuths from each reading.

Pressing a key one more time will display the following message:



Again hit a key and you can delete any shot from the set. To delete one reading from the average type its number and press **[ENTER]**.



The average will then be displayed. Depending upon whether or not you used state grid constants in the Sun Shot Setup Screen, these azimuths will be relative either to the state grid coordinate system or to true north.

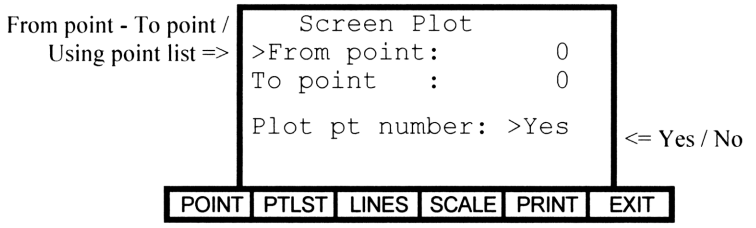
NOTE:

If you are connected to an electronic total station, pressing the **[SOLVE]** key from this screen will prompt you with the proper positioning of the gun. You will then trigger each shot at the proper time by pressing **[ENTER]**. SURVEY-PRO will collect the proper data automatically prior to computing the correct value for your back azimuth.

SCREEN PLOT SCREEN

Purpose of screen - to allow you to view a plot of a block of points in SURVEY-PRO's screen display.

Path: From the Main Menu, press **[P]** Screen plot



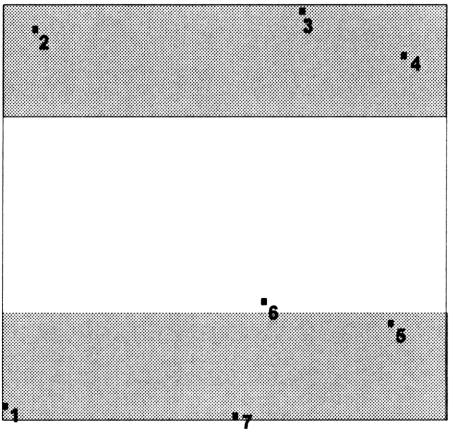
From point: - <Using point list>
To Point: are the techniques used to specify a sequence of points.
Plot pt number: will establish whether or not point numbers will be plotted.

[POINT] will cause the points indicated at the top of the screen to be plotted in SURVEY-PRO's display (see below).
[PTLST] will transfer to the Point List Screen.
[LINES] will cause the points indicated at the top of the screen to be plotted in SURVEY-PRO's display and to be connected by straight lines in the assigned sequence (see below).
[SCALE] will compute a scale for the plot that will display all of the specified points to be shown in the "square" virtual display.
[PRINT] will send the current screen plot to an HP-82240B Infrared Printer.

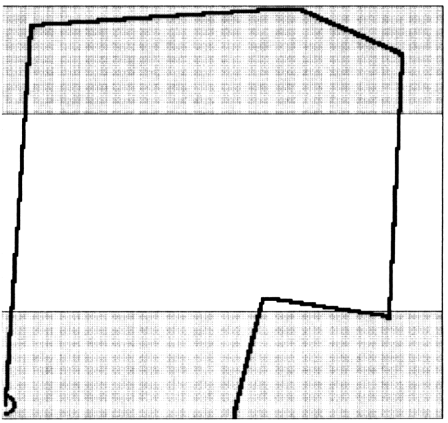
NOTE:

If you are using the Point List option to specify the point sequence and you want to show a figure that has more than one separate connected line sequence, you may "lift the pen" in this screen plot by inserting a PENUP command in the point list. Use the **[PENU]** softkey in the Point List Screen.

POINTS SCREEN



LINES SCREEN



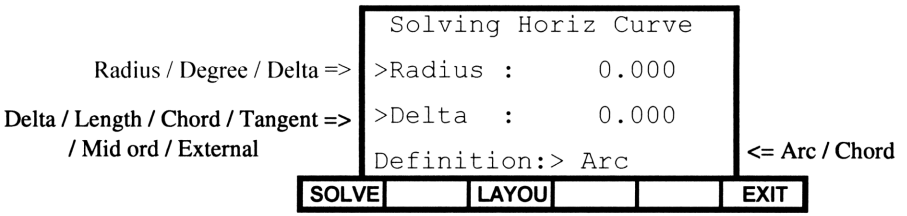
The points and lines screens are shown on a square virtual display with the north direction at the top of the display. You may press and hold down the vertical cursor keys **[↑]** and **[↓]** to scroll to the rest of the display. To return to the Screen Plot Screen, press **[ON]**. The Points screen is displayed with the point numbers **On** while the Lines screen on the next page, has then **Off**.

CURVE MENU SCREENS

SOLVING HORIZONTAL CURVE SCREEN

Purpose of screen - to solve for the properties of a horizontal curve.

Path: From the Main Menu, press **[Q]** Curve Menu - **[G]**



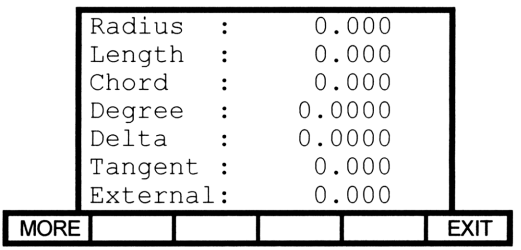
Radius: - Degree (of curvature): - Delta: is a measure of the curvature of the curve.
Delta: -Length: - Chord: - Tangent: - Mid ord: - External: is a measure of the size of the curve segment.

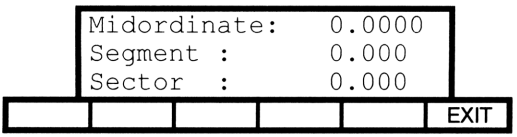
[SOLVE] will solve for the remaining curve parameters and display them on the Curve Solution Screen (see below).
[LAYOU] will transfer to the Horizontal Curve Layout Menu (see below).

CURVE SOLUTION SCREEN

Purpose of screen - to display the results of the horizontal curve solution.

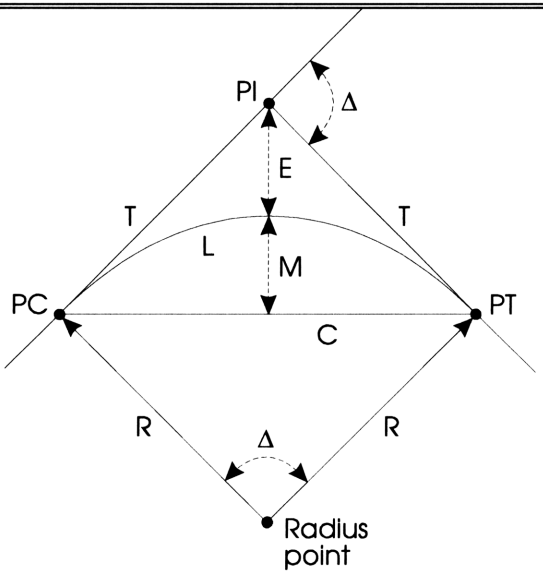
Path: From the Main Menu, press **[Q]** Curve Menu - **[G]**
Horizontal Curve Screen - **[SOLVE]**





All terms are defined as in the figure shown below.

Radius: - R
Length: - L
Chord: - C
Degree: - (18000/(P R)) expressed in degrees. minutes seconds
Delta: - D
Tangent: -T
External: - E
Mid ordinate: - M
Segment: The area bounded by the arc of the curve and the chord of the curve.
Sector: The area bounded by the arc of the curve and the two radii to the ends of the arc.



[MORE] will show the value of the mid ordinate. Then pressing the **[EXIT]** key will return to the previous screen or menu.

PC DEFLECTION SCREEN

Purpose of screen - to allow you to lay out a horizontal curve by deflection angles from the PC and entered from within the Curve Menu. The Special Option Setup screen is used to set several parameters for this routine.

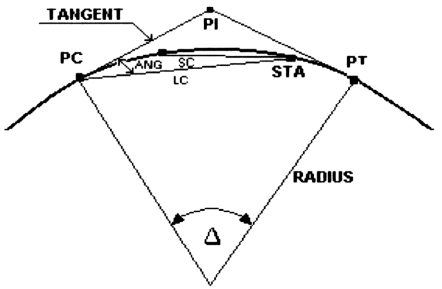
Path:	From the Main Menu, press **[Q]** Curve Menu - **[G]** Horizontal Curve Screen - **[LAYOU]** Horizontal Curve Layout Menu - **[G]**

```
  PC Deflection
PC sta. :    0+  0.000
Curr sta:    0+  0.000
Sta.intvl:    0.000
Def angle  :    0.0000
Long chord :     0.000
Short chord:     0.000
```

SOLVE		STA+	STORE		EXIT

PC sta: is the station number of the PC. Your gun should be occupying the PC and backsighting the PI.
Sta interval: is the interval from the current station to the next station.
Curr sta: is the station number of the current station.
Def ang: {output only} is the deflection angle from the PC-PI line to the next station assuming the current station is occupied.
Long chord: {output only} is the chord length from the next station to the PC.
Short chord: {output only}is the chord length from the current to next station.

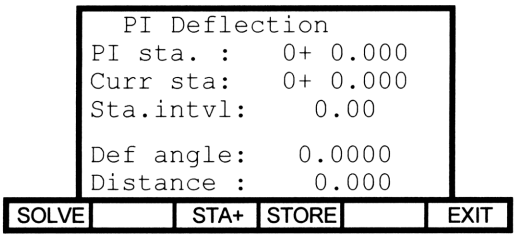
[SOLVE] will compute the deflection angle and chord lengths from the data.
[STA+] will increment from the current station to the next station using the assigned station interval.
[STORE] will store the coordinate generated from the above data. The store point is set in the Store Points Setup screen described below.



PI DEFLECTION SCREEN

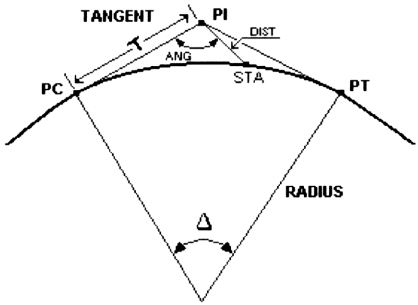
Purpose of screen - to allow you to layout a horizontal curve by deflection angles from the PI from within the Curve Menu. The Special Option Setup screen is used to set several parameters for this routine.

