MicroSurvey Layout v1.0.6 (7/19/2013)

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        - A searchable "Helpdesk" section with general user instructions and information about the Software.
        - A link to allow end users of the Software to download any bug fixes, error corrections or other updates to the Software that MICROSURVEY may make available through the Site.
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MicroSurvey Software Technical Support is available to help you get the most out of your MicroSurvey program. The following information explains how to prepare for your call so that your inquiry can be answered promptly and accurately.

Please prepare yourself before you call for Technical Support

Take a few minutes before you place your call to check the printed documentation and the online help files to see if the answer is already at your disposal. Our Web site on the Internet can also save time. Please check it for assistance if you can. Please have the following information available if requested: Hardware model, version of the program, and your Technical Support Number.

Please make sure that you have all the steps you completed prior to your problem and can explain them to the technical support representative. We may ask that you forward a copy of your data to us if we cannot find the problem immediately.

MicroSurvey offers a 90-day complimentary support period to all of our registered users, starting the date of purchase. Introductory support is available weekdays between 8:00 am and 5:00 pm (Pacific Time) excluding holidays.

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For clients who have had their original 90-day complimentary support period expire and feel that they will need on going support over the next year, we have a Yearly Support Contact option available. This gives you the ability to contact us for technical support, as much as you require, and you pay a flat fee once a year. This option is not to be used in place of training but is to assist you on the occasions when you really need it. The charge for the Yearly Support Contract is to be billed and paid for prior to the support commencing. This rate is subject to change, call for current rates.

Electronic Support

MicroSurvey maintains and provides at no charge, our Internet Web site at the following address: www.microsurvey.com

This web site has sections on frequently asked questions, Technical Notes, Technical Specifications, and as required, free updates and program fixes, along with a lot of other helpful information.

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MicroSurvey Software Inc. can provide training to you, in your office or in a classroom situation (where facilities and numbers allow. MicroSurvey has training staff that will travel to almost anywhere and provide you with the professional skills you require to operate your MicroSurvey program. Please feel free to call and ask for a quotation or inquire about potential classroom situations. Your local

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GETTING STARTED

Getting Started

Introduction

MicroSurvey Layout was designed specifically for construction and layout contractors to provide unequaled data collection simplicity and field calculating performance.

Layout takes advantage of the touch screen capability by allowing you to tap points and lines in your drawing to open toolbars with all the function you need instantly. Functions that are not available directly from the Layout graphics display are available from a simple main menu which is organized by task. Please spend some time looking over this document to become familiar with the functionality of Layout.

Layout was built for MicroSurvey's latest data collector and total station models. Instrument control using the touch-screen is easy to use and very powerful. Access to your instrument controls is available on the main interface at all times so there is no need to swap to other screens or menus.

A graphical interface is the heart of Layout; it helps you see your project in real-time as it is being created. You can quickly visually inspect the data you've gathered and be confident that you have all you need before leaving the site.

Exchange your projects seamlessly between Layout on your data collector and MicroSurvey Point Prep on your desktop or laptop, for easy preparation or review of your data. Or, easily transfer your data to other software packages using the industry-standard ASCII and DXF formats.

As always, MicroSurvey welcomes your comments and suggestions for our products.

Hardware Requirements

Layout may be installed on the following Windows CE, PocketPC, and Windows Mobile devices.

Layout may also be installed on any Desktop, Laptop, or Tablet PC running Windows XP SP3, Windows Vista SP2, or Windows 7.

- **Juniper Systems Allegro MX** - Layout installs to secure RAM by default.
- **Juniper Systems Archer** - Layout installs to secure RAM by default.
- **Juniper Systems Mesa** - Layout installs to secure RAM by default.
- **Nautiz X7** - Layout installs to secure RAM by default.
- **Algiz 7** - Layout installs to secure RAM by default.

- **Leica iCON CC50** - Layout installs to secure RAM by default; a storage card is not necessary for persistent storage.
- **Leica iCON CC 60/61** - Layout installs to secure RAM by default.
- **Leica TS15, CS10 and CS15** - Layout installs to secure RAM by default; a storage card is not necessary for persistent storage.
- **Windows Mobile 6 Devices** - Layout is compatible with most devices running WM6 and installs to secure RAM by default.

Call MicroSurvey at 800-668-3312 or check our web site at www.microsurvey.com if your device is not listed here.

Installing Layout

If you purchased a new data collector with Layout from MicroSurvey then Layout comes pre-loaded on it.

If you are installing Layout yourself onto an existing data collector, the first thing is to confirm that your hardware is supported by Layout. If you're reading this topic then you probably already know if Layout will run on your data collector. If you're not sure, you can refer to the hardware requirements topic or call our technical support department.

To install onto your data collector you need to make sure you have a Microsoft ActiveSync or Windows Mobile Device Center connection established between your computer and your data collector.

There are two ways that you can install Layout onto your device: it can be installed from the CD that came with your purchase, or it can be downloaded from our website at www.microsurvey.com.

Starting Layout

During install, shortcuts are created and will be located in either your Start Menu, or Start Menu | Programs, or directly on your desktop. Simply press the shortcut to start the program.

Auto Repair

Upon startup Layout checks the registry for corruption, and also checks to make sure important system files are where they need to be for Layout to run properly. If it detects any problems, it will automatically fix them for you.

Hard Reset or Battery Drain

In these scenarios with other software, you would usually have to re-install your software. However, because Layout can repair itself all you need to do is use the File Explorer or My Computer program

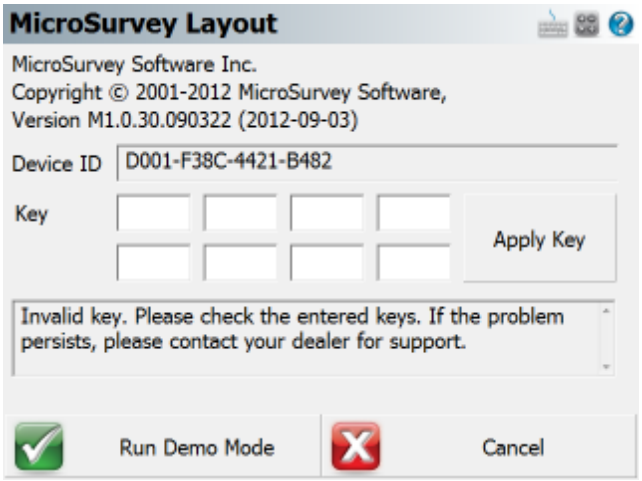
on your data collector to browse to where Layout is installed and find the programs folder. In there, if you run the "splash" program it will automatically fix all problems and re-install your shortcuts for you.

The splash program will be an executable file and it will include the word "splash" in it. For example on the Archer, the file is called **SplashPPC.exe**.

Registration & Demo Mode

Main Menu | About

When you start Layout for the first time you will see the registration screen which will list the machine ID. This ID is unique for each device that Layout is installed on.



Activation

To activate Layout you need access to the Internet. With your purchase you should have received a GUID (Serial Number) that you will need along with the Device ID generated by Layout.

A typical serial number will look something like the following:

D9C83164-FB0E-4713-B457-CE593EFEA296

A typical device id will look something like the following:

F008-F38C-4421-B482

Step 1

From a computer that has access to the internet, please visit the following web page:

www.microsurvey.com/register

Follow the instructions on the Layout registration pages.

NOTE: Your serial number is valid for only one activation.

Step 2

Using the Key generated by the online registration system, enter the key values into Layout.

When done, press the Apply Key. You will see the words "Activation Key Valid". The **Run Demo Mode** button will also change to say **Continue**.

More Help or Purchase

HELP: For online help, click here.

To purchase Layout please call MicroSurvey at 800-668-3312.

Available Modules

- **Standard** - Real-time Automated Linework, COGO Calculations, Traverse Closure and Adjustments, ASCII/DXF Import/Export, MicroSurvey Exchange, and more!
- **Total Station** - Adds non-robotic total station control.
- **GNSS** - adds RTK GNSS (GPS and Glonass) control, Coordinate Calculator, Helmerts' Transformations.
- **Robotic** - adds Robotic Total Station control.

Run Demo Mode

To run Layout in demo mode press the **Run Demo Mode** button.

Retrieve Lost Key Codes (passwords)

The key code that was generated for a serial number can be accessed from the online registration page (www.microsurvey.com/register). Just enter the serial number you which to retrieve the key code for and the key code and the device id it is assigned to will be displayed.

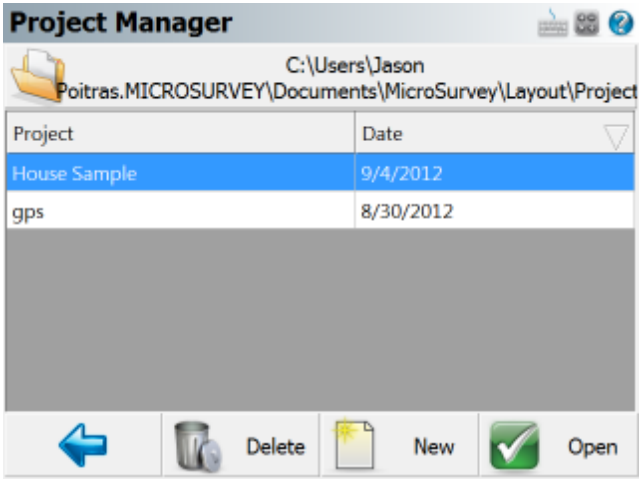
Technical Support

If you need help with Layout please contact Technical Support.

Project Manager

Main Menu | Project | Project Manager

The Project Manager is used to create, open, or delete projects currently residing in your data collector. When you start Layout this is always the first screen you will see.



By default the project manager will display the contents of the ...\MicroSurvey\Layout\Projects\ directory, which is the default location for all projects that you create. You can sort the list by project name or date by tapping on the column's header.

Projects Folder

Press this button to specify a different project folder than the default. The default is..-.\MicroSurvey\Layout\Projects\. Once you set the directory it is written to the msurvey.ini file so it is used for all subsequent projects.

Open Project

To open an existing project, simply select it in the list and press the **Open** button.

New Project

To create a new project, simply press the **New** button. You will then see the new project screen which will allow you to enter a name, and set the units for the project.

Delete Project

To delete a project you first need to select it in the list and then press the **Delete** button. You will be asked to confirm that you really want to delete the project.

> **Notes:**
> • You can not delete a project that is currently open.
> • Projects that have been deleted can not be restored.

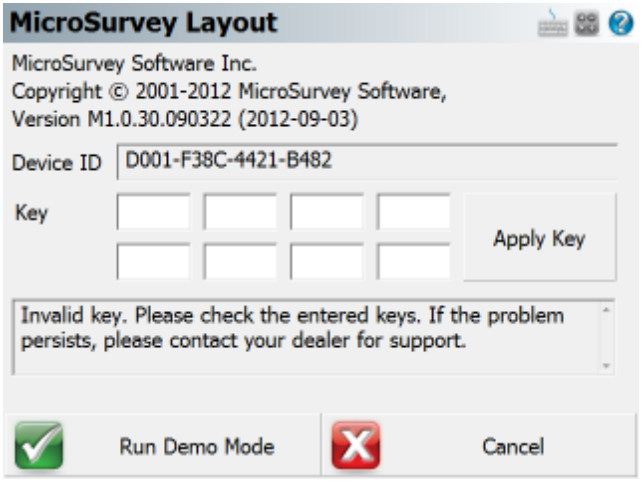
Exit

To exit from the project manager press the **Back Arrow** button.

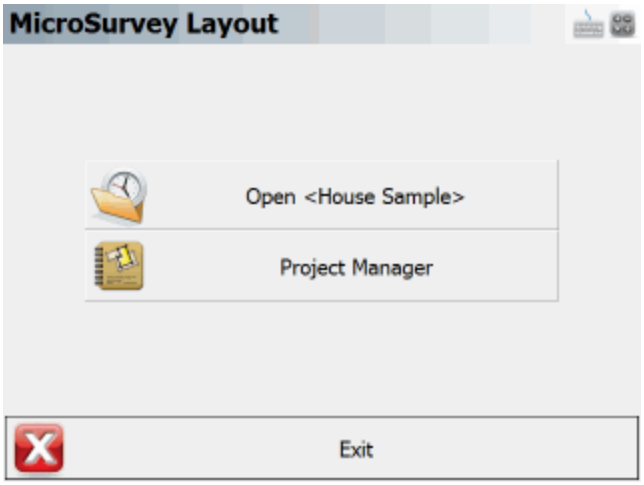
Quick Start: Open Existing Project

Start Layout by running the icon contained either in your Start Menu or on the Desktop of your data collector.

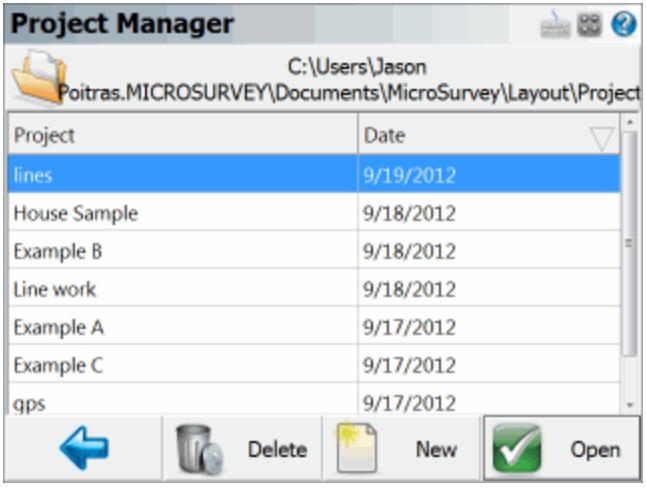
If you start Layout in demo mode, the first screen you will see is the About screen, where you can enter a registration code to license your copy of Layout. Press the **Run Demo Mode** button if you see this screen.



You can then immediately open the most recently used project or you can access the Project Manager which allows you to open a new or existing project.

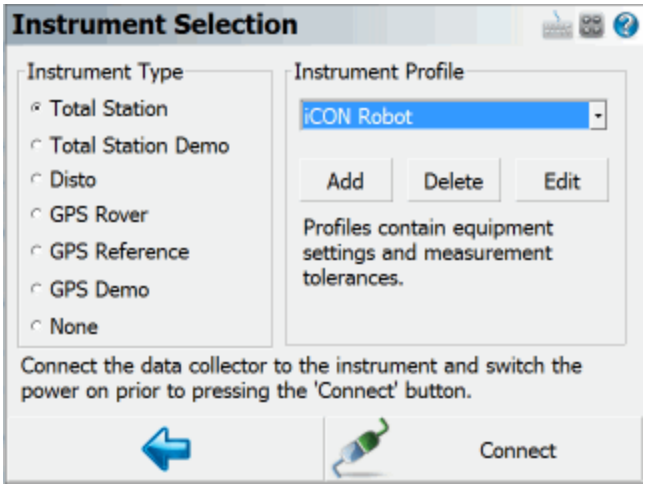


By default a project named House Sample is installed. For this example let's open it by highlighting it and pressing the **Open** button. You can also double tap the file name which will also open it.

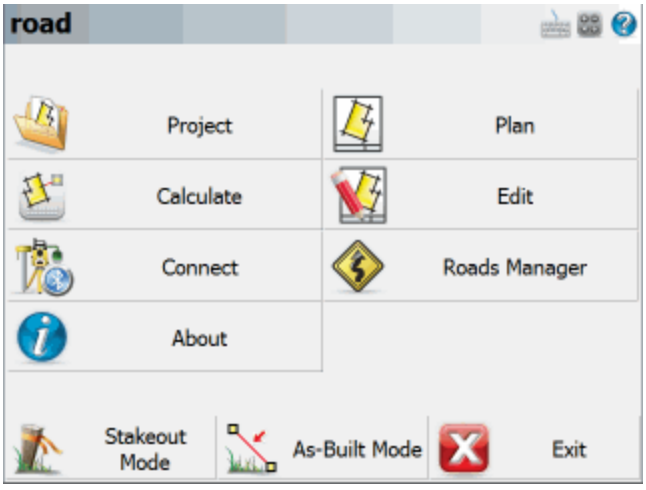


Layoutwill then check to see if the project has a previous instrument setup. If one is found you will be asked if you would like to reuse it.

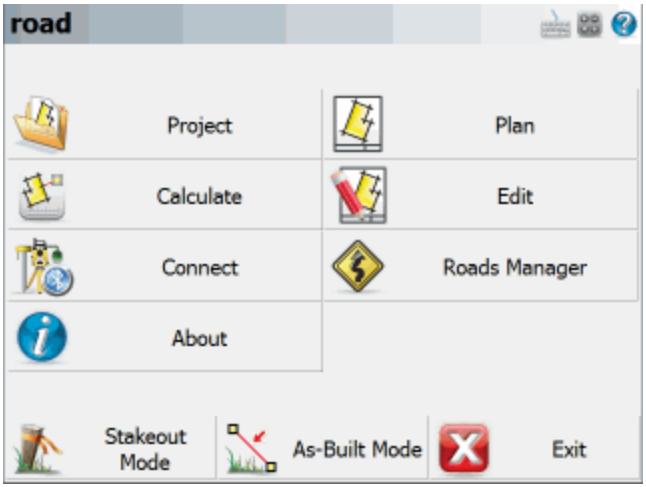
You are then prompted to select the instrument that you want to connect to. Let's set it to and press **Connect** to continue. (Note, you will not see this screen if Layout is running onboard your instrument.)



The main menu will then be displayed. Press the **Go to work...** button to access the map screen, or use any of the available menu commands.



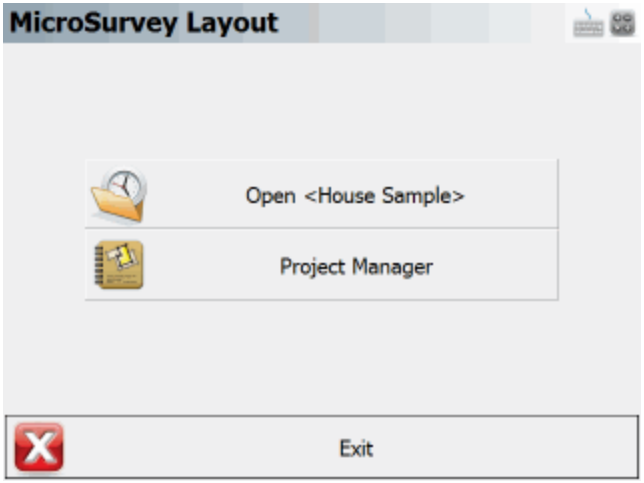
The Map screen will then be displayed. You should now see your project, here is what the House Sample project should look like:



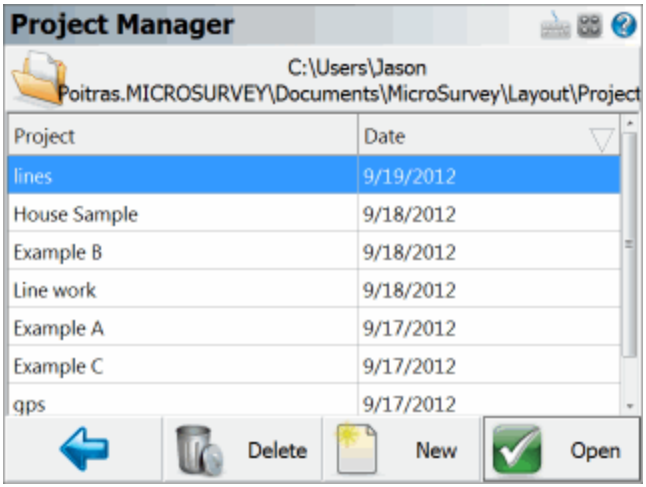
Quick Start: New Project

Start Layout by running the icon contained either in your Start Menu or on the Desktop of your data collector.

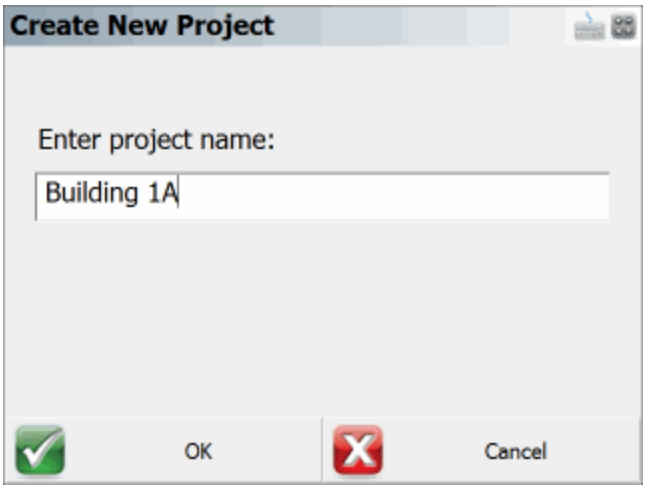
When you start Layout in demo mode the first screen is the About screen, where you can enter a registration code to license your copy of Layout. Press the **Run Demo Mode** button if you see this screen.



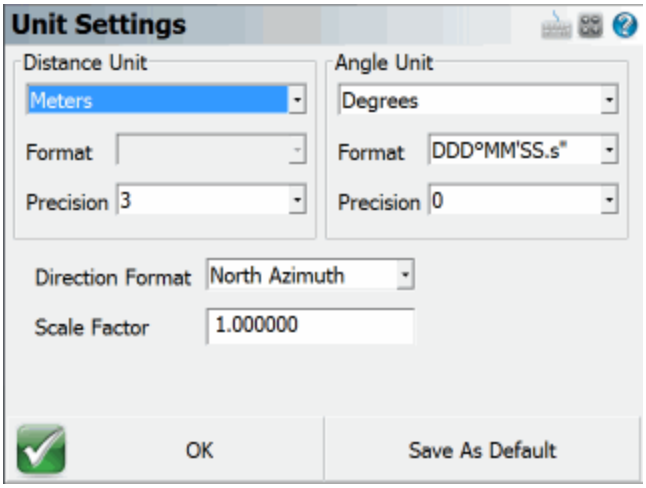
Press the **New** button to create a new project.



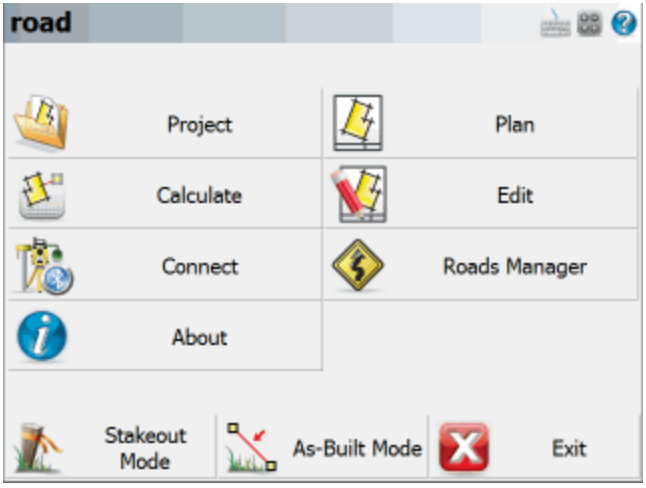
You will then have to enter a name for your new project, then press **OK** to continue.



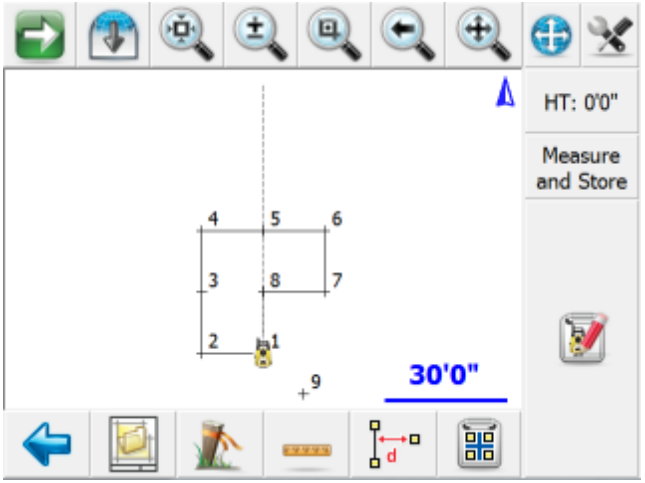
Now the Unit Settings screen will appear allowing you to specify the units for your project. Set them as desired, then press the **Save As Default Settings** button to remember these settings for all subsequent new projects, then press **OK**.



You will then see the Main Menu for your new project.



Press the Stakeout Mode or Linework Mode buttons to access the map screen.



Stakeout Mode

When you chose to use Layout in Stakeout mode, specific functions and tools will be loaded for you automatically that will aid you with stakeout tasks. You can enable Stakeout Mode by selecting it from the Main Menu.

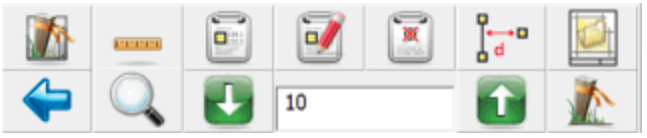
Figure Toolbar

The following toolbar will be loaded when you click on a figure.

Please review the Line Toolbar topic for more details.

Point Toolbar

The following toolbar will be loaded when you click on a point.



Please review the Point Toolbar topic for more details.

Stakeout Mode Toolbar

In the map screen you will see the following toolbar which contains tools used most often during stakeout procedures.

Main Menu Button

This button takes you into the Main Menu.

Plan Builder

Use this tool to quickly enter and draw a plan. Please review the Plan Builder topic for more details.

Staking Menu

Use this to display a menu with staking options. Please review the Staking Menu topic for more details.

Calculate Length

Use this to calculate the length of a line or arc. Please review the Calculate Length topic for more details.

Offset Tool

Use this to offset points from lines or arcs. Please review the Offset Tool topic for more details.

Point Patterns

Use this to create point patterns for stakeout. Please review the Point Pattern topic for more details.

As-built Mode

When you choose As-Built Mode from the Main Menu Layout will load toolbars and tools to help you generate as-built data as you survey.

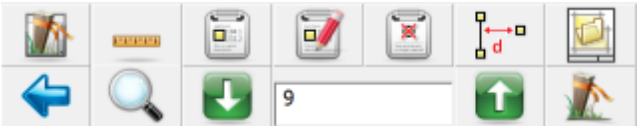
Figure Toolbar

The following toolbar will be loaded when you click on a figure.

Please review the Line Toolbar topic for more details.

Point Toolbar

The following toolbar will be loaded when you click on a point.



Please review the Point Toolbar topic for more details.

Linework Toolbar

The following toolbar will be available along the bottom of the map screen.

The Linework ModeToolbar is used to help automate linework as well as show you the description and next point number for your shot. With Layout you can control your linework by tuning on and off the line, arc and curvy toggles as you measure.

Please review the Active Linework topic for more detailed information regarding linework generation.

Main Menu Button

This button takes you into the Main Menu.

Draw Lines Button

This is used to toggle on and off the draw lines function. When turned on points will be connected with a line as you measure them.

Draw Curvy Lines Button

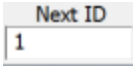
This is used to toggle on and off the draw curvy lines button. This function will draw a best-fit curve through your points as you shoot them.

Draw 3-Point Arc Button

3-Point arcs can be started using the same method as for a Line or Curvy Line.

However, to switch to 3-Point arc within an ongoing Line, select the **Draw 3-Point Arc** button before shooting the second of the three points that will define the arc (POC: Point on Curve). (Note that this is not the radius point). After measuring to the 2nd point, a dashed line will appear to illustrate that a 3-Point arc is in progress. Shoot the 3rd point and the arc will appear. The current draw option will change from Draw 3-Pt Arc to Draw Line after the third shot and the arc is complete.

Compound 3-point arcs are supported. Simply re-select the **3-Point Arc** button before measuring the next POC.



Next ID Field

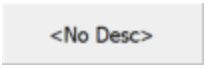
This field displays the point number that will be assigned to your next shot. You can change it at any time prior to recording your shot. In a new project this field will always start at 1. If you open an existing project, then we scan the raw file for the last sideshot or store point and if we find one, we'll set the point number accordingly. For example, if the last sideshot in the raw file was to point 58, then the next time the project is setup we will set the next id to 59.

Active Line List Button

Much like the first line in the project, just select the desired description from the list and select the desired draw option before shooting the first point for the new line. When you press the button a screen will appear listing all your active lines. Selecting one of them and pressing the **OK** button will make it the current line.

The key to note is the display of <Start line> in the Active Lines list. Once the first point for the new line has been measured, the Active Lines list will set and display the new line as current.

To change the current line, simply select the desired line from the Active Lines list and continue taking shots to add to the selected line. All settings are stored for each line so there is no need to re-select the Description or draw option.



Description Selection Button

Use this button to set the current description that will be used when you shoot your points. When you press the description button you will see a screen listing all the descriptions read in from your AutoMap Library. Select the description you want to use and press the OK button. You can type in the letters of the description which will automatically scroll to the descriptions matching your entry.

Common Layout Buttons

The Layout interface has a consistent structure and to use it effectively the user needs to become familiar with several commonly used buttons.

Clicking on this button will open up the keypad.

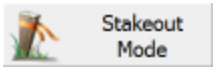
Clicking on this button will open up the Windows Start Menu. Available on Pocket PC and Windows Mobile devices only.

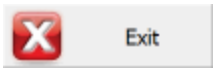
Clicking on this button will open up the RPN Calculator.

Clicking on this button will open up the help page for whatever topic you are currently at. The help page will open up in an Internet Explorer window.

This button will take you back to the main menu.

This button will take you back to the map screen.





This button will save your project and close Layout.

This button will accept the changes you've made and will return you to the previous screen.

This button will close the current screen and return you to the previous screen without saving any changes.

Pressing this will close the currently open toolbar and return you to the previous screen.

Pressing this will open the Point Chooser toolbar.

Layout Project Files

Every Layout project will contain usually 7 files, but may contain more depending on what files you've exported or copied to the directory. Typically you will see that the file names will begin with the name of your project.

Filename.cdx	This is the index for the database file.
Filename.dbf	This is the database file that contains your coordinate information.
Filename.ini	This file contains information pertinent to your project.
Filename.raw	This is the raw file that contains your observations.
Filename_figures.dbf	This is the database for your figures in your project.
Filename_figures.cdx	This is the index file for the figures database.
Filename_automap.csv	This is the Automap Library for your project.

When you create a new project, the project name that you use will become the "folder" for your project files. By default, your project will be stored in the ...\MicroSurvey\Layout\Projects\ directory.

> **Note:**
> After creating a new project, do not later rename the folder containing your project's files or the actual files, doing so will cause Layout to not recognize the folder as a valid project and you will not be able to open it.

Automatic Save

There are a few things to keep in mind when manually entering data in Layout:

All stored data is automatically saved. There is no need for a Save function. Always close the program by going to the Main Menu and choose the Exit button to prevent loss of measurement data.

Input fields that are left blank are stored as undefined. For example, if you enter only a horizontal coordinate for a point and leave the elevation field blank, we do not automatically set the elevation as 0.000. The elevation remains undefined.

Data Entry (Extended Edit Fields)

Throughout Layout you will see edit fields for entering various values. These types of fields are called Extended Edit Fields, and can be used not only for typing values, but can also launch related commands such as the keypad, calculator, point chooser, inverse tool, etc. This type of functionality is unique to Layout.

Text Entry

For most text entry fields in the program, tapping in it will open up the keypad.

Points

When you see an extended edit field for a point id, tapping in it will open the point chooser toolbar.

Distance and Angles

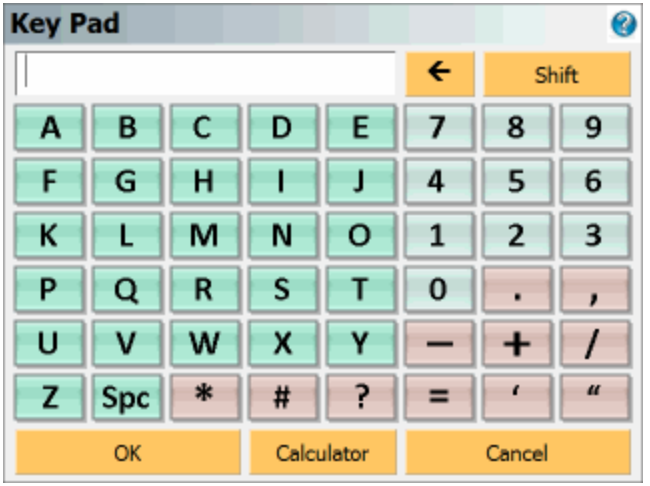
Tapping in other numeric fields such as those for directions and distances will open the RPN Calculator, and some distance fields will open the Inverse tool.

Multi-function Fields

Some fields will display a pop up menu if multiple functions can be opened from that field, just select the desired function from the list.

Keypad

The keypad can be opened from any extended edit entry field. This provides a method of easy text and numeric entry on devices that do not have a physical keypad but it can be used on any device.



