Tsunami

User Manual

Carlson Engineering System

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Introduction

Introduction

Tsunami is an AutoCAD-based data collection software package that runs in Windows. It creates maps as you survey directly in an AutoCAD drawing. The program collects data by interacting directly with a total station, impulse laser, or real-time kinematic Global Positioning System (RTK GPS) equipment. Tsunami runs with AutoCAD v14, 2000 and standalone AutoCAD OEM. In the field, Tsunami is typically run on a ruggedized laptop computer.

This user's manual covers applications for Tsunami including: field-to-finish, cut sheet stakeout, slope staking, laser offsets, depth sounders and GIS data collection. This manual also includes specific setup procedures for the various equipment supported by Tsunami. There is a separate Tsunami Reference Manual that describes all the Tsunami commands in detail.

Field to Finish

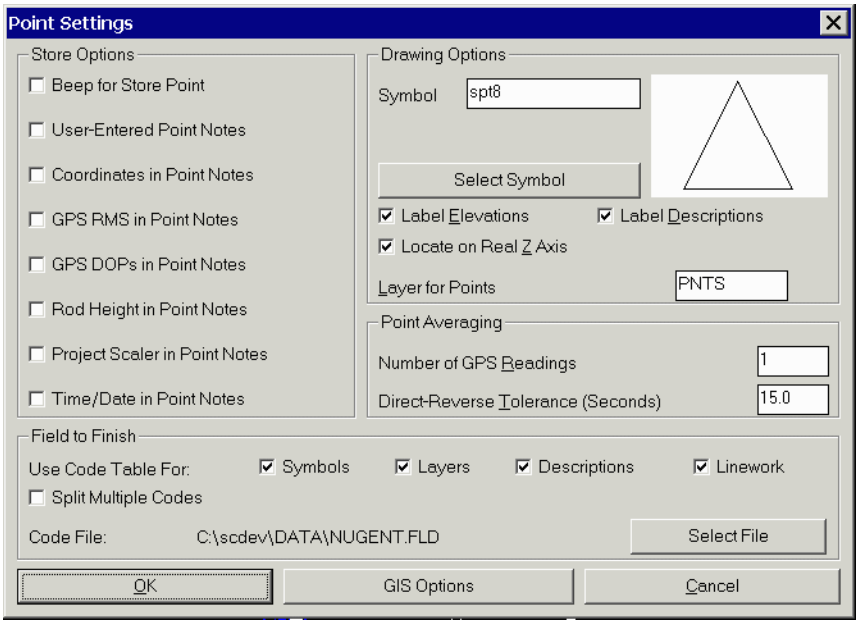
When collecting field data, the Field-to-Finish process can be used to draw the points with distinct layers, symbols and other settings based on the point description. Each point description is looked up in the Field-to-Finish code table which defines the layer, symbol and other properties for that description. The code definition can also be used to draw linework between the points. This code table is created using the *Field to Finish* command in the *COGO* menu. Codes can be alpha, numeric or alphanumeric. The Tsunami data collection functions *Point Store* and *AutoPoints at Interval* can use a Field-to-Finish code table.

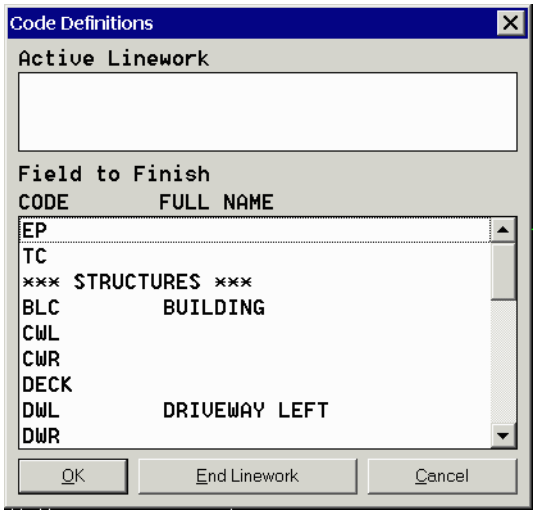
Field-to-Finish - Use Code Table ...

For Field-to-Finish mapping while collecting field data, go to *Configure Tsunami*, select *Point Settings*. Under the *Field-to-Finish* heading check the boxes to the right of *Use Code Table For.* This activates Field-to-Finish so that points stored with descriptions that are defined as codes in the code table are drawn using the code symbol, description, linetype and layer.

Field-to-Finish - Code File

The currently active code table file is displayed next to *Code File.* Only one Field-to-Finish code table is active at a time. Several code tables can be created for different clients or applications. Use the *Select File* button to set which code file is active.





Selecting a Code

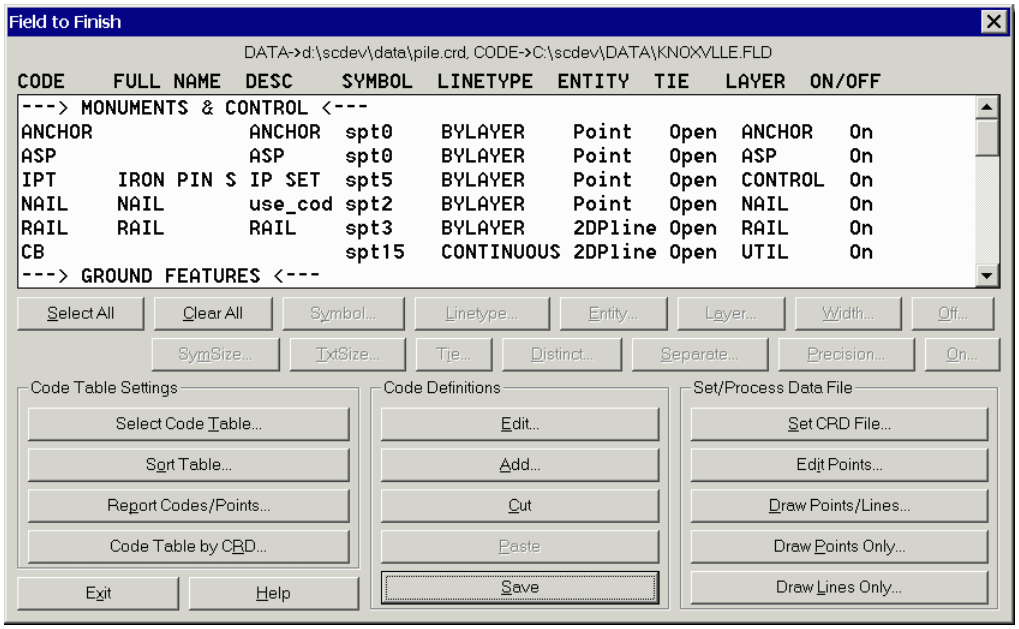
Both functions *Point Store* and *Auto Points at Interval* can use Field-to-Finish capabilities. Each of these data collection functions can display a list of the codes from the currently active Field-to-Finish code table. This alleviates you from having to guess code abbreviations. When you pick *Code* or press F7, a summary of the currently active code table appears. Use Page Down or Page Up to scroll quickly though the code table. Use the Up or Down arrow keys to highlight the code description desired and double click or press Enter to select. If you already know the code, you can just type it in the *Desc* field.

Field-to-Finish - *Options* (F6)

If you are using the *Point Store* or *Auto Points at Interval* functions, you can change your Field-to-Finish settings by clicking *Options* or hitting F6. This brings up the *Point Settings* window. You can toggle the *Field to Finish* options on or off, or you can select a different code table. You can also change the default point settings here. All of this can be done without leaving *Point Store* or *Auto Points at Interval*.

Field-to-Finish - Editing the Code Table

The code table can be displayed using the command *Field to Finish* under the *COGO* menu. Each line corresponds to a code. All of the code's parameters (layer, symbol type, description, size,



linetype) are controlled from here. Clicking on a code will bring up a window which will let you change the settings for this code. New codes can be added using the Add button on the code table.

Field to Finish - Linework

Linework includes all mapping by 2D or 3D polylines with line and arc segments. The Field-to-Finish code table controls the linetype, color and layer for all linework. It does not control where polylines, lines or arcs start or end. Starting and ending linework is controlled directly in Tsunami's data collection commands *Point Store* and *Auto Points at Interval*.

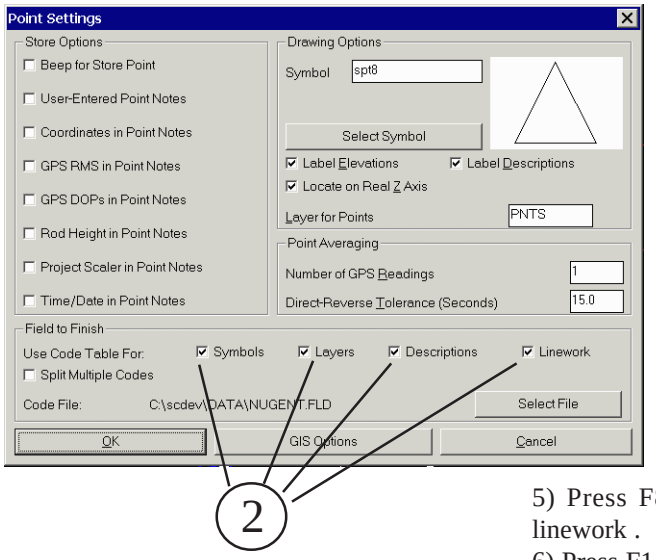
2D Polylines are always drawn at zero elevation. Their linetypes can be defined in the code table. A simple curve requires three points: a PC, one point on the curve and a PT. The simple curve is drawn as an arc. Complex curves can be shot using multiple points along the curve between the PC and PT. There is no upper limit to how many points can be used. Tsunami does a Bezier fit to join all these points. The complex curve is actually drawn as a series of very short chords.

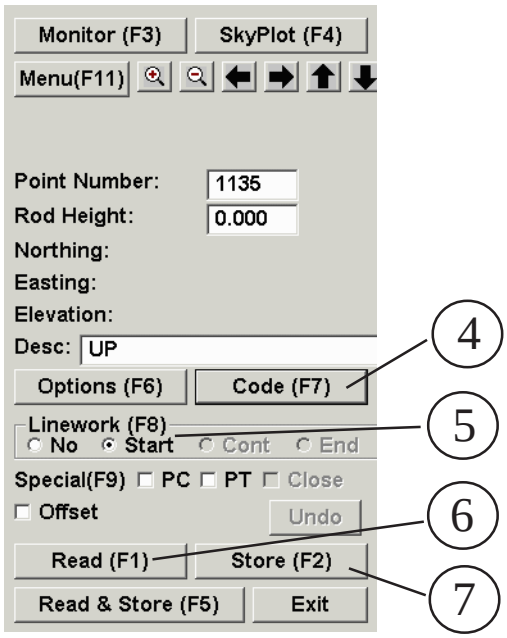
3D Polylines are a series of connected 3D points. All curved sections of 3D polylines are drawn as series of very short chords. Elevations of these chords are interpolated from the elevations of the curve endpoints. 3D polylines can be used as breaklines for surface modeling of curving curb lines, retaining walls or any other structure. Using Tsunami's Triangulate and Contour command, operators can create a contour map in the field using the data they just gathered and thus check that no areas or breaklines lines are missing or incomplete prior to leaving the site.