Path:	From the Main Menu, press **[Q]** Curve Menu - **[G]** Horizontal Curve Screen - **[LAYOU]** Horizontal Curve Layout Menu - **[H]**



PI sta: is the station number of the PI. Your gun should be occupying the PI and backsighting the PC.
Curr sta: is the station number of the current station.
Sta interval: is the interval from the current station to the next station.
Def ang: {output only} is the deflection angle from the PI-PC line to the next station.
Distance: {output only} is the distance from the PI to the next station.

[SOLVE] will compute the deflection angle and distance from the screen data.
[STA+] will increment from the current station to the next station using the assigned station interval.
[STORE] will store the coordinate generated from the above data. The store point is set in the Store Points Setup screen described below.



TANGENT OFFSETS SCREEN

Purpose of screen - to allow you to lay out an horizontal curve by tangent offset from the PC. The Special Option Setup screen is used to set several parameters for this routine.

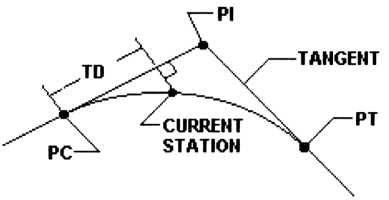
Path:	From the Main Menu, press **[Q]** Curve Menu - **[G]** Horizontal Curve Screen - **[LAYOU]** Horizontal Curve Layout Menu - **[I]**

```
  Tangent Offsets
PC sta. :    0+  0.000
Curr sta:    0+  0.000
Sta.intvl:       0.000
Tangent dist:    0.000
Tan offset:      0.000
Tan-Tan.dist:    0.000
```

SOLVE		STA+	STORE		EXIT

PC station: is the station number of the PC.
Current station: is the station number of the current station.
Sta. interval: is the interval from the current station to the next station.
Tangent dist: {output only} is the distance from the PC to the point at which the tangent is closest to the current station. This point is the point from which the Tangent Offset is measured.
Tangent offset: {output only} is the distance from the current station to the point on the tangent line which is closest to the current station.
Tan-Tan.dist: {output only} is the distance from the PI to the point at which the tangent is closest to the current station.

[SOLVE] will compute the Tangent distance, Tangent offset, Tangent, and Tangent - Tangent distance from the screen data.
[STA+] will increment from the current station to the next station using the assigned station interval.
[STORE] will store the coordinate generated from the above data. The store point is set in the Store Points Setup screen described below.



CHORD OFFSETS SCREEN

Purpose of screen - to allow you to lay out an horizontal curve by chord offset from the PC and entered from within the Curve Menu. The Special Option Setup screen is used to set several parameters for this routine.

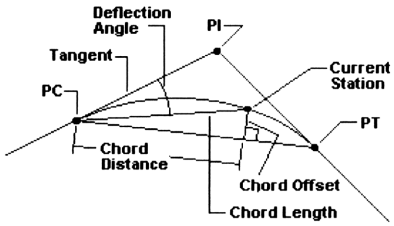
Path:	From the Main Menu, press **[Q]** Curve Menu - **[G]** Horizontal Curve Screen - **[LAYOU]** Horizontal Curve Layout Menu - **[J]**

```
  Chord Offsets
PC sta.:     0+  0.000
Curr sta:    0+  0.000
Sta.intvl:       0.000
Def. angle:    0.0000
Chord dist.:     0.000
Chord offset:    0.000
```

SOLVE | STA+ | STORE | EXIT

PC station: is the station number of the PC.
Current sta: is the station number of the current station.
Sta. interval: is the interval from the current station to the next station.
Deflect ang: {output only} is the deflection angle from the last station to the next station, assuming the current station is occupied.
Chord dist: {output only} is the distance from the PC to the point on the chord which is closest to the current station.
Chord offset: {output only} is the distance from the current station to the closest point on the chord.

[SOLVE] will compute the Chord distance, Chord offset, PC deflection angle, and the length of the chord from the screen data.
[STA+] will increment from the current station to the next station using the assigned station interval.
[STORE] will store the coordinate generated from the above data. The store point is set in the Store Points Setup screen described below.



STORE POINTS SETUP SCREEN

Purpose of screen - to allow you to set parameters for point stored during curve layout routines.

Path: From the Main Menu, press **[Q]** Curve Menu - **[G]** Horizontal Curve Screen - **[LAYOU]** Horizontal Curve Layout Menu - **[K]**

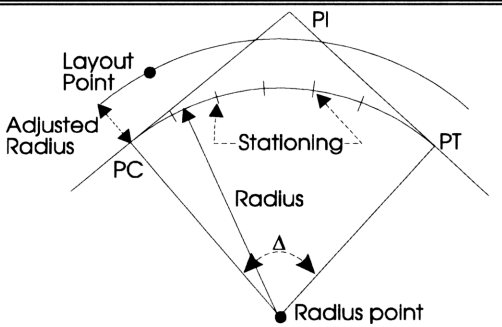
```
 Store Point Setup
PC point:            0
PI point:            0
Curve turn:  >Right
Sto point:           0
  for non-C.L. curve
  Radius +/-:    0.00
```

<= Right / Left

SOLVE | | | | | EXIT

PC point: is the point number of the Point of Curvature used in the Curve Layout routines.
PI point: is the point number of the Point of intersection used in the Curve Layout routines.
Curve turn: is the direction of turn of the curve being laid out; Can be set to either **Right** or **Left**
Sto point: is the point number where the layout coordinates are to be stored.
For non-C.L. curve Radius +/-: this value will be added to the radius in the curve layout screen to facilitate laying out a curve offset to the center line (see diagram below). The station being computed is still measured along the center line curve using the un-adjusted radius.

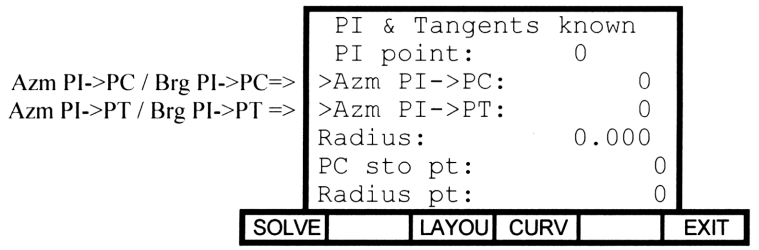
[SOLVE] will compute the coordinates of the PC and PT and store them in the job file at the appropriate point numbers.



KNOWN PI & TANGENTS SCREEN

Purpose of screen - to allow you to compute the coordinates of the PC and PT of a curve with a known PI, the bearings of the tangents, and the radius or other curve parameters.

Path: From the Main Menu, press **[Q]** Curve Menu - **[H]**



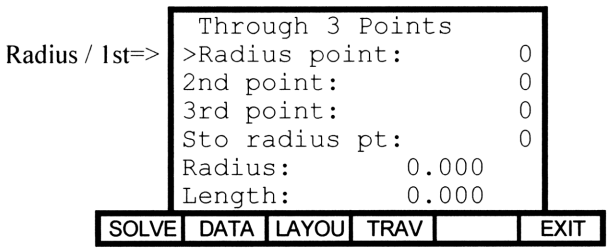
PI pt: is the point number of the PI.
Brg PI to PC:- Azm PI to PC : are two ways of specifying the direction of the line from the PI to PC.
Brg PI to PT:- Azm PI to PT : are two ways of specifying the direction of the line from the PI to PT.
Radius: is the radius of the curve.
PC store pt: is the point number where the computed coordinates of the PC should be stored. The computed coordinates of the PT will be stored in the next consecutive point number.
Radius pt: if this field has a valid point number, the radius point will be computed and stored. If this field is zero, no radius point will be computed.

[SOLVE] will compute the coordinates of the PC and PT and store them in the job file at the appropriate point numbers.
[LAYOU] will transfer to the Horizontal Curve Layout Menu (see above).
[CURV] will transfer to the Horizontal Curve Solution Screen (see above).

THROUGH 3 POINTS SCREEN

Purpose of screen - to allow you to solve for the curve which will pass through three known points. Also, to allow you to solve for a curve given two known points and the known center.

Path: From the Main Menu, press **[Q]** Curve Menu - **[I]**



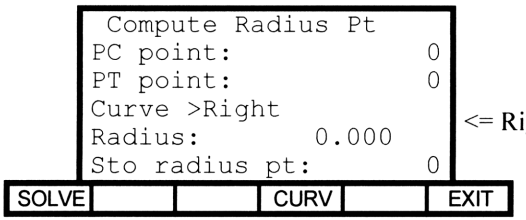
1st Point: - Radius Point : 1st Point is the point number of the Start of Curve Point. Radius Point is the point number of the center of the curve.
2nd point: if the 1st Point-Radius Point line is set to 1st Point, this is the point number of the second point on the curve. This point may be at .any location between the start and the end of the curve. If the 1st Point-Radius Point line is set to Radius Point, this is the Start of Curve point.
3rd point: if the 1st Point-Radius Point line is set to 1st Point, this is the point number of the End of Curve point. If the 1st Point-Radius Point line is set to Radius Point, this is the point number of the End Azimuth Point.
Sto radius pt: if this field has a valid point number, the radius point will be computed and stored. If this field is zero, no radius point will be computed.
Radius: is the radius of the curve.
Length: is the arc length of the curve.

[SOLVE] will solve for the curve parameters.
[DATA] after solving for the curve parameters, this key will transfer to the Curve Solution Screen to display them.
[LAYOU] will transfer to the Horizontal Curve Layout Menu (see above).
[TRAV] will transfer to the Traverse on a Curve Screen (see above).

COMPUTE RADIUS POINT SCREEN

Purpose of screen - to allow you to find the coordinates of the radius-point of a curve given two points on the curve and one other known curve parameter.