Calculator

The RPN Scientific Calculator can be called up from the keypad by pressing the **Calculator** button. If you press the Calculator button, the value entered in the keypad entry field will be copied to the calculator's command line (Note, it must be a numeric value, alpha portions will be stripped off in the calculator) where it can be used for any calculations. When you are done with the calculator, pressing its OK button will return the result back into the keypad.

OK

Pressing the **OK** button will close the keypad, and set the entered value into the text field from which the keypad was opened.

Cancel

Pressing the **Cancel** button will close the keypad without setting anything into the text field from which the keypad was opened.

Distance Entry & Recall

Distance Entry

You can customize Layout to work with the direction input of your choice. See the Units & Scale topic for details.

The number you enter is assumed to be in the same units as your project, unless a unit modifier is specified (see below). So 5.25 would be interpreted as 5.25 feet, or 5.25 meters depending on your project's unit setting.

Distance Recall

You can recall the distance between two points, by inputting in the form: <firstID>..<otherID> Example: 26..84 will be recognized as the distance computed between points 26 and 84. The distance will be returned in whichever format your units settings is set to.

Unit Modifiers

Recognition of the unit symbols m, ', ft, usft, ftus are supported, and can be used to override the project's unit settings.

Meters

You can specify that a distance is in meters by entering "m" after the value, for example 100m means 100 Meters, even if your project is in Feet. Therefore, if your project is in US Feet and you enter 100.00m in a distance field, you will see it automatically get converted to 328.08 feet.

Feet (International or US Survey)

The ' symbol will be interpreted as either International Feet or US Survey Feet, whichever units the current project is in. For example, entering 1000' will match the feet units that your project is in, so it can mean either 1000 International Feet or 1000 US Survey Feet. If your project is in meters, then the ' symbol is interpreted as International Feet.

Fractional Feet

When entering distances in a fractional format, use a ' symbol or a space between the feet and inches values to separate them. An " symbol is not required. For example, you can enter 10'6 or 10 6 which both mean 10'6". You can enter fractional inches by placing a space between the whole and fractional inches, and using a / symbol in the fraction. For example, 10'6 1/2 or 10 6 1/2 both mean 10'6.5". You can also enter decimal values, such as 10.5' to mean 10'6" or 10'6.5 (or just 10 6.5) to mean 10'6 ½".

International Feet

You can specify that a distance is in International Feet by entering ”ft” after the value, for example 1000ft means 1000 International Feet.

US Survey Feet

You can specify that a distance is in US Survey Feet by entering ”usft” or ”ftus” after the value, for example 1000usft and 1000ftus both mean 1000 US Survey Feet.

Distance Entry Examples

Project Units:	International Feet	
Format:	Decimal	
User Entered Value:	**Interpreted As:**	**Result (always matches project units):**
1000.23	1000.23 in project units	1000.23'
1000.23'	1000.23 in project units	1000.23'
1000.23usft 1000.23 usft 1000.23ftus 1000.23 ftus	1000.23 US Survey Feet	1000.25'
20.117m 20.117 m	20.117 meters	66.00'
10000m 10000 m	10000 meters	32808.40'
10 6 10'6 10'6"	10 feet 6 inches	10.50'
10 6 1/2 10'6 1/2	10 feet 6.5 inches	10.54'

Project Units:	US Survey Feet	
Format:	Decimal	
User Entered Value:	**Interpreted As:**	**Result (always matches project units):**
1000.23	1000.23 in project units	1000.23'
1000.23'	1000.23 in project units	1000.23'
10000.23usft 10000.23 usft 10000.23ftus	10000.23 US Survey Feet	10000.23'

10000.23 ftus		
10000.23ft 10000.23 ft	10000.23 International Feet	10000.21'
20.117m 20.117 m	20.117 meters	66.00'
10000m 10000 m	10000 meters	32808.33'
10 6 10'6 10'6"	10 feet 6 inches	10.50'
10 6 1/2 10'6 1/2	10 feet 6.5 inches	10.54'

Project Units:	Meters	
Format:	Decimal	
User Entered Value:	**Interpreted As:**	**Result (always matches project units):**
1000.23	1000.23 in project units	1000.23m
1000.23'	1000.23 International Feet	304.870m
10000.23usft 10000.23 usft 10000.23ftus 10000.23 ftus	10000.23 US Survey Feet	3048.076m
10000.23ft 10000.23 ft	10000.23 International Feet	3048.070m
20.117m 20.117 m	20.117 meters	20.117m
10'6	10 feet 6 inches	3.200m
10'6 1/2	10 feet 6 1/2 inches	3.213m
10 6	Not allowed, must enter units for feet such as 10ft 6, or 10usft 6.	
10 6 1/2	Not allowed, must enter units for feet such as 10ft 6 ½, or 10usft 6 ½ .	

Using Math Operations

Math operators are now supported again. You are now permitted to use math operators in distance fields.

User Entered Value	Interpreted As	Result if Project Units Set to Feet	Result if Project Units set to Metric
3.5/2+1.2	3.5 divided by 2 plus 1.2	2.95 feet	2.950 metres
1..2/2+10 (assume 1..2 = 10)	((Distance from point 1 to 2) divided by 2) plus 10	15.00 feet	15.000 metres
8' + 3'	8 feet plus 3 feet	11.00'	3.353m
1'+2 3+1m	1 foot plus 2 feet 3 inches** plus 1 metre	6.53'	1.991m

**Note: If your project is set to feet and you enter 2 3 (2 space 3), this will be interpretted as 2 feet 3 inches. This occurs if your project is set to either decimal or fractional feet.

You can also use the RPN Calculator to further manipulate distance values. For example, if you want to find the distance halfway between points 1 and 2, enter 1..2 into the distance field to recall that distance. Then double tap on that extended edit field to pull that recalled distance into the calculator, where you can divide the distance by 2 (or perform any other calculations with it). Then press the "**OK**" button in the calculator to copy the result back into the field you started from.

Direction Entry & Recall

Direction Entry

You can customize Layout to work with the direction input of your choice. See the Units & Scale Settings topic for details.

To enter an angle using the format selected in your units settings, simply enter the angle. For example, 120.4530 means 120°45'30" if your project is in Degrees/Minutes/Seconds, 120°45.3' if your project is in Degrees/Minutes, or 120.453° if your project is in decimal degrees.

Direction Recall

You can recall the direction between two points, by inputting in the form: <firstID>..<otherID> Example: 26..84 will be recognized as the direction computed between points 26 and 84. The direction will be returned in whichever format your units settings is set to.

Unit Modifiers

You can always override your project's units setting by entering the bearing with the cardinal quadrant indicated before or after the direction. If there is no quadrant specified, then the input direction will be interpreted as an Azimuth.

Decimal Degrees

You can always specify that an angle is in decimal degrees by entering "d" after the value, for example 45.5083d means 45.5083° or 45°30'30".

Degrees, Decimal Minutes

You can always specify that an angle is in degrees and decimal minutes by entering "dm" after the value, for example 45.305dm means 45°30.5' or 45°30'30".

Degrees, Minutes, Decimal Seconds

You can always specify that an angle is in degrees, minutes, and decimal seconds by entering "dms" after the value, for example 45.3030dms means 45°30'30".

Bearings

To enter a bearing, use the cardinal quadrant letters (N, E, S, and W) before or after the angle. For example: NE60.4530, 60.4530NE, or N60.4530E means NE 60°45'30” if your project is in DMS, NE 60°45.3' if your project is in DM, or NE 60.453° if your project is in decimal degrees. It does not matter if you have spaces between the quadrant designation and the angle. You can also separate the degrees, minutes, and seconds values with a space. For example, N 60 45 30 E or N60.4530E both mean NE 60°45'30". You can of course also use any of the "d", "dm", or "dms" (or "g" or "r", see below) designators with a bearing entry, such as NE45.305dm to mean N 45°30'30" E.

Gons (Gradients)

You can specify that an angle is in Gons/Gradients by entering "g" after the value, for example 100g means 100 Gradients (equals 90 degrees).

Radians

You can specify that an angle is in Radians by entering "r" after the value, for example 1.57r and means 1.57 Radians (approximately 90 degrees).

Project set to Azimuth

Direction Entry Examples

Angle Units:	Degrees	
Format:	DDD°MM'SS.s"	
Format:	Azimuth	
User Entered Value:	**Interpreted As:**	**Result (always matches project units):**
90.5016	90 degrees, 50 minutes, 16 seconds	90°50'16"
NE45.3030 NE 45.3030 N45.3030E N 45.3030 E 45.3030NE 45.3030 NE	North East quadrant, 45 degrees, 30 minutes, 30 seconds	45°30'30"
SE45.3030 SE 45.3030 S45.3030E S 45.3030 E 45.3030SE 45.3030 SE	South East quadrant, 45 degrees, 30 minutes, 30 seconds	134°29'30"
SW45.3030 SW 45.3030 S45.3030W S 45.303 W 45.3030SW 45.3030 SW	South West quadrant, 45 degrees, 30 minutes, 30 seconds	225°30'30"
90.5016dm 90.5016 dm	90 degrees, 50.16 minutes	90°50'10"
90.5016d 90.5016 d	90.5016 degrees	90°30'06"
100g 100 g	100 gradians	90°00'00"
100.2345g	100.2345 gradians	90°12'40"

100.2345 g		
3.141593r 3.141593 r	3.141593 radians	180°00'00"

Project Set to Bearings

The angle codes below provide versatile direction input.

When your project is set to **Bearings**, you are permitted to use numeric and alpha character codes for angle and direction input.

1 or NE = North East bearing

2 or SE = South East bearing

3 or SW = South West bearing

4 of NW = North West bearing

Angle Units:	Degrees	
Format:	DDD°MM'SS.s"	
Format:	Bearing	
User Entered Value:	**Interpreted As:**	**Result (always matches project units):**
90.5016	90 degrees, 50 minutes, 16 seconds azimuth	S89°09'44"E
NE45.3030 NE 45.3030 N45.3030E N 45.3030 E 45.3030NE 45.3030 NE	North East quadrant, 45 degrees, 30 minutes, 30 seconds	N45°30'30"E
SE45.3030 SE 45.3030 S45.3030E S 45.3030 E 45.3030SE 45.3030 SE	South East quadrant, 45 degrees, 30 minutes, 30 seconds	S45°30'30"E

SW45.3030 SW 45.3030 S45.3030W S 45.303 W 45.3030SW 45.3030 SW	South West quadrant, 45 degrees, 30 minutes, 30 seconds	S45°30'30"W
90.5016dm 90.5016 dm	90 degrees, 50.16 minutes azimuth	S89°09'50"E
90.5016d 90.5016 d	90.5016 degrees azimuth	S89°29'54"E
100g 100 g	100 gradians	S90°00'00"E
100.2345g 100.2345 g	100.2345 gradians	S89°47'20"E
3.141593r 3.141593 r	3.141593 radians	S0°00'00"W

Using Math Operations

You can then use the calculator to further manipulate the angle. For example, if you want to determine 1..2 then add 90 degrees, enter 1..2 to recall that angle. Then double tap in the extended edit field to pull that recalled angle into the calculator, where you can add 90 to it (or perform any other calculations with it).

Note: You can perform advanced direction recall functions that include math operators directly in a direction field. For example, 1..2+90 is a valid entry. In this example the direction between points 1 and 2 will have 90 degrees added to it (if project is in degrees).

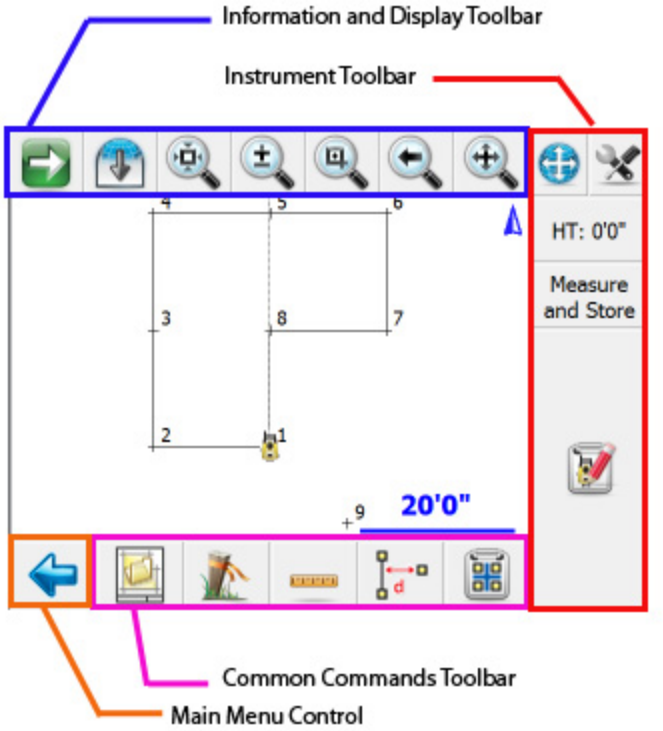
Math operations can also be done using the RPN calculator. Please refer to the Calculator section for more information on performing specific math operations.

MAIN INTERFACE

Main Interface

Main Interface

The Layout interface is separated into various toolbars which contain common functions or tools that the user will use most often.

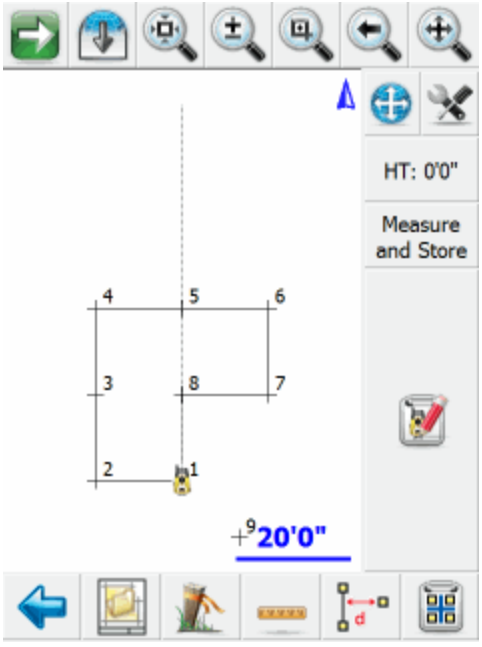


Display Toolbar
Instrument Toolbar
Main Menu button
Stakeout Mode Toolbar
Linework Mode Toolbar

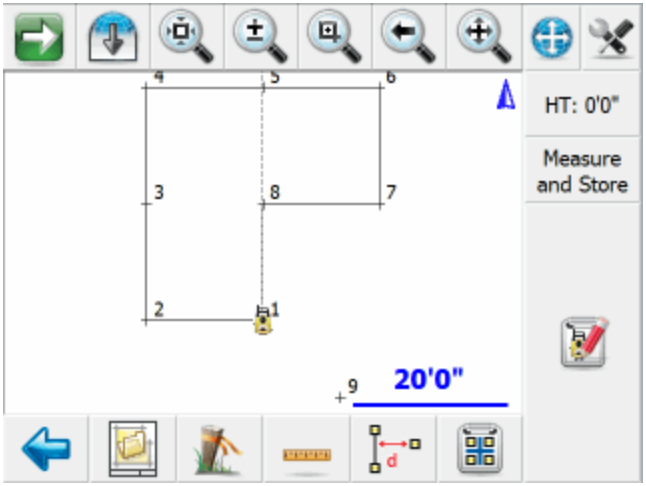
Two Versions of the User Interface

There are two versions of the user interface depending on which handheld device you're using. Some devices have a landscape screen orientation, and have the advantage of a physical keyboard. Others have a portrait screen orientation, and utilize a virtual on-screen keyboard. Note that the function of both versions is essentially the same.

Portrait Display



Landscape Display



Toolbars

Stakeout Mode

When you chose to use Layout in Stakeout mode, specific functions and tools will be loaded for you automatically that will aid you with stakeout tasks. You can enable Stakeout Mode by selecting it from the Main Menu.

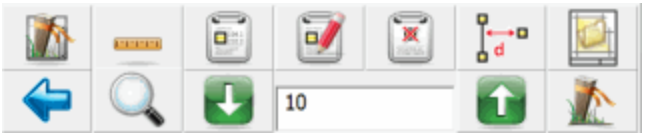
Figure Toolbar

The following toolbar will be loaded when you click on a figure.

Please review the Line Toolbar topic for more details.

Point Toolbar

The following toolbar will be loaded when you click on a point.



Please review the Point Toolbar topic for more details.

Stakeout Mode Toolbar

In the map screen you will see the following toolbar which contains tools used most often during stakeout procedures.

Main Menu Button

This button takes you into the Main Menu.

Plan Builder

Use this tool to quickly enter and draw a plan. Please review the Plan Builder topic for more details.

Staking Menu

Use this to display a menu with staking options. Please review the Staking Menu topic for more details.

Calculate Length

Use this to calculate the length of a line or arc. Please review the Calculate Length topic for more details.

Offset Tool

Use this to offset points from lines or arcs. Please review the Offset Tool topic for more details.

Point Patterns

Use this to create point patterns for stakeout. Please review the Point Pattern topic for more details.

As-built Mode

When you choose As-Built Mode from the Main Menu Layout will load toolbars and tools to help you generate as-built data as you survey.

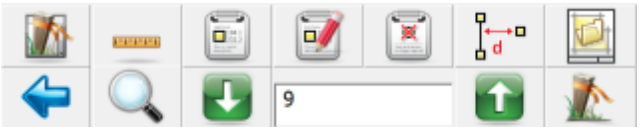
Figure Toolbar

The following toolbar will be loaded when you click on a figure.

Please review the Line Toolbar topic for more details.

Point Toolbar

The following toolbar will be loaded when you click on a point.



Please review the Point Toolbar topic for more details.

Linework Toolbar

The following toolbar will be available along the bottom of the map screen.

The Linework ModeToolbar is used to help automate linework as well as show you the description and next point number for your shot. With Layout you can control your linework by tuning on and off the line, arc and curvy toggles as you measure.

Please review the Active Linework topic for more detailed information regarding linework generation.

Main Menu Button

This button takes you into the Main Menu.

Draw Lines Button

This is used to toggle on and off the draw lines function. When turned on points will be connected with a line as you measure them.

Draw Curvy Lines Button

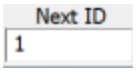
This is used to toggle on and off the draw curvy lines button. This function will draw a best-fit curve through your points as you shoot them.

Draw 3-Point Arc Button

3-Point arcs can be started using the same method as for a Line or Curvy Line.

However, to switch to 3-Point arc within an ongoing Line, select the **Draw 3-Point Arc** button before shooting the second of the three points that will define the arc (POC: Point on Curve). (Note that this is not the radius point). After measuring to the 2nd point, a dashed line will appear to illustrate that a 3-Point arc is in progress. Shoot the 3rd point and the arc will appear. The current draw option will change from Draw 3-Pt Arc to Draw Line after the third shot and the arc is complete.

Compound 3-point arcs are supported. Simply re-select the **3-Point Arc** button before measuring the next POC.



Next ID Field

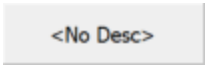
This field displays the point number that will be assigned to your next shot. You can change it at any time prior to recording your shot. In a new project this field will always start at 1. If you open an existing project, then we scan the raw file for the last sideshot or store point and if we find one, we'll set the point number accordingly. For example, if the last sideshot in the raw file was to point 58, then the next time the project is setup we will set the next id to 59.

Active Line List Button

Much like the first line in the project, just select the desired description from the list and select the desired draw option before shooting the first point for the new line. When you press the button a screen will appear listing all your active lines. Selecting one of them and pressing the **OK** button will make it the current line.

The key to note is the display of <Start line> in the Active Lines list. Once the first point for the new line has been measured, the Active Lines list will set and display the new line as current.

To change the current line, simply select the desired line from the Active Lines list and continue taking shots to add to the selected line. All settings are stored for each line so there is no need to re-select the Description or draw option.



Description Selection Button

Use this button to set the current description that will be used when you shoot your points. When you press the description button you will see a screen listing all the descriptions read in from your AutoMap Library. Select the description you want to use and press the OK button. You can type in the letters of the description which will automatically scroll to the descriptions matching your entry.

Display Toolbar

The display toolbar, located at the top of the map screen, is used to zoom, pan, change 3d perspectives, and for displaying information.

Next, Previous

These switch to the next or previous set of buttons.

Zoom Extents

This is a zoom extents which will zoom to the extents of your project.

Dynamic Zoom

This is a dynamic zoom. When enabled, drag from top to bottom of the screen to zoom out, or bottom to top of the screen to zoom in. Or, when enabled, you can also use the arrow keys on your keypad to zoom in and out in the map.

Zoom Window

This is a zoom window. When enabled, drag on the map screen to define a zoom window.

Dynamic Pan

This is a dynamic pan. When enabled, you can drag across your map screen to pan around your project. Or, when enabled, you can use the toggle or arrow keys on your keypad to pan around.

Zoom Previous

You can use this to zoom back up to 10 previous views. This includes zoom and pan changes.

World Button

It is used by the staking commands to hide unrelated points and lines in your map during stakeout.

3D View

When this is turned on you will be able to rotate your project in a 3D perspective. To return to plan view, press the Zoom Extents button.

3D View - Full Screen

When using the full screen mode for Layout this will allow you to rotate your project in a 3D perspective. To return to plan view, press the Zoom extents button.

3D Set Target Pin

This allows you to set the target point for the 3D view command. The view will rotate around the point you select. The point you select will become the target point and will be identified by a blue circle in the map screen.

Layers Manager

This opens the Layers Manager for managing visibility of layers in your database, DXF Layers, LandXML elements, and Raster Images.

Surface Manager

This opens the Surface Manager for importing and displaying DTM surface models (TIN, TGRID, or Contours) and for computing Volume Calculations.

Options

This opens the Options screen, and will automatically expand the Point Labels section for quickly turning on or off the ID, description, and elevation labels for your points.

Help

This opens the Help topic for the current toolbar(s) visible on your screen. If there are multiple toolbars visible, you are prompted to select the help file based on the position of the toolbar: Top, Side, or Bottom Toolbar. The help file will open up in your default web browser such as Internet Explorer .

Observation Toolbar

Display Toolbar | Observation Results button

You can access the Observation Toolbar by tapping on this icon in the Display Toolbar.

Total Station Observations

Total Station users can toggle through the following information:

- Horizontal Angle (HA), Vertical Angle (ZA), and Slope Distance (SD)
- Horizontal Angle (HA), Horizontal Distance (HD), and Vertical Distance (VD)
- Northing (N), Easting (E), and Elevation (H)

If using a conventional (non-robotic) total station, the observations displayed in the toolbar will be from the last measurement taken with Layout.

If using a robotic total station, the observations displayed in the toolbar will continually update in real time.

GPS Observations

GPS users can toggle through the following information:

- Latitude (Lat), Longitude (Lon), and Geodetic Height (h)
- Northing (N), Easting (E), Orthometric Height (H)
- Standard Deviation Horizontal (SD H), Standard Deviation Vertical (SD V), and Dilution of Precision (PDOP).
- Velocity (SOG) and Heading (COG) of the GPS receiver as well as current UTC Time.

If using GPS, the observations displayed in the toolbar will continually update in real time.

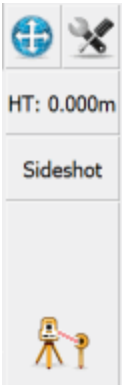
Display Size +/-

By tapping on the **+** and **-** buttons on the screen you can increase or decrease the displayed font size/text for easier viewing.

Page Toggle

The **Page** button allows you to swap between pages changing the displayed observation information.

Instrument Toolbar



When you use Layout in either manual or total station mode, you will see the instrument toolbar beside the map area.

This toolbar allows you to control your instrument settings, EDM modes, measurement modes and target heights.

Auto-Center

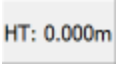
This toggles the auto-center feature on or off. If turned on, whenever you take a measurement, the map screen will always re-center on the measured point.

Instrument Settings

This opens the instrument settings screen where you can control specific settings for your total station such as EDM settings, Tolerance setting and Instrument Connection/Disconnection.

Measurement Mode

This opens the Measurement Modes screen where you can select what type of measurement you want to take. The current measurement mode is always displayed on this button - for example if you're using the distance offset mode it will display "Dist Off".



Target Height

This opens the Target Heights screen where you can change the current target height. The current target height is always displayed on this button.

Measure Button

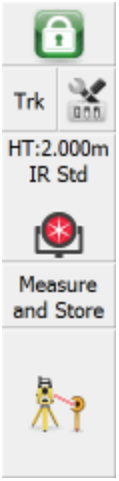
This triggers your total station to take a measurement.

If you are using a robotic total station, please see the Robotic Instrument Toolbar topic.

If you are using GPS, please see the GPS Toolbar topic.

Robotic Instrument Toolbar

When you use Layout in robotic total station mode, you will see the Robotic Instrument toolbar in the map area. Like the Instrument Toolbar, this toolbar allows you to control your instrument settings,access the Target Manager,change measure modes, and make a measurement. It also lets you search and lock onto the prism.



Lock Button

Layout uses a button to trigger the instrument to search for the prism and lock onto it. You can also use this button to turn the lock off.

The button when not locked on a prism will display a **No Lock** status with a un locked icon. To search for the prism, simply press the No Lock button.

After you have pressed the No Lock button you will see a **Search** icon on the button while the instrument searches for your prism.

When Layout finds a prism and locks onto it, the button will display a **Lock** icon. To stop the instrument from tracking, you can press the Lock button again to set it to a No Lock status.

If you're using multiple prisms and you want to force Layout to look for another one when you're locked onto a prism, double tapping the Lock button will force it to search for the next available prism.

Also during a search you can cancel the current search by pressing the Stop Search button on the search progress toolbar.

Cursor Tracking

This turns the cursor tracking feature on or off. If turned on, the current position of the target will be displayed on the screen in real time. You can only use this feature once you have specified an instrument setup using the Setup Occupy Point command.

Note: The cursor tracking position will use a coarse measurement to plot your position. When you are stationary, the cursor is a hollow triangle pointing towards the instrument. When you are moving, the cursor is a solid triangle pointing in the direction of travel.

Instrument Settings

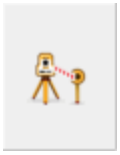
This opens the Instrument Settings Toolbar. On this toolbar you can control specific settings for your total station such as EDM modes.

Target Manager

Press this button to access the Target Manager. Here you can create, edit, copy, and delete targets.

Measurement Mode

This button will open the Select Measurement Mode screen, From here you can select what type of measurement you will be using. When you choose your mode, this button will display the mode you're using. For example, if you're using the Distance Offset mode, the button will display "Dist Off".



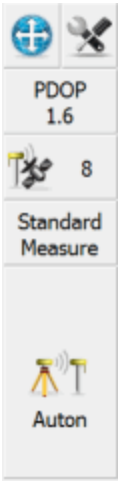
Measure Button

Use this to trigger your total station to take a measurement.

If you are using a conventional non-robotic total station, please see the Instrument Toolbar topic.

If you are using GPS, please see the GPS Toolbar topic.

GPS Toolbar



Once the user has selected a GPS receiver and communication has been established, the GPS toolbar will appear on the main interface.

NOTE: You will only see the GPS toolbar if you selected GPS Reference, GPS Rover, or GPS Demo as your instrument type. If you have selected a GPS Profile but are not yet connected to the receiver, most of these buttons will be disabled.

Auto-Center

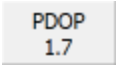
Single-tapping this button will re-center the display on the current position of your receiver.

Double-tapping this button will set the system into an auto-pan mode where the display will always be centered on the current position. When active, single-tapping this button once more will disable the auto-pan mode.

GPS Settings

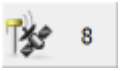
If you press this button while you are connected to a receiver, you will see the GPS Settings screen. At any time this button can be used to adjust or stop your GPS survey.

If you press this button without being connected to a receiver, you will see the Instrument Selection screen where you can edit your GPS profiles or connect to your receiver.



DOP Values

This displays the current DOP (Dilution of Precision) values. Pressing this button will cycle through the PDOP, HDOP and VDOP. The PDOP is the default setting as this is most often used to ascertain the quality of the satellite geometry.

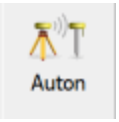


Satellite Plot/Satellite List

This shows the total number of satellites the receiver is currently using in its solution. Press this to view a sky plot of the current SVs visible to the rover, or to access the Satellite List.

GNSS Measurement Modes Menu

This menu contains all the available measurement modes that can be used with your GNSS receiver. Please review the GNSS Measurement Modes topic for more details.



Measure

This is the measure button.

This button also indicates the current solution type. This tells the user if the solution is Fixed, Float, WAAS, DGPS or Autonomous. This button will also indicate to the user if the corrections from the reference station have been discontinued by denoting "No Link".

Please refer to the GPS Measurement topic for more information.

If you are using a conventional non-robotic total station, please see the Instrument Toolbar topic.

If you are using a robotic total station, please see the Robotic Instrument Toolbar topic.

Draw Plan

Main Menu | Plan

Line Toolbar | Pencil button

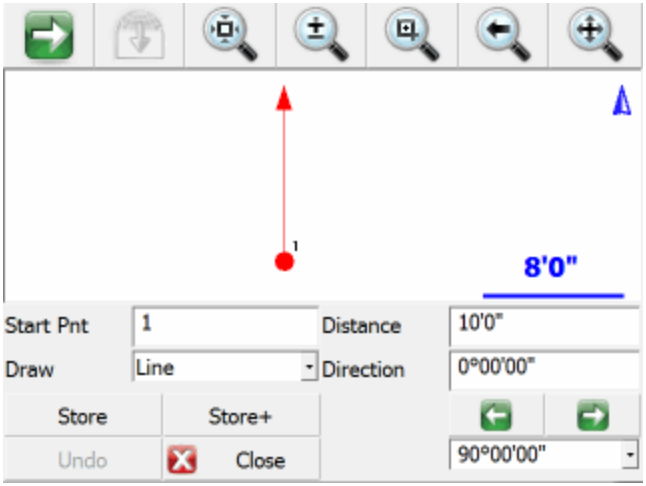
Point Toolbar | Pencil button

This tool allows you to quickly draw a plan such as a pad or a building footprint into your project, and is typically used to recreate plans from a paper hard-copy. You can use this to either calculate new points, or to connect existing points that are already in your project.

You must have at least one point in your project before you can start, to define the starting position for your plan. If a point does not yet exist (for example if this is the first command you run in a new project), you will be prompted to store a new point before you can proceed.

Line Mode

Use the Line draw mode to add straight line segments to your figure.



Start Point

Specify the start point for the new segment.

For starting a new plan, this should be set to an existing point in your project, typically a corner that you will begin drawing the plan from.

As you continue adding subsequent points/segments to your plan, you will see the Start Point field automatically advance for you.

Distance

Specify the length of the line segment you wish to draw.

Direction

Specify the direction (Azimuth or Bearing) of the line segment you wish to draw. The easiest way to do this is to use the right/left arrow buttons, which will increment/decrement the direction value by the amount shown in the pulldown list below the arrows. You can select a common angle from the choices in the list (90, 45, or 30 degrees), or you can type any value if you need to increment it by some other amount.

Store

After you have defined the segment to add, press this to store the new point and line segment into your project.

Store+

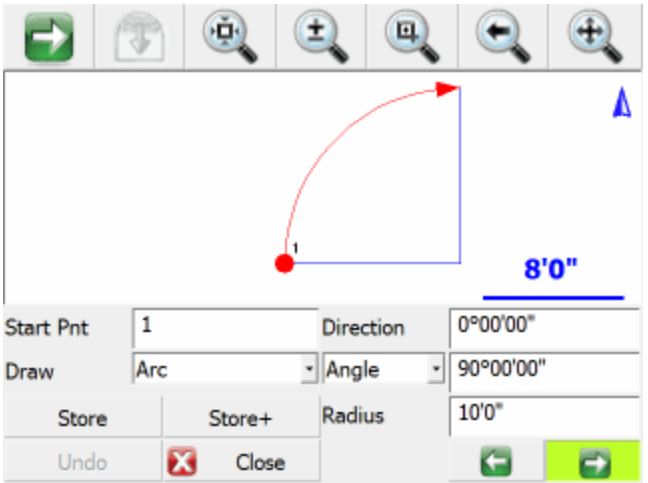
This does the same as the Store button, but you will see the Store/Edit Point screen. Use this to confirm or view the coordinates, or to specify a description.

Point by Line Mode

This is the same as the Line mode, except that when you press Store or Store+ it will only store the point, without drawing the line segment.

Arc Mode

Use the Arc draw mode to add arc segments to your figure.



Start Point

Specify the start point for the new segment.

For starting a new plan, this should be set to an existing point in your project, typically a corner that you will begin drawing the plan from.

As you continue adding subsequent points/segments to your plan, you will see the Start Point field automatically advance for you.