Nesting Linework & Points

Both *Point Store* and *Auto Points at Interval* allow you to be drawing multiple polylines at the same time. Without ending your current line, you can start another line by simply changing the description code. As long as you didn't select *End* under *Linework* for your first line, you can come back to it later. Tsunami will always recognize if a code next to *Desc* refers to a line currently active. If it does, Tsunami continues that line to the new point. To stop a line from being active, you can choose *End* under *Linework* before storing the point number.

If two or more polylines are drawn in the same session using the same code, you must add a number after the code to differentiate between two lines. (e.g. EP, EP1, EP2...)





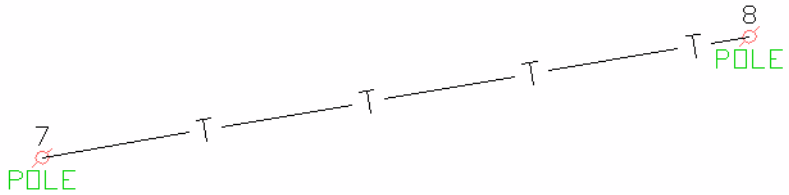
Tsunami Field-to-Finish Quick Overview

Point Store - Steps to draw using Field-to-Finish:

1) Configure Tsunami - Select the GPS or Total Station equipment in the first dialog.
2) In Configure Tsunami->Point Settings, select the code table to be used. Enable "Use Code Table For" by checking "Symbols", "Descriptions", "Linework" and "Layers".
3) Initiate "Point Store" in Tsunami.
4) Press F7 for the Code button to select the defined code "UP" from the Field-to-Finish code list.
5) Press F8 to start linework or check "Start" under linework .
6) Press F1 for the Read button to take a shot.
7) Press F2 for the Store button to store this point.

Now move to the next location and hit F1 then F2 again to repeat steps 6 and 7. Notice a line between points 7 & 8 draws with a "T" for telephone line and the symbol drawn is a utility pole symbol. The symbol, linework and layer are predefined for the "UP" code in the Field-to-Finish code table.

Remark: In "Linework", after picking "Start", the next shot with the same description defaults to "Cont"(continue) automatically and the line continues to this next point. When finishing linework, you must select "End" to stop the linework. Linework for breaklines should always be 3D polylines with elevations. 2D polylines are always drawn at zero elevation and their linetype is defined in the Field-to-Finish code table.



Special Characters and Conditions

When collecting points with additional description information besides the code, use a forward slash (/) after the code and before the additional description. All text after the forward slash is appended text that does not affect the code table (e.g. UP/#531, BLD/COR, PIPE/24", 14D/OAK). When drawing the point in the CAD drawing, the forward slash disappears and UP/#531 will plot as POLE #531. The original code, with forward slash and appended text, is stored in the coordinate and raw file.

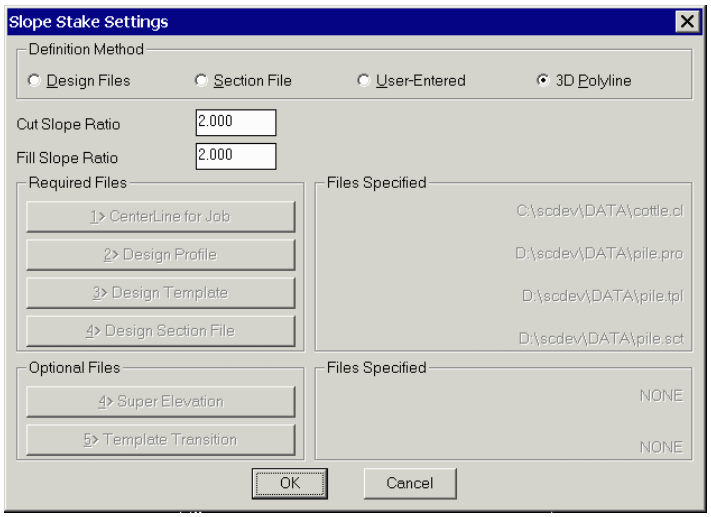
Mulitple codes are allowed in *Point Store*. In collecting a point such as a "T" intersection in a fence, the point can be collected once, but with two codes (seperated by a space) as the *Desc* (e.g. *FP1 FP2*). This also applies when storing a point that contains two or more distinct ground features (e.g. Edge Of Pavement and Catch Basin). Here also you can collect one point and store this point with two codes seperated by a space (e.g. *EOP CB*). The point plots twice: once in the EOP layer and a second time in the CB layer. The point is plotted on two layers in the drawing, but is stored only once in the coordinate file. Points collected in this fashion can have multiple symbols and have multiple lines drawn through them.

Undefined Codes

All points stored without descriptions or with descriptions not stored in the Field-to-Finish code table are drawn using the default *Drawing Options* in *Configure Tsunami->Point Settings*.

Slope Staking

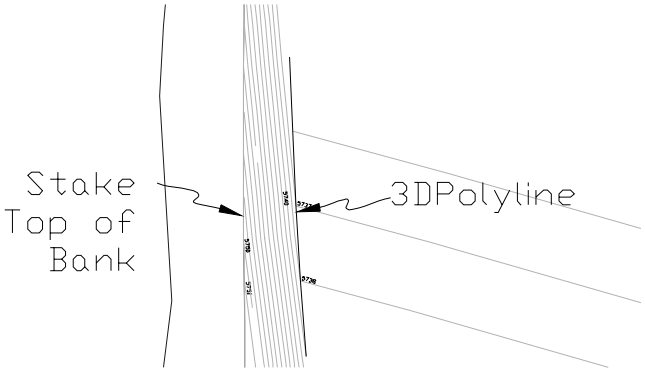
1. There are four methods for slope staking that allow flexability for defining the slope design. In this example to keep Life Simple, choose the 3D polyline option within Slope Staking, as shown below:



This allows you to just pick a 3D polyline to stake from. The User-Entered method requires that you have stored a centerline file, and asks you to enter the desired station, offset and elevation each time (this is good for complicated state highways with variable pivot points for the slope stakes). The Design Files options is good on simple industrial access roads and subdivision streets where you have never-changing template, profile and centerline. The Section File approach requires that you enter 2-point sections that start at the left pivot and stop at the right pivot, and between stations the program will interpolate.

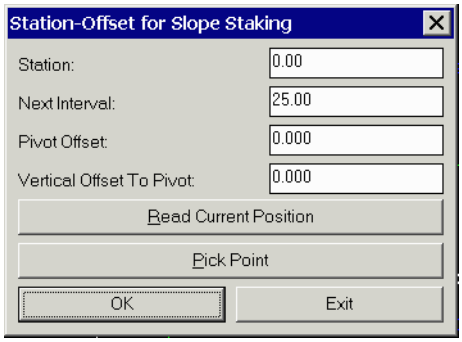
2. Either in the office or in the field, draw a 3D polyline (or a 2D polyline at a fixed elevation) representing the design "break" or pivot line from which the slope staking occurs. This polyline needs to be drawn before starting slope staking.

The thing to remember about slope staking is that it starts from the given design and goes out to find the "catch" on the original ground (which never matches plan). So it is a necessary field thing. The road shoulder is "given". The 2:1 slope is "given". But where that 2:1 slope catches existing ground



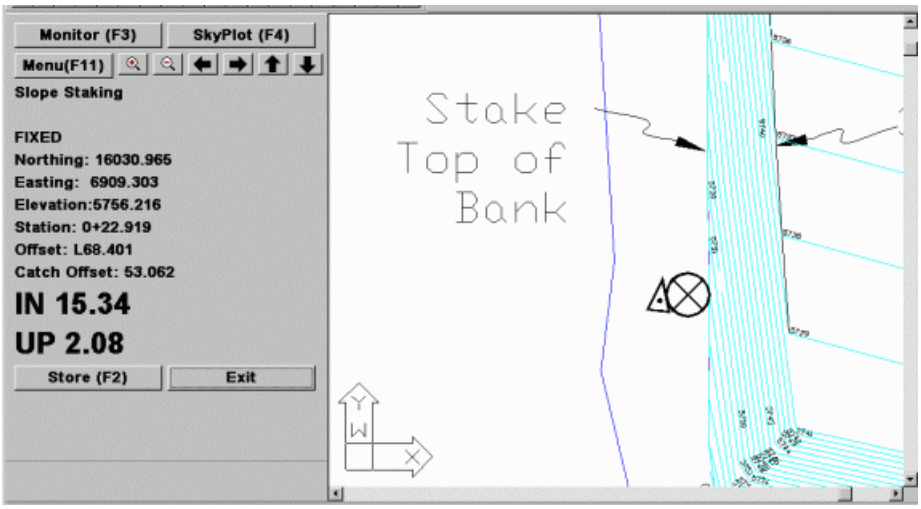
is not given. It is shown on the plans, but needs to be measured to actual ground. So it is done in the field. Surveying these "catches" is slope staking. For roads, the pivot or break line is the back of ditch in cut (heading out to top of cut) or the outside shoulder in fill (heading down to the toe of fill). For site jobs, like that shown above, the pivot or break line is the last, fixed design slope before that uphill or downhill slope to the "catch". In the example shown above, it is the bottom left corner of a borrow area, which then runs uphill at some slope to the catch.

3. In the first Slope Stake Settings dialog, select the 3D Polyline method. Then enter the cut and fill slope ratios.



4. After clicking OK from the first dialog, you are asked to pick the 3D polyline, then set the starting station and the interval along that polyline. (The 3D polyline should be drawn in the direction of increasing stations. If the polyline is not going the right direction, then use the Reverse Polyline command). The pivot offsets can be used as follows: say you are slope staking top of a sewer cut, and you have a 3D polyline for the centerline of the sewer invert. But if the bottom trench is 4' wide, you need to offset 2' horizontally, 0' vertically to get to the cut edge where the steep (maybe 0.5:1) upslope is to daylight. That is how pivot offset is used. If you are coming right off that 3D polyline, then there is no pivot offset. Another note: if you had a sewer trench that was 0.5:1 for 5' of depth then leaned back at 2:1, you would have to handle a multiple slope deal with the template approach, using a centerline file, profile and template file.