Path: From the Main Menu, press **[Q]** Curve Menu - **[J]**



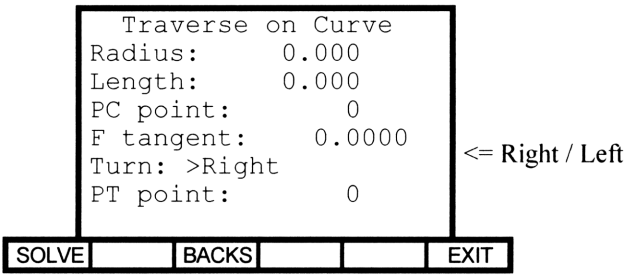
PC point: is the point number of the Point of Curvature on the curve.
PT point: is the point number of the Point of Tangency on the curve.
Curve Turn: is the direction that the curve should turn from the PC to the PT.
Radius: is the radius of the curve.
Store radius pt: is the point number into which the solved coordinates will be stored.

[SOLVE] will compute the radius point from the screen data and store the result.
[CURVE] will transfer you to the Horizontal Curve Solution Screen.

TRAVERSE ON CURVE SCREEN

Purpose of screen - to include a horizontal curve in a traverse.

Path: From the Main Menu, press **[Q]** Curve Menu - **[K]**



Radius: is the radius of the curve.

Length: is the arc length of the curve.

PC point: is the point number of the PC.

F tangent: is the azimuth of the tangent to the curve from the PC in the forward direction of the curve (toward the PT).

Turn: is the direction (right or left) that the curve turns from the forward tangent.

PT point: is the point number of the PT.

[SOLVE] will compute the coordinates of the PT and add this point to the coordinate file from the data in the rest of the screen.

[BACK] will transfer to the Backsight Screen. The Backsight Screen may be used to compute the azimuth of the forward tangent. When you return to this screen from the Backsight Screen, the value of the azimuth of the forward tangent will be automatically computed to be in the *opposite* direction of the backsight azimuth.

VERTICAL CURVE SCREEN

Purpose of screen - to allow you to compute the elevations at various stations along a vertical curve.

Path: From the Main Menu, press **[Q]** Curve Menu - **[L]**

PVC Sta./ PVI Sta. =>

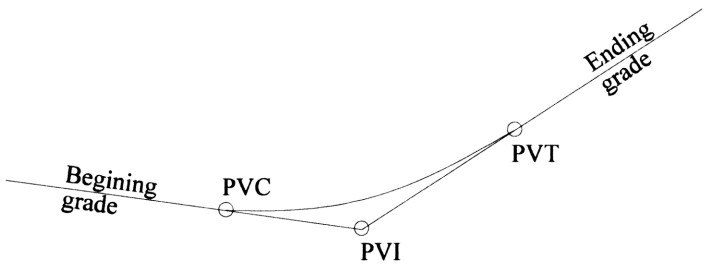
Length / Sta. Elevation / => H/L El

```
   Vertical Curve
>PVC sta.:    0   +0.000
 Elevation:       0.000
>Length:    0.00
 Beg.grade(%):    0.000
 End grade(%):    0.000
```

SOLVE | | LAYOU | | | EXIT

PVC sta: - PVI sta: is the station number of either the PC or the PI of the vertical curve.
Elevation: is the elevation at the PVC or PVI station.
Beg grade (%): is the beginning grade of the vertical curve expressed as a % (+ for uphill; - for downhill).
End grade (%): is the ending grade of the vertical curve expressed as a % (+ for uphill; - for downhill).
Length: - H/L pt ele: - Sta:
Elevation: is the horizontal length between the PC and PT or another station number and elevation along or the elevation of the high or low point of the vertical curve.

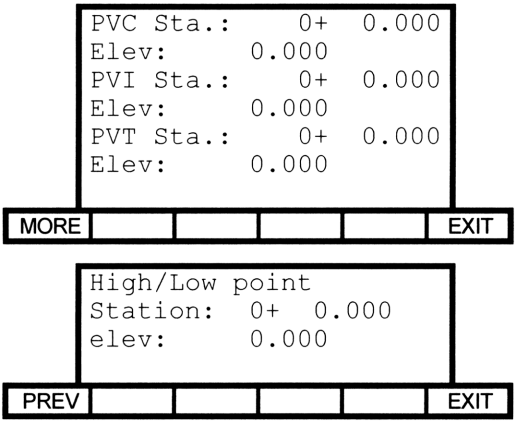
[SOLVE] will compute the properties of the vertical curve and display the results in the Vertical Curve Solution Screen (see below)
[LAYOU] will transfer to the Vertical Curve Layout Screen (see below).



VERTICAL CURVE SOLUTION SCREEN

Purpose of screen - to display the results of the vertical curve solution from the data in the previous screen.

Path:	From the Main Menu, press **[Q]** Curve Menu - **[L]** Vertical Curve Screen - **[SOLVE]**



PVC Sta: is the station number of the PC of the vertical curve.
Elev: is the elevation of the PC of the vertical curve.
PVI Sta: is the station number of the PI of the vertical curve.
Elev: is the elevation of the PI of the vertical curve.
PVT Sta: is the station number of the PT of the vertical curve.
Elev: is the elevation of the PT of the vertical curve.

High/Low point

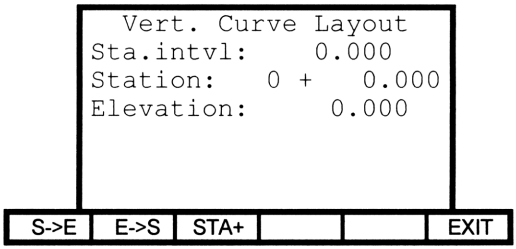
Station: is the station number of the highest or lowest point along the vertical curve.
Elev: is the elevation of the highest or lowest point along the vertical curve.

[MORE] will display the High / Low point values of the Solution screen.

VERTICAL CURVE LAYOUT SCREEN

Purpose of screen - to allow you to layout a vertical curve by station number from the Curve Menu.

Path:	From the Main Menu, press **[Q]** Curve Menu - **[L]** Vertical Curve Screen - **[LAYOU]**



Sta. intvl: is the interval between stations to be laid out.

Station: is the current station.

Elevation: is the elevation at the current station.

[S-->E] will assume the station in the current station line; compute the elevation at that station; and display it in the elevation line of this screen

[E-->S] will assume the elevation in the elevation line; compute the station at which that elevation occurs; and display it in the station line of this screen.

[STA+] will increment the current station line in the display by an amount equal to the station interval.

STRAIGHT GRADE SCREEN

Purpose of screen - to solve for the elevation at various stations along a straight grade.

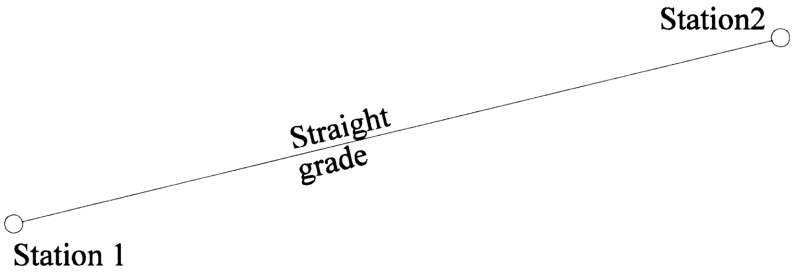
Path: From the Main Menu, press **[Q]** Curve Menu - **[M]**

```
  Straight Grade
Sta. 1:     0+   0.000
Elev 1:      0.000
Grad(%):    0.000
Sta.intvl:   0.000
Sta. 2:     0+   0.000
Elev 2:      0.000
```

S->E	E->S	STA+			EXIT

Sta. 1: is the station number of a station with a known elevation.
Elev 1: is the elevation at Sta 1.
Grade (%): is the grade of the section (+ for uphill; - for downhill).
Sta. intvl: is the interval to the next station
Sta. 2: is the station number of the next station.
Elev 2: is the elevation of the next station.

[S-->E] will assume the station in the Sta 2 line; compute the elevation at that station; and display it in the Elev 2 line of this screen.
[E-->S] will assume the elevation in the Elev 2 line; compute the station at which that elevation occurs; and display it in the Sta 2 line of this display.
[STA+] will increment the Sta 2 line in the display by an amount equal to the station interval.



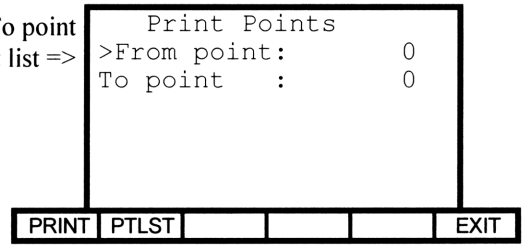
PRINT MENU SCREENS

PRINT POINTS SCREEN

Purpose of screen - to print out the coordinates of a block of points on a printer.

Path:	From the Main Menu, press **[R]** Print Menu - **[G]**

From point - To point / Using point list =>



From point: - <Using point list>
To point: are the techniques for specifying the points to be printed.

[PRINT] will begin printing the coordinates of the specified points.

[PTLST] will transfer to the Point List Screen.

PRINT RAW DATA COMMAND

Purpose of command - to obtain a printout of the raw data of a job.

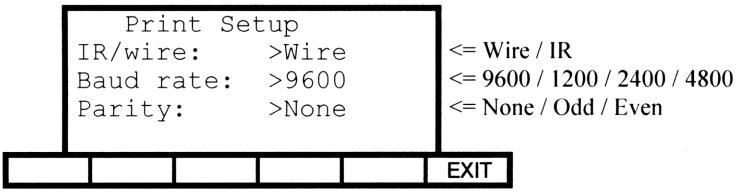
Path: From the Main Menu, press **[R]** Print Menu - **[H]**

Pressing **[H]** from the Print Menu will cause SURVEY-PRO to print out the contents of the raw data file of the *currently active* job.

PRINT SETUP SCREEN

Purpose of screen - to setup your SURVEY-PRO for printing.

Path: From the Main Menu, press **[R]** Print Menu - **[I]**



IR/wire: indicates whether or not the data communication is to be via the RS232 link or via the wireless infrared link.