Direction

Specify the direction (Azimuth or Bearing) of the **tangent in** to the arc segment you wish to draw. This will default to either the direction of the previous line segment or the tangent out of the previous arc segment, so as long as your arc is tangential to the previous segment you will not need to change this value.

Angle / Chord Length / Arc Length

Specify one of the three available methods to define your arc:

- Angle: Enter the interior delta angle of the arc.
- Chord: Enter the chord length of the arc.
- Arc: Enter the arc length of the arc.

Radius

Specify the radius to define your arc.

Clockwise / Counter-Clockwise Arrows

Use the Right/Left arrow buttons to define whether the arc rotates clockwise or counter-clockwise.

Store

After you have defined the segment to add, press this to store the new end and radial points, and draw the arc segment into your project.

Store+

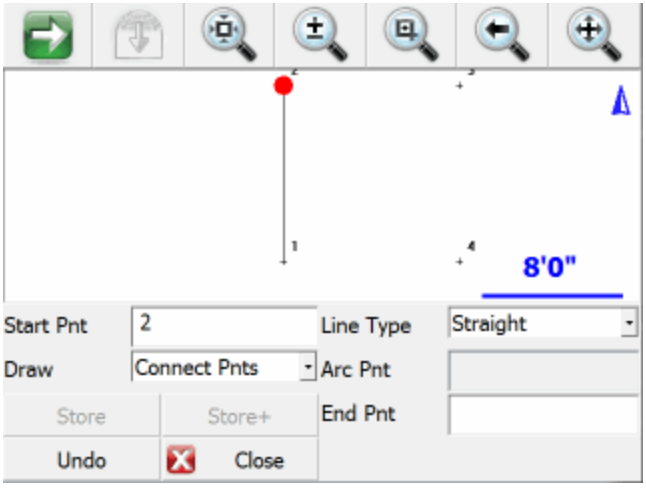
This does the same as the Store button, but you will see the Store/Edit Point screen. Use this to confirm or view the coordinates, or to specify a description.

Point by Arc Mode

This is the same as the Arc mode, except that when you press Store or Store+ it will only store the points, without drawing the arc segment.

Connect Points Mode

This mode lets you draw lines/arcs by connecting points that already exist in your project.



Start Point

Specify the start point for the new segment.

For starting a new plan, this should be set to an existing point in your project, typically a corner that you will begin drawing the plan from.

As you continue connecting subsequent points to your plan, you will see the Start Point field automatically advance for you.

Line Type

Specify one of the five available methods to define your next figure segment:

- Straight: this will draw a straight line between the specified Start Point and End Point.
- Arc (CW): this will draw a clockwise arc between the specified Start Point and End Point, with the specified Radial Point.
- Arc (CCW): this will draw a counter-clockwise arc between the specified Start Point and End Point, with the specified Radial Point.
- Arc (3Pnt): this will draw an arc (clockwise or counter-clockwise) between the specified Start Point and End Point, going through the specified intermediate Arc Point (any point directly on the arc, does not need to be the midpoint).
- Spline: this will draw a curvey line between the specified Start Point and End Point.

Store / Store+

The Store and Store+ buttons are disabled for this mode, because new points are not being calculated for your project. The line or arc segment will be automatically drawn into your project after you specify its parameters.

Undo

Press the **Undo** button to Undo the last segment you computed, removing both the point and/or the line segment (as appropriate) from your project. You can undo multiple steps.

Note, there is no Redo function.

Close

Press the **Close** button to exit from the Draw Plan command, and you will be returned to the map screen.

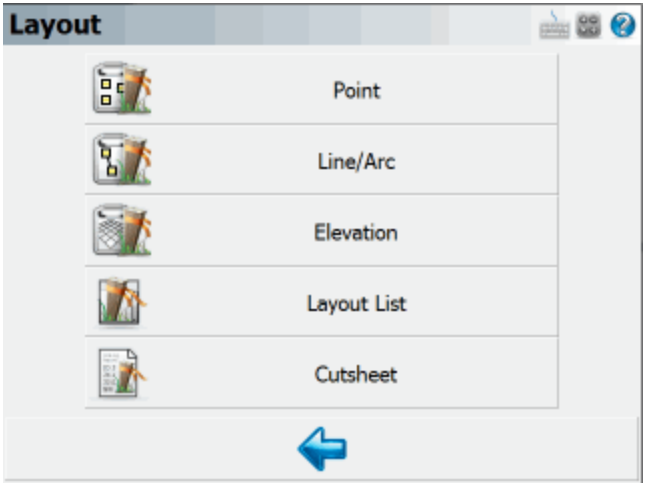
Layout menu

Layout Menu

Map Screen | Layout Menu

Map Screen | Measure Modes | Layout

This menu contains related functions.



You can access the Layout menu from the Map View by pressing the Layout icon on the Common Commands Toolbar.

On the layout menu, pressing any of the buttons will take you to its sub-menu.

Point

Use this to layout points from a list or from a screen selection. Please see the Layout Points topic for more information.

Line/Arc

Use this to layout lines and arcs. Please see the Line/Arc topic for more information.

Stake Surface

Use this to stake to a DTM (Digital Terrain Model) surface. Please see the Stake Surface topic for more information.

Elevation

Use this to stake to a constant elevation. Please see the Layout Elevation topic for more information.

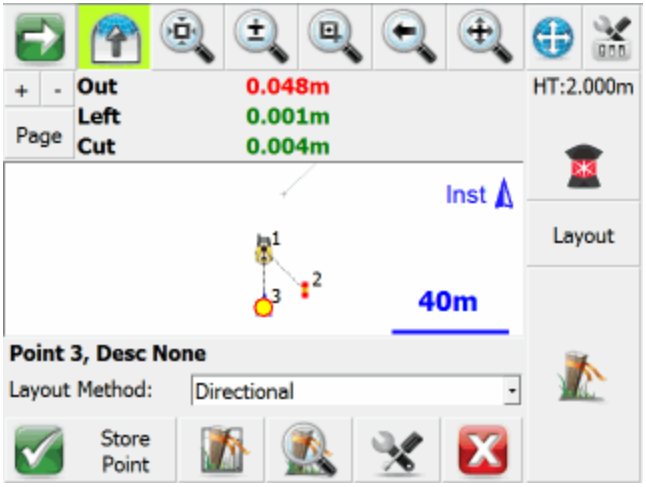
Layout List

Use this to define a staking list that can be used for staking. Please see the Staking List topic for more information.

Cut Sheet

Use this to open the Cut Sheet Reports screen. Please see the Cut Sheet Reports topic for more information.

Layout Toolbar



The layout toolbar is used in conjunction with the Observation Toolbar to help you navigate to your stake point. If you're using a robotic or conventional instrument the staking process will be similar.

The layout toolbar can be accessed by pressing the Layout Point button on the Points screen. It will also be accessed from many other commands that require a point to be laid out.

When you first see the toolbar you may see the words "Waiting for data" in the Observation Toolbar which means you need to take a measurement first so it can calculate the current position of the rod. Press the measure button if you're using a conventional instrument, or turn on the cursor tracking button if you're using a robot or GPS.

You should define a map orientation in the layout settings. Setting this will twist your map view to help you with your layout and change the way the "move by" distance are reported. Press the Settings button to adjust your Orientation Reference setting. For best results, set the Orientation Reference to Prism for a conventional total station, Instrument for a robotic total station, North for GPS staking.

Layout Method

For each of the following methods, if you are within the Tolerance setting defined in the Layout Settings, then the direction/distance text will be green; if you are outside the tolerance then the text will be red. You can also switch pages within the Observation Toolbar at any time to see other measurement information, for example if you want to see the rod elevation instead of a Cut/Fill.

Turn An Angle

This method will display both the required and measured horizontal angles in the Observation Toolbar near the top of the screen. This method is useful while staking with a conventional total station, to quickly get online with the design point.

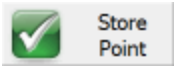
Directional

This method will display the In/Out and Left/Right (or N/S/E/W), and Cut/Fill distances from the current rod position to the design point in the Observation Toolbar near the top of the screen. This method is useful while staking with a conventional or robotic total station, but be sure to set the "Orientation Reference" option to Prism for a conventional total station, Instrument for a robotic total station, or North for GPS staking.

Radial

This method will display the Direction (Bearing or Azimuth) and Distance from the current rod position to the design point in the Observation Toolbar near the top of the screen. This method is useful while staking with a robotic total station or GPS.

Other Buttons



Store Point

When this is pressed the Store / Edit Points screen will appear so you can store the position of the rod. The default is to store a point in the project database as well as write raw records to the raw file. You might not want to store a point for the staked position but want to have a record of it in the raw file. This can be done by turning off "Store Layout Point" in Layout Settings. (This button not available for GPS staking, use the Measure button to record the point.)

This displays the staking list.

Zoom

This will automatically zoom to the extents of your current target position and the point you're laying out.

Settings

This will open the Layout Settings screen which allows you to setup parameters that will be used during the layout such as your Tolerance, Orientation Reference, and more.

Close

This will close the Layout Toolbar, and return you to the previous screen.

Conventional Total Station Tips

If you're using a conventional total station you need to press the measure button on the instrument toolbar before the navigate distances are displayed.

To help with navigating, set your map orientation to Prism in the staking settings screen. This will force the map to orientate itself so the prism is at the top and the instrument is at the bottom.

You can use the Turn An Angle method to quickly get online with your point, then switch to the Directional method to navigate accurately to the point.

Robotic Total Station Tips

If you're using a robotic instrument you need to turn on the cursor tracking button on the instrument toolbar before the navigate distances are displayed. Note that with a robotic instrument, there is no need to press the measure button as the cursor tracking provides real-time positions to the Observation Toolbar.

To help with navigating, set your map orientation to Instrument in the Settings screen. This will force the map to orientate itself so the instrument is at the top and the prism is at the bottom.

You can set the EDM mode on the instrument toolbar to use a fine measurement setting that can be used to record the position of the point. When cursor tracking is on it uses a coarse mode which might not be suitable for the storing the point, but suitable enough to for navigation. For precise layout you can use the following procedure:

1. Use cursor tracking to navigate to your point.
2. When you attain the position to be laid out you can do one of two things:
    a. If tracking mode is precise enough for your needs you can turn off cursor tracking, then press the Lock button to stop the instrument from tracking the prism. It is useful to do this as the instrument will still be pointed at the layout location and prevents the instrument from following the prism if you have to lay it down.
    b. If you need to take a more accurate position before marking the point or pounding in your stake: You can turn off cursor tracking, then press the measure button to help you locate the layout point. By doing this it will use the EDM mode set in the instrument toolbar (make certain it is set to a fine mode) instead of using the coarse (tracking) mode. Once the point is located, make sure to press the Lock button to stop the instrument from tracking the prism. It is useful to do this as the instrument will still be pointed at the layout location and prevents the instrument from following the prism if you have to lay it down.
3. Mark your point or pound in your stake.
4. Set the prism on the point you just marked and press the No Lock button which will initiate a search. Since you stopped the instrument from tracking in the previous step the instrument should lock onto the prism very quickly.
5. Press the Measure button to record one final position for the stake point.
6. Press the Store Point button on the staking toolbar to store the final location of the point you just staked.

GPS Tips

To help with navigating, set your map orientation to North in the settings screen. This will force the map to orient itself so that North remains up on the screen.

Use cursor tracking to navigate to your point (this provides real-time positions to the Observation Toolbar) then when you attain the final position to be laid out press the Measure button. The usual GPS Measurement procedure will apply, and your current tolerance mode and masks will be in effect for the measurement.

Raw File

When you store your point several records are written to the raw file. Following is an example of a point that was laid out:

```
SP,PN1400,N 715346.319,E 2381454.812,EL1.009,--
CF,EL1.0087,GD1.0000
DE,PN342,N 715346.319,E 2381454.770,EL1.000,--
SD,ND-0.000,ED-0.042,LD-0.009
SK,OP251,FP1400,AR180.00000,ZE89.05000,SD63.0500,--Design Point: 342
```

The SP record is the point that was recorded when you pressed the Store Point button.

The CF record displays the measured elevation versus design.

The DE record displays the design coordinates for the point to be laid out.

The SD record displays the delta values of the laid out point. This is the DE record - SP record.

The SK record is the recorded raw observation used to compute the store point (SP) record.

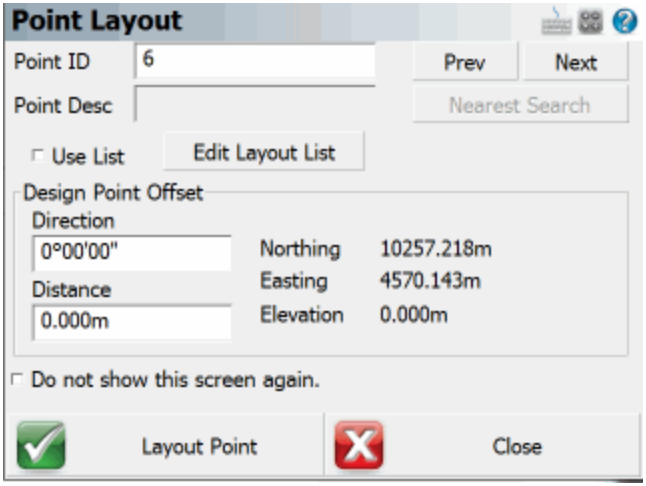
Note: If you turned off "Store Layout Point" in the layout settings, then no SP or CF record will be stored in the raw file.

Layout Points

Point Toolbar | Layout

Step 1: Select Design Point

When you start the layout points command you will be able to pick a point from the map, or enter a point id in the point id field, or use a point list by turning on the "Use List" toggle.



Point ID

This allows you to manually enter in the point you would like to stake.

Point Desc

This shows the description of the current design point.

Previous & Next

Use this to automatically advance to the next or previous point in your database. Note that you need to have a value entered in the point number field.

Select Design Point

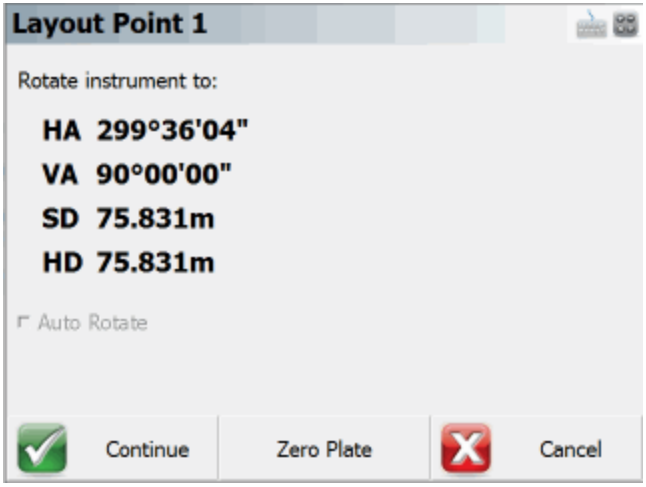
This will open the point chooser toolbar and allow you to select a point to stake from the map.

Point button:

If you're using a non robotic instrument, you will see the "turn to" screen displaying the angle and distance you need to measure to layout the point. Please see section Step 2a below.

If you're using a robotic instrument or GPS, you will see the map screen and the point toolbar. Please see section Step 2b or 2c below.

Step 2a: Non Robotic Total Station Layout



Rotate instrument to:

From this screen you will see what angle and distance you need to turn to on your instrument to layout your point.

At this point you can turn your instrument to match the angles and when ready to start, press the Continue button. The Turn To information is also available on the next screen in case you need to see it again.

Note: Your target height is used to determine the vertical angle for the stake point.

Auto Rotate

If your instrument has servo motors and Layout supports your instrument, this option will be available. It will be on by default and will automatically turn to match both the horizontal and vertical angles needed to layout the point. The instrument will begin to turn when you press the Continue button.

Zero Plate

This is used to modify plate reading on your instrument in such a way that if you manually turn to zero you will be facing towards the point you want to layout.

When you do so, you will see a message "Zero the plate circle to the design point and update the backsight setup?" Press Yes to continue, or No to Cancel. After you press Yes, a new backsight reading is set on the instrument and a BK record is written to the raw file.

You will also note that the turn to angle will now display zero, which is the angle you now need to turn to on the instrument.

You can continue using this for any other points you want to layout. Since the plate reading is changing a lot, you will want to check the backsight frequently to make certain any error meets your tolerances.

Continue

Press this button to continue. You will now see the map screen and the point layout toolbar.

Step 2b: Robotic Total Station Layout

If you're using a robotic instrument and have the Robotic Staking option enabled, the layout routine will bypass the screen and steps explained in the Step 2a section. Instead, Layout will take you directly to the map screen where you will see our point layout toolbar.

By default, Layout will have the robotic staking option enabled for all robotic total stations.

Some users may need their robotic instrument to automatically turn to the layout point instead. If this is desired, just disable robotic staking.

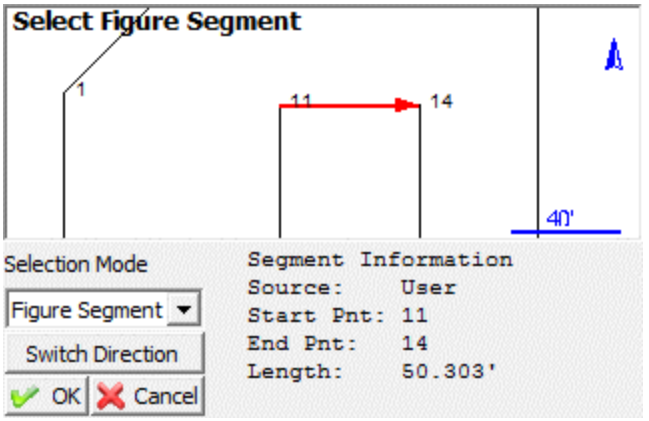
Layout Line/Arc

Line Toolbar | Layout

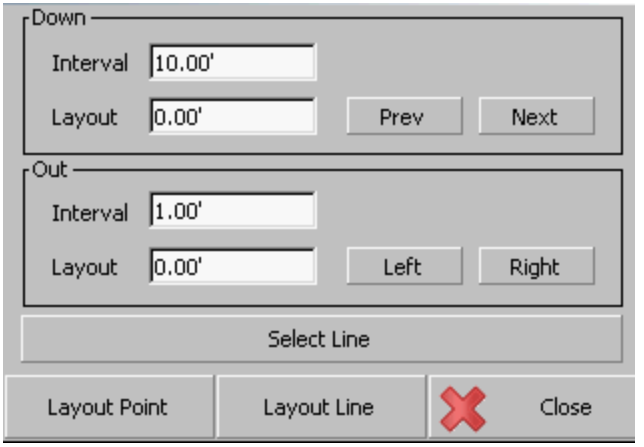
Layout Line

You can layout a line by selecting points in the drawing, or by selecting an existing figure or a DXF line.

When you start the command from the Layout Menu you will see the Select Line Toolbar that will allow you to select the object you want to layout.



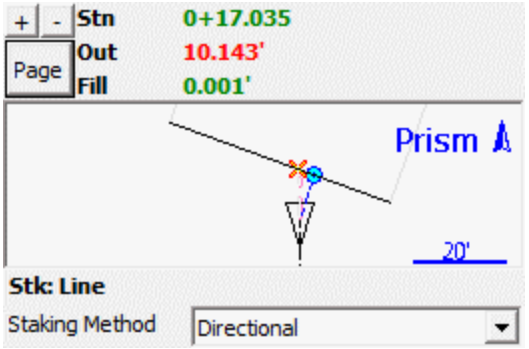
Press OK to continue on to the Down/Out screen.



If you want to layout the line, just press the **Layout Line** button which will display the stake line toolbar.

If you want to layout a specific point along the line, specify the down/out distances then press the **Layout Point**button which will display the layout point toolbar for the specified design point.

When the layout line toolbar opens you have to take a shot before any information will appear on the toolbar.



Layout Methods

For each of the following methods, if you are within the Tolerance setting defined in the Layout Settings, then the direction/distance text will be green; if you are outside the tolerance then the text will be red. You can also switch pages within the Observation Toolbar at any time to see other measurement information, for example if you want to see the rod elevation instead of a Cut/Fill.

Directional

This method will display the current Station (perpendicular from the rod, as marked by a blue circle on the line), the In/Out, Left/Right, or N/S/E/W distance to the line (from the rod to the red x on the line, keeping the same horizontal angle), and the Cut/Fill distance (from the rod to the interpolated elevation of the station point marked by the blue circle, where a cut represents that the rod is higher than the interpolated station elevation, and a fill represent that the rod is lower than the interpolated station elevation) in the Observation Toolbar near the top of the screen.

When using this method, be sure to set the "Orientation Reference" option to Prism for a conventional total station, Instrument for a robotic total station, North for GPS staking, or use one of the other reference options if preferred.

You can force Layout to display either In/Out or Left/Right distances by changing the Line Mode option in the Layout Settings.

Stationing - Absolute

This method will display the current Down, Out, and Cut/Fill distances relative to the line in the Observation Toolbar near the top of the screen. The station point is marked by a blue circle on the line, the Offset is the Left/Right distance from the blue station point to the current rod position, and the Cut/Fill is the elevation difference from the current rod position to the interpolated elevation of the station point where a cut represents that the rod is higher than the interpolated station elevation, and a fill represent that the rod is lower than the interpolated station elevation.

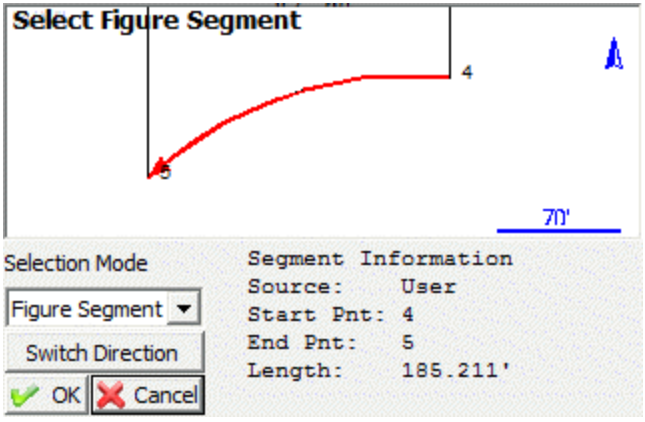
Stationing - Relative

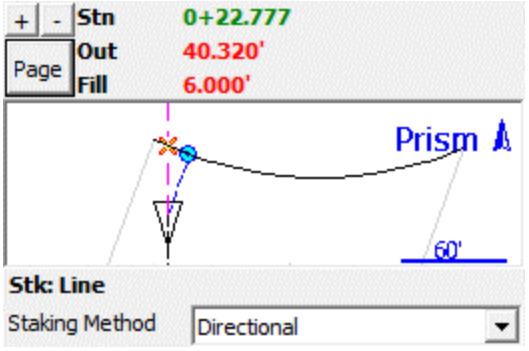
This method will display the current Down, Out, and Cut/Fill distances relative to the line in the Observation Toolbar near the top of the screen. The station point is marked by a blue circle on the line, the Offset is the Left/Right distance from the blue station point to the current rod position, and the Cut/Fill is the elevation difference from the current rod position to the interpolated elevation of the station point where a cut represents that the rod is higher than the interpolated station elevation, and a fill represent that the rod is lower than the interpolated station elevation.

> **Note:**
> Please refer to the Point Layout Toolbar topic for additional information and tips.

Layout Arc

The process is identical whether staking a line or an arc - the only difference is you begin by selecting or defining an arc instead of a line





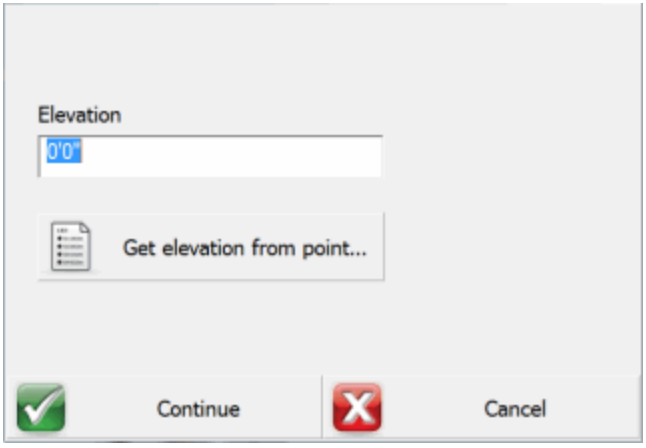
Layout Elevation

Main Interface | Layout Button| Elevation

This routine allows you to layout to a specific elevation (called the **Design** elevation). The routine will report the cut and fill values from the selected (Design) elevation to your current rod elevation. The horizontal position is not the focus of this routine.

Why would I want to use this? Maybe you may want to use this function if you have to layout a building pad before concrete is poured and you know what the height of the pad should be. You enter this value in the **Elevation** field and walk around your pad. This routine will inform you of how far your rod is above or below the design elevation.

The first step is to define your constant elevation. You can either type in a design elevation manually into the **Elevation** field, or you can use the **Get elevation from point...** button to select a point from your points database, and use its elevation.



Continue

Press this button to continue to the Map view. You will now see the map screen displaying the Layout toolbar. The Display toolbar displays the design elevation (the intended or desired elevation), the actual measured elevation (displayed in the Elev field), and the cut/fill amount required to get to the design elevation from the measured elevation.

Design = Elev+ Fill amount or

Design = Elev - Cut amount

Get elevation from point...

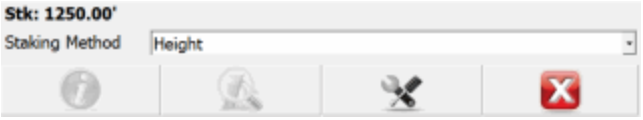
Press this button to acquire an elevation from a selected point's elevation. The point database dialog will open and you can select a point to use its elevation.

The **Elev** and **Cut/Fill** text fields will display values that are within your layout tolerance in the colour green. Measurements made outside of your layout tolerance are displayed in the colour red.

Design	**383.304m**	**Design**	**383.304m**
Elev	**383.285m**	**Elev**	**383.476m**
Fill	**0.019m**	**Cut**	**0.172m**

Please refer to the Options Layout topic for more information on layout tolerances,

Layout Tool Bar



Please refer to the point layout toolbar topic for more information on how to use the staking toolbar.

Auto-Locate - Point On Floor or Ceiling

Map Screen | Layout Menu

Map Screen | Measure Modes | Layout

The Auto Layout Point on Floor and Point on Ceiling modes are only available for the following equipment:

- Leica 3D Disto
- Leica iCON Robot
- Leica TS15
- Leica MS50

These advanced layout modes allow you to compute the position of a point on a floor or ceiling using only the non prism EDM mode. The routine will interpolate and determine the location of the floor or ceiling and will compute the theoretical intersection using the x,y location of the point. The laser pointer on your instrument will point to the location of the layout point. Your layout points don't need to have elevations, and only require x,y coordinates.

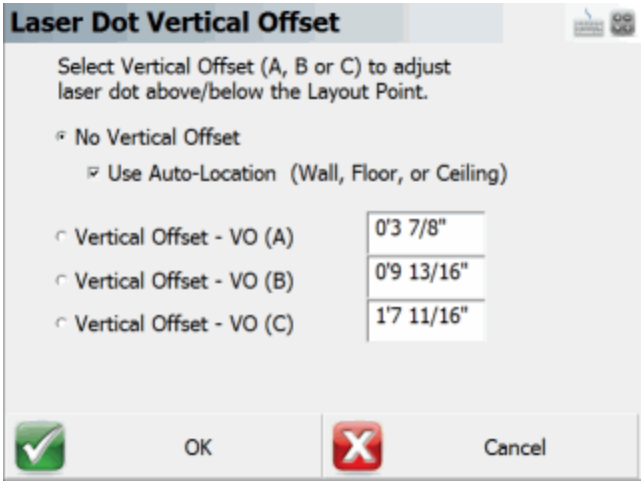
MEP Module

This advanced feature is available when the MEP module is enabled.

Procedure

Target Heights

When using the auto-locate routines you will not need to use a vertical offset. The routine will always default the vertical offset to "No Vertical Offset" and enable "Use Auto-Location".

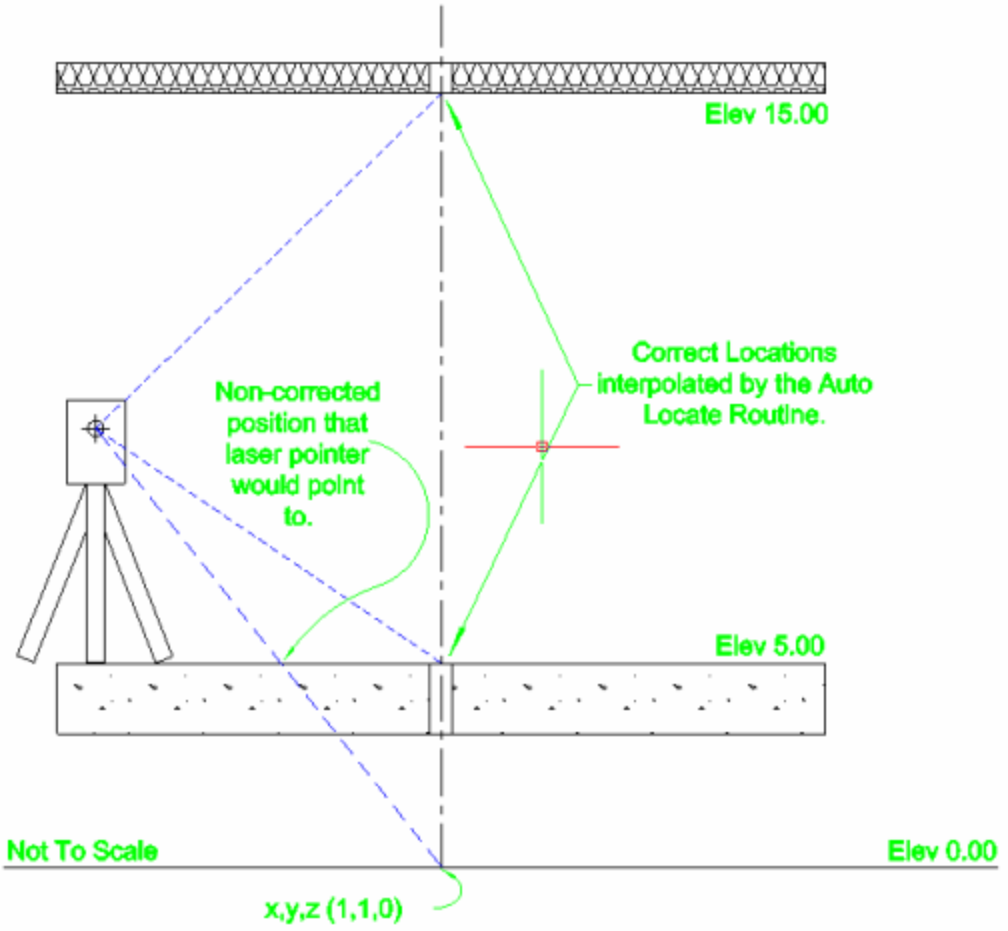


When you start the routine it will automatically start taking measurements on the floor or ceiling depending on the layout mode selected. The measurements will determine a plane that the design point will be projected onto for layout.

Important Notes

It's important to understand the importance of finding the plane that defines the floor or ceiling. In the following image you will see that a point with coordinates (1,1,0) is being located on the floor and ceiling. Since the laser pointer is being used to locate this point, if all the instrument did was turn to and point at the theoretical position you will see that it would mark a spot clearly in the wrong location.

Layout will determine where the floor or ceiling is by taking several shots to derive a plane. The point is then intersected with this plane and the instrument will then turn to and point directly at the intersection point.



Once the location is marked you can then store it and locate your next point.

Auto-Locate - Pipe Through Wall

Map Screen | Layout Menu

Map Screen | Measure Modes | Layout

The Auto Layout Point on Wall mode is only available for the following equipment:

- Leica 3D Disto
- Leica iCON Robot
- Leica TS15
- Leica MS50

This advanced layout mode allows you to compute the penetration location of a pipe through a wall using only the non prism EDM mode. The routine will interpolate and determine the location of the wall and will compute the theoretical penetration point and the laser pointer on your instrument will point to the location that you should mark.

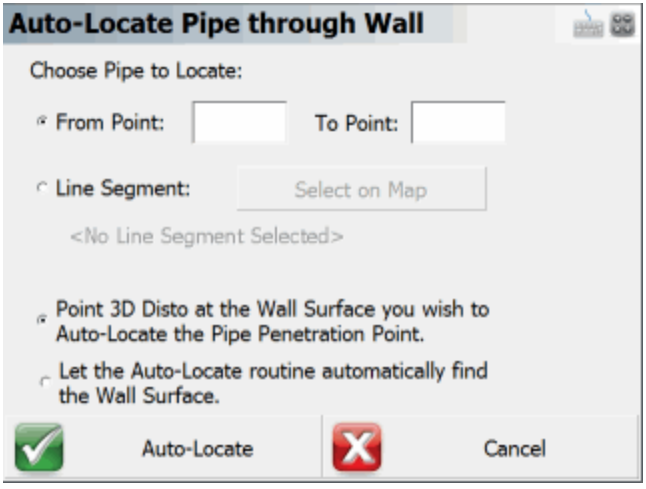
MEP Module

This advanced feature is available when the MEP module is enabled.