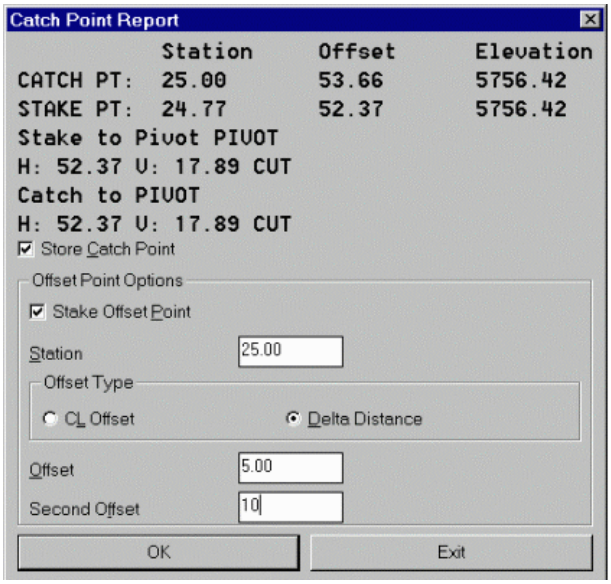
5. When you press OK, slope staking begins to guide you to the catch point. The fantastic thing about slope staking is that immediately you have a bullseye to go to, which is the computed catch point. It does this by figuring where you are X,Y,Z through the GPS, and it will make a plane, flat

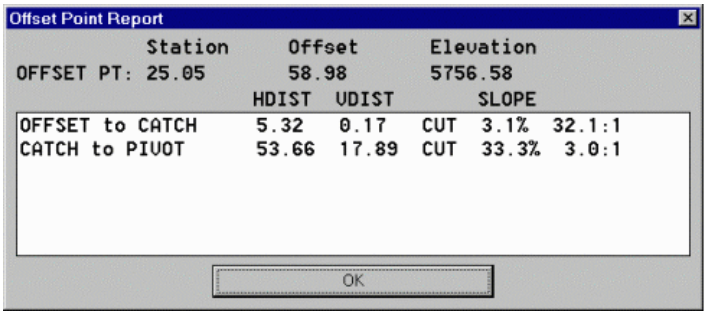


surface of the grade you are at, intersect the 3D polyline at the set slope with that grade at the appropriate station, and show the target X symbol. If you are on the other side of the centerline, it will show the X on the otherside—right away, immediately. As you move, it models the current surface and moves the X slightly—to its correct point. So all you do is walk to it.

In the text dialog next to the drawing, the program shows the distance in/out from the current position to the catch offset and the distance up/down from the current station to the catch station. For this example, IN means in to the centerline 15.34' and UP means up the centerline (up-station). So in this example, walk north 2.08 and to the right 15.34 and set the stake. As you get closer and your actual elevations on the ground change, you might in fact find yourself waling 16.07 feet in (up won't change—it can't, perpendicular to centerline is perpendicular, period).

6. When you get on that slope stake point, hit that F2 to store. You then get this screen. Note that I missed it by 0.23 feet on the stationing (I didn't go far enough north) and 1.29 on the offset (I was too close in). Now I can stake one Offset point or even a second Offset point. Typically one offset is placed in case the slope stake gets removed (sometimes the slope stake is omited and just the offset stake is used). Many surveyors like to put in a second offset stake to "get line". If the slope stake gets removed (or is never set), the 2 stakes give line to reset the slope stake. The first offset stake might get this report:





GIS Data Collection

1. GIS Information - GIS Predefined Prompting Files and Data Storage

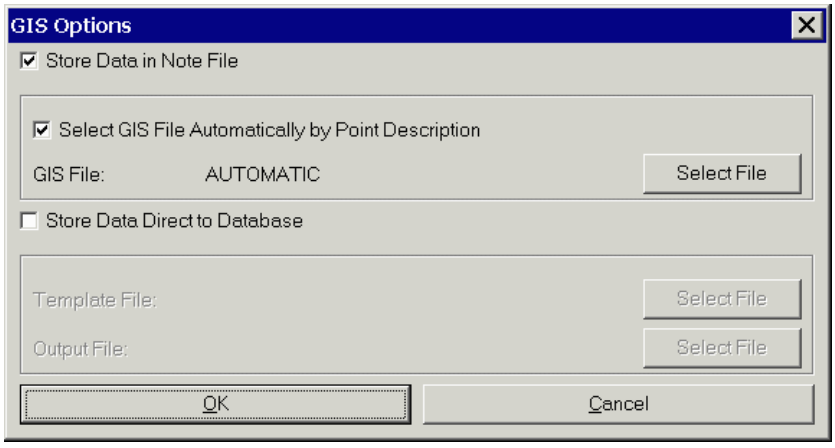
Tsunami can store GIS information with points collected with total stations, pulse lasers and GPS surveying equipment. When storing field data, Tsunami can be set to prompt for additional GIS information for each stored point. There are two seperate GIS prompting and data storage methods that can be employed within Tsunami. The Note File method uses ASCII (.NOT) files. The other method uses Microsoft Access database (.MDB) files. Both methods can use the descriptions of stored points (e.g. SCO for Sewer Cleanout, FH for Fire Hydrant ...), to look for a corresponding GIS prompting file, to prompt and store GIS information. Both the Note File and MDB File methods require creating GIS predefined prompting files prior to collecting field data.

2. Storing GIS Information in Tsunami

The steps to toggle On GIS prompting and storage for either method ASCII or MDB in Tsunami are detailed and numbered below:

Step 1) From the main menu pick the Tsunami drop down menu then pick Configure Tsunami.
Step 2) Click on the button *GIS Options.* This brings up the GIS Options dialog box.
Step 3) The GIS Options pop-up box allows you to choose from the two GIS methods. The two methods are *Store Data in Note File* (ASCII method) and *Store Data Direct to Database* (MDB method). These two GIS prompting and data storage methods are decribed fully in the two sections 4 and 5.

When storing points in Tsunami using Point Store or Auto Points at Interval, you can toggle GIS prompting and data storage on and off by picking *Options* to access Point Settings->GIS Options.



3. Storing GIS information using the ASCII or MDB method

The recommended method for GIS data storage in Tsunami is the MDB method. The MDB method stores GIS information directly to a Microsoft Access Database. Only the MDB method can attach digital photographs to points. Tsunami can create, display, query, input and edit the MDB information. Another important feature that only the MDB method can accomplish is maintaining database connectivity when importing and exporting ESRI Arcview (2D or 3D) shape files.

The ASCII (Note File) method was developed to work with our DOS based data collection package, SurvStar. There are conversion routines to convert between MDB data files and GIS Note files. The only limitation with the ASCII method is that digital photographs cannot be linked to points or entities.

4 Two File Types are used by the ASCII method - GIS & NOT

The two file types for the ASCII method have GIS and NOT file extensions. The GIS files define the GIS prompting and fields. The Note file (.NOT) stores the GIS data for the points.

Each GIS file defines the prompting and fields for one GIS feature. For example, MH.GIS could define GIS prompts for manholes including fields like size, depth, condition, location, etc. These GIS files can be created with the Define Note File Prompts command. GIS prompting files are explained fully in section 5C.

One Note file per job is used to store all GIS information. The Note file always has the same filename as the coordinate CRD file, but with a NOT file extension. For example, job5.not would be the file name for the companion note file to job5.crd. Note files for GIS data storage are always ASCII files and are explained fully in section 7, Note File Data Structure and File Creation.

5. Store Data in Note File - ASCII GIS Prompting and Data Storage

The *GIS Options* button in the Configure Tsunami command brings up the GIS Options pop-up dialog box. It controls GIS prompting and how GIS information is stored in Tsunami. There are two formats and methods for GIS prompting and storage, ASCII or MDB. *Store Data in Note File* is the ASCII method. If the ASCII method is selected (checked) you can choose between two GIS prompting methods. The first method is to have one GIS prompting file for all collected points. This method will then have prompting for one type of GIS feature for the points. The second method uses different prompting for every type of point. It looks for a corresponding GIS prompting file to match the description of each stored point. The method to use is set by the *Select GIS File Automatically by Point Description* toggle.

5A. One ASCII GIS Prompting File for All Collected Points.

Step 1) Pick the check box for *Store Data in Note File* (ASCII method).
Step 2) Hit *Select File.* This brings up a pop-up dialog box titled GIS File Name.
Step 3) Choose one GIS filename for prompting. Browse to the drive and subdirectory where the GIS prompting files reside and highlight one. Pick *Open* to load the selected GIS filename and close the pop-up box. The GIS filename selected should be displayed in the GIS Options dialog pop-up box after *GIS File:*

This ASCII method will prompt for the same GIS information for every point stored, regardless of description. For example, a FH.GIS (Fire Hydrant) file selection would have the prompting for fire hydrant GIS fields for every point stored.

5B. Select ASCII GIS Prompting File Automatically by Point Description.

Step 1) Pick the check box for *Store Data in Note File*.
Step 2) Pick the check box for *Select GIS File Automatically by Point Description.* The GIS file name displayed after *GIS File* will change to *AUTOMATIC*. GIS prompting will only appear if the stored point's description corresponds exactly to an existing GIS prompting filename (excluding the GIS extension). For example, if the point description is SMH, then Tsunami looks for SMH.GIS for the GIS fields. If a point's description has no corresponding GIS file name, Tsunami briefly displays "*No GIS File Found*" and continues automatically.

5C. ASCII GIS Prompting File Structure

The .GIS file defines the GIS fields and prompting for one GIS feature. This file is a ASCII file where each line contains a field definition. The definition line has the field name, prompt and default value separated by commas. If the field is a choice of options, the definition line also has each choice separated by commas. If the field's value is to be calculated automatically by an equation, the equation takes the place of the default value. The field's value is calculated automatically once the point is stored or edited. An example ASCII GIS file for Sewer Cleanout GIS prompting (SCO.GIS), is displayed below for a detailed explanation on ASCII GIS prompting file structure.

```
SCO,SCO (#), ,
SIZE,Size  (4/6/8/10/12),4,4,6,8,10,12
TYPE,Type (L/M),L,L,M
COMMENTS,Comments, ,
```

SCO.GIS is an ASCII file. It is displayed here as it would appear in any text editor. Each line in the GIS file is a GIS prompt in SurvStar and Tsunami. Each line consists of four items separated by commas. The first is Field Name (SIZE). The second is the prompt, including allowed input in parentheses and separated by slashes (Size (4/6/8/10/12)). The next is the default value (4). This is followed by the allowed values, separated by commas (4,6,8,10,12).