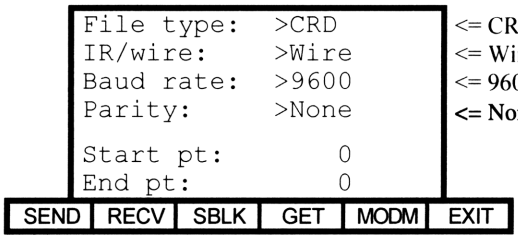
Baud rate: is the data communication rate expressed in baud.

Parity: is the data communication parity setting (even, odd, or none)

FILE TRANSFER SCREEN

Purpose of screen - to transfer data to or from SURVEY-PRO from into a PC.

Path: From the Main Menu, press **[S]**



<= CRD / RAW / PLST
<= Wire / IR
<= 9600 / 1200 / 2400 / 4800
<= None / Odd /Even

File type: is the type of file to be transferred, either coordinate, raw data, or point list.
IR/Wire: indicates whether or not data communication is to be via the RS232 link or via the wireless infrared link.
Baud rate: is the data communication rate expressed in baud.
Parity: is the data communication parity setting (even, odd, or none).
Start pt: is the starting point if a block of points is to be sent.
End pt: is the ending point if a block of points is to be sent.

[SEND] will cause the designated data to be sent from SURVEY-PRO to another device according to the established screen parameters.
[RECV] will set up SURVEY-PRO to receive data from another device according to the established screen parameters and store it as the named job.
[SBLK] will cause a block of data to be sent as determined by the start and end points in the screen. The Start pt. and End pt. fields are only used when **[SBLK]** is pressed.
[GET] allows you to get a file from a remote storage device to which you are connected. You will be prompted for a file name for the data collector to retrieve from the remote system.
[PTLST] will transfer to the Point List Screen.

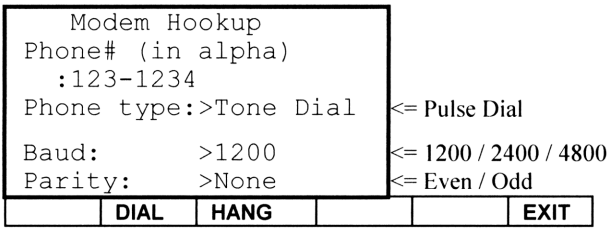
NOTE:

If you are using SURVEY-PRO's companion program, TFR PC software, the proper communication parameter settings are: Baud rate - 9600, Parity - None, IR/Wire - Wire.

MODEM COMMUNICATION

Purpose of screen: enables the machine to dial in, and send files to or get files from a host mode TFR program through a Hayes compatible modem. The KERMIT file transfer protocol is used. TFR can now become a host which allows users to call in and send or receive files. If a host mode TFR program is not available, a server mode KERMIT program that has been set up to answer phone calls can also be used.

Path:	From the Main Menu, select **[S] File Transfer**. Then press the **[MODM]** key



Phone#: is the number that will be dial when the **[DIAL]** key is pressed. Be sure you press the **[↵]** key before entering the phone number.
Phone type: is the type of dial signal that is provided by the modem or phone line. It is either Tone or Pulse. The default is Tone and is usually supported.
Baud: is the baud rate, the speed at which data is transferred. Make sure your modem can work at the selected baud rate because this routine will not step down to find a working baud rate.
Parity: is the parity, a check to see if data has arrived correctly.

NOTE

Make sure that the sending and receiving system are using the same parity. If not, communications cannot be completed.

[DIAL] - dials the phone number entered by the user in the Phone# field. Once connection is established, there will be "CONNECT" message displayed on the screen.
[HANG] - will hang up the phone by resetting the modem. It is a good practice to power off the modem after use to assure the line is disconnected.

Transferring data over the phone lines requires a modem on both the PC and the data collector. Configuring a modem for your office PC is usually well documented and the dealer who sold the modem should be able to answer any question you might have concerning the PC modem. The communication port on the data collector is less standard and therefore more difficulty may arise in the configuring of this modem. You may need to carefully consult you modem manual for switch setting and setup needs. There may need to be cable modifications also. For your convenience, Tripod Data Systems can provide a configured and tested modem and cable for our data collectors. Please call TDS for more information.

UTILITY SCREENS

NOTE: These screens can be accessed from a number of locations throughout the SURVEY-PRO program by pressing the **[BACK]** or **[PTLST]** softkeys.

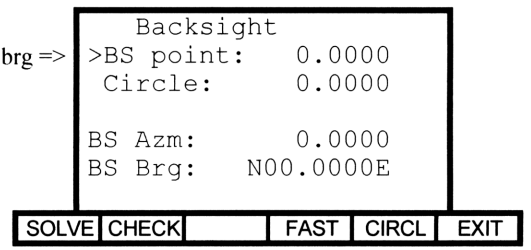
BACKSIGHT SCREEN

Purpose of screen - to allow you to establish a backsight for your field work.

Path:

- → From the Main Menu, press **[I]** Stakeout Menu - **[H]** Offset Stakeout Screen - **[SETUP]** Offset Stakeout Setup Screen - **[BACK]**
- → From the Main Menu, press **[I]** Stakeout Menu - **[I]** Slope Stake Screen - **[SETUP]** Offset Stakeout Setup Screen - **[BACK]**
- → From the Main Menu, press **[J]** Traverse/Sideshot Menu - **[BACK]**

BS point / BS azm / BS brg =>



BS point: - BS azm: - BS brg: specifies the azimuth or bearing to be used as a back azimuth or back bearing or the point number that is to be used for a back sight.

Circle: is the horizontal angle reading of the gun when you are sighting the back sight.

BS azm: {output only} the computed back azimuth from the data supplied in this screen.

BS brg: {output only} the computed back bearing from the data supplied in this screen.

[SOLVE] will take the information provided in the first two lines of this screen; compute the back azimuth; and display it in the output line. this key must be pressed prior to pressing **[EXIT]** or the backsight will not be set properly.

[CHEC] will transfer to the Check Backsight Menu (see below).

[FAST] will toggle the *instrument coarse* mode on and off. Coarse mode is only available for certain brands of guns. If coarse mode is not available for your gun model, the computer will display: "Fast (Coarse) Mode not Applicable". The effect of coarse mode is to put the gun in a fast measurement mode. This mode may be used for topographic surveys to speed up the gathering of data or for stakeout. However, when used from the Stakeout Screen, coarse mode will not cause SURVEY-PRO to take shots continuously.

[CIRCL] will transfer to the Backsight Circle Menu (see below).

CONFIRM BACKSIGHT POINT BY SHOOTING DISTANCE COMMAND

Purpose of screen - to allow you to double check your backsight point by taking a distance measurement.

Path:	From the Backsight Screen (see above), press **[CHEC]** Check Backsight Menu - **[G]**.

Selecting this command will prompt you to take a shot to a prism located on your Backsight point. SURVEY-PRO will then compare the measured distance to the calculated distance and display the difference. If your prism is located on the correct Backsight point, this difference should be very small.

CHECK BACKSIGHT CIRCLE COMMAND

Purpose of screen - to allow you to double check your instrument circle reading by taking an angle measurement.

Path:	From the Backsight Screen (see above), press **[CHEC]** Check Backsight Menu - **[H]**.

Selecting this command will take a horizontal circle reading to your Backsight point. SURVEY-PRO will then compare the measured horizontal circle to the circle value shown in the Backsight screen and display the difference. If you are pointing at the correct Backsight point, and your instrument horizontal circle is still correct, this difference should be very small.

READ BACKSIGHT CIRCLE FROM INSTRUMENT COMMAND

Purpose of screen - to allow you to set the Backsight circle field in SURVEY-PRO by reading the horizontal circle value from your instrument.

Path:	From the Backsight Screen (see above), press **[CIRCL]** Backsight Circle Menu - **[G]**.

Selecting this command (if connected to an electronic total station) will trigger the gun to read the horizontal angle and record it in the Backsight screen as the circle angle to the backsight.

SEND BACKSIGHT CIRCLE TO INSTRUMENT COMMAND

Purpose of screen - to allow you to set the horizontal circle value in your instrument to the same value as the Backsight circle field in SURVEY-PRO.

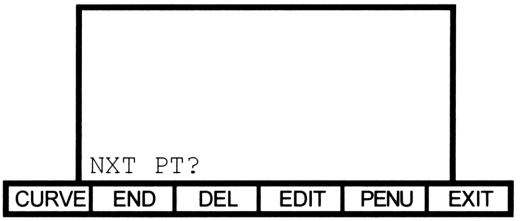
Path:	From the Backsight Screen (see above), press **[CIRCL]** Backsight Circle Menu - **[H]**.

Selecting this command (if connected to an electronic total station) will send the value currently set in the Backsight circle field to your instrument.

POINT LIST SCREEN

Purpose of screen - to allow you to specify a block of points that are not consecutively numbered for a variety of operations within SURVEY-PRO. You may also use the point list to specify a curve within the list of points as well as controlling several functions of the plotter.

Path:	from any screen which has a **[PTLST]** "soft" key, press **[PTLST]** Point List Menu - **[G]**



The Point List is a mechanism with which you can specify a block of points for some operations in SURVEY-PRO. You may build the list one point at a time or by specifying sequentially numbered points as groups by keying in the first and last point in the group with a **[-]** between. (such as "10-15"). Another special command is to insert a sideshot in a point list. To do this, press **[α] [S] [S]** [space] followed by the point number of the sideshot. These features may be combined. To insert a group of consecutively numbered sideshots into a point list, press **[α] [S] [S]** [space] followed by the first point number; then **[-]**; then the last point number in the sequence. This feature is particularly useful if you want to do an adjustment of a traverse that has sideshots in it. The traverse point coordinates will be adjusted according to the selected rule. The sideshot coordinates will be adjusted according to the adjusted values of the traverse coordinates. The screen plot will also recognize the SS symbol.

[CURVE] will transfer to the Horiz/Vert Curve Screen (see below).

[END] will move the scroll bar to the end of the point list.

[DEL] will delete the Point List entry line that is in the screen *immediately above* the data entry bar.

[PENU] will "lift the pen" and not draw a line to the next point when doing a screen plot of the lines in this point list.