Procedure

Define Wall

When you start the routine you will see the Auto-Locate Point on Wall dialog.

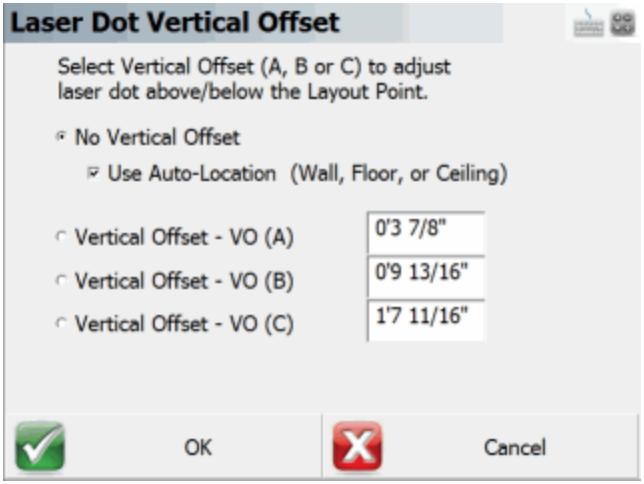


On this dialog you can specify the pipe centerline by selecting two points or an existing line in your project.

The second option lets you define the wall by pointing at it with your instrument, or by letting the software find the wall automatically.

Target Heights

When using the auto-locate routines you will not need to use a vertical offset. The routine will always default the vertical offset to "No Vertical Offset" and enable "Use Auto-Location".



Important Notes

It's important to understand the importance of finding the plane that defines the wall. During construction, walls are never perfect and will differ from the design location. Since the laser pointer is being used to locate the penetration point, the software must determine the current location of the wall.

Layout will determine where the wall is by taking several shots to derive a plane. The pipe line is then intersected with this plane and the instrument will then turn to and point directly at the penetration point.

Auto-Locate - Pipe Through Wall

Map Screen | Layout Menu

Map Screen | Measure Modes | Layout

The Auto Layout Point on Wall mode is only available for the following equipment:

- Leica 3D Disto
- Leica iCON Robot
- Leica TS15
- Leica MS50

This advanced layout mode allows you to compute the penetration location of a pipe through a wall using only the non prism EDM mode. The routine will interpolate and determine the location of the wall and will compute the theoretical penetration point and the laser pointer on your instrument will point to the location that you should mark.

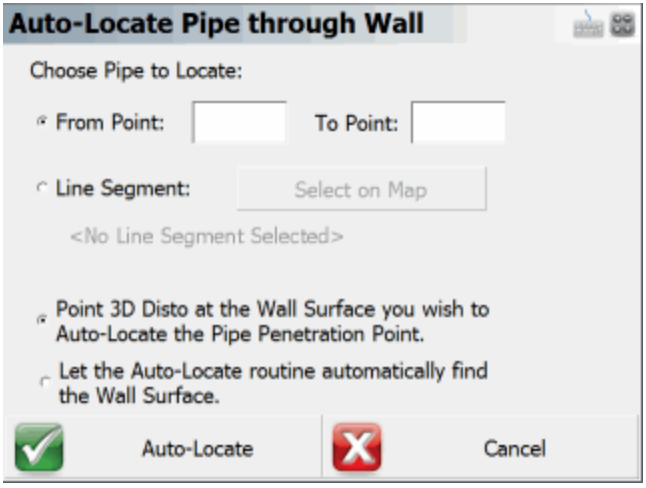
MEP Module

This advanced feature is available when the MEP module is enabled.

Procedure

Define Wall

When you start the routine you will see the Auto-Locate Point on Wall dialog.

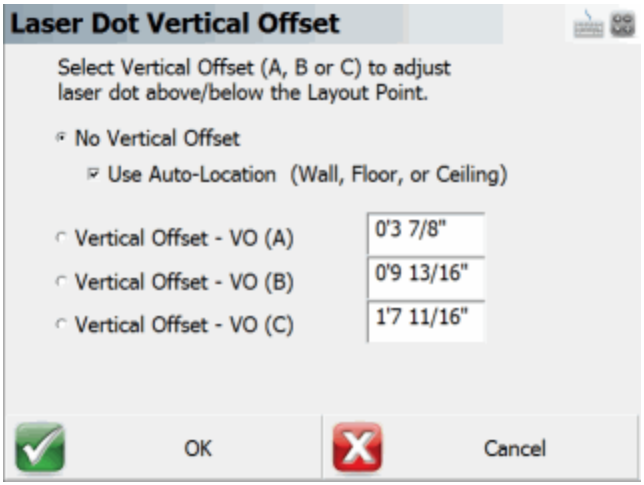


On this dialog you can specify the pipe centerline by selecting two points or an existing line in your project.

The second option lets you define the wall by pointing at it with your instrument, or by letting the software find the wall automatically.

Target Heights

When using the auto-locate routines you will not need to use a vertical offset. The routine will always default the vertical offset to "No Vertical Offset" and enable "Use Auto-Location".



Important Notes

It's important to understand the importance of finding the plane that defines the wall. During construction, walls are never perfect and will differ from the design location. Since the laser pointer is being used to locate the penetration point, the software must determine the current location of the wall.

Layout will determine where the wall is by taking several shots to derive a plane. The pipe line is then intersected with this plane and the instrument will then turn to and point directly at the penetration point.

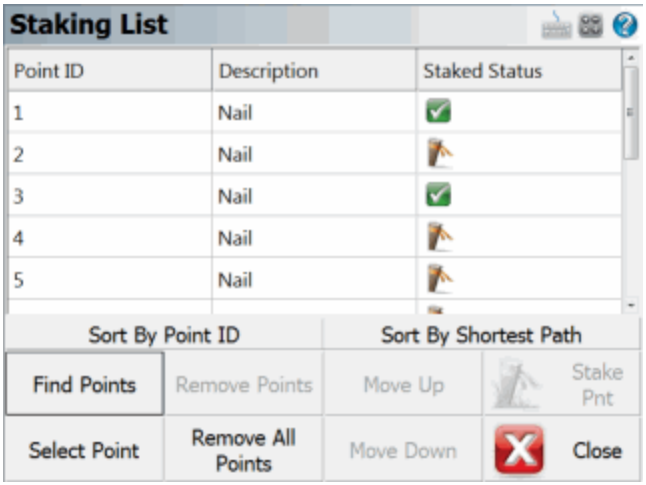
Layout List

Use a layout list to layout points from a predetermined list of points.

Why Use a Layout List?

The layout list is separate from the Points database. We have added intelligence to the layout list specifically for layout. After importing points and assigning the "To Stake Out" survey role to them, you will never have a measured point appear as a point to be laidout. Moreover, the layout list will always search for and present the next nearest point (shortest path) from the current position as the next point to lay out. This functionality was added to help you lay out more points in a day.

When you start the layout list command you will see the layout list screen and it will be empty, if you haven't previously added any points to it. The image below is of a layout list that contains points.



Sort By Point ID

Use this to sort the layout list by Point ID.

Sort By Shortest Path

Select the first point you want to layout, then use this to sort the layout list by shortest path distance from the selected point.

Find Points

Use this to find points that will be added to the list. You can find points based on the Point ID, Coordinate, or Description. The system will look in the Points database for points to add to the layout list.

Select Point

Use this to pick a point from the map. Points will be added to the list in the order they're selected.

Remove Points

Use this to delete a single row or multiple rows. This will only remove the points from the list and will not delete any points from the Points database.

Remove All Points

Use this to clear the current list. This will only remove the points from the list and will not delete any points from the Points database.

Move Up

This will move the currently highlighted point up one row.

Move Down button:

This will move the currently highlighted point down one row.

Stake Pnt

This will take you to the layout toolbar to layout the point that is currently highlighted in the list.

Layout Status

If a point in your layout list has not been laid out yet, it will have a stake icon displayed in the Layout Status column. You will see a green checkmark icon if the point has already been laid out.

Point ID	Description	Staked Status
1	Nail	
2	Nail	

As you can see in the image above, point 1 has been laid out, and point 2 has not.

Adding Points to the Layout List

There are two ways to add points to a layout list. You can add points that already exist in the Points database via the layout list screen by pressing the **Find Points** button. The alternative (and possibly the easiest) way is to assign the survey role of **To Stake Out** to points being imported via the **ASCII Coordinate File Import** button in theTransfer Menu. When points are imported using the **ASCII Coordinate File Import** button and are assigned the survey role of **To Stake Out**, these points will automatically be added to the layout list.

Working From the List

To work from the list simply highlight the point you wish to layout and press the **Stake Pnt** button which will begin the process. Please see the Point Layout Toolbar topic for more information. Since you started from the layout list, it will automatically turn on the **"Use Layout List"** checkbox in the Layout Points screen.

When you store your layout point, the layout point command will automatically go to the next point in the list.

Survey Role Setting

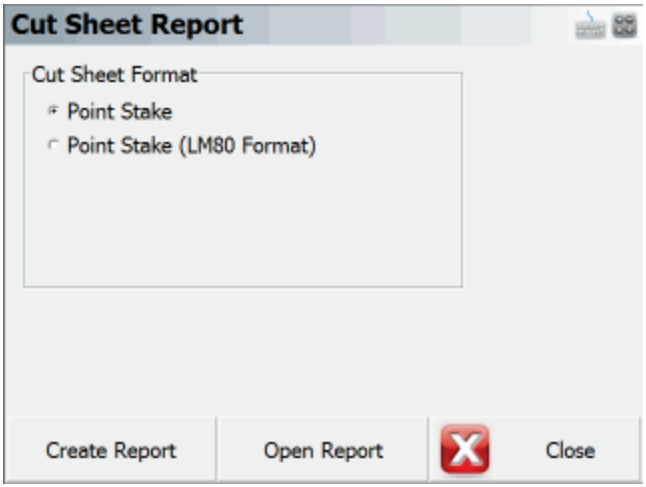
The status of a point is controlled by the Survey Role type in the project database. You can view the role by using the Coordinate Database viewer. If the point is pending, it will have a survey role type of "to stake out" (point 2 in the image below). If it has been staked, it will have a survey role of staked out (point 1 in the image below).

1	5523958.627m	312330.376m	393.413m
2	5523853.287m	312321.092m	392.877m

Cutsheet Reports

Main Interface | Layout | Cutsheet

Layout includes a cut sheet generator. When you points or alignments, cut sheet records are recorded in the raw file.



The different cut sheet formats will be described below. To create a cut sheet, select the desired cut sheet format, then press the **Create Report** button, then choose the folder and filename for it. You can give it any extension (one will not be automatically added) but we recommend using either .CSV or .TXT. The extension you provide will not affect the contents of the file in any way.

If you've already created a cut sheet and want to open it to review it, press the **Open Report** button.

Layout automatically creates a (.CSV) comma separated value file for each cut sheet format you create. This file can be read into Excel, which will allow you to format it and print it. The records stored during staking follow the RW5 format so cut sheet records can be created using software packages that support this format.

Point Stake Format

If you've staked points using the Stake Point command you will be able to create a stake point cut sheet report.

Design Pt	As Built Pt	Cut(-)/Fill(+)	Design N	Design E	Design El	Delta N	Delta E	Design Desc	As Built Desc
17	5005	0	5007.202	5003.499	100.202	0	0	GRD	Design Pnt 17
19	5006	0	5006.076	5001.161	100.119	-0.007	0	GRD	Design Pnt 19
20	5007	0	5008.335	4998.831	100.061	-0.007	0	GRD	Design Pnt 20
51	5009	-0.001	5006.573	4992.566	99.815	-0.001	-0.001	GRD	Design Pnt 51
51	5010	-0.001	5006.573	4992.566	99.815	-0.001	-0.001	GRD	Design Pnt 51
30	5011	-0.425	4997.663	4996.693	99.815	-6.249	14.371	E/ASPH	Design Pnt 30
31	5012	-0.739	4996.107	4991.625	99.502	-7.805	9.302	E/ASPH	Design Pnt 31

LM80 Format: This option will format the cut sheet in the LM 80 format.

Offset Stakes Format

If you've staked points using the stake alignment command, you can create a cut sheet report for your station and offset stakes.

Station	Offset	Offset Length	Cut(-)/Fill(+)	Elevation	Grade	Description
1	Left	1.002	0	100.1662	100.1665	0+01.00 L 1.000
2	Left	0.984	0	100.0624	100.0619	0+02.00 L 1.000
2	Center	0.001	-0.001	100.0629	100.0619	0+02.00 C 0.000
2	Right	1.005	0	100.0622	100.0619	0+02.00 R 1.000
3	Left	1.001	-0.007	99.9643	99.9574	0+03.00 L 1.000
3	Right	0.006	-0.014	99.9715	99.9574	0+03.00 C 0.000
3	Right	1.002	-0.005	99.9619	99.9574	0+03.00 R 1.000

Slope Stake Format

If you've staked points using the slope stake alignment command, you can create a cut sheet report for your slope stakes.

Station	Offset Direction	Cut/Fill	Design Slope	Offset Length	Pt Name	Actual El	Design El	Ahead On Station	HD to Hinge Pt	VD to Hinge Pt	HD to Center Line	VD to Center Line	Observed Slope	Description
12	Left	Cut	1.00:1	N/A	81	99.984	100.24	-0.032	1.011	0.968	2.011	0.968	1.04:1	CP 0+012.000 L 1.000
6	Left	Cut	1.00:1	N/A	5000	100.15	100.15	-0.013	0.507	0.501	1.507	0.501	1.01:1	CP 0+06.00 L 1.000
6	Left	Cut	1.00:1	N/A	5001	100.15	100.15	-0.002	0.498	0.501	1.498	0.501	0.99:1	CP 0+06.00 L 1.000
6	Left	Cut	1.00:1	N/A	5002	100.14	100.18	0.017	0.521	0.501	1.52	0.501	1.04:1	CP 0+06.00 L 1.000
6	Left	Cut	1.00:1	1	5003	101.53	100.14	0.017	1.513	0.501	2.513	0.501	1.04:1	REF CP 0+06.00 L 2.000
6	Left	Cut	1.00:1	N/A	5004	100.14	100.14	-0.002	0.498	0.501	1.498	0.501	0.99:1	CP 0+06.00 L 1.000
6	Left	Cut	1.00:1	1	82	102.28	100.14	-0.002	1.39	0.501	2.387	0.501	0.99:1	REF CP 0+06.00 L 2.000

Point and Offset Stake Format

This type of report will display the same records as the Point Stake and Offset Stake reports, but combine them into a single report.

Station	Offset	Offset Length	Design Pt	As Built Pt	Design N	Design E	Design El	As Built El	Cut(-)/Fill(+)	Delta N	Delta E	Design Desc	As Built Desc
			17	5005	5007.202	5003.499	100.202	100.2018	0	0	0	GRD	Design Pnt 17
			19	5006	5006.076	5001.161	100.119	100.1191	0	-0.007	0	GRD	Design Pnt 19
			20	5007	5008.335	4998.831	100.061	100.0615	0	-0.007	0	GRD	Design Pnt 20
1	Left	1.002		5008	5011.787	5004.505	100.166	100.1662	0	0.001	-0.001		0+01.00 L 1.000
			51	5009	5006.573	4992.566	99.815	99.8163	-0.001	-0.001	-0.001	GRD	Design Pnt 51
			51	5010	5006.573	4992.566	99.815	99.8163	-0.001	-0.001	-0.001	GRD	Design Pnt 51
			30	5011	4997.663	4996.693	99.815	100.2405	-0.425	-6.249	14.371	E/ASPH	Design Pnt 30
			31	5012	4996.107	4991.625	99.502	100.2405	-0.739	-7.805	9.302	E/ASPH	Design Pnt 31
2	Left	0.984		5014	5011.047	5003.832	100.062	100.0624	0	-0.018	0.005		0+02.00 L 1.000
2	Center	0.001		5015	5011.719	5003.092	100.062	100.0629	-0.001	-0.001	0		0+02.00 C 0.000
2	Right	1.005		5016	5012.391	5002.352	100.062	100.0622	0	-0.006	0.001		0+02.00 R 1.000
3	Left	1.001		5017	5010.306	5003.16	99.957	99.9643	-0.007	0	-0.001		0+03.00 L 1.000
3	Right	0.006		5018	5010.978	5002.42	99.957	99.9715	-0.014	-0.007	0.002		0+03.00 C 0.000
3	Right	1.002		5019	5011.651	5001.68	99.957	99.9619	-0.005	-0.004	-0.001		0+03.00 R 1.000

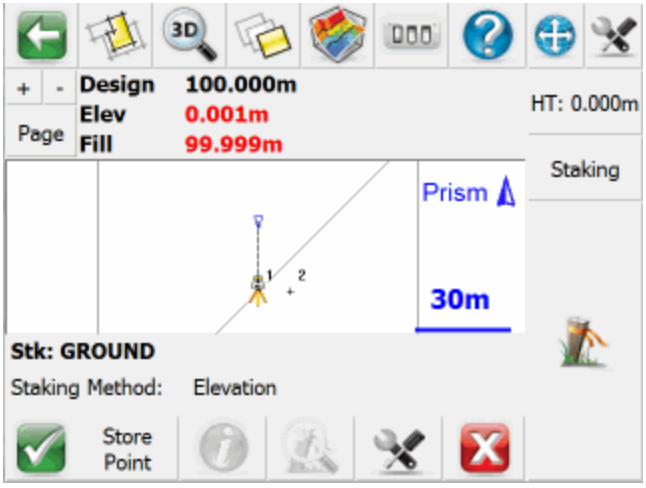
Stake Surface

Main Menu | Layout | Surface

The Stake Surface command allows you to take a shot anywhere on a surface and a cut or fill value will be computed. The current northing and easting position of the rod is based on the measurement, but the Z value is computed by intersecting the surface at the rod location.

You will first be prompted to select a surface to stake. If you have already imported and turned on the TIN or Contours for any surfaces, they will be displayed in the list for you to choose from. If the list is empty, you need to use the Surface Manager to import or enable one. Please refer to the Surface Manager topic for more information on how to load a surface.

When you first see the toolbar you may see the words "Waiting for data" in the Observation Toolbar which means you need to take a measurement first so it can calculate the current position of the rod. Press the measure button if you're using a conventional instrument, or turn on the cursor tracking button if you're using a robot or GPS.



Once you take a shot you will see the following information in the Observation Toolbar near the top of the screen: the Design elevation based on the surface model's elevation at your rod's horizontal position, the actual Height or elevation of the rod, and the Cut or Fill between the two. To help you visualize where your shot is in relation to the surface you can always use our 3D view capabilities.

Staking Method

Unlike Point or Line/Arc staking, there is only one available staking method: Height.

Store Point

When this is pressed the Store / Edit Points screen will appear so you can store the position that was staked. Also a raw record will be written to the raw file.

Information

This isn't applicable when staking to a surface and will be grayed out.

Zoom

This isn't applicable when staking to a surface and will be grayed out.

Settings

This will open the Staking Settings screen which allows you to setup parameters that will be used during the staking process.

> **Note:**
> Please refer to the Point Toolbar topic for additional information and tips.

Roads

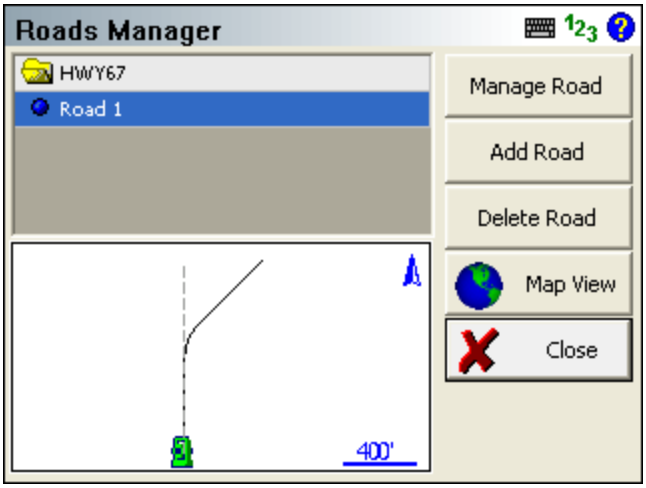
Roads Manager

Main Menu | Roads Manager

To stake an alignment you first need to define the geometry that defines the horizontal and vertical element. You can also define a template that will be used to define cross sections at specific stations along the alignment.

Layout can use the following three methods to define an alignment.

1. Manual Entry – You can manually enter the data to define the alignment.
2. Import XML – You can import a LandXML file that contains your alignment data.



By default you will see an alignment in the list with the current project name. A project can contain multiple roads, and each road can contain the following elements.

- **Horizontal Element:** This can contain straight tangents, curves and spirals.
- **Vertical Element:** This can contain grade breaks, parabolic curves and non-symmetrical curves.
- **Templates:** Template can contain horizontal and vertical offsets, as well as widening and super elevation data.
- **XML Cross Sections:** XML cross sections define specific stations along an alignment. These sections contain horizontal, vertical and template data. XML cross sections are created using desktop software which is then imported into Layout.

Manage Road

This option is only available once you've created a road using the New Road button or imported an XML file. To input or review alignment data, press the Manage Road button to access the Road Settings screen.

If you imported a LandXML file, or manually inputted a road you can stake it by pressing this button. As a minimum you need to have the following before the stake command will continue.

- XML Cross sections
- Horizontal C/L, Vertical Profile and template.
- Horizontal C/L and DTM Surface

Add Road

Use this button to create a new road. You can create as many roads as needed and they will be stored in an XML file that will reside is the project directory.

Delete Road

Use this to delete a road. You first need to highlight the road you want to delete, and then press the button to remove the road from the alignment. This road will be permanently deleted and can not be undone.

Map View

Use this button to display the map view. From this view you can use the zoom controls to zoom around your drawing so you can find important or relevant data for your alignment such as a POB point. Press the Close View button to return back to the Roads Manager.

Tell me more about ...
Road Settings
Manua Entry - Alignment C/L
Manual Entry - Vertical Profile
Manual Entry - Template
LandXML Cross Sections
Alignment DTM Surface
Alignment Staking - Part 1
Alignment Staking - Part 2
Alignment Slope Staking

Length

Main Menu | Calculate | Length

This command will calculate for you the length between two points. It will display the horizontal / slope distance, direction, vertical distance and slope between the two points. You do not need to have a line drawn between the points to use the length command.

All length information is saved in the COGO History file called CogoCalcs.txt located in your project folder.

Traverse Length

Function

1. Start the length command and make sure the **Traverse Length** and **Line** options are selected.
2. Enter or choose the first point to calculate from, and press your enter key to continue on to the next point.
3. Now you can choose or enter the second point and press your Enter button to compute an answer.
4. The length information will be displayed in the results toolbar.
5. In the COGO history you will see the following information for the two points:

```
|-------------------------------                                                |
|INVERSE                                                                        |
|-------------------------------                                                |
|PNT 44 to 8 (HD 1352.84' @ NA 323°48'03.1")SD 1353.39' GR -2.85' VD -          |
|38.51'AR 323°48'03.1"                                                          |
```

Your first length will calculate a right angle from north to the direction you calculated.

Multiple Lines

After you have specified two points, you can continue from point to point. You should notice that the point id previously in the 2nd point field will move to the 1st point field, and the cursor will remain in the 2nd point field allowing you to quickly enter in your next point.

If you continue calculating from point to point, the angle right will not be referenced to north, but the last leg you calculated. Essentially this is computing a clockwise angle between the current and last legs you calculated.

Perimeter Distance and Area

If you close back to the first point, a perimeter distance and enclosed area will also be computed.

Radial Length

You can compute radial lengths from a point.

Function

1. Start the length command and make sure the **Radial Length** and **Line** options are selected.
2. Enter or choose the 1st point to calculate from, and press your enter key to continue on to the next point.
3. Now you can choose or enter the 2nd point and press your Enter button to compute an answer.

4. The length information will be displayed in the results toolbar.
5. You can now continue computing radial lengths. The 2nd point field will remain activated allowing you to continue entering point numbers.

Radial Arc

You can compute the curve information for an arc defined by three points, PC (start), Radius Point, and PT (End)

Function

1. Start the length command and make sure the **Rad Arc** button is turned on.
2. Enter or choose the starting point for the arc in the Start field, and press your enter key to continue on to the next point.
3. Enter or choose the radius point in the Arc field, and press your enter key to continue on to the next point.
4. Enter or choose the end point for the arc in the End field, and press your enter key to compute an answer.
5. The length information will be displayed in the results toolbar.

Three Point Arc

You can compute the curve information for an arc defined by three points along the arc.

Function

1. Start the length command and make sure the **3 Pt Arc** button is turned on.
2. Enter or choose the starting point for the arc in the Start field, and press your enter key to continue on to the next point.
3. Enter or choose the point that falls on the arc in the Arc field, and press your enter key to continue on to the next point.
4. Enter or choose the end point for the arc in the End field, and press your enter key to compute an answer.
5. The length information will be displayed in the results toolbar.

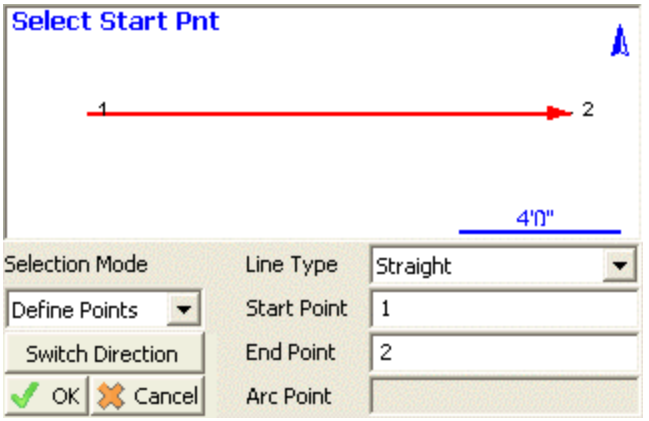
Offset Tool

Main Menu | Calculate | Down/Out

This routine allows you to calculate and draw points and/or figures, offset from other existing points, figures, or DXF entities in your project. You can calculate points on a line or down and out from a line, or offset complete figures.

Selection Mode

Press the "Select Line" button to go into Selection Mode. You will also automatically go into Selection Mode if a line is not yet selected when you start this command.



Whichever Selection Mode you use, the selected line will be highlighted in red in the map screen along with a direction indicator. If necessary, you can press the **Switch Direction** button to reverse the start and end of the selected line. Press OK to accept the selected line and proceed to the next step.

Selection Mode: Figure/DXF

Pick this mode to select an existing figure or DXF entity by selecting the desired figure from the map screen. You can select any of the following:

- Figures containing lines and/or arcs (but not curvey splines)
- DXF lines, arcs, and/or polylines (but not splines, splined polylines, or fitted polylines)

Selection Mode: Figure Segment

Pick this mode to select an individual line or arc segment from a complex figure, by selecting the desired segment from the map screen. You can select any of the following:

- a line or arc segment from a Figure (but not a curvey segment)
- (line or arc segments from a DXF polyline cannot be selected)

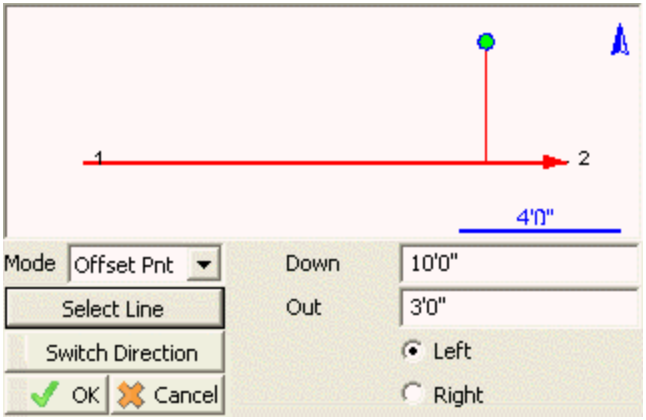
Selection Mode: Define Points

Pick this mode to select points in your project to define a line or arc. You can define the following line types:

- Straight Line: select a Start Point and End Point
- Arc (CW): select a Start of Curve Point, Radial Point, and End of Curve Point
- Arc (CCW): select a Start of Curve Point, Radial Point, and End of Curve Point
- Arc (3Pnt): select a Start of Curve Point, Point on Curve, and End of Curve Point.

Offset Point Mode

Use this mode to calculate a point measured Down and Out from the selected line.

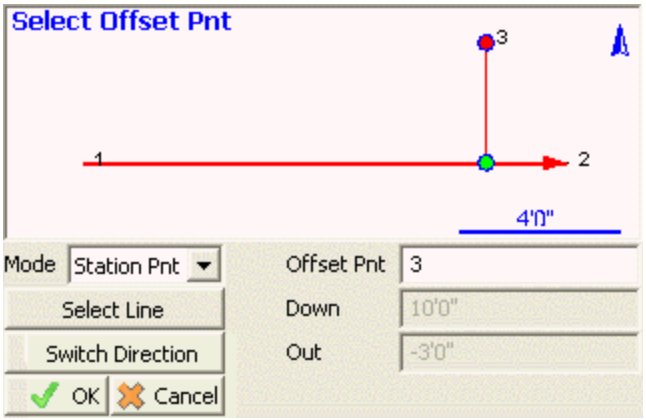


After selecting a line using any of the above Selection Modes, pick this mode and enter the Down/Out distances and the offset direction (left or right, looking down the line).

The calculated point will be previewed in green in the map screen. Press the **Save** button to store this point.

Station Point Mode

Use this mode to calculate the Down and Out distances to a selected point, and to calculate a perpendicular intersection point On the selected line.



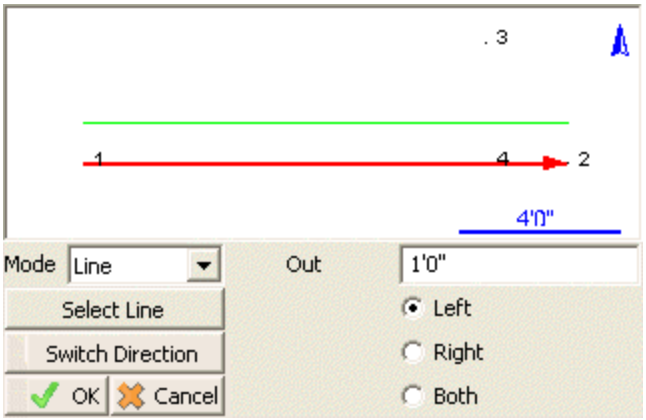
After selecting a line using any of the above Selection Modes, pick this mode and select the Offset Point by either typing in its Point ID or by selecting it from the map screen when the Offset Pnt field has focus.

The selected point will be highlighted in red in the map screen, and its Down/Out distances from the selected line will be displayed.

A perpendicular intersection point On the line will be calculated and previewed in green in the map screen. Press the **Save** button to store this point.

Line Mode

Use this mode to draw a new line or figure, offset from the selected line.



After selecting a line using any of the above Selection Modes, pick this mode and enter the distance and direction (left or right looking down the line, or both sides).

The offset line will be calculated and previewed in green in the map screen. Press the **Save** button to store this line. When a line is saved, points will be automatically stored at the start and end points, arc radial points if applicable, and polyline vertex points if applicable.

Point Patterns

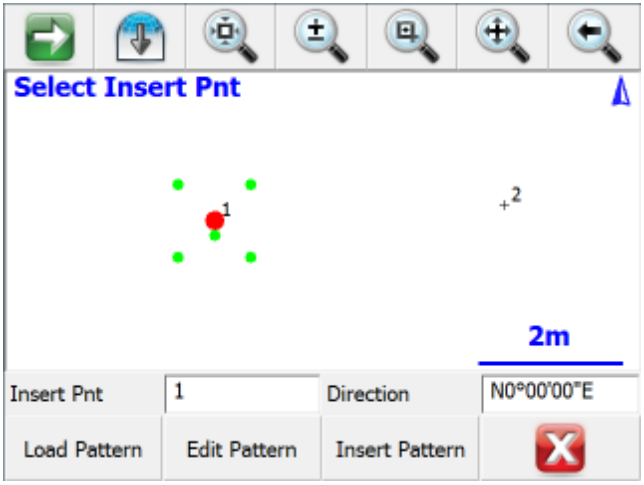
Main Interface | Point Patterns

This routine allows you to create or edit point patterns, and apply them to existing points in your project. This is useful for creating drill holes for bolt patterns, pillar columns, etc.

> **Note**
> The *.pattern data files are completely interchangeable between both Layout and MicroSurvey Point Prep, so any patterns created in one program can be edited or used in the other.