Descriptions for each of the four items and naming conventions for GIS prompting files are described in detail below:

Item 1 - Field Name: Field 1 is never displayed to the operator in Tsunami. The Field Name is inserted at the beginning of each line in the Note file before the input GIS data. This Field Name corresponds to a column name in a Microsoft Access database table. If you convert GIS ASCII Note data files to MDB tables, the Field Name will become the column name. Converting collected Note files to MDB tables is only an option, not a requirement. The Field Name must be unique for the GIS file and is not allowed to have spaces or special characters.

Item 2 - Prompt: This is the prompt that actually appears when storing ASCII GIS information. It is usually the same name as Field 1 but can include spaces or special characters. Also displayed in the Prompt within parentheses are all allowed input options. Notice the line shown with a prompt *SCO (#)*. The pound sign in parentheses signifies that a number is expected. In the next line the prompt is *Size (4/6/8/10/12)*. When entering GIS information at this prompt only 4, 6, 8,10 and 12 are expected. IMPORTANT: Commas are not allowed within the prompt. All entries in the Prompt should be seperated by a / (forward slash) instead.

Item 3 - Default: The default value is displayed directly after the prompt. If the field operator presses return without entering anything, the default will be stored as this line's GIS information. In the example for *SIZE,Size (4/6/8/10/12),4,4,6,8,10,12* the next value after the parentheses is 4. Four will be the default value. If the default space is left blank as in the last line *COMMENTS, Comments, ,* then there is no default value and no value will be saved if the operator doesn't enter anything.

Item 4 - Options: These are the only allowed input options at this GIS prompt. When inputing data, only one of these values will be accepted. So only one of the values 4, 6, 8, 10 or 12 will be accepted as input at the Size prompt. These values are the ones that actually control the input; the options appearing in Item 2 are only there so the operator can see his choices.

6. Creating Prompting Files

The .GIS prompting files can be created by the Define Note File Prompts command. A brief description is included here for all the command options found in the Define Note File Prompts dialog box.

Load brings up a dialog pop-up box titled *Specify .GIS File*. This dialog box allows you to load an existing GIS prompting file.

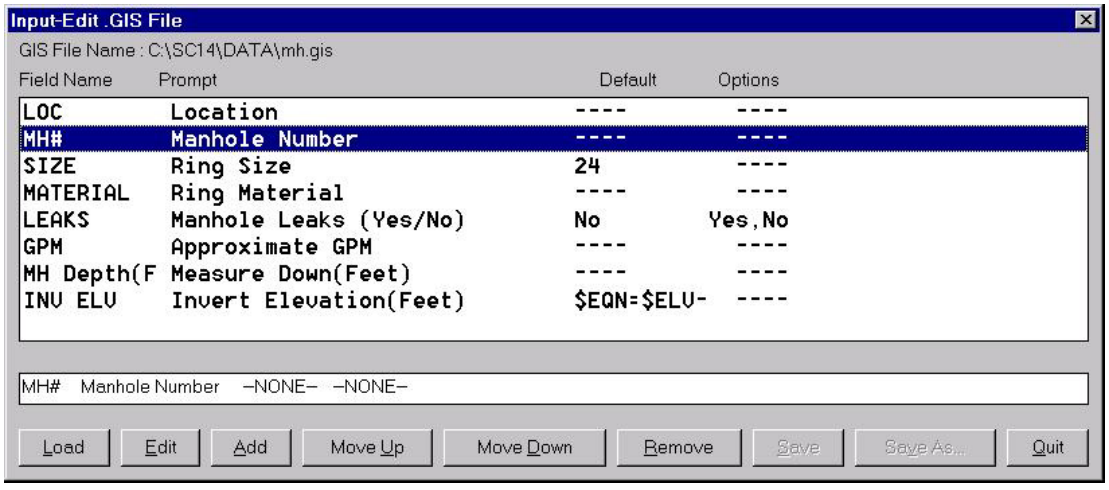
To edit any individual GIS prompting line, highlight that line and pick *Edit*. The following pop-up dialog box titled GIS Field Record appears. You can input the four items of the prompting file line here. GIS prompting files need to be structured as described in section 5C. *Add Option* brings up a pop-up dialog box titled New GIS Option. To remove a value in *Options for value*, highlight the value and pick *Remove Option*.

To add a GIS prompting line, highlight the line above where you want the new line to go. Pick *Add* to bring up the pop-up dialog box titled GIS Field Record shown above. Enter in the Field Name, Prompt, Default Value and Options for Values and pick *OK*. Remember to follow the structure in Section 5C. The newly added GIS prompting line is inserted below the highlighted line.

The *Move Up* and *Move Down* buttons change the sequence of GIS prompting.

Remove deletes the highlighted GIS prompting line.

Save and *Save As...* store the currently loaded GIS file to the default name or to a new name.



7. NOT File GIS Data Storage and Structure

Note files (.NOT) store the GIS data for the points . Note files are created in Tsunami automatically when *Store Data in Note File* is toggled on in Configure Tsunami->GIS Options. Besides the GIS data, the note files can also store survey data such as GPS RMS and PDOP. The survey data to store in the note file is specified in the Configure Tsunami->Point Settings command. One Note file contains all GIS data and Point Store information for all the field collected points of a job. These Note files always have the same name as the currently loaded coordinate file (with a NOT extention instead of CRD). Note files can contain GIS information, survey information or both. To view the note file data, you can open the note file with any text editor or run the List Points command and turn on the List Point Notes option.

JOB-001.NOT File with GIS Data Only

```
PT_ID:1   GIS_FILE:SMH.gis
SMH,SMH
SIZE,30
TYPE,STND
MANUFACTURER,WOMAK
COMMENTS,SURVEYOR JSC
PT_ID:2   GIS_FILE:SCO.gis
SCO,SCO
SIZE,8
TYPE,M
COMMENTS,SURVEYOR JSC
```

JOB-002.NOT File with GIS & Survey Data

```
PT_ID:1   GIS_FILE:SMH.gis
TIME,17:5:6
DATE,2/15/2000
SMH,SMH
SIZE,24
TYPE,STND
MANUFACTURER,WOMAK
COMMENTS,SURVEYOR JSC
HRMS,0.04
VRMS,0.07
PT_ID:2 GIS_FILE:SCO.gis
TIME,17:6:19
DATE,2/15/2000
SCO,SCO
SIZE,8
TYPE,L
COMMENTS,SURVEYOR JSC
HRMS,0.04
VRMS,0.07
```

The two examples here show how Tsunami's Configure Tsunami > Point Settings > Store Options can add survey information to the same Note file that GIS uses.

The section of Note file corresponding to one point starts with a line showing the point number and GIS prompting file used. If no GIS prompting file exists, NONE is displayed. This line is the point identifier and all GIS and survey data stored below is referenced to this point number until the next point line identifier occurs.

JOB-001.NOT File with GIS Data Only

```
PT_ID:1 GIS_FILE:SMH.gis
SMH,123
SIZE,30
TYPE,STND
MANUFACTURER,WOMAK
COMMENTS,SURVEYORJSC
PT_ID:2 GIS_FILE:SCO.gis
SCO,78
SIZE,8
TYPE,M
COMMENTS,SURVEYORJSC
```

Corresponding GIS Prompting (SHM.GIS)

```
Using SMH.GIS Prompting File for point 1
SMH,SMH (#), ,
SIZE,Size (24/30),24,24,30
TYPE,Type (STND/NSTND),STND,STND,>
 MANUFACTURER,Brand (Richard/Dewey/>
COMMENTS,Comments,,
Using SCO.GIS Prompting File for point 2
SCO,SCO (#), ,
SIZE,Size (4/6/8/10/12),4,4,6,8,10,12
TYPE,Type (L/M),L,L,M
COMMENTS,Comments, ,
```

The second example Note file shown here is for two stored points with both GIS prompting and all Store Options survey information toggled on. The user was prompted to enter the GIS information. The survey information (shown in italics) was saved automatically because these options were toggled on in Configure Tsunami > Point Options.

JOB-002.NOT File with GIS & Survey Data Options Item	**Corresponding GIS Prompting or Store**
PT_ID:1 GIS_FILE:SMH.gis	**Using SMH.GIS Prompting File for point 1**
TIME,17:5:6	*>Time/Date in Point Notes*
DATE,2/15/2000	*>Time/Date in Point Notes*
NOTE1,MISC NOTES LINE 1	*>Point Notes*
NOTE2,MISC NOTES LINE 2	*>Point Notes*
SMH,78	SMH,SMH (#), ,
SIZE,24	SIZE,Size (24/30),24,24,30
TYPE,STND	TYPE,Type (STND/NSTND),STND,STND,>
MANUFACTURER,WOMAK	MANUFACTURER,Brand (Richard/Dewey/>
COMMENTS,SURVEYOR JSC	COMMENTS,Comments,,
HRMS,0.04	*>GPS RMS in Point Notes*
VRMS,0.07	*>GPS RMS in Point Notes*
STATUS,FIXED	*>GPS RMS in Point Notes*
ROD HT,5.250	*>Rod Height in Point Notes*
PT_DATA,1, 4998.000, 4996.000, 95.000, SMH	*>Point Coordinates in Notes*
PT_ID:2 GIS_FILE:SCO.gis	**Using SCO.GIS Prompting File for point 2**
TIME,17:6:19	*>Time/Date in Point Notes*
DATE,2/15/2000	*>Time/Date in Point Notes*
NOTE1,MISC NOTE LINE 1	*>Point Notes*
SCO,222	SCO,SCO (#), ,
SIZE,8	SIZE,Size (4/6/8/10/12),4,4,6,8,10,12
TYPE,L	TYPE,Type (L/M),L,L,M
COMMENTS,SURVEYOR JSC	COMMENTS,Comments, ,
HRMS,0.04	*>GPS RMS in Point Notes*
VRMS,0.07	*>GPS RMS in Point Notes*
STATUS,FIXED	*>GPS RMS in Point Notes*
ROD HT,5.250	*>Rod Height in Point Notes*
PT_DATA,2, 4998.036, 4996.091, 95.000, SCO	*>Point Coordinates in Notes*

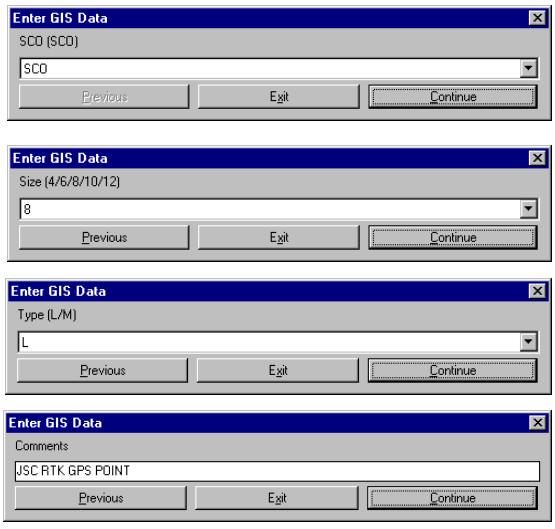
8. Point Store - ASCII GIS using GPS

The Point Store command in Tsunami can store nearly unlimited GIS information with field collected points. The following procedure details the steps needed to field collect points with GIS information using the Point Store command and RTK equipment.