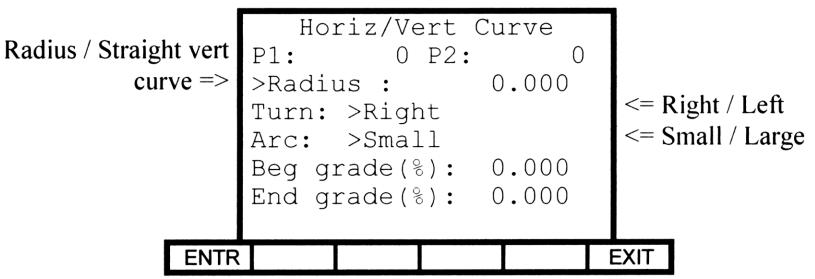
[EDIT] will replace the entry above the data entry bar with the contents of the bar.

[ENTER] (main keyboard) will insert the contents of the data entry bar *after* the last entry currently on view in the screen.

HORIZ/VERT CURVE SCREEN

Purpose of screen - to allow you to insert a curve in a point list.

Path:	from any screen which has a **[PTLST]** "soft" key, press **[PTLST]** Point List Menu - **[G]** Point List Screen - **[CURVE]**



P1: is the first point on the curve.

P2: is the second point on the curve.

Radius: is the radius of a horizontal curve.
Straight line V. crv: indicates that there is a straight grade with a change in elevation.

Turn: indicates that the horizontal curve will turn to the right or left of the forward tangent.

Arc: indicates whether the arc is small (less than 180^{o} central angle) or large (greater than 180^{o} central angle).

Beg grade(%): is the beginning grade for a vertical curve (+ for uphill; - for downhill).

End grade(%): is the ending grade for a vertical curve (+ for uphill; - for downhill).

[ENTER] will place the curve in the Point List.

CLEAR POINT LIST COMMAND

Purpose of screen - to clear all entries in the point list, allowing you to enter a "fresh" point list.

Path:	from any screen which has a **[PTLST]** "soft" key, press **[PTLST]** Point List Menu - **[H]**

Selecting this command will delete all entries in the currently active point list.

STORE POINT LIST TO FILE COMMAND

Purpose of screen - to allow you to save a point list for later use.

Path:	from any screen which has a **[PTLST]** "soft" key, press **[PTLST]** Point List Menu - **[I]**

Selecting this command will prompt you to enter a file name. Your currently active point list will be saved in this file.

RECALL POINT LIST FROM FILE COMMAND

Purpose of screen - to allow you to use a previously stored point list.

Path:	from any screen which has a **[PTLST]** "soft" key, press **[PTLST]** Point List Menu - **[J]**

Selecting this command will display a list of any point list files you have stored. You may then select a file to become the active point list.

DELETE POINT LIST IN FILE COMMAND

Purpose of screen - to allow you to delete a previously stored point list file.

Path:	from any screen which has a **[PTLST]** "soft" key, press **[PTLST]** Point List Menu - **[K]**

Selecting this command will display a list of any point list files you have stored. You may then select a file to be deleted from storage.

ALPHABETICAL LIST OF SCREENS

APPENDIX A

Technical Specifications*

Data Collection Software

Main Operating Functions

- job creation
- initialization
- setup

Traverse/Sideshot

- single readings
- descriptor code tables
- multiple readings and averaging
- control files
- off center shots

Stakeout

- by points
- slope staking
- by station and offset
- rod man next point

Leveling

- trig. leveling
- differential leveling
- 3 wire input
- leveling stakeout
- building pad x, y, z
- building pad stakeout
- cross-section survey

Road Layout

- horizontal, vertical, and profile alignments

CO-GO

- areas
- point-in -direction
- elevation
- 2 and 3 point resections
- conversions
- corner angle computation
- intersections
- benchmark
- inverses
- pre-determined area

Curves

- horizontals
- verticals

Adjustments

- Scale changes
- Job rotations
- Translations
- Angle Adjustment
- Compass Rule

Sunshots

Physical

Interfaces to:

Partial list of electronic total stations supported:

- LIETZ: Set2,3,4, SETsB, SDM3FR, DSM3F, SDM3ER, SDM3E, DT20E
- TOPCON: RS232 port
- NIKON: TOP GUN
- WILD: T2000+EDM, T1000+EDM, T2000, T1000

APPENDIX A

- PENTAX: PTS-10, PTS II
- KERN: E1/E2
- ZEISS: ELTA/C, Old ELTA
- GEODIMETER: RS232 port

File transfer to office equipment:

- Office computers and workstations
  Coordinate files and raw data
- Printers
  Coordinate files and raw data

Dimensions: 7.1" x 3.2" x 1.15"
Weight: 11 oz (including batteries and cards)

Power: 3 AAA Alkaline batteries
[batteries should last several months under normal usage]

Environmental:

- Operating Temperature:
- (with heater off) 32^{o} - 113^{o} F
- Storage Temperature:-20^{o} - 160^{o} F

Hardware features:

- Display: Liquid Crystal 8 line x 22 character
- Keyboard: 49 key membrane actuator with tactile feedback

Software features:

- Operating/Calculator System: (HP-48GX)
- Application: TDS-field computer routines

Memory One required:

- 128k-byte,256k-byte or 512k-byte TDS GX RAM card.
- 128k-byte HP RAM card.
- (up to 12000 points depending on card and amount of raw data stored at each point)

Interfaces:

- RS-232 (4 pin) port built in for communication with desktop computers and total stations
- I/R port built in for wireless communication between units as well as to the HP 82240B Infrared Portable Printer.

**Specifications subject to change without prior notice*

APPENDIX B

How to connect the TDS-48GX to your electronic total station.

1. Use the TDS-48GX's Setup Screen to select the proper instrument and model.

2. Setup and level your gun.

3. Connect the TDS-48GX to the gun with the proper cable.

4. Turn the gun ON.

5. To confirm that the gun is working properly, take a practice shot at a target.

6. Use the proper TDS-48GX functions to trigger your gun and take the data.

Information specific to the use of the TDS-48GX with various electronic total stations:

TOPCON

Models supported - RS232 models

Model:	TDS-48GX setting
GTS 3B-D or GTS 4	GTSB-D & 4
GTS 300 series	GTSB-D & 4
GTS 3	CTS1, GTS3
CTS1	CTS1, GTS3
ET1 or ET2 with RS232	ET1/ET2
DL-100	DL-100

- The Communication parameters default to:
  1200 baud, Even parity, 7 data bits and 1 stop bit.
  The communication parameters need to be set the same in both the total station and the TDS data collector.
- When fast mode is set, all shots will be taken in Coarse Mode.
- There is no distance averaging mode available for Topcon instruments.

APPENDIX B

- When using the Record Mode Press [REC] on the GTS instrument to record data.

NIKON

Models supported - TOP GUN

The Communication parameters are:

4800 baud, No parity, 8 data bits and 1 stop bit.

The communication parameters need to be set the same in both the total station and the TDS data collector.

Fast mode is available for the TOP GUN.

When using the Record Mode Press **[MSR]** or **[TRK]** on the TOPGUN instrument to record data.

When the gun is set up to average distance readings, set the "Measurement Mode" in the Device Setup Screen to "Averaging".

The TOP GUN instrument will transfer data faster when emulating the Lietz SET communications. Set both you instrument and the TDS-48GX to the SET mode as follows:

1. Press 2nd function and ON to run the setup program.
2. Toggle COMM MODE to SET, then press ENT
3. Ensure the rate is set at 1200 then press ENT
4. Press 2nd function key and 7 to set the EDM MODE. (This is tricky and may take several attempts to get the screen to come up).
5. Set the EDM MODE to 1 or 2 and press ENT (EDM MODE 2 is the quickest mode.
6. With in the TDS-48GX set the instrument to LIETZ and the model to SETS.

Once measuring the D-50 will continue to measure until it is turned away from the prism. The TDS-48GX will record the shot.

SOKKIA (LIETZ)

Models supported	Slope distance?	Zenith angle?	Horizontal angle?
SET 2 / 3 / 4	Yes	Yes	Yes
SDM3FR	Yes	Yes	No
SDM3F	Yes	No	No
SDM3ER	Yes	Yes	No
SDM3E	Yes	No	No
DT20E	Yes / No	Yes	Yes

The DT20E is an electronic theodolite. It can only provide angles. By using it with a top mounted EDM, you can get both angles and distances. For this configuration, choose the "SETs" as the Instrument Setup option in the TDS-48GX.

You do not have to push any keys on the gun to obtain readings from Lietz instruments. Requesting information and triggering are done automatically from the TDS-48GX. The data collector will prompt for the proper readings as required by the particular application being done.

Fast mode may be set by placing the gun in tracking mode directly. It will then be in effect whether or not the TDS-48GX has been set for fast mode.

There is no distance averaging mode available for Lietz instruments.

Newer Lietz guns have both a theodolite and an CA (distance) mode. The user must select the CA mode on the gun manually for shooting both angles and distances. To shoot angles only, the gun may be in either mode but the gun will return angles much faster if it is in theodolite mode rather than CA mode.

With all SET instruments, select the following communication parameters:

Baud Rate	1200
Checksum	Yes*
Parity	NO

If you set your instrument to send Checksum data, the TDS-48GX will verify it. The communication parameters need to be set the same in both the total station and the TDS data collector.

APPENDIX B

The record mode for the Sokkia instrument works requires at least two keystroke on the instrument. The setup is as follows:

Key to press	Display will read
[REC]	Select
Use the key	Select
to scroll to the	S, V, H
S, V, H option	Yes/No(exit)
[ENT] for Yes	S dist

The above keystrokes will take the first shot. Following the prompt in the instrument's display to complete the steps of sending data out

The instrument will stay in the recording mode until the [CE-CA] key is press. to take a subsequent shot, just press the [ENT] key.

For each shot the instrument will prompt the user for the target height and descriptor before it will send the data out. The "Config" instrument can be used to suppress the prompts. (See Instrument manual)

CRITERION

Model supported Criterion 400 Laser

The communication parameters need to be set the same in both the total station and the TDS data collector.