Pattern Toolbar

When you start the Point Pattern command, you will see the Pattern Toolbar along the bottom of your map screen.



Insert Pnt

Specify the point ID for an existing point in your project, either by typing in its point ID, or by tapping on a point in the map screen to select it when this field has focus.

The selected point will be highlighted in the map view with a large red point, and the current pattern will be previewed with smaller green points.

Direction

Use this to specify a direction value for your pattern. The default direction of N0°00'00"E will orient the pattern exactly as it was defined.

To orient your pattern along any arbitrary line between two existing points, enter those two points using the pt#..pt# format like 1..2 and the direction between those two points will be automatically calculated for you. The pattern's X-axis will be applied along this direction.

Load Pattern

Press this button to load a previously saved *.pattern file.

Edit Pattern

Press this button to edit the currently loaded pattern, or to create a new pattern if you have not loaded one. Please see below for more information on the Pattern Editor.

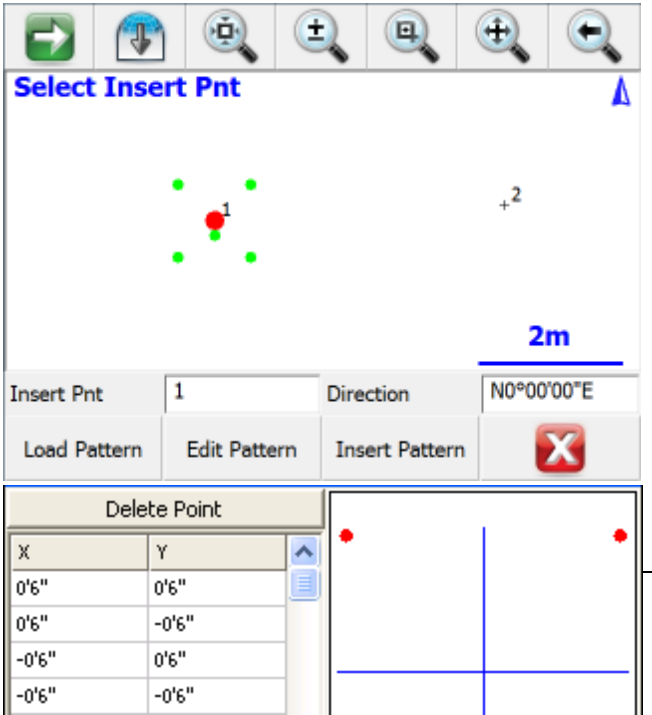
Insert Pattern

Press this button to apply the currently pattern to the selected insertion point. New points will be stored in your project at the coordinates, as previewed by the green pattern points. All inserted points will be created with the description "Pattern", and with the same elevation as the selected insertion point.

To insert a pattern onto multiple points, simply change the insertion point and insert the pattern onto each point one-at-a-time as desired.

Pattern Editor

When you press Edit Pattern on the Pattern Toolbar, you will see the Pattern Editor screen.



Enter the X and Y offset values for your pattern as desired. As you enter the points, they will be previewed in the grid, which will automatically zoom to the extents of your pattern. Please see the Distance Entry & Recall topic for options on entering the offset values in various units.

The 0,0 origin will always be located at the selected Insertion Point, so a point should not be included in your pattern at 0,0. You can also rotate the pattern into any orientation on the Pattern Toolbar (see above), so you do not need to create different variations of the same pattern to insert it in different orientations.

Press the Delete Point button to remove the selected X,Y offset from the pattern.

Load Pattern

Press this button to load a previously saved *.pattern file.

Save Pattern

Press this button to save the current pattern to disk.

This will always do a "Save As" type save, so you can specify a new filename, or select any existing pattern file to overwrite it with the changes. You will always be prompted for confirmation before overwriting an existing pattern file.

New Pattern

To create a new pattern, simply delete all of the existing points from the current pattern. When you press the Save Pattern button you will always be prompted for a new filename, so you will not lose the previous pattern.

Close

Press this button to close the Pattern Editor and return to the Pattern Toolbar. If you have not saved the current pattern, you will be prompted to confirm this before discarding your changes.

POINTS & FEATURES

Points / Lines / Descriptions

Points

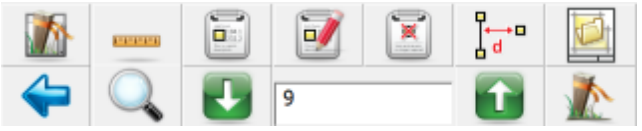
Layout projects typically are comprised of points that have been imported, calculated or measured. These points are always stored in a file made up of the project name and will have an extension of DBF. DBF files can be viewed using a DBF reader or with Microsoft Excel.

Point Labels

In the drawing area you will always see a node or dot that marks the coordinate location of the point. For each point you can control what is displayed on the screen such as the points number, elevation, description and note. To control the visibility of the labels, use the Options button on the Display Toolbar.

Point Toolbar

At any time you can tap on an existing point to open the Point Toolbar. This toolbar will contain common functions that are done with points. Please refer to the point toolbar topic for more information.



Editing Single Points

To edit a point you can tap on it which will open the Point Toolbar. Press the Edit button to open the Review / Edit Points screen.

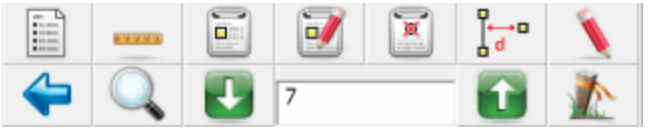
Working with Multiple Points

If you need to search, list, or edit multiple points at the same time you will use the Coordinate Database Editor. Please see the Coordinate Database topic for more information.

Point Toolbar

Point Toolbar in Stakeout Mode

Point Toolbar in Linework Mode



When you tap on an existing point in the drawing you will see the point toolbar appear near the bottom of your screen. The point toolbar contains functions that are frequently used on points in your project. Following is an explanation of what each button will do.

Points List

This will display the list of all points in your current project and you can sort the list by tapping on any of the column headings. When you find the point you want simply tap it and press the ok button.

Staking List

This will display the staking list dialog.

Draw Tool

Use this to draw lines, points, and connect line work between existing points. This will open the Draw Tool.

New Point

This will open the store and edit dialog and allow you to enter coordinates for a new point.

Edit Point

Use this to edit the coordinate value for the selected point.

Offset

This will open the Offset Tool.

Inverse Tool

Use this to measure the inverse between points.

Zoom to Point

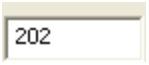
This button when pressed for the first time will force the point to be centered on the screen. Subsequently, if you keep pressing it, it will continue to zoom in on the point.

Stake Point

Pressing this will help you stake the point that is currently selected and take you to the Stake Points screen.

Select Point

Use these two buttons to scroll up and down numerically through the points in your database.



Point ID

This displays the point id of the point you've currently selected.

Select Point Toolbar

The point chooser is a mechanism that is called by routines requiring a point number entry. You access it by selecting the point chooser icon next to point number fields, or by double-tapping in an extended edit point number field.

When select it you will see the point chooser toolbar open up towards the bottom of your screen.

Point ID

You can either type the Point ID into this field if you know what it is, or when you tap on a point in the map screen its point ID will be displayed here.

Quick Select

If Quick Select is turned on, then as soon as you tap on a point in the map screen you will be automatically returned to the routine you were selecting the point for. If Quick Select is turned off, then after you tap on a point in the map screen, the coordinate data of that point will be displayed, and you must press the Select button to get back to the previous routine.

Select

Pressing this will take you and your selected point back to the routine you were selecting the point for.

List

Use this to open a grid displaying all the points in your project database. From this list you can click on a point and when you press the OK button it will be inserted into the Point ID field.

New

Use this to open the Store / Edit Points screen. This will enable you to create a new point.

Cancel

Pressing this will take you back to the routine you were selecting the point for, without selecting the selected Point.

Point Averaging

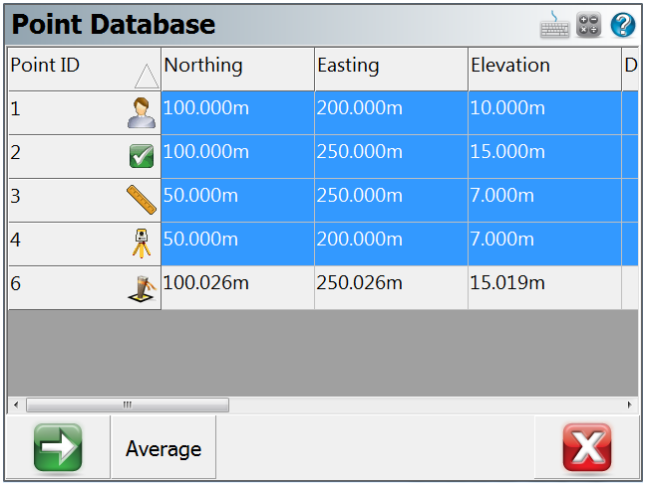
Main Interface | Edit | Points

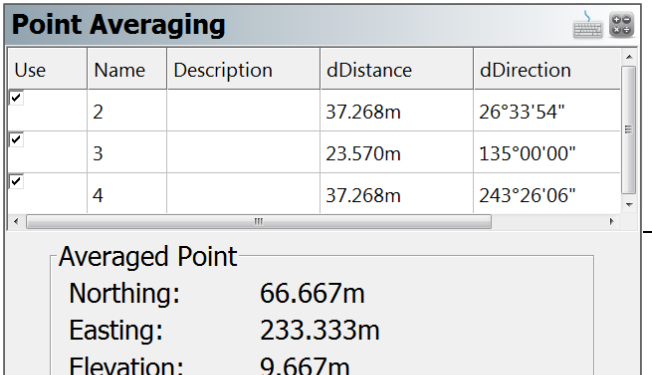
This routine allows you to select a number of points from within the Point Database, and then calculate the average of the coordinate values of the selected points. You can then create and store a new point based on the averaged coordinates.

Point Database

When you enter the Point Database, tap on the green arrow button in the bottom toolbar until you see the **Average** button displayed. **Note**: The items will loop back around to the first item if you keep pressing the green arrow button.

Select multiple points by tapping on the screen and dragging a box around the items you wish to include in the averaging calculation.





Press the **Average** button when finished. This takes you to the Point Averaging dialog.

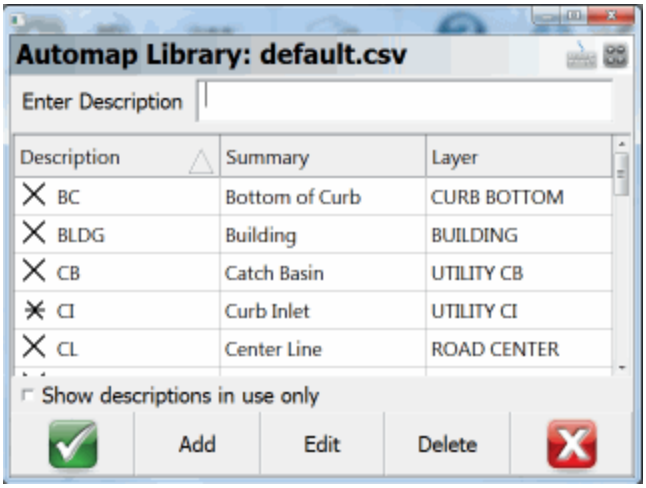
In the Point Averaging dialog, we see the results of the averaging computation. You can uncheck the box in the **Use** column to disable/re-enable a selected point.

The **Store Point** button takes you to the Store Point dialog.

The **Cancel** button returns you to Point Database dialog.

AutoMap Library

The AutoMap Library editor allows the user complete control over the visibility of points and lines based on the descriptions used to code the points. It also allows you to set attributes for the descriptions such as point and line colour.



Enter Description

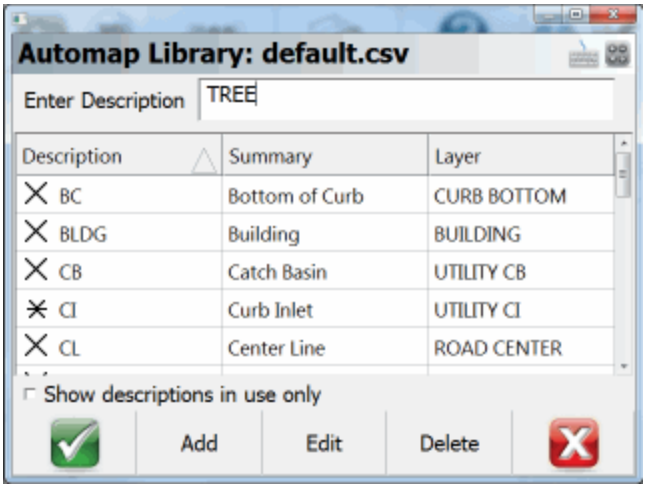
Use this field to auto scroll to description in your list. For example, typing the letters will scroll down to the description. If you type a unique description and press enter, you will be prompted for whether you want to add it into the AutoMap Library or not.

Show descriptions in use only

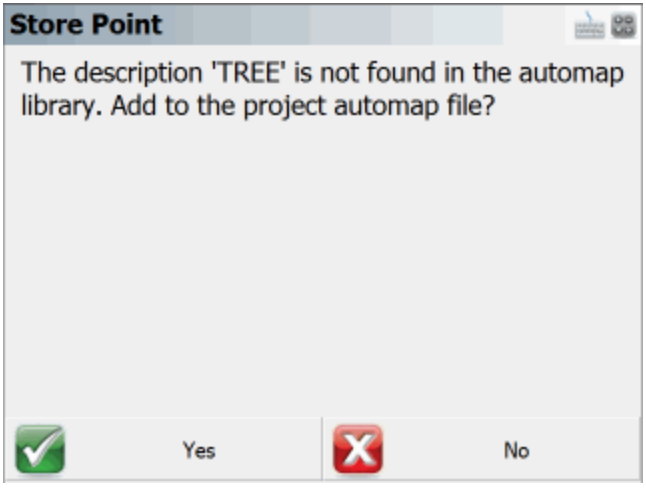
Use this to display only the descriptions found in your AutoMap Library that are used in the current project.

Adding Descriptions to the Library in Layout

While you're working you can add descriptions to the AutoMap Library on the fly. When you enter a description that isn't in the library you will be prompted with a message asking you if you want to add it to your project's AutoMap Library file.



Note: This prompt can be turned off so Layout always uses the new descriptions without adding them into the AutoMap Library file. To do this you need to make sure you have the **"Prompt New Descriptions"** toggle turned off in the Options menu.

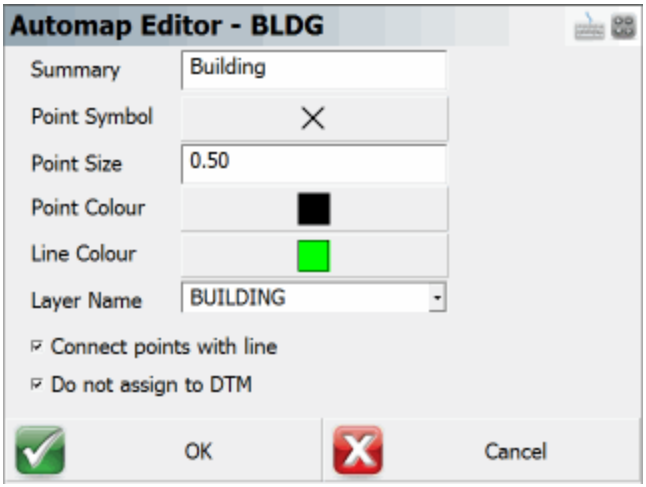


If you answer **Yes**, then the description will be added into the project's AutoMap Library file (not to the AutoMap Template file).

If you answer **No**, then the description will be used without adding it into the AutoMap Library. If you do not add it to the AutoMap Library, then you will not be able to set options such as defining the layer and colour of points and lines with this description.

Editing Descriptions in the Library in Layout

The AutoMap Library editor allows you to edit properties for each description in the library. Pressing the Edit button will bring up the menu shown below for the selected entry:



These properties are stored in the library in specific columns. Please refer to the topic below about editing the library for more information.

Summary

You can use this field to summarize your description. For example, a description IP may have a summary Iron Pin.

Point Symbol

You can define a marker for a point. These markers are not automatically transferred back to the desktop and are not similar to CAD blocks or parts. They are simply point nodes that will be displayed in the map view to help distinguish different points on the screen. There are 27 different marker types. The symbol for each description is also shown on the AutoMap Library screen.

Point Size

This allows you to change the size of the marker. You will find that using a number of 1 is a good starting point. Adjust from there as needed.

Point Colour

This allows you to set the colour of the markers. You can choose from a list of 255 colours.

Line Colour

This allows you to change the colour of lines in your drawing.

Layer Name

This specifies the layer that will be used for lines and points with this description.

Connect Points With Line

If this is checked, when you select the description from the topo toolbar on the main display, the connect lines toggle will be turned on automatically. Use this for descriptions that typically are connected by lines such as an edge of road or ditch center line.

Do not assign to DTM

This is very useful for the creation of real-time surface models. If you toggle this ON, then these points will not be included in any DTM created with Layout. Use this for descriptions that are not at ground level.

Deleting Descriptions from the Library from Layout

The AutoMap Editor allows you to delete descriptions from the library. Pressing the Delete button will prompt you to make sure that you want to delete the selected entry. This will delete that entry from the project's AutoMap Library file, it does not affect the AutoMap Template file.

Editing an Existing Library outside of Layout

The AutoMap Library is a very powerful feature in Layout. When combined with our desktop products, your downloaded files can literally be imported, layers and symbols placed in seconds. For this topic we will concentrate on helping you work with and edit the AutoMap library using Layout.

The Layout AutoMap library is a comma delimited file that can be edited with MicroSurvey Point Prep, with a text editor like Microsoft Notepad, or with a spreadsheet application like Microsoft Excel. Since not every Layout user owns our desktop software we will discuss editing the file with Excel.

The first row in the file is reserved for the column header. Some of the columns are reserved for our desktop products, but the following columns are used in Layout.

Column A = Description (String value)

Column B = Summary of Description (String value)

Column L = Connect Points with Line (1=Yes, 0=No)

Column M = Layer Name (String value)

Column O = Line Colour (Number 0-255)

Column Q = Line or Spline (0=Line, 1=Spline) *** This works in conjunction with Column L.

Column U = Marker Type (Number 0-26)

Column V = Marker Size (Number 0-10)

Column W = Marker Colour (Number 0-255)

Column X = Exclude from DTM (1=Yes/Exclude, 0=No/Include)

Column AF = Zone Number (Numeric Value)

Create New Library outside of Layout

You can easily start a new library from scratch simply by creating a simple text file. In the first row add a header followed by your descriptions and summaries. You have to separate the values with a command and when you're done save the file with an extension of .CSV - an example filename might be CODES.CSV.

```
DESCRIPTION,SUMMARY
PIN,Iron Pin,
EC,Edge of Concrete,
EP,Edge of Pavement,
```

You can then copy the file to your ...\MicroSurvey\Layout\Projects\ directory. When you create a new project or open an exiting one, make sure to select it as the AutoMap Template File.

Point Patterns

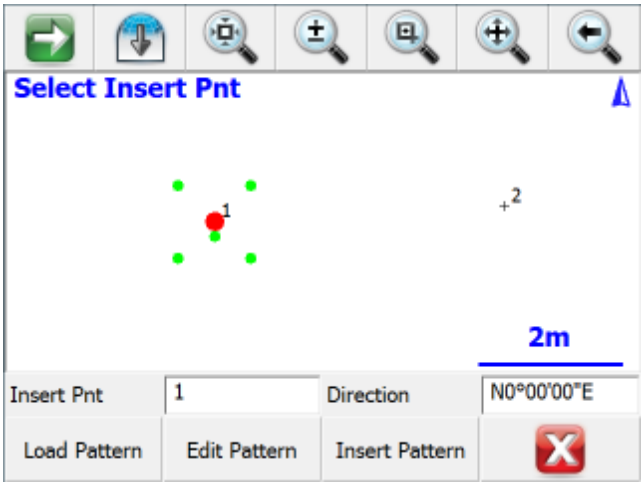
Main Interface | Point Patterns

This routine allows you to create or edit point patterns, and apply them to existing points in your project. This is useful for creating drill holes for bolt patterns, pillar columns, etc.

> **Note**
> The *.pattern data files are completely interchangeable between both Layout and MicroSurvey Point Prep, so any patterns created in one program can be edited or used in the other.

Pattern Toolbar

When you start the Point Pattern command, you will see the Pattern Toolbar along the bottom of your map screen.



Insert Pnt

Specify the point ID for an existing point in your project, either by typing in its point ID, or by tapping on a point in the map screen to select it when this field has focus.

The selected point will be highlighted in the map view with a large red point, and the current pattern will be previewed with smaller green points.

Direction

Use this to specify a direction value for your pattern. The default direction of N0°00'00"E will orient the pattern exactly as it was defined.

To orient your pattern along any arbitrary line between two existing points, enter those two points using the pt#..pt# format like 1..2 and the direction between those two points will be automatically calculated for you. The pattern's X-axis will be applied along this direction.

Load Pattern

Press this button to load a previously saved *.pattern file.

Edit Pattern

Press this button to edit the currently loaded pattern, or to create a new pattern if you have not loaded one. Please see below for more information on the Pattern Editor.

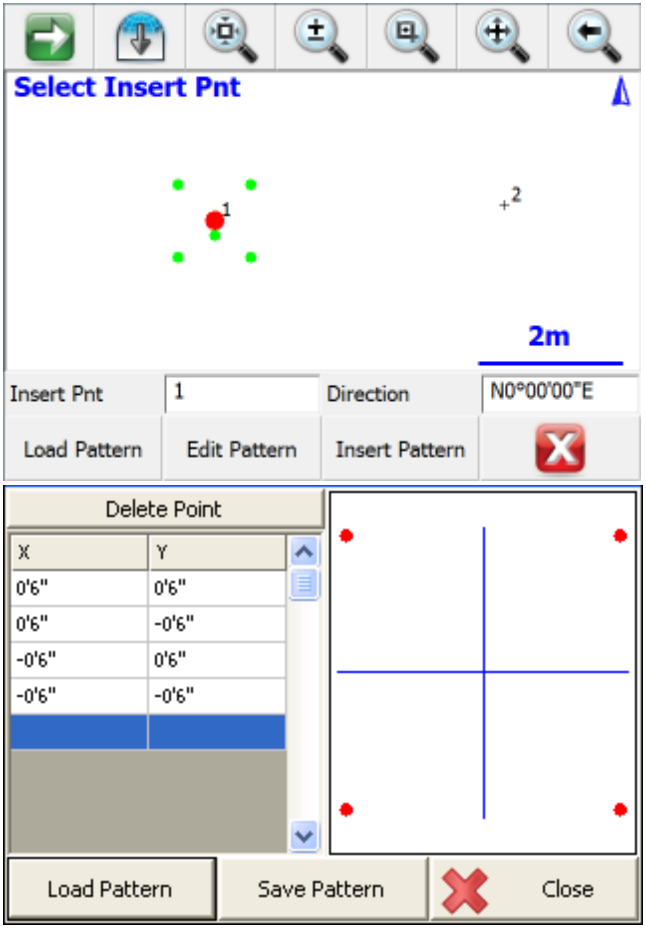
Insert Pattern

Press this button to apply the currently pattern to the selected insertion point. New points will be stored in your project at the coordinates, as previewed by the green pattern points. All inserted points will be created with the description "Pattern", and with the same elevation as the selected insertion point.

To insert a pattern onto multiple points, simply change the insertion point and insert the pattern onto each point one-at-a-time as desired.

Pattern Editor

When you press Edit Pattern on the Pattern Toolbar, you will see the Pattern Editor screen.



Enter the X and Y offset values for your pattern as desired. As you enter the points, they will be previewed in the grid, which will automatically zoom to the extents of your pattern. Please see the Distance Entry & Recall topic for options on entering the offset values in various units.

The 0,0 origin will always be located at the selected Insertion Point, so a point should not be included in your pattern at 0,0. You can also rotate the pattern into any orientation on the Pattern Toolbar (see

above), so you do not need to create different variations of the same pattern to insert it in different orientations.

Press the Delete Point button to remove the selected X,Y offset from the pattern.

Load Pattern

Press this button to load a previously saved *.pattern file.

Save Pattern

Press this button to save the current pattern to disk.

This will always do a "Save As" type save, so you can specify a new filename, or select any existing pattern file to overwrite it with the changes. You will always be prompted for confirmation before overwriting an existing pattern file.

New Pattern

To create a new pattern, simply delete all of the existing points from the current pattern. When you press the Save Pattern button you will always be prompted for a new filename, so you will not lose the previous pattern.

Close

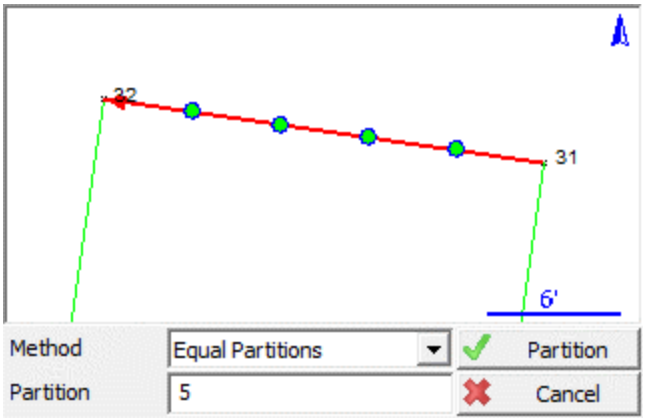
Press this button to close the Pattern Editor and return to the Pattern Toolbar. If you have not saved the current pattern, you will be prompted to confirm this before discarding your changes.

Partition Lines/Arcs

Line Toolbar | Partition button

The Partition command is started by selecting a valid line or arc in the map screen, which will open the Line Toolbar where you can select the partition button. After you select the partition button you will see the partition toolbar.

The partition line and arc command allows you to compute points along objects in your project. You can partition figures that have line and arc segments that have a radius point defined. 3 point arcs can not be partitioned. Straight lines in DXF files can be partitioned, all other DXF entities are not compatible with the partition command.



Equal Partitions

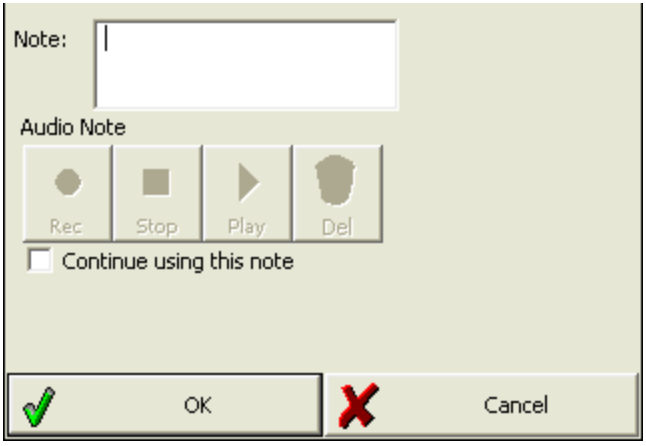
You can partition the segment by equal divisions. Simply select the partition number and press the Partition button. This will compute new points and split the object up into separate segments.

By Distance

You can partition the segment by specifying a distance between partitions. Simply define the partition distance, then press the Partition button. This will compute new points and split the object up into separate segments.

Notes

Use this to enter or record audio notes for your points. You can access the notes screen by pressing the **Notes** button on the Store / Edit Points screen.



Text Notes

You can type a note up to 32 characters in length and it will be stored in the project's DBF file. You can not enter more than this limit into the Note field.

When the file is imported into MicroSurvey Point Prep, the note will appear in its own field, or can be appended to the point's description field.

Continue using this note: Use this if you want to use the note you just entered automatically for future points that are stored.

Audio Notes

Use this function to record and playback audio notes that are related to stored points. These notes will be transferred to MicroSurvey Point Prep desktop software for playback in the office.

The notes will be stored in your project directory and will be automatically named for you. Example, if you recorded a note for point 2, a file would be created pnt2.wav. The file that is created is a standard windows WAV file that can be played by most audio players.

MicroSurvey Point Prepdesktop software will automatically link to any audio note you recorded. This allows you to easily see which points have audio notes.

Recording and Playback Controls

Circle = record

Square = stop

Triangle = playback

Trash = delete

Note that not all handheld devices support audio notes. You must have a record and playback functionality, which for some units requires optional accessories.

To Store an Audio Note:

1. Tap the red circle to activate recording. Speak into your microphone to record the desired information. "This post is bent" etc.
2. Press the square button to stop the recording
3. To confirm your note, press the playback arrow, now green on color displays, and listen to your note

To replace an Audio Note with a new note:

1. Delete the existing audio note. You will be prompted to confirm the deletion.
2. Record a new audio note.

LINES & FIGURES

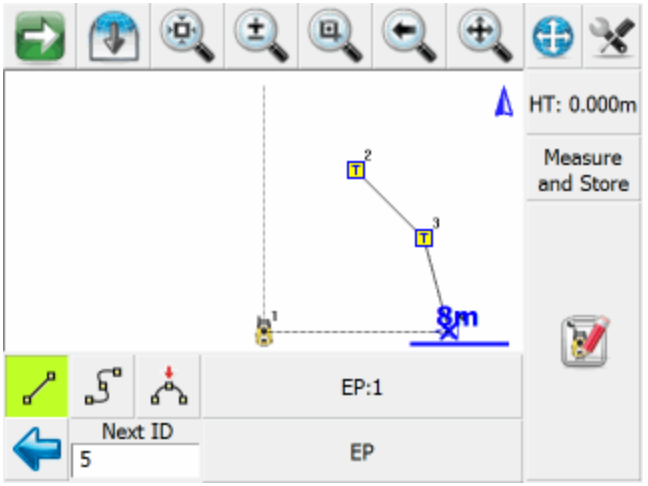
Active Linework

Layout has Code-Free linework control in the field to eliminate the need to remember line codes. To activate linework on the fly while surveying, you simply choose the description you want and start taking shots! For MicroSurvey Point Prep desktop users, line connectivity codes setup in the desktop Automap library will be used by Layout . For more information see the Draw Option Defaults section.

Layout uses the concept of Figures for handling of linework. Some software packages refer to these as "Chains".

At the bottom of the Layout interface, you will see the Active Lines List button on the second row. When a new project is started, it will display **[<No Line>]** as the current, active line.

When a new line figure is about to be started, **[<Start line>]** will by displayed on the button. After the first point for a new line has been measured, the active line will be created, made current and displayed.

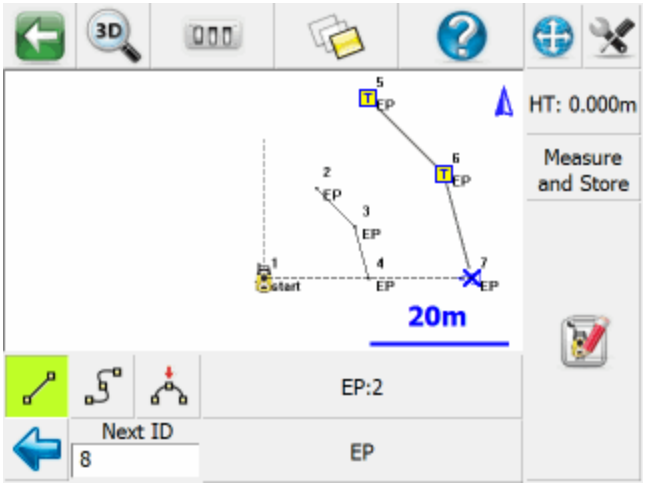


In the example shown, notice E/ASPH:1 on the button. This is the current Active Line. E/ASPH is the point description and 1 is the group number (added automatically). Since this is the first figure in the map, it is assigned group 1.

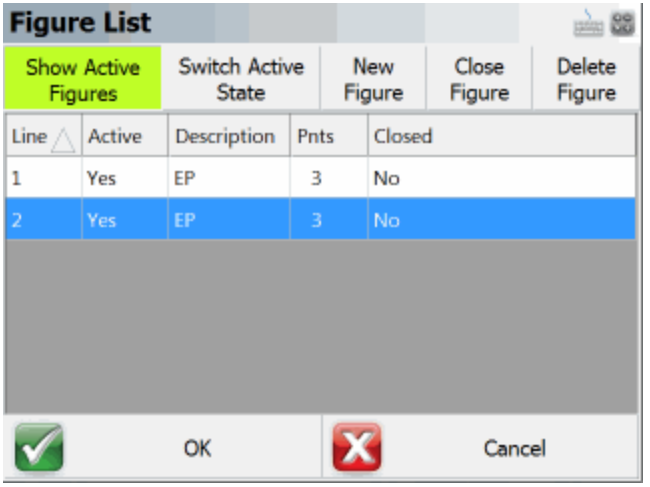
A Figure is a continuous series of Line, Curve and/or Arc segments. The Figure is identified by Point Description and a group number. Whenever a new line is started, a new Figure is created and added to the Active Lines list with an automatically assigned group number. The group number will

increment by one when a previously used point description is used for a subsequent line. (Notice there are two E/ASPH lines in the example)

Furthermore, all linework in Layout is handled in 3D.