Before running this procedure, the following must be setup:

- Run GPS Setup to configure your GPS receiver.
- Run Align Local Coordinates to define the transformation from the GPS coordinate system to your job coordinate system
- Create .GIS prompting files to use with the Define Note File Prompts command.

Step 1 - Pick Point Store in the Tsunami drop down menu.
Step 2 - If no coordinate file (.CRD) has been selected for the current drawing, then Tsunmai will prompt you to load an existing or new CRD file. Pick New to create a new CRD file. For the CRD file name, type in GIS_JOB001 and pick Save to create this new coordinate file.
Step 3 - To toggle on ASCII GIS prompting, pick the Options (F6) button. Then pick the GIS Options at the bottom of the Point Options dialog. In the GIS Options dialog, check on the *Store Data in Note File* and *GIS File Automatically by Point Description* toggles. Pick *OK* to close GIS Options and *OK* again to close Point Settings.
Step 4 - In the Desc field, type the point description that corresponds to an ASCII GIS prompting file (e.g. SCO for the GIS prompting file SCO.GIS)
Step 5 - Plumb the GPS antenna pole and pick *Read (F1)* to take a reading from the GPS receiver. The coordinates of the point appear at the top of the dialog box. Pick *Store (F2)* to store point number 1. (F5 both reads and stores.)
Step 6 - Point Number 1 plots on the screen. Immediately after point 1 plots, the first GIS prompting dialog pop-up box appears. The first GIS item is SCO(#). Enter the number for this sewer clean-out and pick *Continue*.



The four GIS prompts created in the SCO.GIS file appear as dialog boxes. Directly under the *Enter GIS Data* title in each dialog pop-up box you can see the GIS prompt including possible values. You can use the up or down arrow keys or pick the down arrow selection triangle to choose the value for each GIS prompt. If no values are shown, you can type any input for that value. Pick *Previous* or *Continue* to go backwards or forwards. *Exit* ends the GIS prompting.

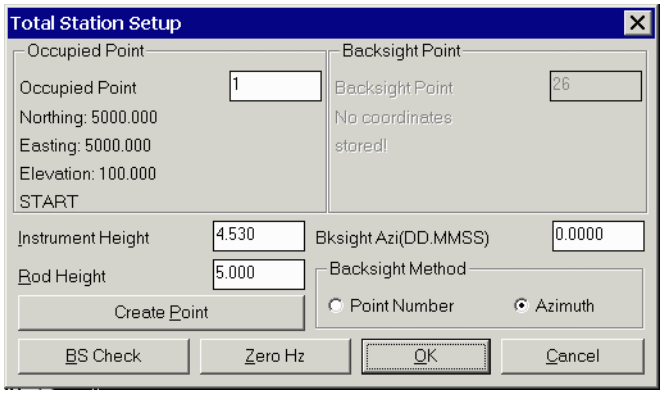
The above procedure stores ASCII GIS information into one Note file with the same name as the current coordinate file. Review section 10 to plot, list and edit Note files in Tsunami.

9. Point Store - ASCII GIS using Total Station

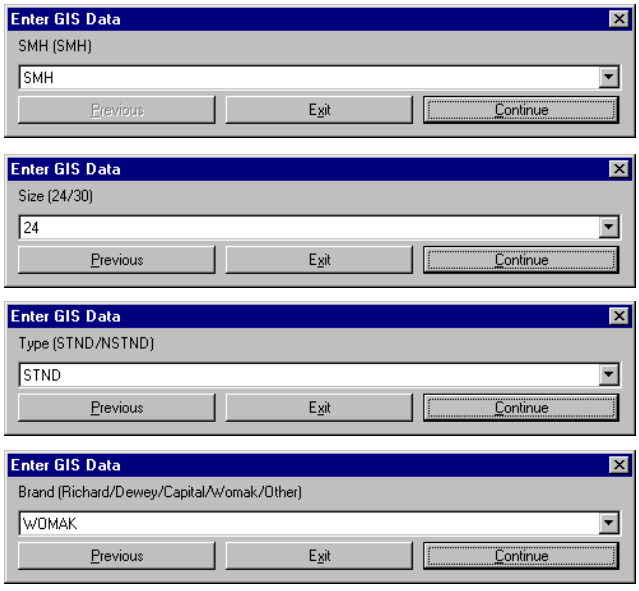
The Point Store command in Tsunami can store both GIS information and survey information with field-collected points. The following procedure details the steps needed to collect points with GIS and survey information using the Point Store command and Total Station equipment.

Before running this procedure, create .GIS prompting files to use with the Define Note File Prompts command.

Step 1 - Pick Point Store in the Tsunami drop down menu.
Step 2 - If no coordinate file (.CRD) has been selected for the current drawing, then Tsunmai will prompt you to load an existing or new CRD file. Pick New to create a new CRD file. For the CRD file name, type in GIS_JOB001 and pick Save to create this new coordinate file.



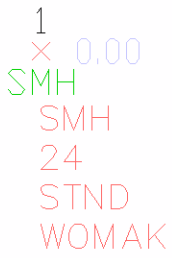
Step 3 - Pick *Setup (F3)* to bring up the pop-up dialog box titled Total Station Setup. The total station and computer running Tsunami must be connected by serial cable.
Step 4 - Type in 1 for the *Occupied Point*. If there are no coordinates for point 1, then pick the Create Point button. In the Create Point dialog, enter point #1, Northing=5000, Easting=5000, Elev=100 and then click OK.
Step 5 - Set the *Backsight Method* to Azimuth and type 0 (zero) for the *Bksight Azi*. Input the *Instrument Height* and *Rod Height*.



Step 6 - Sight the total station toward an object assumed to be due north. The gun (total station) is zeroed in Total Station Setup dialog box by picking *Zero Hz*. A Message dialog pop-up box appears and says *Done*. Check the screen on the total station to see if it is reporting zero for the horizontal angle. If yes, pick *OK* to close this Message box and *OK* again to exit the Total Station Setup dialog box. If the horizontal angle has not changed, the total station configuration settings could be wrong. Check that the proper equipment is selected in *Configure Tsunami*.
Step 7 - To toggle on ASCII GIS prompting, pick the Options (F6) button. Then pick the GIS Options at the bottom of the Point Options dialog. In the GIS Options dialog, check on the *Store Data in Note File* and *GIS File Automatically by Point Description* toggles. Pick *OK* to close

GIS Options and *OK* again to close Point Settings.
Step 8 - You are ready to collect points from this setup with the total station and prism pole. In the Desc field, type the point description that corresponds to an ASCII GIS prompting file (e.g. SMH for the GIS prompting file SMH.GIS)
Step 9 - Have the rodman setup over the point and sight the point with the total station. Press *Read & Store (F5).* The total station takes the shot. Point number 1 plots as a sewer manhole.
Step 10 - A group of pop-up dialog boxes appear that are all titled Enter GIS Data and prompt for the SMH.GIS GIS information *SMH, Size, Type, Brand and Comments*.

10. Plot, List and Edit GIS Notes in Carlson Survey/Tsunami



Note file GIS and survey information can be plotted, reviewed and edited in Tsunami.

Plotting Note Point Data - The command in Tsunami that can plot Notes with points is *Draw-Locate Points*. In the Draw-Locate Points dialog, toggle on (check) *Notes*.

The Point Numbers toggle in the Draw-Locate Points dialog controls two output formats for plotting Note information. The one shown above is plotted with the point number, point elevation, point description and point symbol. The second format, shown to the right, plots the Note information with point number, elevation and description turned off. The point Note information is plotted with the point symbol only.

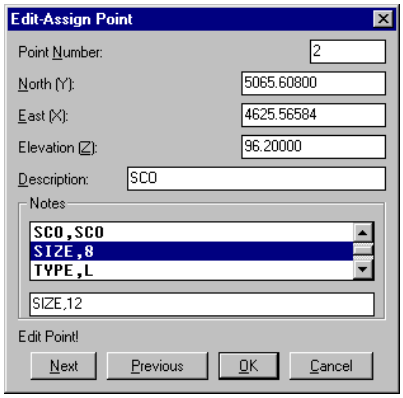
Every line of notes is a separate AutoCAD text entity.

Listing Point Note data for Review - To list the current coordinate CRD file, including Note data, pick *List Points* in the Points drop down menu. Enter the range of points to review or type *all* to review all points. Pick (check) *List Point Notes* to display Note data with coordinate points. Pick *OK*. The pop-up dialog box titled List Points Report appears as shown below. Scroll up or down to review the coordinate points and Note data.

To create a custom report of the coordinate and note data, pick the *Use Report Formatter* toggle in the List Points dialog. This method will display a list of all the coordinate and note field names and you can choose the order of fields to report from this list. The Report Formatter can also output to Excel and Access.

Edit Coordinate and Note Point Data - The Input-Edit command in Coordinate File Utilites allows you to edit Note data. Coordinate File Utilites is found in the Points drop down menu. From the Coordinate File Utilities dialog, pick *Input-Edit Point*.

The Edit-Assign Point pop-up dialog box both reviews and edits coordinate and note data. This pop-



up box displays only one point's coordinate and note values at a time. To go to a specific point number, type the desired point number and hit Enter. The coordinate and note values are displayed for this point number. To display the next or previous point, pick *Next* or *Previous*. To edit any value, pick that box and edit accordingly. To edit note values you must pick the note value and hit enter on the keyboard. This will display the value in the edit box. Edit the note value in this edit box and hit Enter to update this value. If more than three lines are displayed in the *Notes* area, an up/down scroll bar will appear to the right of this box. After editing the displayed values, selecting *Next, Previous or OK* automatically stores the edited values. *Cancel* will exit without storing the displayed edited values. Pick *OK* to save the edited values and exit.

11. GIS Data: MDB method

To use the Access Database method for storing GIS data, run Configure Tsunami->GIS Options and turn on Store Data Direct to Database. This method uses one .MDB Microsoft Database file as a "Template File" to create the GIS prompting and a second "Output File" .MDB Microsoft Database file to store the GIS information directly into. Despite uses the MDB file format, this routine works entirely in Tsunami and doesn't require Microsoft Access to be installed on the computer.