LEICA (WILD)

Models supported -	T1000	TC1000
	T / TC1600	T / TC2000
	TC1610 / 500	NA2000

When using a T1600, you should place the T1600 in a mode that will communicate like a T2000. This can be done from the gun with the following key sequences:

SET MODE 74 RUN 1 RUN

Then choose the T2000 from the Instrument Setup Screen in the TDS-48GX.

The TDS-48GX assumes that Wild instruments are set to communicate at:

- Baud rate - 2400
- Data bits - 7
- Parity - even
- Stop bits - 1

The communication parameters need to be set the same in both the total station and the TDS data collector.

The gun may be set to the communication settings given above with the following key sequences:

SET MODE 70 RUN 4 RUN (to set 2400 baud)
SET MODE 71 RUN 2 RUN (to set even parity)

If the data string in the REC module has been modified, set to standard with:

SET REC 99 RUN REC (to set to standard string)

These sequences only have to be keyed into the gun once. The instrument will remember these settings even if the battery is briefly removed.

Fast mode is available for all models. When using a T2000 or T1600, you need to set the gun tracking mode manually. This can be done by pressing the **|REP|** and **|DIST|** keys on the gun. Both the instrument and data collector must be set to the same mode (fast or standard) for communications to work.

There is no distance averaging mode available for Wild instruments.

When using the Record Mode Press **|ALL|** on the Wild instrument to record data.

Troubleshooting tip:

If the TDS-48GX does not seem to be triggering the gun or if the TDS-48GX does not get the distance reading from the gun, the problem is most likely in the software in you gun. contact your Wild dealer and request an upgrade in the data communication software in you gun.

APPENDIX B

PENTAX

Models supported - PTS-10
PTS-II
PTS-III
PTS-10

For taking a complete shot with the PTS-10, you must first press one of the distance modes of the gun. The TDS-48GX will verify that choice and prompt you to press the **|SLP/V|** key on the gun. If the gun is not in a distance mode, the TDS-48GX will send a command to the gun to take aim. Then it will display: "When *AIM appears, press a key on DC." While the PTS-10 is aiming, its display will show: "-- AIM". When the dash is replaced by a "*", the gun is ready to take a shot. The TDS-48GX will then trigger the gun to take a shot and it will retrieve its data.

When only angular data is required, the TDS-48GX will display: "Press **|V/H|**, then press a key on DC."

If you want to average distances, first set the distance in averaging mode in the TDS-48GX's Device Setup Screen. Then when you take a shot, the TDS-48GX will display "Press **|AIM|** & **|AV|**.. " You should first press **|AIM|** on the PTS-10. Then when the gun is aimed properly (* in the gun display), press **|AV|**.

PTS-II

This gun has no **|AIM|** key. To take a shot with distance, you must first press one of the distance mode keys on the gun. When you take a shot from the TDS-48GX, the data collector will prompt you to press the **|MEAS|** key on the gun: "Press **|MEAS|**, then press a key on DC".

For angular data only, the TDS-48GX will display: "Press, then press a key on DC".

For averaging distances, the TDS-48GX will display "Press **|AVE|**, the press a key on DC".

Communication parameter of the instrument should be set to:

Baud rate - 1200	Parity - none
Data bits - 8	Stop bits - 1

The communication parameters need to be set the same in both the total station and the TDS data collector.

GEODIMETER

Models supported - 400s RS232

When used with the 400 series, you should set the gun for the RS232 interface (see below). When set this way, you must press the **[AIM]** key on the gun to take a shot.

Setting up the Geodimeter 400 Series total stations to communicate with the TDS-48GX. [Note: This procedure needs to be done only once. The gun will remember the proper setting when turned "OFF".]

On the gun:

1. Press **[MNU]**.
2. Press **[4]**. The display will now show:
   Data comm
   1 Select device
   2 Create table
3. Press **[1]**. The display will now show:
   1 Geodat
   2 Serial
   3 Xmem
4. Press **[2]**. The display will now show:
   Serial ON?
5. Press **[REG]** (for Yes). The display will now show:
   Serial
   COM=1.7.2.1200
   (1200 baud, Even parity, 7 data bits and 1 stop bit)

These are the current settings of the communication parameters. If the current readings do not match those shown above, key in the numbers as shown from the digit keypad. The decimal point is the key next to the **[0]** key on the bottom row of the keypad.

Geodimeter 400 series. (See below for steps 6-9 for the 500 series.)

6. Press **[ENT]**. The display will now show:
   U.D.S ?
7. Press **[AIM]** (for No). The display will now show:

Table no=

8. Press **[ENT]** to select the default table number. The display will show:
   Request?

9. Press **[REG]** (for Yes). The display will now show:
   HA:
   VA:
   SD:

Geodimeter 500 series. (See above for steps 6-9 for the 400 series.)

6. Press **[ENT]**. The display will now show:
   Table no=
7. Press **[ENT]** to select the default number. The display will now show:
   REG. key ?
8. Press **NO** The display will now show:
   SLAVE ?
9. Press **NO** The display will now show what was on the screen when MENU was selected

The gun setting is now complete.

On the TDS-48GX:
1. From the Main Menu press **[H]**.
2. From the Setup Menu press **[H]**.
3. Move the scroll bar to the Instrument line and select >Geodimeter
4. Move the scroll bar to the Model line and select >Auto trigger or Manual Trigger.

When using the Record Mode Press **[AIM]** on the Geodimeter instrument to take the shot. Press the **[REG]** key to record the data.

Fast Mode is available with the 400 series total stations.
Fast mode must be set in the gun manually.

ZEISS

Models supported - Elta /C, Old Elta, Elta 50 and DiNi 10/20

Zeiss has changed their communication commands during 1986 and 1987. If you have an Elta gun you should first try the "Elta /C" option. If this doesn't work, then try the "Old Elta" option.

The Communication parameters are:

1200 baud, No parity, 7 data bits and 2 stop bit.

The communication parameters need to be set the same in both the total station and the TDS data collector.

There is no fast mode nor distance averaging mode available for Zeiss guns.

APPENDIX C

File Format of TDS-48 Coordinate Files

Each file begins with a 20 byte header:

Bytes 1 - 13 is the file name in ASCII.
Byte 14 is the file type.
Bytes 15 - 17 is the file size.
Bytes 18 - 20 is the record pointer.

The header is followed by the point coordinate records which are each 41 bytes long:

Bytes 1 - 8 is the northing of the point.
Bytes 9 - 16 is the easting of the point .
Bytes 17 - 24 is the elevation of the point.
Bytes 24 - 41 is the point descriptor in ASCII.

APPENDIX D

Codes and symbols used in TDS-48 Raw Data Files

The Raw Data File is made up of a sequence of ASCII text records. Each record contains data for a complete field operation, such as a traverse or a side shot. A record may consist of multiple fields of data that describe the operation. Each record occupies a line in the screen when you select the Raw Data Screen from the Jobs Menu. The entire line may be viewed by moving the cursor to the appropriate line and pressing **[VIEW]**. These different fields are separated by commas in a record.

Each record is started with a two letter code and a comma to identify the type of the record. Each field is also preceded by a two letter code as the field header. The value or data in a field follows directly after the field header.

A typical traverse record will look as follows:
TR,OP3,FP37,AZ125.3406,ZE87.2617,SD249.87,--FIRE HYDRANT

Meaning:

Type (TR):	Traverse
Occupy point (OP):	3
Foresight point (FP):	37
Azimuth (AZ):	125.3406
Zenith (ZE):	87.2617
Slope Distance (SD):	249.87
Note (--):	FIRE HYDRANT

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Records are described in detail below:

Occupy Record
Record type : OC
Field headers:

PN: Point number
N : Northing (the header is N space)
E : Easting (the header is E space)
EL: Elevation
-- : Note

Traverse / Sideshot Record
Record type: TR / SS
Field headers:

OP: Occupy Point
FP: Foresight Point
(one of the following)
AZ: Azimuth
BR: Bearing
AR: Angle-Right
AL: Angle-Left
DR: Deflection-Right
DL: Deflection-Left
(one of the following)
ZE: Zenith
VA: Vertical angle
CE: Change Elevation
(one of the following)
SD: Slope Distance
HD: Horizontal Distance
-- : Note

Backsight Record
Record type: BK
Field headers:

OP: Occupy point
BP: Back Point
BS: Backsight
BC: Back Circle

Line of Sight Record
Record type: LS
Field headers:

HI:	Height of Instrument
HR:	Height of Rod

Off Center Shot Record
Record type: OF
Field headers:

AR:	Angle right
SL:	Side slope distance
DD:	Delta Distance
ZE:	Zenith (actual)
OL:	Offset Length

TR/SS Repetition Record
Record type: AA (Accumulating Angle-right)
Field headers:

BC:	Back Circle
AR:	Angle-Right
ZE:	Zenith
SD:	Slope Distance

Record type: RD (Repeat Directional)
Field headers:

BD:	Backsight Direct
FD:	Foresight Direct
ZD:	Zenith Direct
FV:	Foresight Reverse
ZV:	Zenith Reverse
BV:	Backsight Reverse

Record type: MD (Multiple distances)
Field headers:

SD:	Slope distance

APPENDIX D

Store Point Record
Record type: SP
Field headers:

PN:	Point Number
N :	Northing
E :	Easting
EL:	Elevation
-- :	Note

Resection Record
Record type: RS
Field Headers:

PN:	Point number
CR:	Circular Reading
ZE:	Zenith (or VA, CE)
SD:	Slope Distance (or HD)

Note: A two point resection will be recorded as:
RS,PN,CR,ZE,SD
RS,PN,CR,ZE,SD (one reading for each point)

Note: A three point resection will be recorded as:
RS,PN,CR
RS,PN,CR
RS,PN,CR (one reading for each point)

Mode Setup Record
The mode setup will be recorded at the beginning of the raw data file and whenever it is changed.
Record type: MO
Field headers:

AD:	Azimuth direction (0 for North, 1 for South)
UN:	Distance unit (0 for feet, 1 for meter)
SF:	Scale factor
EC:	Earth Curvature (0 for off, 1 for on)
EO:	EDM offset(inch)

Stake Out Record

Record type: SK

Field headers:

OP: Occupy Point
FP: Foresight point
AR: Angle right
ZE: Zenith
SD: Slope distance

Slope Stake Record

Record type: CP (catch point)

Field headers:

ST: Station (nn+nn.nn)
OD: Offset direction (0 for center, 1 for right, 2 for left)
OL: Offset length
EL: Elevation
GD: Grade (design)
-- : Note

Cut Sheet Record

Record type: CF (cut or fill)

Field headers:

For an offset stakeout cut sheet

ST: Station
OD: Offset direction (0 for center, 1 for right, 2 for left)
OL: Offset length
EL: Elevation
GD: Grade (design)
-- : note

For a point stakeout cut sheet

PN: Point number
EL: Elevation
GD: Grade
-- : note

The above record will be recorded only if the stake point is stored. A Side shot (or store point) record will also be recorded.