When you press the E/ASPH:2 Active Line button you will see a list of the figures in your project.



See Also ...

- Automap Library

Figures

Tangents, arcs and curvy lines in Layout are also called figures. Figures are created automatically for you as soon as you connect points in the drawing.

Figures can be created while you survey in realtime using our active linework or you can manually create the figure using the pencil tool.

Layout Figures

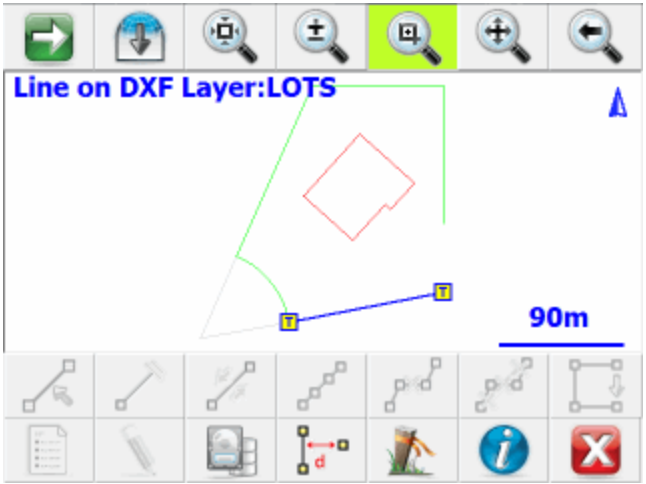
When you click on a figure the Line Toolbar will appear. You will also see bold text in the drawing area indicating what you selected.

DXF Linework

When you import a DXF drawing you will see all the linework that exists in the drawing. When you select a DXF line or arc you will see the Line Toolbar but everything will be greyed out except for the stake and perpendicular distance buttons. If you press the stake button or perpendicular offset to point button, they will open up their respective toolbars.

When you click on a DXF entity you will see bold text in the drawing area indicating that you picked a DXF line or arc, and it will display which layer it is on.

You can control the visibility of DXF layers through the Layers Manager screen.



Coordinate DXF Data

You can add coordinates to the DXF entity by pressing the Coordinate DXF Data button.

Information

You will see the inverse information based on the DXF entity you picked by pressing the Information button

Line Toolbar

Line Toolbar in Linework Mode

Line Toolbar in Stakeout Mode when selecting a figure.

Line Toolbar in Stakeout Mode when selecting a DXF entity

When you tap on an existing line or arc you will see the line toolbar appear near the bottom of your screen. The line toolbar contains functions that are frequently used on line or arcs in your project. Following is an explanation of what each button will do.

Set Figure Current

Use this to make the current line or arc current in the Active Line List.

End Figure

Use this to mark a line as complete or finished.

Reverse Figure Direction

Use this to switch the direction of a figure so you can append to the opposite end.

Partition Line / Arc

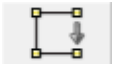
You can partition (split) a figure or DXF line into smaller segments using this command.

Delete Figure Segment

Use this to delete a segment from a figure.

Delete Entire Figure

Use the delete an entire figure.



Close Figure

Use this to close a figure so it finishes at the same point it started at.

Open Figure List

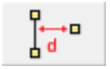
Use this to display the Active Line List.

Draw Tool

Use this to draw lines, points, and connect line work between existing points. This will open the Draw Tool.

Convert Line to Spline

This will turn an existing figure that is comprised of straight lines into a curvy line, and vice-versa.



Offset Tool

Use this to open the offset tool.

Stake Figure

Use this to open the stake line command and stake the current line you have selected.

Coordinate DXF Data

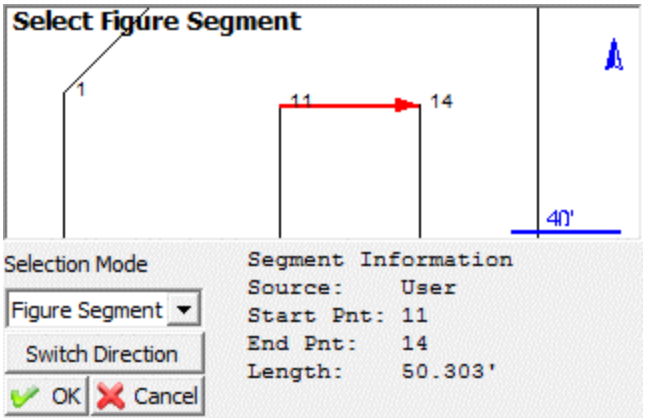
You can add coordinates to the DXF entity by pressing the Coordinate DXF Data button.

Information

This will display the inverse information of the segment you have selected, as well as the perimeter and area if it is part of a closed figure.

Select Line Toolbar

Various commands will use this toolbar to help you select a line.



Whichever Selection Mode you use, the selected line will be highlighted in red in the map screen along with a direction indicator. If necessary, you can press the **Switch Direction** button to reverse the start and end of the selected line. Press OK to accept the selected line and proceed to the next step.

Selection Mode: Figure/DXF

Pick this mode to select an existing figure or DXF entity by selecting the desired figure from the map screen. You can select any of the following:

- Figures containing lines and/or arcs (but not curvey splines)
- DXF lines, arcs, and/or polylines (but not splines, splined polylines, or fitted polylines)

Selection Mode: Figure Segment

Pick this mode to select an individual line or arc segment from a complex figure, by selecting the desired segment from the map screen. You can select any of the following:

- a line or arc segment from a Figure (but not a curvey segment)
- (line or arc segments from a DXF polyline cannot be selected)

Selection Mode: Define Points

Pick this mode to select points in your project to define a line or arc. You can define the following line types:

- Straight Line: select a Start Point and End Point
- Arc (CW): select a Start of Curve Point, Radial Point, and End of Curve Point

- Arc (CCW): select a Start of Curve Point, Radial Point, and End of Curve Point
- Arc (3Pnt): select a Start of Curve Point, Point on Curve, and End of Curve Point.

Switch Direction

The line direction will reverse, and the arrowhead shown in the map screen will show the current "forward" direction of the line.

OK

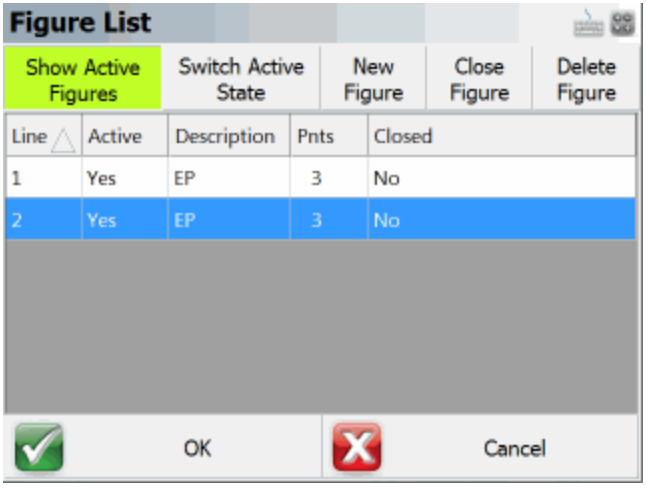
The highlighted line will be selected, and you will be returned to the appropriate command.

Cancel

You will return to the previous screen without selecting anything.

Figure List

The figure list contains a listing of all figures in your project.



Line Column

This is the group id assigned to the figure. Refer to the Active Linework topic for more information.

Active Column

If the figure is active, you will see the work **YES**. To make a figure not active, press the Switch Active State button.

Description Column

This is the name of your figure which will usually match the description of the first point that the figure is connected to.

Points Column

This is the total number of points that the figure is connected to.

Closed Column

If you closed the figure you will see the word **Yes**.

Show Active Figures

When this is selected (default setting) all of your active figures will be listed. You can select a figure that you would like to work on simply by selecting it in the list and pressing the OK button. If this is turned off, then all the figures in the project will be displayed.

Switch Active State

Use this to change the status of a figure to "finished". When this is done, it will no longer be displayed in the figure list of the Show Active Figures button is on. Once a figure is switched to a not active state, nothing can be added to it.

Figures that are not active, can be made active again simply by selecting the figure you want to use and pressing the Switch State button.

New Figure

Use this to create a new figure in the figure list.

Close Figure

Use this to close a figure so it will close back to the starting point.

Delete Figure

Use this to delete a figure that you have highlighted in the list. You can delete figures that are flagged as active, or not active. Review the delete figures topic for more info on deleting.

Using Active Figures

Active Linework Options

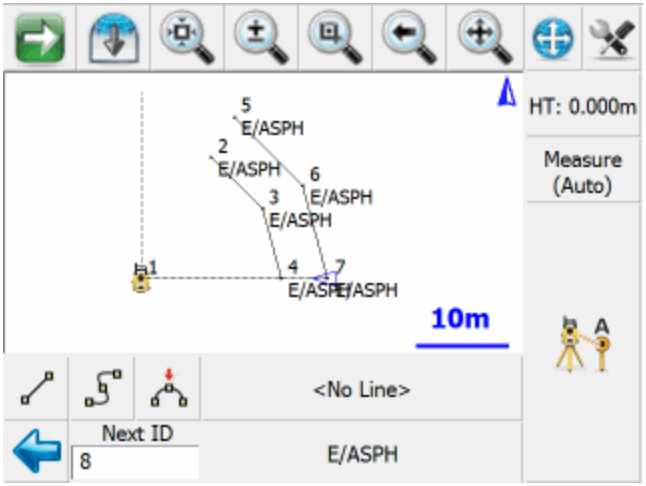
We have 3 Draw Options for Active Linework, selected from buttons that appear beside the Description and Active Lines drop down lists:

	Draw Lines button = Connect points with straight lines

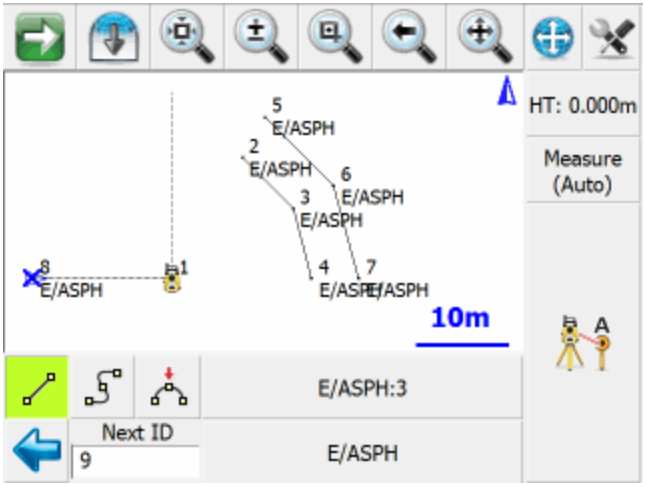
	Draw Curvy Lines button = Connect Points with a best-fit curvy line.
	Draw 3-Point Arc button = Fit an arc through three measured points

Start the first Line in a Project

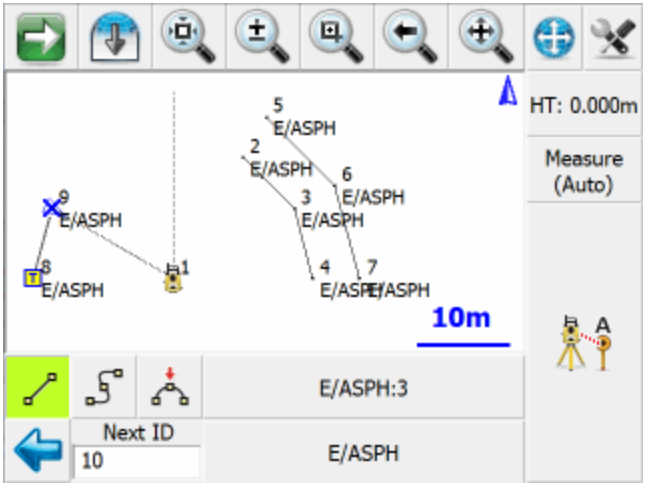
To start the first line in a new project, choose the desired point Description from the Description List and select the desired draw option before you start taking measurements. The Active Lines list will display <Start line> as shown. At this point, the next point measured will be the first point of a new Active Line using the E/ASPH Description. Use the measure button to measure the starting point for the new line.



After the shot to the first point for the new line is complete, the line will be added to the Active Lines list, identified by the current point description and an automatically assigned group number: E/ASPH:3. The group number is three, because this is the third figure using the description E/ASPH.



After the second point for this line has been recorded, the first segment will be created. From this point forward, simply continue taking shots to add to the now current Active Line: E/ASPH:3



Note the insertion of ":3", this is the group number. Re-use of the Description E/ASPH for a new line series in the current project will automatically increment the group number by one. This allows you track and store multiple active lines of the same description without the need for multiple entries in your AutoMap Library. For example, E/ASPH2, E/ASPH3, E/ASPH4…9 can now be replaced with a single E/ASPH entry.

Stop adding to a Line

If you wish to stop adding to the current line, simply deselect the current draw option (Line, Curvy line) before taking any more shots. After turning off the draw option, <No line> will display in the Active Lines list button.

Start a subsequent New Line

Much like the first line in the project, just select the desired description from the list and select the desired draw option before shooting the first point for the new line.

The key to note is the display of <Start line> in the Active Lines list. Once the first point for the new line has been measured, the Active Lines list will set and display the new line as current.

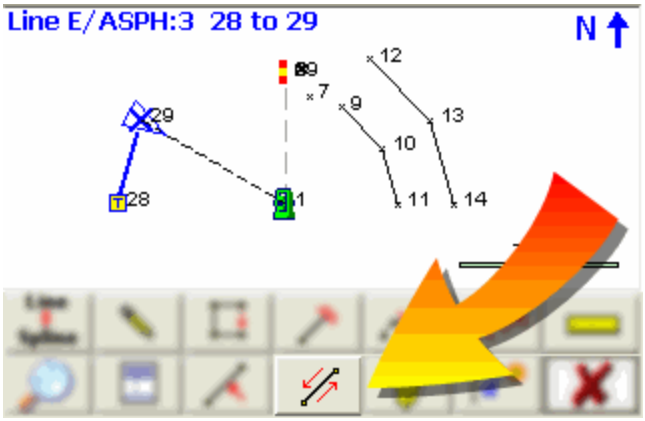
Change Description within an Active Line

You may change the description within one ongoing line. Simply choose a different description and continue taking shots. The ID of the Active Line will not change.

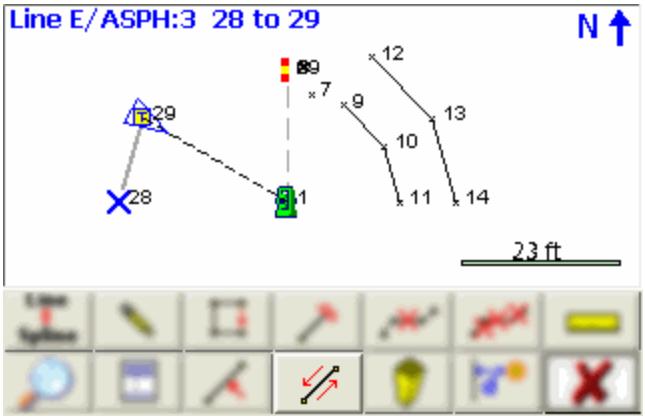
Figure Direction Marker

The current line in the map is always defined by a bold outline and a blue X at the end of the line. The blue X indicates the line direction so you know what end of the line the next measurement will be connected to.

You can see that the blue X is on point 29. After you take your next shot, it will be automatically connected to this point.



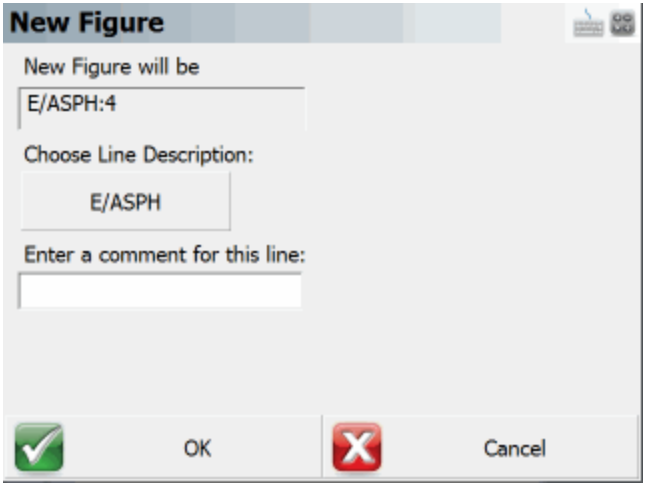
Once you select the figure, you will see the line toolbar. On this toolbar, select this button to reverse the direction. After you switch the direction, you will see the blue "X" move to the opposite end of the figure.



New Figure

Pre-selection of Line Descriptions

A list of Active Lines (Figures) may be pre-specified to aid in planning for a complicated project. Use the **New Figure** button on the Active Line List screen to specify a Line Description before taking any shots.

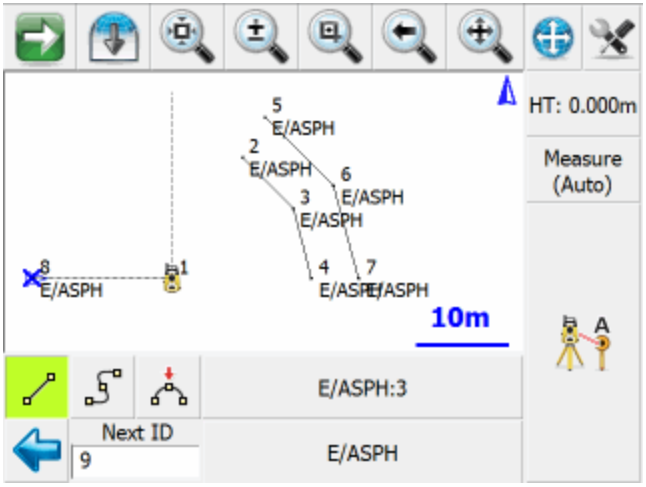


You have the opportunity to use a manually entered comment with this method but the new line will be linked to the selected Line Description. The comment will appear in the Active Lines list to aid correct selection of the line.

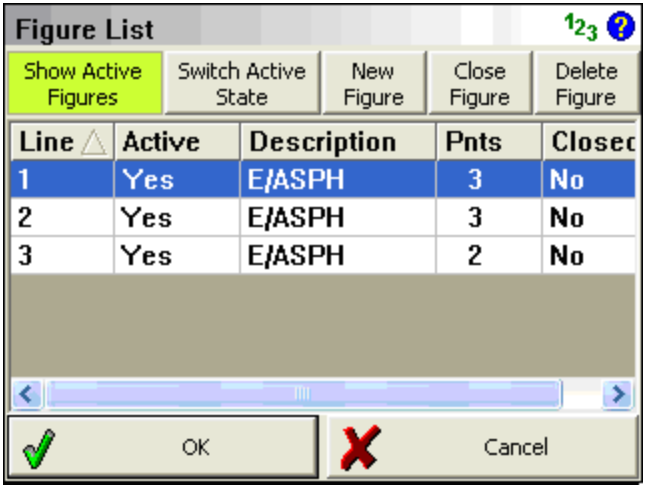
Switching Active Figures

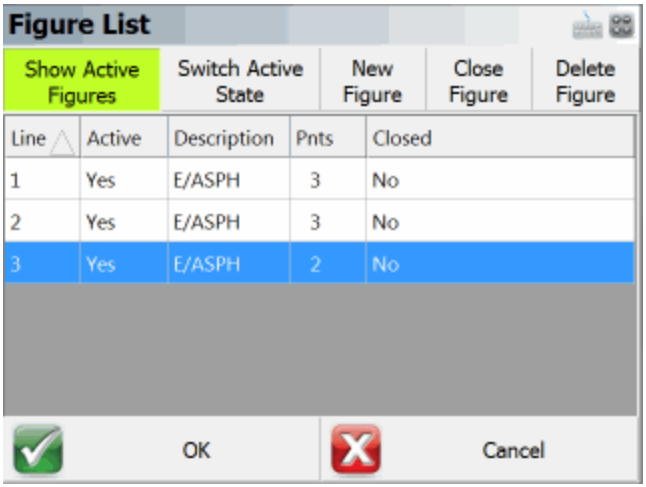
You may work on several figures at once. As described, ongoing figures are listed in the Figure List.

You will notice that in this project there are three figures.



To change the current line, simply select the active line button which will open the Select Figure from List screen. In this example it is the "E/ASPH:3" button.



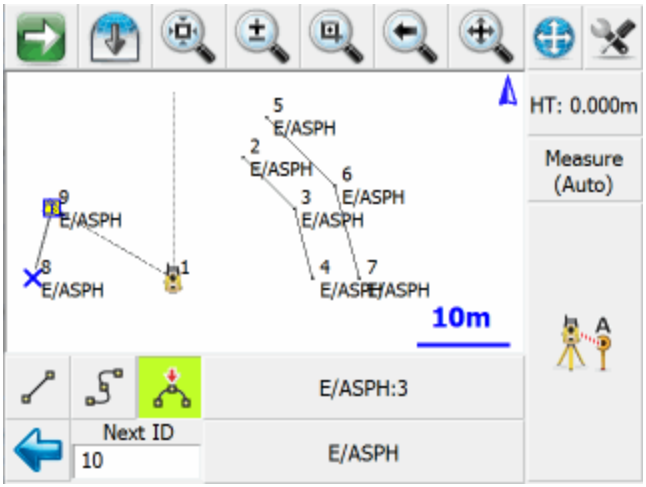


Select the desired figure from the list and continue taking shots to add to the selected line. All settings are stored for each line so there is no need to reselect the Description or draw option.

3-Point Arcs

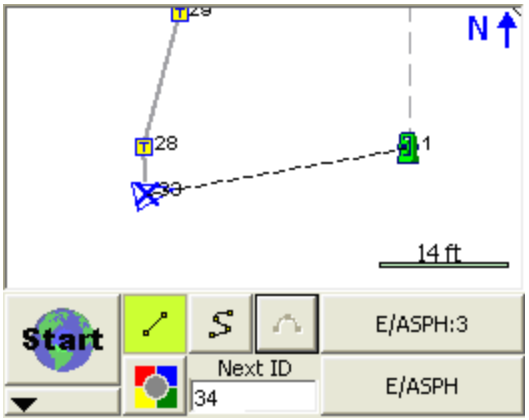
To draw a three point arc on an ongoing Line, select the Draw 3-Point Arc button before shooting the second of the three points that will define the arc (POC). (Note that this is not the radius point). After measuring to the 2nd point, a dashed line will appear to illustrate that a 3-Point arc is in progress. Shoot the 3rd point and the arc will appear. The current draw option will change from Draw 3-Pt Arc to Draw Line after the third shot and the arc is complete.

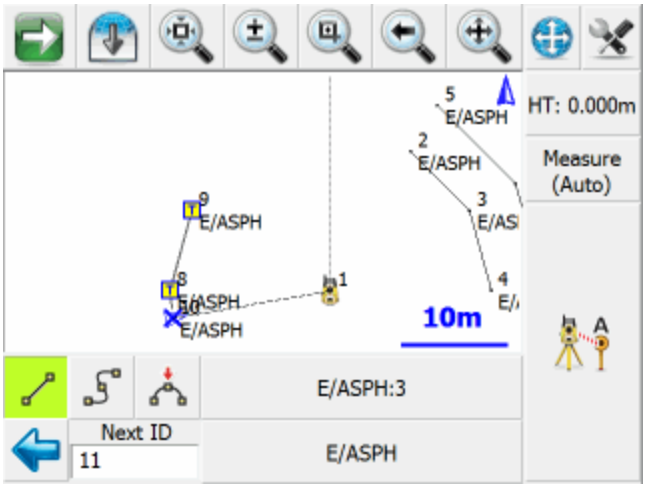
We are going to connect a three point arc to the E/ASPH:3 figure. Since we are shooting the mid point of the arc, you need to turn on the three point arc toggle.



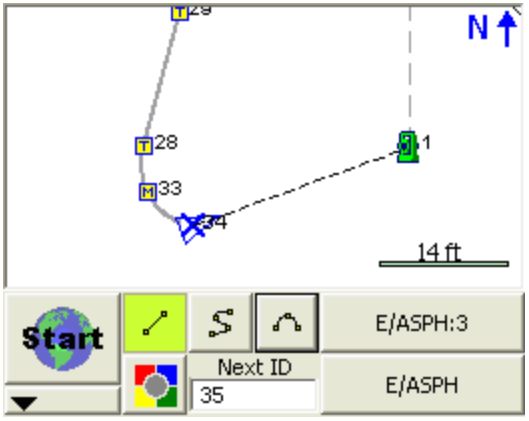
After you take the measurement, you will see the mid point drawn on the screen.

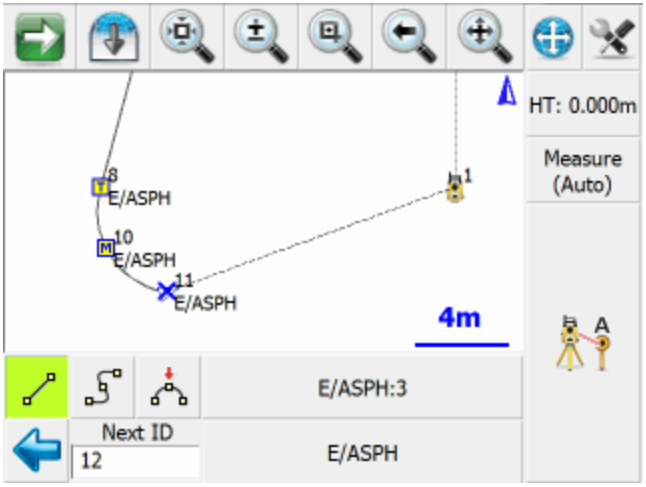
Since compound curves are not allowed, you will see that the three point arc toggle is disabled. Once you take a shot to define the end of the arc, it will become enabled again.





Once you finish measuring the third shot, you will see the arc drawn in the map.





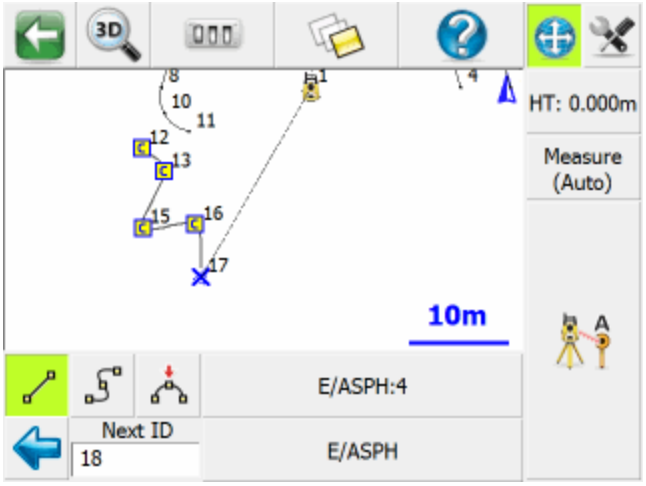
Tip: Multiple three point arcs can be connected in series if needed.

Splines (Curvy) Figures

Figures can contain splines. Splines are "best fit arcs" that are forced to go through the points that define the figure.

Splines can be attached to straight or three point arc segments.

To draw a spline, simply choose the spline toggle.



Changing Active Lines to Curvy Lines

Any Active Line series (figure) can be changed from a series of straight segments to a best-fit curvy line. Select the figure in the drawing to open the line toolbar. On the toolbar press the **Line-Spline** button which will convert the line to a curvy line. If the line is already a curvy line, it will convert it to straight tangents between the points.

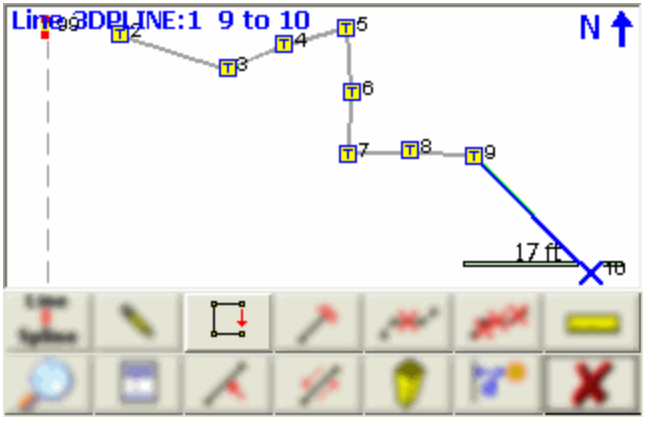
Note that any 3 point arcs or straight line segments will be lost when you use this function.

Complex Figure

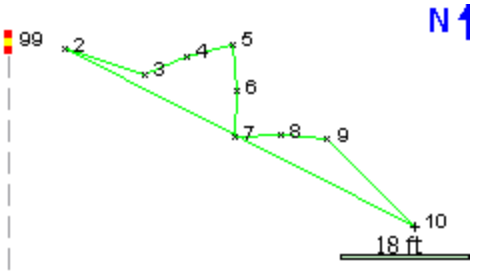
Figures that contain straight segments, arcs and spline segments are said to be a complex figure.

Closing Figures

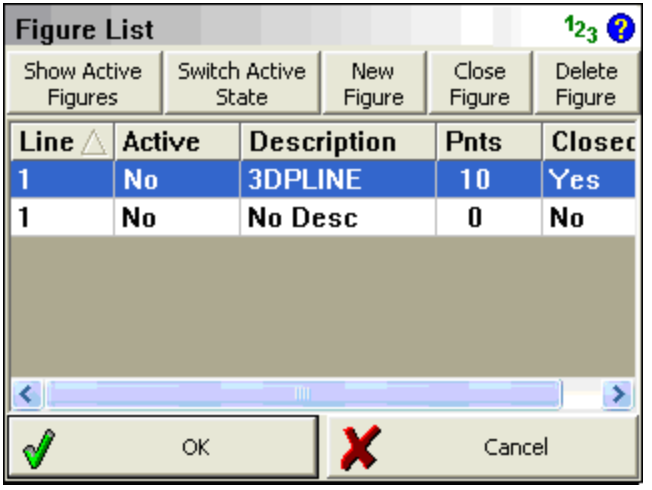
To make a closed figure with an Active Line, select the **Close Current Line** button on the line toolbar. This will draw a line from the last point to the first point shot in the figure. The Line will be removed from the Active Lines list as it is now considered complete.



You will see that the figure now is closed back to the original start point.



In the active lines list, if you turn off the **Show Active Figures** you will see that the 3DPLINE figure is flagged as Active = NO and Closed = YES.



Alternatively, you can also close a figure in the Figure List screen by using the **Close Figure** button.

End (complete) a Figure

To mark a line as complete or finished, use the End Current Line button on the line toolbar. This will remove the line from the Active Lines list so that no more segments or arcs can be added.

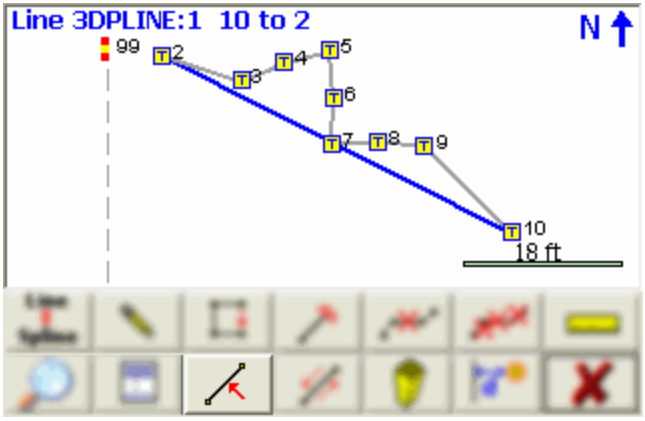
This works similar to closing a figure, but differs in that the figure will not be forced to close back on to the original start point.

Re-Activating Figures

When a figure has been marked as complete, you can activate it again as follows:

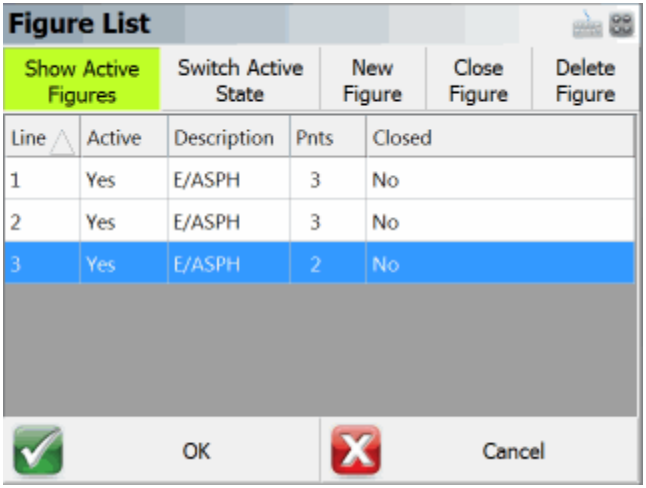
From the Line Toolbar

You can visually pick on the map view the figure that you would like to re-activate. On the line toolbar, select the activate button which will make the selected figure active.