Depth Sounder

Tsunami data collection can be used in conjuction with a depth sounder to survey the beds of rivers and lakes. Tsunami takes input from both a GPS receiver and a depth sounder to determine and record the elevation of the terrain directly below the surveying boat or barge.

All of Tsunami's routines work with the depth sounder to let you collect points on the underwater terrain. The elevation stored for each point is the elevation of the bed. Modelling of the bed surface works as easily as modelling any surface using Carlson Software. Tsunami can be a powerful tool for marine surveying and construction.

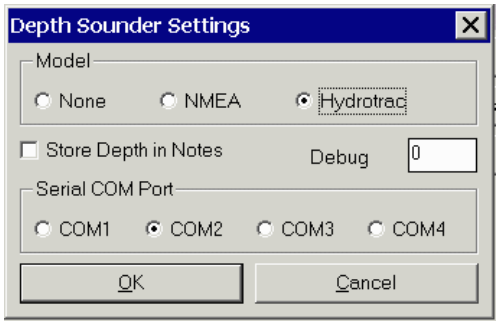
Settings

To modify the Tsunami depth sounder settings, go to the Tsunami menu and select *Configure Tsunami*. Choose the *Depth Sounder Settings* button.

The *Depth Sounder Settings* menu appears. At this point, Hydrotrac by Odom is the only equipment specific depth sounder interface. Tsunami works with other depth sounders that have NMEA standard interface. If you want to use Tsunami without the depth sounder, make sure the Model is set to None.

For the Hydrotrac model, the depth sounder should be set so it outputs message DESO25 I/O. This is done using the Hydrotrac software. Odom should be contacted with any problems involving setting this message. (www.odomhydrographic.com, (225) 769-3051) The draft setting on the Hydrotac should also be set. This will account for the height difference between the water surface and the working sensor of the Hydrotac.

On the next line appears a box labeled *Store Depth in Notes*. Tsunami saves point data in a coordinate file and in a text note file. By checking this box, the note file will record the water depth at each reading along with the other information about that point. (Settings to control the rest of the information saved in this file can be found in the menu *Configure Tsunami->Point Settings*.)



The window labeled *Debug* should be set to zero for normal use.

The row of buttons labeled *Serial COM Port* refer to the COM port on your computer where the depth sounder is plugged in. Tsunami requires two serial points on the computer when working with a depth sounder (one for the GPS and the other for the depth sounder). The depth sounder serial port must be separate from the GPS serial point.

Starting Out

Before working with the depth sounder, we suggest that you make sure the GPS system is working properly with Tsunami. De-activate the depth sounder by setting the Model to None in the *Depth Sounder Settings* dialog box. Set up the GPS system that you are using and plug the rover receiver into the COM port for the GPS. Go to *Monitor GPS Position* under the *Tsunami* menu. Check that the information being output is correct: Are the latitude and longitude readings what they should be? Are the north and east coordinates aligned to your job coordinate grid? Are the HRMS and VRMS low enough (less than one)? Is the status fixed? If it's autonomous or float, this rover could be having trouble receiving the radio corrections the base receiver should be broadcasting. If everything is working properly, exit the monitor screen and start the depth sounder setup.

Measure the vertical distance from the GPS antenna to the surface of the water. This distance will be called the rod height. Go to the *Configure Tsuanmi->General Settings* window and enter this measurement in the *Rod Height* box.

Plug the depth sounder into the depth sounder COM port on your computer. Go to the *Configure Tsunami->Depth Sounder Settings* window and set the depth sounder Model. Set the rest of these settings as you want them and click *OK*.

Go back to *Monitor GPS Position*. Everything should appear as before, except there should be a new entry called *Depth* and *Elevation* should have changed to *Bottom Elv*. The correct depth should be showing and the *Bottom Elv* should be showing the elevation of the bed.

The usual Tsunami functions will all work with the depth sounder active. The windows for *Monitor*, *Point Store* and *Auto Points at Interval* will display the depth when the depth sounder is set as active.

Equipment

CSI GBX Pro

Hardware Setup

1) Connect the receiver to the antenna by coaxial antenna cable if it is not already connected, and ensure that that the receiver has ample power.

2) Ensure that the antenna is tracking corrections from an MSK Radio Beacon. The easiest way to do this is to use the antenna's automatic frequency scanning when first powering on the receiver

a) To do this, enter the [SETUP] menu, and select the option [AUTO BX SEARCH]

-Note that the beacon automatically selected by this scan will be saved to the receiver's memory and used automatically in the future, until either the scan is executed again, or until a new beacon is specified manually. Thus, it is not necessary to scan each time the bacon is used, provided it is still operating in the same general area.

b) A scan can be performed again in the event that the beacon is lost to scan for the next nearest beacon.

3) Enter the [Setup] menu, then select [Options] then [NMEA ON/OFF]. This menu allows the enabling or disabling of various NMEA messages. The only ones which are necessary are the GGA, GSV and GSA messages. All others should be disabled.

Software Setup

4) In Tsunami, no further setup is necessary to make use of the CSI GBX Pro. Simply use the other Tsunami functions as normal. Note however, that the elevations reported by the CSI GBX Pro are MSL(Mean Sea Level).

Geodimeter

Geodimeter 600 For Remote Mode

Note: Firmware version 696-03.xx or higher is required on the instrument.

SET-UP

1. Connect the instrument to the battery pack. There is no need to connect the keyboard to the battery if it is going to be turned off, or attached to the unit.
2. Connect the prism to the top port of GeoRadio.
3. Connect the bottom port of the GeoRadio to Tsunami. Then turn on the radio.
4. Turn on the Geodimeter. The Geodimeter starts with the screen for leveling the instrument. When the instrument is leveled press [ENT] key to continue to the next step. Now the instrument starts compensator calibration. You can wait for calibration to finish or turn it off. To turn calibration off press on [F] 22, enter 0 for comp. This needs to be done when the instrument is turned on and before [ENT] is pressed.
5. Next Geodimeter will ask for different values for pressure, offset, etc. They can either be left like they are by pressing on [ENT] or they can be changed.

6. Press [F] 79, it is the End of Transfer character, which should be set to 4.
7. To set radio, and station channels, press [MNU], and enter 1 for "Set". After set press 5, which will give the user opportunity to change channel, station, and remote address.
NOTE: The channel, station and remote address on the Geodimeter should match the channel, station and remote address in Tsunami.
8. To set the Geodimeter for remote mode, press on RPU, then 3 for remote and 1 for ok, you can answer [NO] to "Define Window?" If [ENT] is pressed, the instrument will ask "Aim to A Press Ent", for which the user have aim to upper/lower left boundary and press [ENT], for "Aim to B Press Ent", aim to the upper/lower right boundary and press [ENT]. For "Measure ref obj?" press [ENT] if you want a reference object, otherwise press [NO]. Than the instrument is going to say remove keyboard however the keyboard can stay on.
9. After Geodimeter display screen turns itself off, it's ready for Tsunami.

TSUNAMI
1. In Configure Tsunami, under equipment type there should be Geodimeter. In General Settings Baud Rate should be set to 9600.
2. After Configure Tsunami go to Total Station Setup and make sure GeoRadio is checked, and the channel, station and remote address is the same as it is in the total station.
NOTE: We recommend using channel 3.
3. If calibration box is checked the instrument will calibrate, to turn of calibration the box should be unmarked.
4. In setup there is also an option to turn on/off-tracking lights.

Geodimeter 600 For Direct Connection
1. Connect the instrument to the battery pack, and the control unit to Tsunami.
2. Under Tsunami go to Configure Tsunami and place Geodimeter in Equipment type.
3. Click on General Settings make sure that the baud rate is set to 9600.
4. Exit Configure Tsunami.
5. Go to Total Station Setup and check Connect to Station and click OK.
Now you are ready.

Impulse Laser

There are two types of Impulse Lasers from Laser Tech. One has a compass for horizontal angles. The other has only a laser range finder for distance. These are refered to in Tsunami as Impulse 9600 and Impulse 4800 respectively. The default baud rate for the Impulse 9600 is 9600 and the baud rate for the Impulse 4800 is 4800. The baud rate is set in Configure Tsunami. To take a shot with the Impulse, press the button that is closest to you. With the Impulse 4800, Tsunami will prompt for an azimuth after reading the distance.

If you do not get data with the Impulse 4800, make sure that the Impulse is configured for the correct format. To check the format, press the far key twice. The screen should show SYS at the top. Then press the close key. Keep pressing the middle key to view the different settings until you see IP 200 or Cr 400. Tsunami needs Cr 400 format. So if the Impulse reads IP 200, press the near button once.

Leica GPS System 500

Setting Up a 500 Series Receiver

1.) Connect the antenna cable to the ANT Port on the front of the receiver, and to the antenna.
2.) If you are using the PacCrest radio module, screw it in place over Port 1 on the receiver and attach its antenna cable. Otherwise, connect any radio being used to Port 1, 2 or 3.
3.) If an external power source is being used, be sure to plug it into the PWR Port on the front of the receiver.
4.) If external power is not being used, ensure that there are batteries in one or both of the batter slots on the bottom of the receiver.
5.) Plug the 9 pin serial connection cable into the serial port of the computer running Tsunami and into the Terminal Port on the front of the receiver.

Configuring Tsunami for Use With a 500 Series Receiver

1.) Select “Configure Tsunami” from the Tsunami pull-down menu. This will open a new window with several buttons on it, as well as a pull down list labelled “Equipment Type.” Select “Leica 500 Series” in the Equipment Type menu, then select “General Settings.”
2.) Ensure that the COM port is set to the one that the serial cable is plugged into, and that the Baud Rate is 9600, the Char Length 8, the Stop Bits 1, and the Parity None. Close this menu and the Configure Tsunami menu.
3.) In the tsunami pull-down menu, select “GPS Setup.” This will open another menu with several selectable options and several buttons.
4.) Use the radio buttons on the top right to select whether the receiver will be a rover or a base

station. Also be sure to select the antenna types being used from the pulldown menu at left.
5.) Enter the desired Satellite Elevation Cutoff in the text box above the column of buttons. All satellites with elevations less than this number will not be used in position calculation(receiver default is 15).
6.) Select the "Radio Settings" button. This will open another window with several selectable settings. Select the Port number the radio is attached to on the front of the receiver, the baud rate of the radio, number of radio stop bits and radio parity. These last three settings should be listed in the documentation for the radio being used. Also, select the desired format to use for sending and receiving messages from the bottomost option. Exit this menu.
7.) If the GPS receiver is being configured as a base station, select the "Configure Base Station" button from the GPS Setup menu, and proceed with step 8. Otherwise, the receiver is ready for use.
8.) There will now be a menu with a few buttons to select a method of determining the base station's present location. The options are:

> Read From GPS- R ead one or more position readings from the GPS and use this position or the average of several poss itions for the base station corrections.