APPENDIX D

Sun Shot Record
Record type: SU
Field headers:

For a sunshot setup
GH: Greenwich hour angle (GHA 0 & GHA 24)
DE: Declination (DECL 0 & DECL 24)
SM: Semidiameter of Sun (in angle)
DT: Local date
TM: Local time

For the actual sunshot
BD: Backsight Direct
FD: Foresight Direct
FV: Foresight Reverse
BR: Backsight reverse
LA: Latitude
LO: Longitude
EG0: Left trailing edge sun position
EG1: Right trailing edge sun position
EG2: Center sun position

Job Record
Record type: JB
Field headers:

NM: Job name
DT: Date
TM: Time

Shoot Benchmark (Remote Elevation) Record
Record type: RE
Field headers:

OP: Occupied point
FE: Foresight elevation
AR: (always 0)
ZE: Zenith angle
SD: Slope distance
-- : (always "Remote elev")

Summary

Alphabetical listing of Record Types

AA:	Accumulating Angle-right
BK:	Backsight
CF:	Cut Sheet
CP:	Slope stake
JB:	Open a job
LS:	Line of sight
MD:	Multiple distances
MO:	Mode setup
OC:	Occupy
OF:	Off center shot
RD:	Repeat Directional
RE:	Remote Elevation
RS:	Resection
SK:	Stakeout a point
SP:	Store Point
SS:	Side shot
SU:	Sun Shot
TR:	Traverse
-- :	Note record

Alphabetical listing of Field Headers

AD:	Azimuth direction (0 for North, 1 for South)
AL:	Angle-Left
AR:	Angle-Right
AZ:	Azimuth
BC:	Back Circle
BD:	Backsight Direct
BP:	Back Point
BR:	Bearing (this field will be recorded as N123.4500W)
BS:	Backsight (when back point is not defined)
BV:	Backsight Reverse
CA:	Center horizontal angle
CE:	Change Elevation
CR:	Circular Reading
DD:	Delta Distance
DE:	Declination

APPENDIX D

DL:	Deflection-Left
DR:	Deflection-Right
DT:	Local date (MM-DD-YYYY)
E :	Easting (the header is E space)
EC:	Earth Curvature (0 for off, 1 for on)
EG0:	Left trailing edge sun position
EG1:	Right trailing edge sun position
EG2:	Center sun position
EL:	Elevation
EO:	EDM offset
FD:	Foresight Direct
FE:	Foresight Elevation
FP:	Foresight Point
FV:	Foresight Reverse
GD:	Grade (design)
GH:	Greenwich hour angle
HD:	Horizontal Distance
HI:	Height of Instrument
HR:	Height of Rod
LA:	Latitude
LO:	Longitude
N :	Northing (the header is N space)
OC:	Occupy Point
OD:	Offset direction (0 for center, 1 for right, 2 for
OL:	Offset length
OP:	Occupy Point
OS:	EDM offset
PN:	Point number
SD:	Slope Distance
SF:	Scale factor
SL:	Side slope distance
SM:	Semi-diameter of Sun (in angle)
ST:	Station
TM:	Local time (HH:MM:SS)
UN:	Distance unit (0 for feet, 1 for meter)
VA:	Vertical angle
ZD:	Zenith Direct
ZE:	Zenith
ZV:	Zenith Reverse
-- :	Note

APPENDIX E

Transverse Mercator Zones

Central Meridians of State Plane Coordinates

E = East
W = West
C = Central

STATE	ZONE	C.M.	STATE	ZONE	C.M.
Alabama	E	85 50	Hawaii	1	155 30
	W	87 30		2	156 40
				3	158 00
Alaska	2	142 00		4	159 30
	3	146 00		5	160 10
	4	150 00	Idaho	E	112 10
	5	154 00		C	14 00
	6	158 00		W	115 45
	7	162 00	Illinois	E	88 20
	8	166 00		W	90 10
	9	170 00			
Arizona	E	110 10	Indiana	E	85 40
	C	111 55		W	87 05
	W	113 45			
			Maine	E	68 30
Delaware		75 25		W	70 10
Florida	E	81 00			
	W	82 00	Michigan	E	83 40
			(1934)	C	85 45
Georgia	E	82 10		W	88 45
	W	84 10			

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STATE	ZONE	C.M.	STATE	ZONE	C.M.
Mississippi	E	88 50	New Mexico	E	104 20
	W	90 20		C	106 15
				W	107 50
Missouri	E	90 30			
	C	92 30	New York	E	74 20
	W	94 30		C	76 35
				W	107 50
Nevada	E	115 35			
	C	116 40	Vermont		72 30
	W	118 35			
			Wyoming	1	105 10
New Hampshire		71 40		2	107 20
				3	108 45
New Jersey		74 40		4	110 05

APPENDIX F

Lambert Zones

Central Meridians and Zone Constants for State Plane Coordinates

N = North
S = South
C = Central
NC = North Central
SC = South Central
M = Mainland
I = Island
O = Offshore

STATE	ZONE	CENTRAL LONGITUDE	LATITUDINAL CONSTANT
Arkansas	N	92 00	0.581899
	S	92 00	0.559691
California	1	122 00	0.653884
	2	122 00	0.630468
	3	120 30	0.612232
	4	119 00	0.596587
	5	118 00	0.570012
	6	116 15	0.549518
	7	118 20	0.561243
Colorado	N	105 30	0.646133
	C	105 30	0.630690
	S	105 30	0.613378
Connecticut		72 45	0.663059
Florida	N	84 30	0.502526
Iowa	N	93 30	0.677745
	S	93 30	0.658701
Kansas	N	98 00	0.632715
	S	98 30	0.614528
Kentucky	N	84 15	0.622067
	S	85 45	0.606462
Louisiana	N	92 30	0.528701
	S	91 20	0.500013
	O	91 20	0.454007
Maryland		77 00	0.627634
Massachusetts	M	71 30	0.671729
	I	70 30	0.661095
Michigan	N	87 00	0.722790
	C	84 20	0.706407
	S	84 20	0.680529
Minnesota	N	93 06	0.741220
	C	94 15	0.723388
	S	84 20	0.700928

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STATE	ZONE	CENTRAL LONGITUDE	LATITUDINAL CONSTANT
Montana	N	109 30	0.746452
	C	109 30	0.733354
	S	109 30	0.714901
Nebraska	N	100 00	0.673451
	S	99 30	0.656076
New York (Long Island)		74 00	0.654082
North Carolina		79 00	0.577171
North Dakota	N	100 30	0.744133
	S	100 30	0.729383
Ohio	N	82 30	0.656950
	S	82 30	0.634520
Oklahoma	N	98 00	0.590147
	S	98 00	0.567617
Oregon	N	120 30	0.709186
	S	120 30	0.684147
Pennsylvania	N	77 45	0.661540
	S	77 45	0.648793
South Carolina	N	81 00	0.564497
	S	81 00	0.544652
South Dakota	N	100 00	0.707738
	S	100 20	0.689852
Tennessee		86 00	0.585440
Texas	N	101 30	0.579536
	NC	97 30	0.545394
	C	100 20	0.515059
	SC	99 00	0.489913
	S	98 30	0.454007
Utah	N	111 30	0.659355
	C	111 30	0.640579
	S	111 30	0.612687
Virginia	N	78 30	0.624118
	S	78 30	0.606925
Washington	N	120 50	0.744520
	S	120 30	0.726396
West Virginia	N	79 30	0.637773
	S	81 00	0.618195
Wisconsin	N	90 00	0.721371
	C	90 00	0.705577
	S	90 00	0.687103

G. TROUBLE SHOOTING

This appendix should be the first place you check for problems that you may have when operating your TDS-48GX. These are a list of the most frequently asked technical support questions.

TRAVERSE, BACKSIGHT AND OTHER DIFFICULTIES

Your Problem	Solutions to Try
You wish to enter a backsight azimuth but your backsight screen is prompting you for a BS point. Or any other prompt that is not the one you want.	Remember, when there is a ">" character in front of a prompt, you can change that prompt, using the |←| or |→| arrow keys. Highlight the field that you want to change the prompt for and scroll through the choices until you have found the one desired.
As you traverse, your foresight point has the same or similar coordinates as your occupied point.	1. Check to see that you are recording a non-0 slope distance. 2. If you are using a Total Station be sure that the gun is set to transmit Zenith angle and that the Zenith angle is not 0. 3. If you are entering data manually check to see that horizontal Zenith angles are 90° or horizontal vertical angles are 0°. A zenith angle of 0° or a vertical angle of 90° is straight up and therefore will result in a 0 horizontal distance.
Naming a file:	Caution should be used when naming a file. All letters and numbers are acceptable in a file name; but some punctuation symbols that will work on the HP-48GX, will cause problems when transferred to your PC. The "-" is fine but avoid using a space or period. Check your DOS manual for expectable characters in a DOS file name. Also if you are using both a TDS-48GX and a TDS-COGO card and want to exchange files, the COGO system requires that the file name begin with a alpha character.