From the Figure List

You can also open the active lines list and if you turn off the **Show Active Figures** button you will see the figures that are marked as not active. Simply select the figure you want and press the **Switch Active State** button which will set it to active.



Deleting Figures

To delete linework in your project simply select the figure you want to delete. When you select the figure, the line toolbar will open.

Use this button on the line toolbar to delete an individual segment between two points or a three point arc.

Use this to delete the entire figure that you have selected.

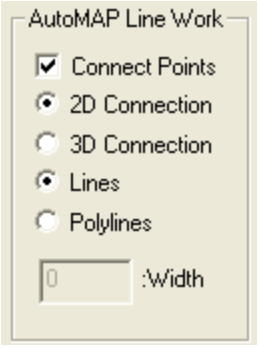
Notes:
Splines: Spline sections are considered to be one entity so using the delete entire figure, or delete segment, each will do the same thing. The entire spline will be deleted.
If a segment or arc is deleted from the middle of a figure, the figure will be broken into two pieces. Each new figure will be assigned a new group number. Closed or ended figures will be re-activated and added to the Active Lines list.

Draw Option Defaults

To setup draw option defaults you need to own a copy of MicroSurvey Point Prep. From within MicroSurvey Point Prep you can use the Automap editor to set default draw settings for each Description in the MicroSurvey Point Prep AutoMap Library. When this library is copied to your collector, selecting a Description will choose the correct Layout Draw option for Active Linework in Layout.

Lines

Choose the following in your desktop Automap library editor to set the draw default for Layout to Lines.

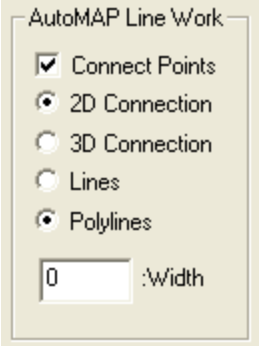


In Layout when the description is selected, the line toggle will be automatically turned on.

As shown below, the line toggle has been automatically turned on when the E/ASPH description was selected from the list.

Curvy Lines

Choose the following to set the draw default for Layout to Curvy Lines

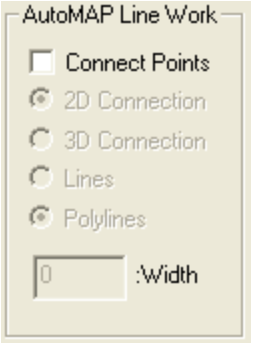


In Layout when the description is selected, the curvey toggle will be automatically turned on.

As shown below, the curvy toggle has been automatically turned on when the E/ASPH description was selected from the list.

None

Choose the following to set the draw default for Layout to None



As shown below, when the HUB description was selected, all line connectivity toggles are turned off.

Notes:
The 2D Connection and 3D Connection settings do not affect Layout, we only make use of these settings as defaults in MicroSurvey Point Prep. All Layout figures are 3D. With Layout data imported to MicroSurvey Point Prep, there is no need to process Automap connections as Layout figures are drawn automatically. For more details on the AutoMap Library, see your MicroSurvey Point Prep Help System.

Draw Plan

Main Menu | Plan

Line Toolbar | Pencil button

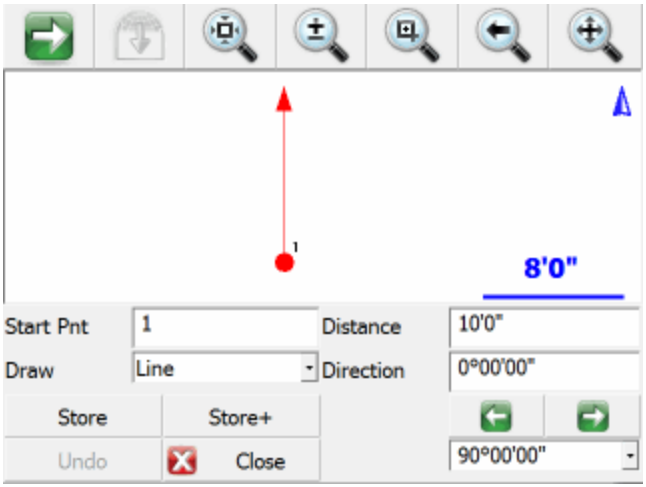
Point Toolbar | Pencil button

This tool allows you to quickly draw a plan such as a pad or a building footprint into your project, and is typically used to recreate plans from a paper hard-copy. You can use this to either calculate new points, or to connect existing points that are already in your project.

You must have at least one point in your project before you can start, to define the starting position for your plan. If a point does not yet exist (for example if this is the first command you run in a new project), you will be prompted to store a new point before you can proceed.

Line Mode

Use the Line draw mode to add straight line segments to your figure.



Start Point

Specify the start point for the new segment.

For starting a new plan, this should be set to an existing point in your project, typically a corner that you will begin drawing the plan from.

As you continue adding subsequent points/segments to your plan, you will see the Start Point field automatically advance for you.

Distance

Specify the length of the line segment you wish to draw.

Direction

Specify the direction (Azimuth or Bearing) of the line segment you wish to draw. The easiest way to do this is to use the right/left arrow buttons, which will increment/decrement the direction value by the amount shown in the pulldown list below the arrows. You can select a common angle from the choices in the list (90, 45, or 30 degrees), or you can type any value if you need to increment it by some other amount.

Store

After you have defined the segment to add, press this to store the new point and line segment into your project.

Store+

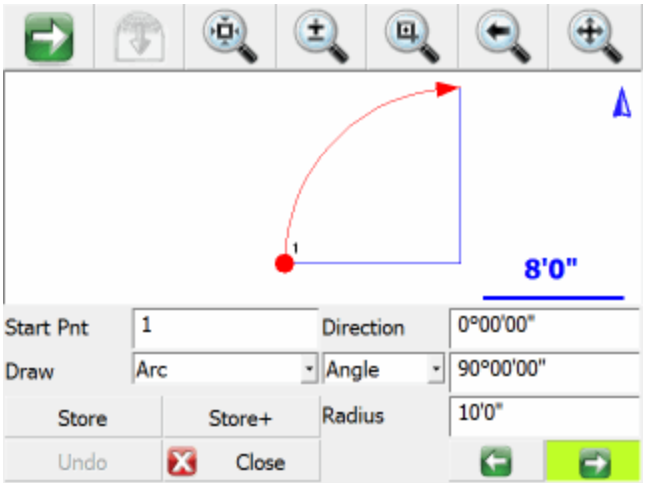
This does the same as the Store button, but you will see the Store/Edit Point screen. Use this to confirm or view the coordinates, or to specify a description.

Point by Line Mode

This is the same as the Line mode, except that when you press Store or Store+ it will only store the point, without drawing the line segment.

Arc Mode

Use the Arc draw mode to add arc segments to your figure.



Start Point

Specify the start point for the new segment.

For starting a new plan, this should be set to an existing point in your project, typically a corner that you will begin drawing the plan from.

As you continue adding subsequent points/segments to your plan, you will see the Start Point field automatically advance for you.

Direction

Specify the direction (Azimuth or Bearing) of the **tangent in** to the arc segment you wish to draw. This will default to either the direction of the previous line segment or the tangent out of the previous arc segment, so as long as your arc is tangential to the previous segment you will not need to change this value.

Angle / Chord Length / Arc Length

Specify one of the three available methods to define your arc:

- Angle: Enter the interior delta angle of the arc.
- Chord: Enter the chord length of the arc.
- Arc: Enter the arc length of the arc.

Radius

Specify the radius to define your arc.

Clockwise / Counter-Clockwise Arrows

Use the Right/Left arrow buttons to define whether the arc rotates clockwise or counter-clockwise.

Store

After you have defined the segment to add, press this to store the new end and radial points, and draw the arc segment into your project.

Store+

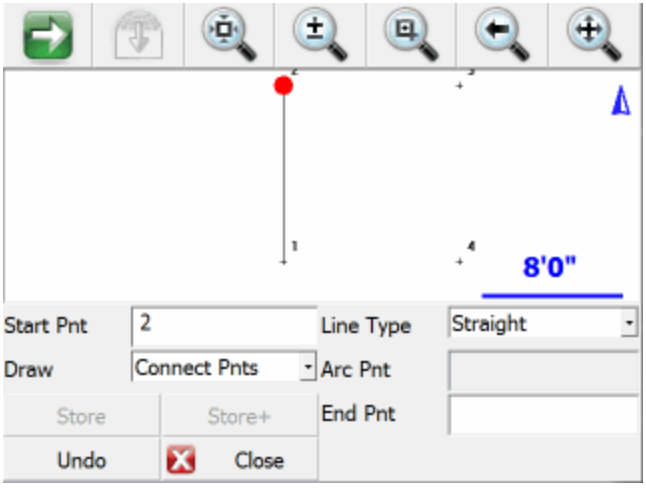
This does the same as the Store button, but you will see the Store/Edit Point screen. Use this to confirm or view the coordinates, or to specify a description.

Point by Arc Mode

This is the same as the Arc mode, except that when you press Store or Store+ it will only store the points, without drawing the arc segment.

Connect Points Mode

This mode lets you draw lines/arcs by connecting points that already exist in your project.



Start Point

Specify the start point for the new segment.

For starting a new plan, this should be set to an existing point in your project, typically a corner that you will begin drawing the plan from.

As you continue connecting subsequent points to your plan, you will see the Start Point field automatically advance for you.

Line Type

Specify one of the five available methods to define your next figure segment:

- Straight: this will draw a straight line between the specified Start Point and End Point.
- Arc (CW): this will draw a clockwise arc between the specified Start Point and End Point, with the specified Radial Point.
- Arc (CCW): this will draw a counter-clockwise arc between the specified Start Point and End Point, with the specified Radial Point.
- Arc (3Pnt): this will draw an arc (clockwise or counter-clockwise) between the specified Start Point and End Point, going through the specified intermediate Arc Point (any point directly on the arc, does not need to be the midpoint).
- Spline: this will draw a curvey line between the specified Start Point and End Point.

Store / Store+

The Store and Store+ buttons are disabled for this mode, because new points are not being calculated for your project. The line or arc segment will be automatically drawn into your project after you specify its parameters.

Undo

Press the **Undo** button to Undo the last segment you computed, removing both the point and/or the line segment (as appropriate) from your project. You can undo multiple steps.

Note, there is no Redo function.

Close

Press the **Close** button to exit from the Draw Plan command, and you will be returned to the map screen.

Smart Tags

When you select an existing or create a figure in your drawing you will see smart tags appear on the points that make up the figure.

Smart Tag "T"

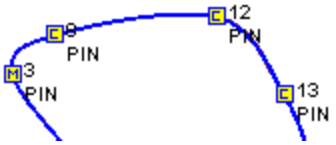
The T smart tag define points connected to straight line segments.

Smart Tag "M"

The M smart tag defines the mid point of an arc.

Smart Tag "C"

The C smart tag define points connected by a curvy line type.

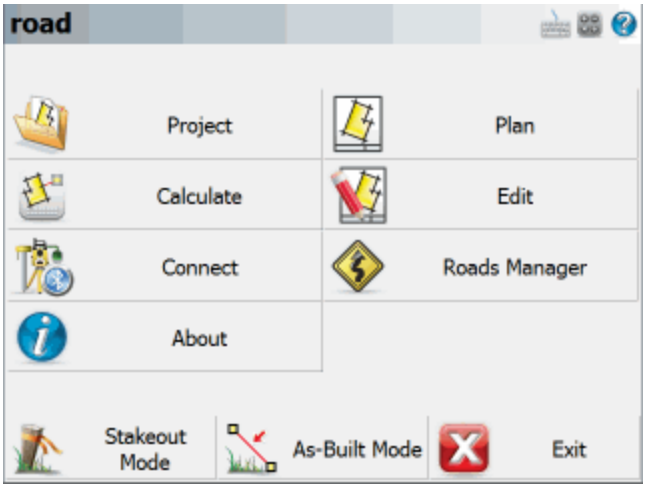


MAIN MENU

Main Menu

Main Menu

Main Menu



On the main menu, pressing any of the buttons will take you to its sub-menu.

The **Exit** button will close Layout.

Roads Manager

Use this to access tools that will help you create or edit alignments, templates, and profiles. Please see the Roads Manager Menu topic for more information.

Project

Use this to access the Project Manager, Transfer Menu, and Settings Menu.

Plan

Use this to draw a plan or pad in your project. Please see the Plan Builder topic for more information.

Calculate

Select this to use our calculating functions such as COGO and inversing. Please see the Calculate Menu topic for more information.

Edit

Use this to manage your points, DXF files, and cutsheet reports. Please see the Edit Menu topic for more information.

Connect

Use this to connect to your total station. Please see the Instrument Selection topic for more information.

About

Select this to see what build and which modules you have registered for Layout. Please see the About Menu topic for more information.

Stakeout Mode

Select this to load staking specific toolbars in the map screen. Pleasereview the Stakeout Mode topic for more details.

As-Built Mode

Select this mode to load as-built tools and functions necessary for as-built work. Please review the As-built Mode topic for more details.

Roads

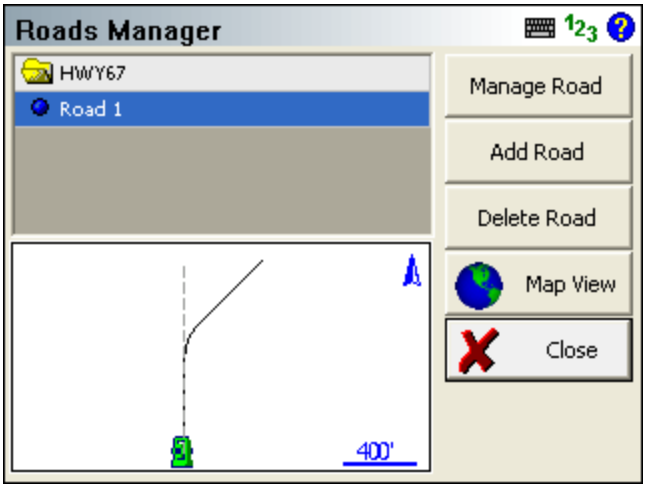
Roads Manager

Main Menu | Roads Manager

To stake an alignment you first need to define the geometry that defines the horizontal and vertical element. You can also define a template that will be used to define cross sections at specific stations along the alignment.

Layout can use the following three methods to define an alignment.

1. Manual Entry – You can manually enter the data to define the alignment.
2. Import XML – You can import a LandXML file that contains your alignment data.



By default you will see an alignment in the list with the current project name. A project can contain multiple roads, and each road can contain the following elements.

- **Horizontal Element:** This can contain straight tangents, curves and spirals.
- **Vertical Element:** This can contain grade breaks, parabolic curves and non-symmetrical curves.
- **Templates:** Template can contain horizontal and vertical offsets, as well as widening and super elevation data.
- **XML Cross Sections:** XML cross sections define specific stations along an alignment. These sections contain horizontal, vertical and template data. XML cross sections are created using desktop software which is then imported into Layout.

Manage Road

This option is only available once you've created a road using the New Road button or imported an XML file. To input or review alignment data, press the Manage Road button to access the Road Settings screen.

If you imported a LandXML file, or manually inputted a road you can stake it by pressing this button. As a minimum you need to have the following before the stake command will continue.

- XML Cross sections
- Horizontal C/L, Vertical Profile and template.
- Horizontal C/L and DTM Surface

Add Road

Use this button to create a new road. You can create as many roads as needed and they will be stored in an XML file that will reside is the project directory.

Delete Road

Use this to delete a road. You first need to highlight the road you want to delete, and then press the button to remove the road from the alignment. This road will be permanently deleted and can not be undone.

Map View

Use this button to display the map view. From this view you can use the zoom controls to zoom around your drawing so you can find important or relevant data for your alignment such as a POB point. Press the Close View button to return back to the Roads Manager.

Tell me more about ...
Road Settings
Manua Entry - Alignment C/L
Manual Entry - Vertical Profile
Manual Entry - Template
LandXML Cross Sections
Alignment DTM Surface
Alignment Staking - Part 1
Alignment Staking - Part 2
Alignment Slope Staking

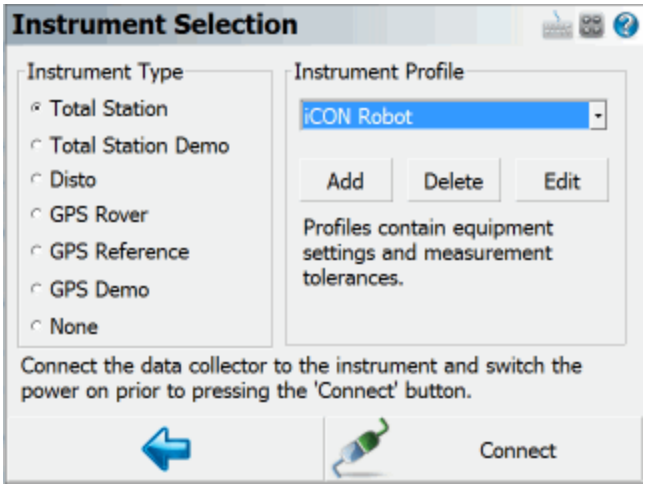
Instrument Selection

Main Menu | Connect

Main Menu | Project | Settings | Instrument

The Instrument Selection screen allows you to choose the type of equipment you will be connecting to Layout. An Instrument Profile can be created for each different instrument you will be working with, to make changing between different hardware a breeze. Once you have setup a profile for each different instrument you will be using, switching between them is a simple matter of selecting the appropriate profile and pressing **Connect**.

Note, this screen is not available if Layout is running onboard your instrument.



For all future projects you create with Layout, when you create a new or open an existing project you will see the Instrument Selection screen with the profiles you have already created. It will default to the last Profile you used, so if you are using the same instrument just press Connect. If you are using different equipment, just select the appropriate Instrument Type and Profile (or add a new profile if one does not yet exist for it), then press **Connect**.

Your profiles are stored in the file ...\MicroSurvey\Layout\Programs\MSURVEY.INI so once you have configured one data collector, you can simply copy this file onto your other data collectors to make the profiles available on them. This file should also be backed up for easy recovery.

Total Station

When you select Total Station mode, you will be able to Add, Delete, or Edit a profile to setup parameters for connecting to your conventional and robotic total stations, as well as laser devices. See the Total Station Configuration topic for more details about configuration for your total station.

For more information on connecting to your instrument please refer to the Conventional Total Station and Robotic Total Station topics.

Total Station Demo

If you choose this you will have to manually enter your shots. Manually entered shots are recorded in the raw file and points are computed based on the values you enter. A profile is not needed for this mode, just press Connect to begin using the Total Station Demo mode.

Disto

If you choose this option you can connect to Leica Geosystems laser distance tools. Please review the Disto Reference topic for more details.

GPS Rover / GPS Reference

When you set it to GPS Rover or GPS Reference you will be able to Add, Delete, or Edit a profile for your rover or reference receiver. When you edit a GPS Rover or GPS Reference profile, you will see the Configure Rover or Configure Reference screens. For more information about using Layout for GPS surveying, you should review the Starting GPS topic.

If you have not purchased the GPS module for Layout, then you will not have access to the GPS commands and you will see a "Requires GPS module license" message.

GPS Demo

When you set it to GPS Demo you will be able to Edit and Connect to a profile for a simulated rover receiver. When you edit the RTK Demo profile, you will see the Configure Rover screen. Feel free to play with the Tolerance Mode settings, but please do not change the Model and Communications settings. For more information about using Layout for GPS surveying, you should review the Starting GPS topic.

The GPS Demo will simulate connecting Layout to a GPS Rover receiver. The coordinates in the GPS Demo are located outside our office in Westbank, British Columbia, Canada, so to use the GPS Demo mode you need to set your Coordinate System Settings to UTM Zones, NAD83, UTM83-11, Ellipsoidal.

None

Use this option if you're not connecting anything to Layout and also don't need to manually enter any shot information. With this mode, the instrument toolbar will not be displayed in the map screen.

Draw Plan

Main Menu | Plan

Line Toolbar | Pencil button

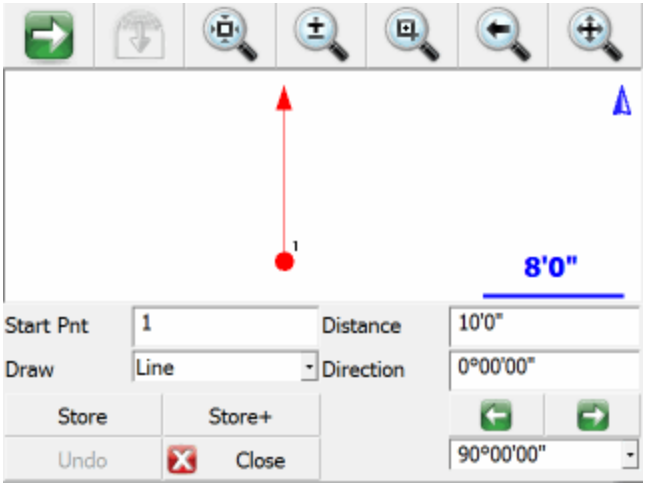
Point Toolbar | Pencil button

This tool allows you to quickly draw a plan such as a pad or a building footprint into your project, and is typically used to recreate plans from a paper hard-copy. You can use this to either calculate new points, or to connect existing points that are already in your project.

You must have at least one point in your project before you can start, to define the starting position for your plan. If a point does not yet exist (for example if this is the first command you run in a new project), you will be prompted to store a new point before you can proceed.

Line Mode

Use the Line draw mode to add straight line segments to your figure.



Start Point

Specify the start point for the new segment.

For starting a new plan, this should be set to an existing point in your project, typically a corner that you will begin drawing the plan from.

As you continue adding subsequent points/segments to your plan, you will see the Start Point field automatically advance for you.

Distance

Specify the length of the line segment you wish to draw.

Direction

Specify the direction (Azimuth or Bearing) of the line segment you wish to draw. The easiest way to do this is to use the right/left arrow buttons, which will increment/decrement the direction value by the amount shown in the pulldown list below the arrows. You can select a common angle from the choices in the list (90, 45, or 30 degrees), or you can type any value if you need to increment it by some other amount.

Store

After you have defined the segment to add, press this to store the new point and line segment into your project.

Store+

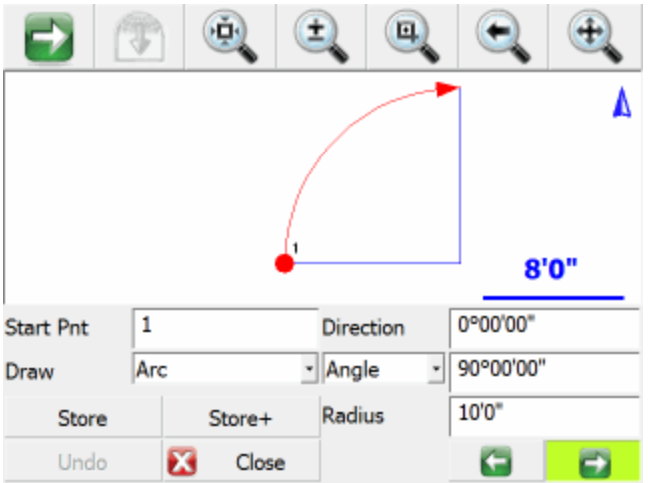
This does the same as the Store button, but you will see the Store/Edit Point screen. Use this to confirm or view the coordinates, or to specify a description.

Point by Line Mode

This is the same as the Line mode, except that when you press Store or Store+ it will only store the point, without drawing the line segment.

Arc Mode

Use the Arc draw mode to add arc segments to your figure.



Start Point

Specify the start point for the new segment.

For starting a new plan, this should be set to an existing point in your project, typically a corner that you will begin drawing the plan from.

As you continue adding subsequent points/segments to your plan, you will see the Start Point field automatically advance for you.

Direction

Specify the direction (Azimuth or Bearing) of the **tangent in** to the arc segment you wish to draw. This will default to either the direction of the previous line segment or the tangent out of the previous arc segment, so as long as your arc is tangential to the previous segment you will not need to change this value.

Angle / Chord Length / Arc Length

Specify one of the three available methods to define your arc:

- Angle: Enter the interior delta angle of the arc.
- Chord: Enter the chord length of the arc.
- Arc: Enter the arc length of the arc.

Radius

Specify the radius to define your arc.

Clockwise / Counter-Clockwise Arrows

Use the Right/Left arrow buttons to define whether the arc rotates clockwise or counter-clockwise.

Store

After you have defined the segment to add, press this to store the new end and radial points, and draw the arc segment into your project.

Store+

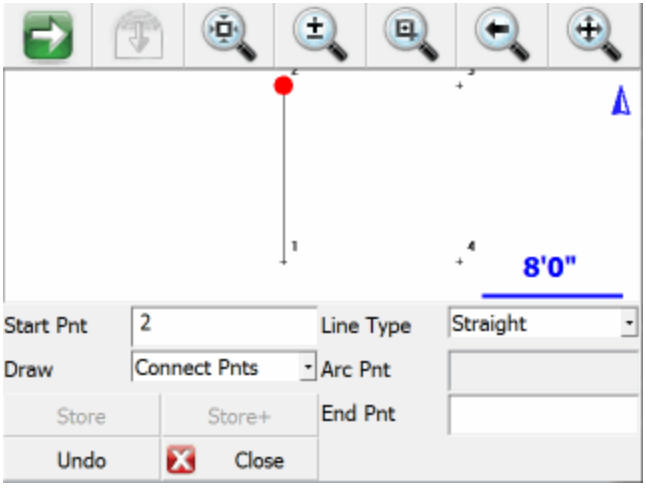
This does the same as the Store button, but you will see the Store/Edit Point screen. Use this to confirm or view the coordinates, or to specify a description.

Point by Arc Mode

This is the same as the Arc mode, except that when you press Store or Store+ it will only store the points, without drawing the arc segment.

Connect Points Mode

This mode lets you draw lines/arcs by connecting points that already exist in your project.



Start Point

Specify the start point for the new segment.

For starting a new plan, this should be set to an existing point in your project, typically a corner that you will begin drawing the plan from.

As you continue connecting subsequent points to your plan, you will see the Start Point field automatically advance for you.

Line Type

Specify one of the five available methods to define your next figure segment:

- Straight: this will draw a straight line between the specified Start Point and End Point.
- Arc (CW): this will draw a clockwise arc between the specified Start Point and End Point, with the specified Radial Point.
- Arc (CCW): this will draw a counter-clockwise arc between the specified Start Point and End Point, with the specified Radial Point.
- Arc (3Pnt): this will draw an arc (clockwise or counter-clockwise) between the specified Start Point and End Point, going through the specified intermediate Arc Point (any point directly on the arc, does not need to be the midpoint).
- Spline: this will draw a curvey line between the specified Start Point and End Point.

Store / Store+

The Store and Store+ buttons are disabled for this mode, because new points are not being calculated for your project. The line or arc segment will be automatically drawn into your project after you specify its parameters.

Undo

Press the **Undo** button to Undo the last segment you computed, removing both the point and/or the line segment (as appropriate) from your project. You can undo multiple steps.

Note, there is no Redo function.

Close

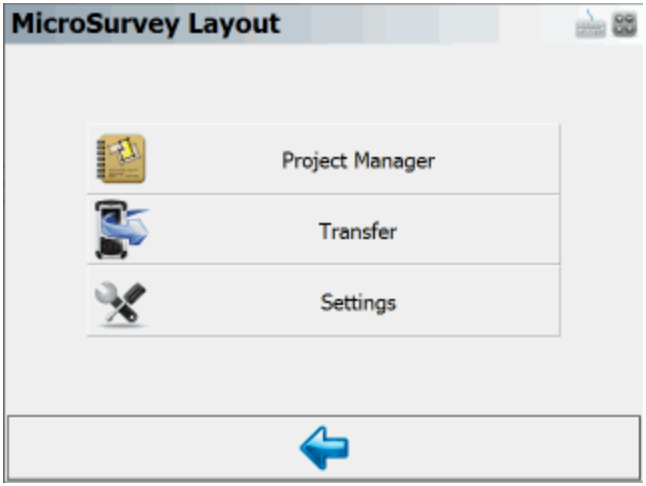
Press the **Close** button to exit from the Draw Plan command, and you will be returned to the map screen.

Project

Project Menu

Main Menu | Project

The project menu contains import/export functions and settings for your project.



Project Manager

This will open the Project Manager, for opening new or existing Layout projects. Please see the Project Manager topic for more information.

Transfer

Use this to access the Transfer Menu which contains tools for importing and exporting various files. Please see the Transfer Menu topic for more information.

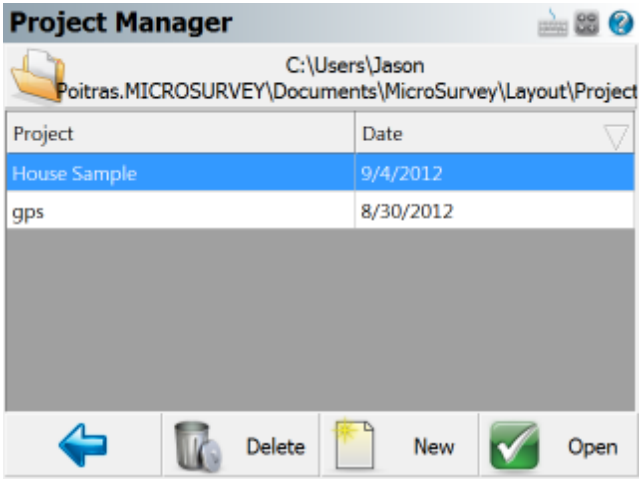
Settings

Use this to open the Settings Menu which contains project and program settings. Please see the Settings Menu topic for more information.

Project Manager

Main Menu | Project | Project Manager

The Project Manager is used to create, open, or delete projects currently residing in your data collector. When you start Layout this is always the first screen you will see.



By default the project manager will display the contents of the ...\MicroSurvey\Layout\Projects\ directory, which is the default location for all projects that you create. You can sort the list by project name or date by tapping on the column's header.

Projects Folder

Press this button to specify a different project folder than the default. The default is..-.\MicroSurvey\Layout\Projects\. Once you set the directory it is written to the msurvey.ini file so it is used for all subsequent projects.

Open Project

To open an existing project, simply select it in the list and press the **Open** button.

New Project

To create a new project, simply press the **New** button. You will then see the new project screen which will allow you to enter a name, and set the units for the project.

Delete Project

To delete a project you first need to select it in the list and then press the **Delete** button. You will be asked to confirm that you really want to delete the project.

> **Notes:**
> • You can not delete a project that is currently open.
> • Projects that have been deleted can not be restored.

Exit

To exit from the project manager press the **Back Arrow** button.

Transfer

Transfer Menu

Main Menu | Project | Transfer

Use this menu to display different options for importing data into or exporting data out of your project.

ASCII Coordinate File Import

Use this to import an ASCII file into your project. Please see the ASCII Coordinate File Import topic for more information.

ASCII Coordinate File Export

Use this to export an ASCII file of your points. Please see the ASCII Coordinate File Export topic for more information.

DXF File Import

Use this to import a DXF file into your project. Please see the DXF File Import and Map Data Layers topics for more information.

DXF File Export

Use this to export a DXF file of your current project. The DXF file will contain drawing entities of your points and lines. Please see the DXF File Export topic for more information.

ASCII Coordinate File Import

Main Menu | Project | Transfer | ASCII Coordinate File Import

Use this option to import a list of coordinates to the current project.

This may be required if a separate coordinate file is uploaded to the device by itself (not as part of a project with linework). This is also useful for transfer of points from one file to another.

Function

1. Click on the "Browse for File..." button to navigate to and select your file.
2. Choose the field delimiter, either Comma or Space.
3. Choose the file format. See below for more information regarding file format. If you are uncertain, use the **Standard** format.
4. Use the assigned role field to select the survey role of the points being imported. If these points are to go into the layout list, then select **To Stake Out** as the survey role.

5. **Write SP** (Store Point) **record to raw file** will store the imported coordinates to the raw file. This is very useful if you wish to reprocess coordinates later, so we recommend that you select this when importing points.
6. **Overwrite Existing Coordinates** - allows you to control whether points will be overwritten during the import.
7. **Set as Control Points** – will set a flag in the database that will prevent these points from being edited or changed in Layout (under any circumstances!)
8. Choose **OK** to import the coordinates, **Cancel** to abort the import.
9. You will be shown a confirmation of how many points were imported to the current project.

File Formats

Both space and comma delimited files are supported.

For all formats, the order of the Northing and Easting fields are determined by setting the Coordinate Order in the Options screen.