> Enter Lat/Lon- this option will bring up a menu to enter the exact Latitude, Longitude, and elevation of the receiver's position by hand.

> Enter State Plane Coord- This option will bring up a menu to enter the coordinates of the position of the base station according to the state plane coordinate system.

> Read from File- this option will read a coordinate set from a file already saved to the computer.

Select whichever method will be used, and enter any necessary data. The receiver is now configured and ready for use.

Other Buttons In the Setup Menu:

1.) Power Cycle Receiver- This will shut the receiver down and then power it up again. Used to clear the receiver's memory.
2.) Power off Receiver- Shuts the receiver down. Note that if this button is pressed, any settings changes made while in this menu will not be saved to the receiver.
3.) Send command to receiver- this will allow for sending messages to the receiver. The user must enter the message by hand. This feature is only intended for use in conjunction with the technical support provided with Tsunami.

Troubleshooting the Leica 500 Series in Tsunami

Several possible errors can occur in the course of using a 500 Series Leica receiver with Tsunami. Tsunami will use all its standard error messages to report usual types of error messages, such as an inabilty to communicate with the satellites that are being tracked. In addition, the Leica 500 Series of receivers will have their own set of error messages unique to themselves. This type of error message is reported if there is an error during the transmission of various configuration messages to the receiver to set up the base station settings. Such messages will say "Set Port Message Rejected", or "Set Base Antenna Message Rejected" or "Set Antenna Height Message Rejected" or "Set RTK Message Rejected." Each indicates which particular facet of the configuration failed. If one of these messages is rejected, it is likely a momentary transmission error. If, on the other hand, several (or all) are rejected, it is possible there is a problem in the communication line between the computer and the receiver, which should be checked.

Leica TC Series

Remote Mode

1. Turn on Leica
2. Connect Leica to rover radio, and connect the radio to the larger battery.
3. Connect the base radio to Tsunami, and the smaller battery.
4. In Tsunami go to Configure Tsunami, and under equipment type put Leica TC
5. To make sure the baud rate matches, under Tsunami menu click on General Settings and check if the baud rate is 19200. When Leica is turned on under Main Menu enter 5 for "Configuration", and 2 for "Communication Mode", then enter 1 for "Gsi parameters", and check if the baud rate is also set 19200.
6. Press [F1] for "cont" when done.
7. When back in Communication Mode screen enter 5 for "RCS (Remote) ON/OFF" and make sure it's NOT set for remote mode.
8. In Main Menu press [F6}] for "meas" when ready to measure.
9. In Tsunami go to Total Station Setup and for Connection Mode check remote.
10. When done click on OK.

To put Leica in Tracking: On Gun press "FNC" then ATR+ and LOCk+

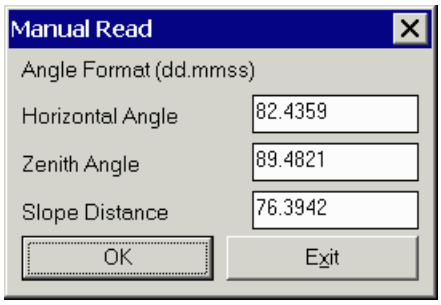
TCA 1800

1. Turn on Leica
2. Connect Leica to Tsunami
3. In Tsunami go to Configure Tsunami, and under equipment type put Leica TC
4. To make sure the baud rate matches, under Tsunami menu click on General Settings and check the baud rate. When Leica is turned on press [F3] for "conf", then enter 3. The baud rate can be changed by pressing [F6] for "list", when done enter [CONT]. In addtion to baud rate parity, char length, and stop bits should also match.

NOTE: Default in Tsunami is not the same as default in Leica.

Manual Total Station

This method allows you to run Tsunami in total station mode without being connected to equipment. The program will prompt you to enter the horizontal angle, zenith angle and slope distance. This method can be used for demonstration purposes or to work with total stations that cannot connect to Tsunami. For these total stations, instead of the automatic connection, you can take a shot, read the instrument and then manually enter the data into Tsunami.

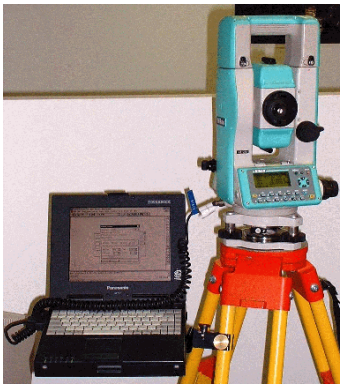


As with other total stations, the first step is to run Total Station Setup to establish the occupied point, backsight and instrument/rod heights before running Tsunami functions. Then in Tsunami functions, when you pick the Read button, the program will bring up a dialog for entering the angles and distance. The angles should be entered in dd.mmss format (degrees.minutes seconds).

Nikon Total Stations

Nikon A-Series includes the A5LG/A5, A10LG/A10 and A20LG/A20. Also the C-100 and D-50 have the same communication as the A-Series and should be used in the SET mode.

Nikon 500 Setup



1. Turn on Nikon
2. Turn it Horizontally and Vertically to set it.
3. Connect Nikon to Tsunami

NOTE: 9-pin serial cable from Nikon to Tsunami should be NGT type and not SOKTOP.

4. In Tsunami go to Configure Tsunami, and under equipment type put Nikon 300,400,500 series.
5. To make sure the baud rate matches, under Tsunami menu click on General Settings and check the baud rate. On Nikon press [MENU], then 3 for “sett”, and 6 for “comm”. The baud rate can be changed using the arrow keys.
6. Exit the Configure Tsunami menu.
7. To check if units (Ft /M) matches for correct results, in Tsunami under Inq-Set go to Drawing Setup and select the appropriate button. On Nikon, press [MENU] and 3 for “sett” again, but now press 5 for “unit”.

Simulation (GPS)

Simulation GPS mode is for demonstration purposes to show or pratice Tsunami functions. This mode allows you to run Tsunami without being hooked up to any equipment. The program will automatically generate a position. This position is the first point in the alignment. If there is no alignment, then the starting point is 5000,5000,1000. There are keyboard commands to control the simulation position during continuous read commands such as Stakeout and Track Position. Here are the keyboard commands:

L - Turn Left
R - Turn Right
F - Go Faster
S - Slow Down
U - Up
D - Down
W - Switch Direction

Sokkia

Sokkia Radian IS

Hardware Setup

1) Make sure that the Radian IS has fully charged batteries installed, as described in the receiver documentation.
2) Connect the Radian IS serial cable to “COM1” on the Radian IS, plugging the other end into the controlling computer’s serial port.
3) If the Radian IS is to be used as a base, connect a PDL base radio to the “COM2” port of the receiver. If the IS is to be used as a rover, connect a PDL rover radio to the “COM2” port if the receiver.
4) Power the Radian IS on with its external power switch.
5) Once the receiver finishes its self-initialization (when all the lights on the side panel go out and then the battery light lights in just one position), it is ready for use with Tsunami. However, positions will not be able to be logged until the receiver has acquired a few satellites. The receiver has enough satellites when the center light is at the second or higher level (when it is orange instead of red).

Software Setup

6) To configure the IS for use, select “GPS Setup” from the Tsunami pull-down menu. This will open a menu with several options:
a) Radio Baud Rate- This radio button sets the baud rate for COM2, the radio COM port. Make sure this number and the number the PDL’s are set for is the same.
b) Station Type-This sets whether the Radian IS is to be configured as a base station or a rover.
c) Elevation Type-This allows selection of Geoid (MSL) or Ellipsoidal measures for height/altitude.
d) RTK Dynamics- This sets the dynamics mode of the receiver. In general, this setting should be

set to “Dynamic/Kinematic”
e) Message Type-sets what format of corrections this receiver will send/receive for RTK.
f) Motion Dynamics-Used to set the receiver’s calculations appropriate to the motion of the receiver.
g) Elevation Mask-This is the satellite elevation cutoff. No satellites with elevation less than this number will be used in corrections. This allows filtering out of satellites close to the horizon, which provide less accurate calculations for positions.
h) Send Command to Receiver- Allows a specific user-entered command to be sent to the receiver. Mostly used for troubleshooting with Technical support.
i) Configure Base- Configures the parameters of a base station for the receiver (Ex: Current position, etc.)
j) Power Cycle Receiver- powers the receiver down and then turns it back on, clearing the main memory.
k) Save and Exit-save all settings changes and exit this menu.
l) Cancel-Restore original settings and exit this menu.

To set the Radian IS up as a Rover:
7) Select “Rover” for Station Type, and set the Radio Baud to match the PDL’s which are being used. Also, set “RTK Dynamics” to “Dynamic/Kinematic”, and set Motion Dynamics to the appropriate option.
8) Select “Exit and Save”. The receiver is now ready for use as a rover.

To set the Radian IS up as a Base:
7) Select “Base” for station type, and set the Radio Baud to math the PDL’s which are being used. For most jobs, set RTK Dynamics to “Dynamic/Kinematic” (unless you are *sure* that static is more appropriate-even small fluctuations from wind on the pole can cause problems in Static mode). Set motion dynamics to Foot/Walking, and then select “Configure Base Station”
9) In the menu dialog that opens, there are a few buttons:
a) Read from GPS-Read a position from the GPS and fix to that position
b) Enter Lat/Lon-Fix to a manually entered Lat/Lon position
c) Enter State Plane Coord- Fix to a manually entered State Plane Northing/Easting position
d) Read From File- Fix to a position read from a *.ref file.
e) Cancel-Cancel base setup
If Read From GPS is selected, the software will read once from the GPS receiver, and then fix to that position. If Enter Lat/Lon is selected, a dialog box will open and a Latitude and Longitude must be input manually. If Enter State Plane Coord is selected, a dialog box will open allowing the input of a set of Northing/Easting coordinates by hand. Read from File will open a File->Open dialog and ask for the file name of the file to open.

Regardless of which option is selected, after the position is determined, this position will be displayed, and dialog boxes will open to enter a station id and the measured base antenna height. Once these values are entered, base setup is complete and the “Exit and Save” button can be selected to exit the GPS Setup menu.