TROUBLE SHOOTING

COMMUNICATIONS INTERFACE (To PC or Instrument)

Your Problem	Solutions to Try
For each of these: You have TFR running on you PC, and you are connected to a TDS-48GX, but you cannot get them to communicate. or TFR has worked in the past but now you cannot get it to communicate. or You are able to communicate with your with instrument but not with your PC.	Try all of the following Solutions: 1. Check to see if the Port you are using, is the one you have assigned in TFR. TFR versions before Ver 5.0, will only recognize ports 1 and 2. 2. The HP-48GX's battery warning is set to alert you to the fact that the batteries are almost too low to run the calculator. The HP-48GX communication port takes more current to run than the calculator itself and will stop communicating long before the battery warning will come on. Changing batteries will often correct communication problems. If you are able to transfer part of a file and each try transfers less of the file, the problem is probably batteries. 3. If the communication port you are using is also used by any other device, check to see if that device uses a device driver. You should not share a port with a mouse or digitizer because each of these has a device driver that takes control of the port and may prevent TFR from seeing incoming data. 4. Do not allow your HP-48GX, nor its cable to sit over a digitizer. A digitizer emits a powerful electromagnetic field that will interrupt communications and can course memory loss or other serious problems in the 48. If your TDS-48GX or its PC cable passes near a digitizer, move them and retry your transfer.

5. The HP-48 has a built in self test that can indicate a problem with the RS232 port. Press the **|ON|** and the **|D|** keys a the same time. When you release them the 48 screen should blank except for 3 vertical lines. Now short together the center two pins of the 48s RS232 port with a metal object. With the center pins shorted press the **|H|** key. The short should be maintained until the result is displayed. A display of "**U_LB 20000**" indicates that, either the short was not properly made or the HP-48GX has a problem with its port. You should short the pins together and press **|H|** several more times, in an attempt to get a "OK" response. A display of "**U_LB OK**" indicates that the loop back test has passed. This is not proof positive that the 48s port is working properly but is a good indicator that it is OK. To return to the normal operation, hold down **|ON|** and **|C|** at the same time. This should return you to the **HOME** screen.

6. Your cable should be tested for shorts, to see if all necessary wires are still connected. A continuity meter can be used for this purpose or the cable can be taken to an electronics repair shop. If you have a 9 pin connector on the PC end of your cable, then pins 2,3 and 5 should each go to one and only one pin on the 4 pin HP-48 end. If you have a 25 pin connector into your PC then pins 2,3 and 7 should each go to one and only one pin on the 4 pin HP-48 end.

   Care should be taken when plugging the cable into the HP-48GX. The 4 pins in the 48 can slip between the rubber housing and the plastic plug itself. When you look at the end of the 4 pin connector, if you can see 4 small indents on one side of the connector you have slid the pins into the side. In the future be sure that the connector is directly in line with the pins before pushing the connector in place.

7. The TFR program stores a number of system variables and parameters in a file called SETTINGS. If this file becomes corrupted, TFR will act erratic. You can delete this file and TFR will regenerate it when it finds it is no longer there.

If the above solutions do not solve your communication problems, the indication would be that your problem is with your PCs RS232 port. You should test that port by sending data to another RS232 device or by taking your PC to a computer repair shop.

TROUBLE SHOOTING

You are able to communicate with your with PC but not with your instrument.	This would indicate that your TDS-48GX is working fine and that the problem must be with your instrument cable or the interface of your total station. See solution 6 above.
If you are using Kermit as your communication software, TDS cannot support your interface difficulties that are attributed to configuring Kermit. It is the users responsibility to properly configure Kermit for his system. It is difficult to determine where a communication problem is coming from when a system is improperly setup. TFR takes care of most of these difficulties.	Some helpful tips when using Kermit: • Set all Comm. parameters that are displayed in the TDS-48GX transfer screen, to the same values, in both the HP-48 and Kermit. • Use the transfer screen within the TDS-48GX program. Do not try to use Kermit that is built into the HP-48GX operating system. When sending from the PC to the 48: • The file must have a POINT #, NORTHING, EASTING, ELEVATION and NOTE field. All fields must be there, separated by a coma. There cannot be any other fields or data. No header, tailer, or formatting information in the file. The file must look just like it would if it was down loaded from the TDS-48. • The file must have a suffix of .CR5. The "CR" must be entered in upper case. If you are still having problems, see your dealer about getting the TFR program. Most communication parameters and system problems are taken care of by TFR.

HP-48GX HARDWARE (Reset / Batteries / Memory cards)

Your Problem	Solutions to Try
The HP-48GX system is not responding. Pressing the **|ON|** or **CANCEL** key will not bring it back to life. Try the solutions to the right starting a the top:	**KEYBOARD RESET:** Hold down the **|ON|** key and press the **|C|** key; then release them both. Both the **|ON|** and **|C|** key must be depressed at the same time and then be released before the reset will occur. The calculator screen will blank and the **{HOME}** system stack should be displayed.
	HARDWARE RESET: On the back of the HP-48GX there are 4 rubber pads that can be removed by gentle prying on their edge, with a fingernail. Under the upper right pad (as you look at the back of the 48) will be a hole with the letter R next to it. Straighten one end of a metal paper clip and insert it into this hole as far as it will go. Hold for one second and remove. Press the **|ON|** key. You may also need to execute a Keyboard reset at this time.
The TDS-48GX program is not functioning as it once did or one routine is acting incorrectly. Try the Solutions to the right one at a time, starting at **SYSTEM SHUTDOWN**	**SYSTEM SHUTDOWN:** This will shut the 48 OFF in such a way as to reset the operating system. No memory should be effected. Hold down the **|ON|** and the **|SPC|** keys at the same time. When you release them the calculator should turn itself OFF.
	CLEAR MEMORY: The Memory Clear function will erase all of the main system memory and any memory card that is merged with it. When using the TDS-48GX software, all survey data is stored to independent memory and therefore will not be effected by a MEMORY CLEAR. It will, however, erase all TDS-48GX setup parameters (Device type, Repetition modes

If the above solutions will not bring your 48 back to life try removing the 3 AAA batteries from the 48 and let it set over night with the batteries out. In the morning, test the batteries and replace if necessary. If your 48 is still dead, contact HP for repairs.	ext.). You will need to re-enter the set up parameters. The procedure for clearing memory is to hold down the **[ON]**, the **[A]** and the **[F]** keys all at the same time. Release them all and the 48 will display "`Try to Recover Memory`". Press **[F]** for NO. This will clear all calculator main memory. If you respond with an **[A]** for YES the 48 will try to recover the memory and a clear will not be performed.
One of the 48 expansion card is not recognized or is having problems. You may be receiving one of the following prompts: **"WARNING Invalid Card Data"** **"No RAM Card in Port 2"** **"Low Battery in Port 2"**	Try the following: • With the HP-48 OFF, remove the card and reinstall it, making sure it is well seated in the port. • Cleaning the gold contacts on the end of the card. If the card has a stainless steel plate it will slide up under the cards case to reveal the gold contacts. Clean these contacts with an alcohol damp (not wet) cotton swab. If the problem card is a RAM: • Check its battery. See schedule below. • Check the position of the Read/Write switch. Switch it back and forth several times and then be sure it ends in the Write position; which is toward the center of the card.

Battery	Recommended replacement schedule
HP-48GX Main (AAA)	Typically, every 30 days when used as a data collector.
RAM card (Lithium)	Once a year.

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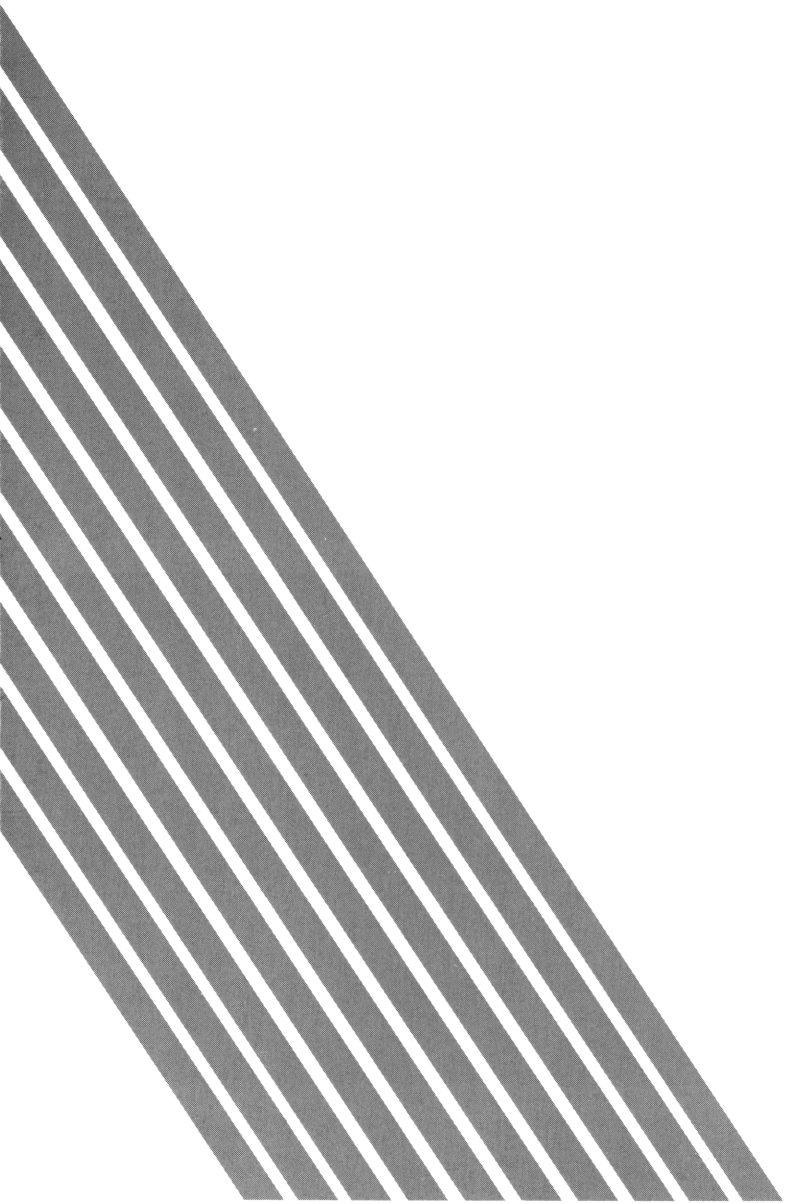

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