Sokkia 500 Series

1) Turn on Sokkia
2) Turn it Horizontally and Vertically to set it.
3) Connect Sokkia to Tsunami
4) In Tsunami go to Configure Tsunami, and under equipment type put Sokkia
5) To make sure the baud rate matches, under Tsunami menu click on General Settings and check the baud rate. On Sokkia press [ESC], then [CNFG]. Scroll down or enter 4 for "Comms setup." The baud rate can be changed using the arrow keys, when done press [ESC].
6) Exit the Configure Tsunami menu.
7) To check if units (Ft /M) matches for correct results, in Tsunami under Inq-Set go to Drawing Setup and select the appropriate button. On Sokkia, in [CNFG] scroll to or enter 5 for "unit" and select appropriate unit using the arrow keys.

Topcon Total Stations

The Topcon instrument must have CR/LF (carriage return/linefeed) turned on for communication with Tsunami.

To set this with 200 series:

1. Turn instrument off
2. Turn instrument on while holding F2 key
3. Choose F3 (Others set)
4. Press F4 (Page down)
5. Choose F3 (CR/LF) and set it on

To set this with 700 series:

1. Choose Parameter from the main screen
2. Scroll down until you find CR/LF and set it on

Topcon GTS-700

To set the instrument to work with Tsunami, press [F2] for "std" on the instrument.

Topcon 800-A Remote Setup

Topcon Setup:
1. Turn on the Topcon
2. Connect the Topcon to one of the radios, and the other radio connect to Tsunami
3. Under Tsunami menu go to Configure Tsunami, and under equipment type select Topcon800A-Remote.
4. To set Topcon for external mode Press [F1] for "prog", then [F6] for

"more". This will lead to more programs. Enter [F2] for "Ext.Link."
5. To select the radio channel, in External Link enter 2 for "settings" and 4 for "parameter (radio modem)", then 3 for "set channel". Using the arrow keys change the channel. When done press for [F1] for set, then press [ESC] until get back to External Link Menu.
NOTE: Channel on the Topcon should match the channel set in Tsunami.
6. After channel is set press 1 for "Execute"
7. Topcon is ready.

NOTE: If the batteries are low either in Topcon or the radios, communication problems will arise.

Tsunami Setup:
1. In Configure Tsunami, under equipment type there should be Topcon800A-remote. In General Settings Baud Rate should be set to 9600.
2. After Configure Tsunami go to Total Station Setup and make sure the radio channel or radio frequency matches the channel and frequency in Tsunami. Press Ok when done.

Topcon 800A Quick Lock
1. Dismount the handle from the Topcon, and mount RC-2H. Secure it with the fixing screw.
2. Attach RC-2R to the prism, and turn it on.
3. Using the Y cable attach the RC-2H to the radio and Tsunami.
4. In Joystick click on Quick Lock and Topcon will do angle turn until it finds a prism in which it will lock to, and will start tracking.
5. If RC-2H is not attached to the radio with Y cable, when Quick Lock is pressed the big yellow button on RC-2H needs to be pressed in order for the Topcon to search for the prism.

Trimble

Trimble NT300D
1) In order to properly configure the NT300D to work with Tsunami, it must first be powered up in Setup mode (by holding down the [Setup] button on the front panel of the receiver while powering it on) so that the advanced setup options are available. Once the NT300D is powered up in this mode, bring up the Setup menu via the [Setup] button. Page down using the *More* menu option until the *I/O* menu item is available, and select it.
a. In the I/O menu, select whichever port is to be used to interface the receiver with the computer running Tsunami (Port 1 by default). Next, set both the input and the output to transmit/receive in *NMEA*, at *9600* baud rate. The final option, Remote Select, should be set to *Primary*.
b. Now the NMEA sentences must be configured. From the I/O menu, enter the *NMEA Sentences* submenu. Disable all sentences, save for the *GGA* sentences and the *GSA* sentences. Ensure the Talker ID is *GP*. From here, *Return* to the I/O menu.
c. The *NMEA Control* menu item, reachable from the I/O menu, has three options. The Output Rate here should be set to *1 second*, the Position Output Rate set to *Output Rate*, and the

NMEA Output Version to *2.1*.
Next, the GPS settings must be configured, and can be found in the *GPS* menu under the main *Setup* menu.
The GPS Mode should be set to *3D*, and the DGPS mode set to *Auto*. The DGPS source should be toggled to *Internal*, and the Pos/Vel Filter should be *Off*. Mask Values should be left at *Default*, and the SNR at *M*.
Finally, the Beacon Receiver configuration (under *Beacon Receiver* on the Setup Menu) needs to have its Search Mode set to *Auto-Dist* Mode. All other values in all menus ought to either be left at their default settings, or configured as necessary to the local conditions (in the case of antenna height, etc.).

2) The RMS value reported in Tsunami is the RMS value of the standard deviation of the range inputs to the navigation process including pseudoranges and DGPS corrections.

The NT300D is now properly configured, and if connected to a computer running Tsunami, will transmit position fix data to the computer automatically. Before using it, however, it is best to power it down and then turn it back on normally, as running it in Setup Mode is not recommended.

Trimble 4000 Series
Hardware Setup:
1. Setup the antenna and GPS receiver as normal. The radio should be on I/O Port 2.
2. Connect the Computer that Tsunami is running on to I/O Port 1 by the appropriate cable.
Front-Panel Configuration:
Base Station:
1. After powering on the receiver, press the [Control] Button. From the selections available, select **MORE**. This will bring up a second page of options. Select **MORE** again. The front panel screen should now be on **RECEIVER CONTROL** "3 of 7".
2. Select **BAUD RATE/FORMAT**, and from the menu that this creates, select **SERIAL PORT 1 SETTINGS**.
3. Ensure that the port is set to 38400 baud, 8-Odd-1 Format, with no flow control.
4. Similarly, make sure that the settings for I/O Port 2 agree with those of the type of radio being used (typically 9600 8-None-1).
5. Return to the **RECEIVER CONTROL** menu, and go to page 4 o 7. Select **REFERENCE POSITION**.
6. Enter the Lat/Lon of the position the base is located at. Alternately, select **HERE** to have the GPS unit read the current position and use that as the base reference point.
7. On page 1 of the **RECEIVER CONTROL** menu, select **RTK OUTPUT CONTROL**.
8. Set the **RTK OUTPUTS** to Port 2, and the **ANTENNA HEIGHT** to the measured height of the antenna.
9. Ensure that all other forms of output (Cycled Output, 1PPS output, Event Markers, etc.) are disable. These options may all be accessed with the submenus accessible through the [Control] button.
10. Ensure that the Synch time of the Rover and Base are the same. This setting may be accessed by first pressing [Control] and then cycling through the menus until the **MASKS/SYNCH TIME** option is available

Rover Station:
1. After powering on the receiver, press the [Control] Button. From the selections available, select **MORE**. This will bring up a second page of options. Select **MORE** again. The front panel screen should now be on **RECEIVER CONTROL** "3 of 7".
2. Select **BAUD RATE/FORMAT**, and from the menu that this creates, select **SERIAL PORT 1 SETTINGS**.
3. Ensure that the port is set to 38400 baud, 8-Odd-1 Format, with no flow control.
4. Similarly, make sure that the settings for I/O Port 2 agree with those of the type of radio being used (typically 9600 8-None-1).
5. Return to the **RECEIVER CONTROL** menus, and go to page 2.
6. Select **RTK ROVER CONTROL**.
7. Toggle the **ENABLE** setting to **L1/L2**.
8. Push the [Status] button, and select **POSITION**. There should now be an **RTK** option. Select it. This will bring up a screen displaying delta Northing/Easting, correction status, etc.
9. Ensure that the **STATIC** option appears at the right. This means you are in kinematic/rover mode. If instead the **ROVE** option is available, select it.
10. Ensure that all other forms of output (Cycled Output, 1PPS output, Event Markers, etc.) are disable. These options may all be accessed with the submenus accessible through the [Control] button.
11. Ensure that the Synch time of the Rover and Base are the same. This setting may be accessed by first pressing [Control] and then cycling through the menus until the **MASKS/SYNCH TIME** option is available.

Trimble 4700/4800
Hardware and Equipment:
1. Make sure that the computer's serial port is connected to the 4700/4800 in it's COM1 port (typically the port that a data collector is normally plugged into). Power should be supplied on COM2, and any radio used for RTK should be plugged into COM3.
2. All other equipment (antenna, wires, etc.) should be set up as normally directed by the manuals.

Software Configuration:
1. After selecting the Trimble 4700 equipment type from the "configure tsunami" menu, open up "GPS Setup." This should bring up a new window/dialog box with the following options:
a. Receiver Type- Select whether you are using a 4700 or 4800 receiver.
b. Station Type- Choose what type of RTK station you are setting this receiver up as- a base or rover.
c. RTK Correction type- Select the type of Corrections you would like a base station to transmit. Note that CMR messages should be used for most precision applications, as RTCM is only capable of producing less-accurate floating precision positions
d. Radio Baud Rate- The baud rate of the radio port. This should be left at the default setting of 9600 in general
e. Satellite Elevation Cutoff- All satellites with elevation from the horizon of less than this numeber will *not* be used in calculating a position. This allows less accurate low elevation satellite to be factored out of a position.
f. Configure Base Station- Will configure the receiver to act as a base. See "Configuring the Base

Station" below.
g. Cancel without saving- will exit this menu without saving any changes that have been made.
h. Save and Exit- Will save these settings to the reciever and to Tsunami's setup and exit out of this menu.

Configuring Rover:
No real configuration is necessary, aside from setting up the equipment and setting the appropriate Receiver Type, Station Type, and Satellite Elevation Cutoff.

Configuring Base Station:
1. After selecting all the appropriate settings in "Configure GPS," click on the "Configure Base Station" button.
2. In the menu dialog that opens, there are a few buttons:
a. Read from GPS-Read a position from the GPS and fix to that position
b. Enter Lat/Lon-Fix to a manually entered Lat/Lon position
c. Enter State Plane Coord- Fix to a manually entered State Plane Northing/Easting position
d. Read From File- Fix to a position read from a *.ref file.
e. Cancel-Cancel base setup
If Read From GPS is selected, the software will read once from the GPS receiver, and then fix to that position. If Enter Lat/Lon is selected, a dialog box will open and a Latitude and Longitude must be input manually. If Enter State Plane Coord is selected, a dialog box will open allowing the input of a set of Northing/Easting coordinates by hand. Read from File will open a File->Open dialog and ask for a file name of a reference file (*.REF) to open for use in corrections.

Regardless of which option is selected, after the position is determined, this position will be displayed, and dialog boxes will open to enter a station id(used by the base to identify iteself to the rover(s)) and the measured base antenna height. Once these values are entered, base setup is complete and the "Exit and Save" button can be selected to exit the GPS Setup menu. At this point, whenever looking at a menu that displays the connection status, "REFERENCE" will be displayed, instead of Float, Fixed, or Autonomous.