Standard

```
ID, Northing/Y or Easting/X, Easting/X or Northing/Y, Elevation, Description:Note
```

This format expects the file to be in a standard ASCII format. If your descriptions have a colon in them, then Layout will store everything before the colon as a description, and everything after the colon will be considered to be a note.

Standard with Header

Same as the Standard format, but the first row in the file is ignored.

Extended

```
ID, Northing/Y or Easting/X, Easting/X or Northing/Y, Elevation, Description, Note, Latitude, Longitude, Ellipsoidal Height, Latitude StdDev, Longitude StdDev, Height StdDev
```

This format is different than the standard such that notes are separate from descriptions. Also if you collected GPS data, the WGS 84 information can also be included and imported along with other information related to the GPS point.

Extended with Header

Same as the Extended format, but the first row in the file is ignored.

More about the Extended Format

If you import aLayout extended file format ASCII file, Layout will create EP and GS records in the raw file. Also, the coordinates will be imported and stored in the database. Importing this type of file is

useful for seeding points when using the OmniStar GPS system or to create a list of geodetic and cartesian points that you can select while programming a GPS base receiver.

ID	Northing	Easting	Elevation	Description	Note	Latitude	Longitude	Ellip
100	5523097.874	311564.984	399.387	CONTROL		49.83067177	-119.6202724	
101	5523168.871	311529.912	401.188	CONTROL		49.83129864	-119.620794	
102	5523164.192	311507.476	400.85	CONTROL		49.83124955	-119.6211034	
103	5523135.07	311511.185	399.795	CONTROL		49.83098906	-119.6210377	
104	5523099.336	311521.81	399.552	CONTROL		49.83067133	-119.6208728	
105	5523074.024	311506.919	399.233	CONTROL		49.83043923	-119.6210673	
106	5523046.282	311521.379	398.049	CONTROL		49.83019451	-119.620853	
201	5523161.883	311526.004	400.632	CONTROL		49.83123463	-119.6208449	
202	5523159.786	311530.386	400.665	CONTROL		49.83121716	-119.620783	
203	5523167.28	311538.864	401.095	CONTROL		49.83128716	-119.6206689	
204	5523165.261	311551.194	400.946	CONTROL		49.8312729	-119.6204967	
205	5523172.776	311493.661	401.686	CONTROL		49.83132233	-119.6212995	

Importing Cartesian and Geodetic Coordinates

Above is an example of an Extended ASCII file. For the format to work correctly, each point should include Cartesian and Geodetic coordinates for each point. The standard deviations are not needed unless the point is going to be used to "seed" a position for use with the OmniStarVBS system. **The Latitude and Longitude values are required to be stored in decimal degrees.**

So if this type of file is imported into Layout the following will occur:

- A point is stored in the project database using the Cartesian Coordinates.
- A GS record is written in the raw file using the Cartesian Coordinates as a reference.
- An EP record is written to the raw file using the Geodetic Coordinates as a reference.

Importing Geodetic Coordinates Only

You can create an Extended ASCII Point file that only contains a point number, description, note and Geodetic coordinates. Upon import Layout will use the Geodetic coordinates and your defined coordinate system in your coordinate system settings to compute Cartesian coordinates to be stored in the database.

So if this type of file is imported into Layout the following will occur:

- Using the horizontal and Vertical datum settings you've defined in your coordinate system settings, Layout will compute a Cartesian coordinate for each point using the Geodetic values imported from the ASCII file.

- A point is stored in the project database using the Cartesian Coordinates that was computed. The point will be assigned the point number that was imported from the ASCII file.
- A GS record is written in the raw file using the Cartesian Coordinates as a reference.
- An EP record is written to the raw file using the Geodetic Coordinates as a reference.

ASCII Coordinate File Export

Main Menu | Project | Transfer | ASCII Coordinate File Export

Use this option to export a coordinate list from the current file.

This is useful for transfer of points from one file to another.

Function

1. Specify a range of point to export in the form **#..#**. Accept default of **All** if desired.
2. Specify number of decimal places to carry on the export. (maximum=6)
3. Specify if you want to export them with either a space or comma delimiter.
4. Choose the file format type that you want to use. See below for more details about the different file formats. If you are uncertain, use the **Standard** format.
5. Choose **Export** to export the coordinates, or **Cancel** to abort the export.
6. Browse to the folder where you want to save the file, enter a filename including an extension, then press **Save File.**Layout will not add any extension to the filename you enter.
7. You will be shown a confirmation of how many points were exported.

File Formats

Both space and comma delimited files are supported.

For all formats, the order of the Northing and Easting fields are determined by setting the Coordinate Order in the Options screen.

Standard

```
ID, Northing/Y or Easting/X, Easting/X or Northing/Y, Elevation, Description:Note
```

This format will append any notes you have to your description, separated by a colon.

Standard with Header

Same as the Standard format, but with Header data in the first row.

Extended

```
ID, Northing/Y or Easting/X, Easting/X or Northing/Y, Elevation, Description, Note, Latitude, Longitude, EllipsoidalHeight, LatitudeStdDev, LongitudeStdDev, HeightStdDev
```

This format is different than the Standard such that notes are separated from descriptions.

If you collected GPS data, the WGS 84 information will also be exported along with other information related to the GPS point. The WGS 84 information will be extracted from your GS records in the raw file.

Extended with Header

Same as the Extended format, but with Header data in the first row.

GD-1

This format allows you to export your GPS measured points in a slightly different format than the Extended format. This option will scan your raw file and find all EP records and export the corresponding GS, or GK point that was stored in the database.

This option is only available for export.

```
ID, Northing/Y or Easting/X, Easting/X or Northing/Y, Elevation, Latitude (in Degrees Minutes Seconds), Longitude (in Degrees Minutes Seconds), Description
```

GD-1 with Header

Same as the GD-1 format, but the first row in the file is ignored.

More about the Extended Format

If you import a Layout extended file format ASCII file, we will create EP and GS records in the raw file. Also, the coordinates will be imported and stored in the database. Importing this type of file is useful for seeding points when using the OmniStar GPS system.

There is more detailed information about the extended format in the ASCII Coordinate File Import topic.

DXF File Import

Main Menu | Project | Transfer | DXF File Import

Use this function to import CAD DXF files into a Layout project.

Layout supports all Point nodes, Lines, Arcs, Polylines, Text and 3D Faces in the DXF file.

Layout does not support Blocks or any other entities not mentioned above in the DXF file.

All items from the DXF file will be drawn in their respective layers as defined in the DXF file. These layers may be toggled on and off using Layout's layer manager.

Importing Steps

1. Using the browse window, find the DXF file you would like to import and press the **Open File** button.
2. Use the Layer Manager to turn on or off any layers you don't want to view.
3. Press **Close** and return to the map view.
4. Press the zoom extents button to see your entire DXF file.

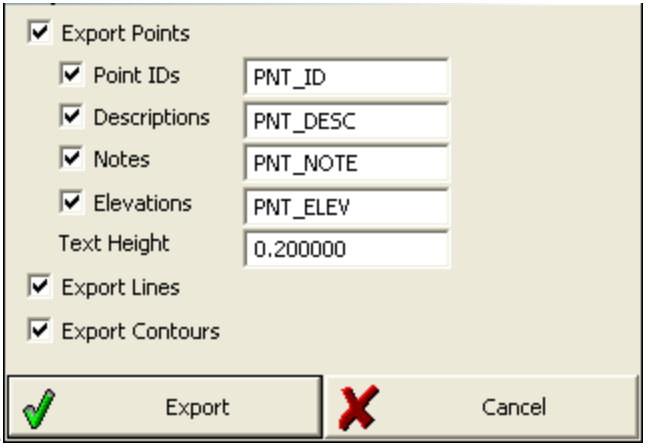
For more information on the layer manager please visit the Layer Manager topic.

Important Notes:
- Your CAD desktop system likely has a super fast processor and 1GB or more of RAM but most current Windows CE devices run at 206Mhz and have 32 or maybe 64MB of RAM. For this reason, you will not be able to manipulate a 5MB DXF file with the same speed as your desktop system so minimize the size of the DXF files for most efficient operation.
- TEXT is the biggest performance reducer in your DXF files. For best performance, minimize the amount of text in the DXF files or turn off layers containing text when not needed.

DXF File Export

Main Menu | Project | Transfer | DXF File Export

Use this to export your current Layout drawing as a DXF file. This allows for easy import of linework and nodes into most cad or graphic systems



Function

1. Select the options for your DXF file.

   Export Points: If this is checked, your coordinate point nodes will be exported to the DXF file. You can also specify what layer you want the labels to go on and a default text height.

   Export Lines: If this is checked, all figures (lines, arcs, and splines) will be exported to the DXF file.

   Export Contours: If this is checked, all contour lines drawn using the Surface Manager will be exported to the DXF file.
2. Click **Export.**
3. Browse to the folder where you want to save the file, enter a filename, then press Save File. Layout will add a .dxf extension to the filename if you did not include it.
4. The DXF file is created and you can copy it to your desktop computer.

Notes about DXF files:

- Upon export, Layout will compare the figure name to see if it has a match in the AutoMap file. If it does, Layout will draw the points along the figure, as well as draw the figure on the layer specified in the AutoMap library.
- Points that are exported will match the point color settings set in the Automap library.
- Figures that don't have a match in the Automap library will be drawn on a layer named "Default". Color setting will be set to 256.
- Points or nodes will be 2D or 3D depending on the Z value.

- Lines will be 2D or 3D depending on the Z values of the end points.
- Figures will be drawn as polylines.
- Curvy lines or arcs will be drawn as segmented polylines. Layout will automatically interpolate an elevation along the arc or curved section of the figure at 1° intervals.
- Contours will be drawn as polylines and will be 3D based on the contour elevation.
- Points or nodes will appear as an "X" marker in the DXF file because the PDMODE variable is being set to 3 in the DXF file. In most desktop CAD programs you can change this marker type by typing PDMODE.

LandXML File Import

Main Menu | Import/Export | Import LandXML

Main Menu | Data Manager | Map Data Layers | Add File

Layout can import LandXML files. Rather than convert these files into some different format, you can read these files directly into Layout.

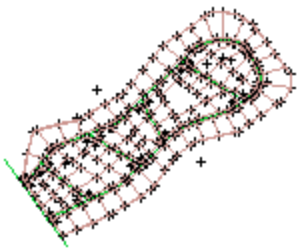
Importing a LandXML File

There are several different methods of importing a LandXML file:

- By using the Import LandXML File command.
- By using the Data Manager | Map Data Layers | Add File command.
- By placing a LandXML file into a project folder. This is normally done by desktop software like MicroSurvey Point Prep. If Layout finds a LandXML file that has the same name as the project, and it is in the project folder, then it will automatically be imported when you load the project.

When a LandXML file is read, it is scanned to make a list of the objects that it contains. Loading the entire file into the Layout project could use many megabytes of valuable memory. Therefore, when you wish to use data from a LandXML file, you need to load it as needed. Sample LandXML files are available at the LandXML web site: www.landxml.org

One of the example files posted is subdivision-xsec.xml. We have downloaded and are now going to show the results of reading it into Layout:



LandXML Components and How to Use Them

There are many different types of objects in a LandXML file. Layout will be expanding the use of these objects as the program grows.

As of the date this manual was written, the following objects are supported. This list will change, so you may notice other options on the smart menus for these objects.

CgPoints

A LandXML file can contain many different sets of points. The LandXML specification requires that every point in a LandXML file have a different id. For example you can not have two CgPoint sets containing a point with the same id. Since a LandXML file can contain many different CgPoint sets, and these point sets may contain thousands of points, FieldGenius lists these sets in the Project Manager. When you want to see them on the screen, you need to use the Smart Menu to Load the CgPoint Sets.

By default when you import your LandXML file, the CgPoints will be displayed on the screen. CgPoints are not stored in the database but they can be used by our commands. For example you can use the Occupy Point command and select the CgPoints with the point chooser for the setup and backsight points. You can also consider them to be read only points.

Surfaces

Surfaces can be imported into Layout from a LandXML file. The surfaces can be imported in two ways:

- Fast: We can use the points that define the surface and let Layout re-calculate the TIN model. This might be acceptable for an area where no attempt was made to edit the triangles or add break lines. Layout can compute a surface in seconds from large numbers of points.
- Maintain Triangulation: we can force Layout to read the TIN exactly as computed by the desktop software. This requires much more computing by the import program, but it will exactly maintain the triangulation in the original surface. For example, if the LandXML surface was

created by using breaklines and hand editing, you will want to maintain the exact triangles for staking and viewing the surface.

You can set the import method by going to the Main Menu | Data Manager | Surfaces | Surface Options.

From the Surfaces screen you can see a list of the surfaces in the XML file. Select the one you want to load.

Alignments, Profiles, and Cross Sections

Alignments, cross sections, and staking of these items are some of the powerful features in Layout. Almost all modern road design software will export alignments in LandXML format. We read the horizontal alignment (which is normally at elevation zero), the vertical profile, and the cross sections from LandXML files. Individual components can be selected for staking or viewing information. The Project Manager is used for visibility of these items, and you can drill down into the components right to the coordinate level.

Reading the basic alignment information is done when you import the LandXML file. Alignments generally are not too large, so we read the alignment, profile and cross sections into memory for later use. There may be several surfaces in an alignment, so you can view each cross section surface separately. Each may be staked. In this sample file, there are several alignments. Each alignment can be turned on or off, or just the cross sections for an alignment can be turned off.

Following is a tiny excerpt from the first few lines of this LandXML file. Fortunately, it is rarely necessary to open a file; however, if you open one in Internet Explorer, you will see the format. They are easily explored, because you can "collapse" sections of the file by picking on the negative signs at the beginning of the lines in Internet Explorer. In this picture, all of the file has been collapsed except for the header. It is easy to see that the file was created by Autodesk Land Desktop version 3 with Service Pack 1 installed.

```
<?xml version="1.0" ?>
- <LandXML xmlns="http://www.landxml.org/schema/LandXML-1.0"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://www.landxml.org/schema/LandXML-1.0
    http://www.landxml.org/schema/LandXML-1.0/LandXML-1.0.xsd" version="1.0"
    time="10:08:09" readOnly="false" language="English">
    <Project name="subdivision" />
  + <Units>
  + <Application name="Land Desktop" manufacturer="Autodesk" version="3 - Service Pac
      manufacturerURL="www.autodesk.com">
  + <CgPoints>
  + <Surfaces>
  + <Parcels>
  + <Alignments>
  </LandXML>
```

Parcels/Lots

Parcels are displayed in the graphics when you import a LandXML file. You can select the lines to get basic information, and you can drill down into the Project Manager to see more details. The points that define a Parcel are stored in the CgPoints section of the LandXML file. If you want to see the point numbers on the screen, then you need to load the CgPoints. If you want to stake the points, then you need to load the CgPoints into the Points DB.

Chains/Figures

These LandXML items may or may not appear, because a chain can cross from one CgPoints set to another. This means that if you do not have all the CgPoint sets loaded, then the chains cannot appear.

Settings

Settings Menu

Settings Menu

Main Menu | Project | Settings

The settings menu is used to setup and review settings that have been set for your current project. You can also specify default settings for new projects that are created.

Most of these settings are stored in a file named msurvey.ini which can be found in the ...\MicroSurvey\Layout\Programs\ directory. It is recommended that once you have defined your settings, that you make a backup of this msurvey.ini file.

Options

Use this to set or change settings that affect Layout's functionality. Please see the Options topic for more information.

Units

Use this to set or change the units, bearings, distances and scale settings for your project. Please see the Units Settings topic for more information.

Instrument

Use this to set the type of equipment that will be used with Layout. If you're not connecting to anything, you can specify that you would like to enter your measurements manually. Please see the Instrument Selection topic for more information. (Note, you will not see this option if Layout is running onboard your instrument.)

Coordinate System

Use this to define the coordinate system for your project. Please see the Coordinate System Settings topic for more information.

Information

Use this to enter and save information about your project. Please see the Project Information topic for more information.

Unit Settings

Main Menu | Project | Settings | Units

The units and scale menu allows you to specify settings for your project. Some of these settings are recorded in the raw file and the project's ini file, as well as recorded in the msurvey.ini file.

> **Notes:**
> • The Distance Unit (Meters or Feet) and Angle Unit (Degrees, Radians, or Gons) can only be set when creating a new project. After a project has been created, these will remain greyed-out and cannot be changed.

You can set these settings as defaults for new projects by pressing the **Save as Default Settings** button. The default settings can also be set in the Options screen.

Note: the actual precision on distances and angles returned from your instrument may be limited to less than the precision you select here. Selecting a higher precision here will not increase the precision of values queried from your instrument.

Distance Unit

Choose the distance unit that you will be using: Meters, International Feet, or US Survey Feet. All distances will be displayed in the selected format. All distances will be recorded to the raw file in decimal format. Database coordinates are always stored with 6 decimal places, and rounded to the desired precision for display.

Meters

If you choose Meters as your distance unit, you can also specify the number of decimal places to display within Layout, from 0 to 6.

International Feet / US Survey Feet

If you choose International Feet or US Survey Feet, then you can specify to use either a decimal format with a precision from 0 to 6, or a Fractional format with feet and inches.

If you use the **decimal** format, distances will be displayed in decimal feet, such as 10.5' to indicate 10.5 feet or 10feet-6inches.

If you use the **fractional** format, distances will be displayed in feet and fractional inches, such as 10'6 1/2" to indicate 10feet-6.5inches or 10.54166667 feet.

Angle Unit

Choose the angular unit that you will be using: Degrees, Gons/Gradients, or Radians. All angular values written into the raw file will be recorded in the selected format.

Degrees

If you select Degrees, then you can also select which format to use, either DDD°MM'SS.s" for degrees-minutes-decimal seconds, DDD°MM.m' for degrees-decimal minutes, or DDD.d° for decimal degrees. You can also specify the number of decimal places to use, from 0 to 8.

Gons (Gradients)

If you select Gons (Gradients) then you can also specify the number of decimal places to use, from 0 to 8.

Radians

If you select Radians then you can also specify the number of decimal places to use, from 0 to 8.

Direction Format

Choose the direction format that you will be using: North Azimuth, South Azimuth, or Bearings. When entering a direction, you can always override this setting by entering the angle with the cardinal

quadrant indicated before or after the angle. If there is no quadrant specified, then the input angle will be interpreted as an Azimuth.

Scale Factor

You can use a scale factor to adjust ground distances to grid distances.

Distances measured with a total station will be recorded in the raw file with the unscaled, true measured slope distance. This scale factor is applied to the computation of coordinates only.

Distances entered using the Traverse/Intersect tool (COGO) will be scaled by the scale factor.

Distances calculated using the Inverse tool, or recalled using the pt..pt format will be scaled by the inverse of this scale factor. The result will be the inversed grid distance times the inverse of the scale factor, so that the ground distance is returned.

This Scale Factor does not affect any GPS measurements. Please see the GPS Local Transformation topic for information on using a GPS Scale Factor.

Save As Default

Use this to permanently write the current settings to the msurvey.ini file. When you create a new project, it will use these settings. The default settings can also be set in the Options screen.

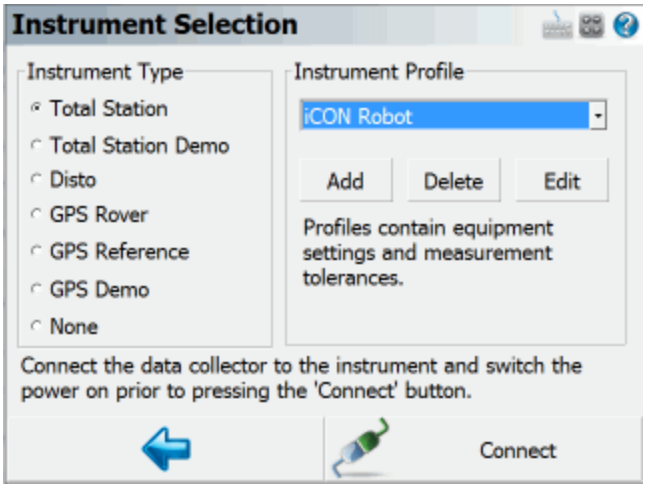
Instrument Selection

Main Menu | Connect

Main Menu | Project | Settings | Instrument

The Instrument Selection screen allows you to choose the type of equipment you will be connecting to Layout. An Instrument Profile can be created for each different instrument you will be working with, to make changing between different hardware a breeze. Once you have setup a profile for each different instrument you will be using, switching between them is a simple matter of selecting the appropriate profile and pressing **Connect**.

Note, this screen is not available if Layout is running onboard your instrument.



For all future projects you create with Layout, when you create a new or open an existing project you will see the Instrument Selection screen with the profiles you have already created. It will default to the last Profile you used, so if you are using the same instrument just press Connect. If you are using different equipment, just select the appropriate Instrument Type and Profile (or add a new profile if one does not yet exist for it), then press **Connect**.

Your profiles are stored in the file ...\MicroSurvey\Layout\Programs\MSURVEY.INI so once you have configured one data collector, you can simply copy this file onto your other data collectors to make the profiles available on them. This file should also be backed up for easy recovery.

Total Station

When you select Total Station mode, you will be able to Add, Delete, or Edit a profile to setup parameters for connecting to your conventional and robotic total stations, as well as laser devices. See the Total Station Configuration topic for more details about configuration for your total station.

For more information on connecting to your instrument please refer to the Conventional Total Station and Robotic Total Station topics.

Total Station Demo

If you choose this you will have to manually enter your shots. Manually entered shots are recorded in the raw file and points are computed based on the values you enter. A profile is not needed for this mode, just press Connect to begin using the Total Station Demo mode.

Disto

If you choose this option you can connect to Leica Geosystems laser distance tools. Please review the Disto Reference topic for more details.

GPS Rover / GPS Reference

When you set it to GPS Rover or GPS Reference you will be able to Add, Delete, or Edit a profile for your rover or reference receiver. When you edit a GPS Rover or GPS Reference profile, you will see the Configure Rover or Configure Reference screens. For more information about using Layout for GPS surveying, you should review the Starting GPS topic.

If you have not purchased the GPS module for Layout, then you will not have access to the GPS commands and you will see a "Requires GPS module license" message.

GPS Demo

When you set it to GPS Demo you will be able to Edit and Connect to a profile for a simulated rover receiver. When you edit the RTK Demo profile, you will see the Configure Rover screen. Feel free to play with the Tolerance Mode settings, but please do not change the Model and Communications settings. For more information about using Layout for GPS surveying, you should review the Starting GPS topic.

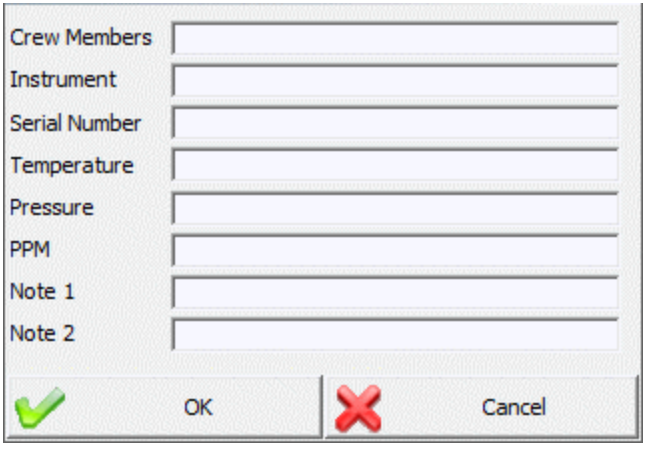
The GPS Demo will simulate connecting Layout to a GPS Rover receiver. The coordinates in the GPS Demo are located outside our office in Westbank, British Columbia, Canada, so to use the GPS Demo mode you need to set your Coordinate System Settings to UTM Zones, NAD83, UTM83-11, Ellipsoidal.

None

Use this option if you're not connecting anything to Layout and also don't need to manually enter any shot information. With this mode, the instrument toolbar will not be displayed in the map screen.

Project Information

Main Menu | Project | Settings | Info



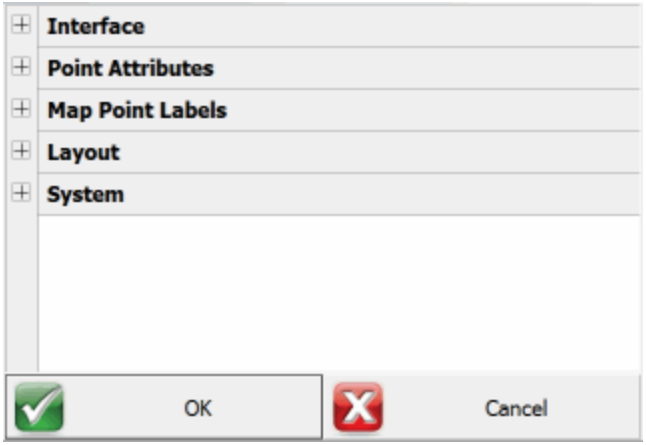
Use this option to record job information about your project.

Tap **OK** to save your information to the raw file, or **Cancel** to exit without saving your changes. Each entry field can accept up to 64 characters.

Options

Main Menu | Project | Settings | Options

The options screen helps you set settings that affect the look and feel of Layout.



Press the [+] buttons along the left to expand (show) each section, and the [-] buttons to collapse (hide) it.

- Interface Options
- Point Attributes Options
- Map Point Labels Options
- Default Units Options
- GPS Options
- Layout Options
- Roading Options
- System Options

Interface Options

Text Size (Info/Grid)

Use this to force the text shown in the Information screens (such as the Observation toolbar and the COGO History screen) and grid screens (such as the Project Manager and Angle Offset shots) to use a small or large sized text.

User Input Options

Extended Edit Boxes

Use this to control how you want to bring up the selected keypad when tapping in an edit box: either with a single tap, a double tap, or off. Users of devices with a keyboard should leave this set to Double Click, and users of devices without a keyboard should set this to Single Click. Setting this to Off disables both the keypad and any other commands that may be started directly from the edit field, such as the Point Chooser or Inverse Tool, so that edit fields can only be used for typing values from your physical keypad.

Point Attributes Options

Coordinate Order

Use this to control the display of coordinate values in Layout. Options are NEH, ENH, XYZ and will affect any area of the program where coordinates are displayed.

This option also affects whether the ASCII Import and ASCII Export commands use a N,E or E,N (X,Y) file format.

**Important note: The imported format only affects display of the coordinates and the ASCII file itself. The internally stored point database, or raw file stored will always be stored as N,E,Z.

Alpha-Numeric IDs

When this is enabled you will be allowed to enter alpha-numeric point IDs such as 21a, AB3, EV2. If this isn't turned on, then Layout will not accept anything but integer numbers. Alpha numeric input of point IDs can contain up to 31 characters. **Note:** Alpha-Numeric ID's are only supported in the MicroSurvey Point Prep 2008 or newer desktop software. Previous versions of MicroSurvey Point Prep do not support it.

Point ID Range - Minimum

Use this to force Layout to limit the point numbers that are used to a specific range; here you would specify the minimum range value. If you try to use a point number that is less than this value, you will see a message that will ask you to select a different point number. **Note:** If you have the Alpha-Numeric IDs toggle turned on, then any values specified here are ignored.

Point ID Range - Maximum

Use this to force Layout to limit the point numbers that are used to a specific range; here you would specify the maximum range value. If you try to use a point number that is greater than this value, you will see a message that will ask you to select a different point number. **Note:** If you have the Alpha-Numeric IDs toggle turned on, then any values specified here are ignored.

Alphanumeric Point ID's can have a maximum length of 31 characters.

New Description Prompt

This controls how Layout deals with descriptions that don't match anything in your Automap library. If this is on, when you enter a description that isn't in the Automap library you will see a warning message asking you if you want to add it.

If it is off, any description that doesn't have a match in the Automap library will be automatically added to your project's Automap library.

Time Stamp Saved Points

This tells Layout to write a timestamp into the raw file whenever a point is stored.

Map Point Labels Options

Show ID

This is used to show or hide the point number labels for your points.

Show Description

This is used to show or hide the point description labels for your points.

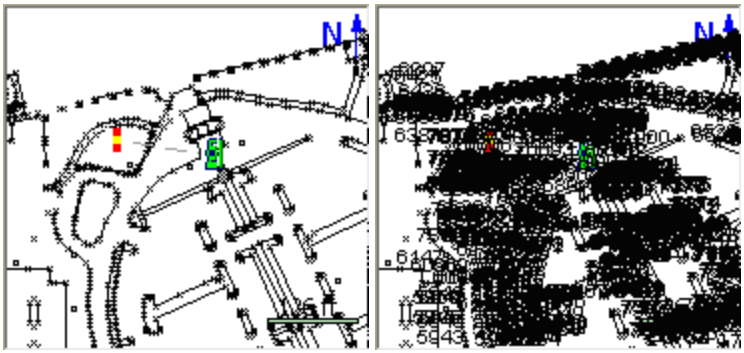
Show Elevation

This is used to show or hide the point elevation labels for your points.

Level of Detail

The Level of Detail filter, when turned off, will force Layout to show the point labels all the time, independent of your zoom level. If it is turned on, Layout uses an algorithm to determine if displaying the point labels is necessary.

This is demonstrated in the following two images, the first has LOD turned on and the second has LOD turned off.



With LOD on, as soon as you zoom in to a reasonable level, the labels will appear automatically. Under normal circumstances you will keep the LOD feature active.

Default Units Options

These options provide the default settings shown in the Units & Scale screen when creating a new project; they do not necessarily reflect the actual settings for the current project. Please see the Units & Scale topic for more detailed information on each option.

Distance Unit, Format, Precision

Specify whether new projects should default to Meters or Feet, in which format, and with how much precision.

Angle Unit, Format, Precision

Specify whether new projects should default to Degrees, Radians, or Gons/Grads, in which format, and with how much precision.

Direction Format

Specify whether to use Bearings or Azimuths by default for new projects.

Scale

Specify the default ground-to-grid scale factor to use for new projects.

Corrections

Specify whether to enable or disable the "Curvature and Refraction Corrections" option by default for new projects.

GPS Options

EP+ Records

When this is used the standard EP record type specified by the RW5 format will be slightly different. The main difference is that when turned on, the standard deviations for the X, Y, and Z components

will be stored. Setting this to on is only required if you want to use Layout with the OmniStar GPS service.

OnPOZ Tagging

Turn this on if you wish to use effigis' OnPOZ GNSS post processing software. If this is enabled then a measurement time start and end tag are written to the raw file. **Note**: An end tag is not written until you press the **Store Pnt** button in the GNSS measurement dialog. Remember, you must be logging GNSS data for this to work.

If this is turned on, during a measurement if the tolerances are met the store point screen will appear automatically. If this is off, then the user is required to press continue to get to the store point screen.

Auto Start Store

If this is turned on, the user will not see the store point screen. It is a fast way to store your GPS points and is useful when used in conjunction with the Auto Start Statistics option.

Correction Timeout

GPS data sent from a reference base had a time stamp of the start of the transmission associated with the positions being broadcast. When the rover processes the data, the time stamp is compared to the current time to ensure that there wasn't a big delay in receiving the position. Large time gaps can deteriorate the position quality at the rover. You can adjust the "time check" comparison value by adjusting the correction timeout value. Sometimes you have to increase this setting if you are far from your reference receiver, or are experiencing transmission interference. You can use any value between 0 and 20 seconds.

Note: You can also access these options directly from the staking toolbar.

Tolerance

This is the error tolerance that the staking command will use. When your staking "move by" distances are equal to or less than this amount, your direction to a point will be indicated in green text in the Observation Toolbar at the top left hand corner of the screen. Green text will be displayed to notify you that you're meeting your tolerance; if you do not meet the tolerance, the text will switch to red.

Orientation Reference (Total Station & GNSS)

The user can set an orientation preference for either total station or GNSS layout. Depending on the equipment currently in use, Layout will automatically use the defined orientation.

Orientation Reference = North

With the North orientation, North is the reference direction. The "move by" distances are standard cardinal directions.

North: This is the distance you need to move North.

South: This is the distance you need to move South.

East: This is the distance you need to move East.

West: This is the distance you need to move West.

Cut: This is the amount you have to go down from the current rod position to the stake point's elevation.

Fill: This is the amount you have to go up from the current rod position to the stake point's elevation.

Orientation Reference = Instrument

With the staking reference set to Instrument the map view will be twisted so the instrument is centered towards the top of your screen. The "move by" distances are with respect to the rod position looking towards the instrument. This view is useful when using a robotic instrument.

In: This is the distance you need to move towards the instrument.

Out: This is the distance you need to move away from the instrument.

Right: Facing the instrument, move right by this amount.

Left: Facing the instrument, move left by this amount.

Cut: This is the amount you have to go down from the current rod position to the stake point's elevation.

Fill: This is the amount you have to go up from the current rod position to the stake point's elevation.

Orientation Reference = Prism

With the staking reference set to Prism the map view will be twisted so the prism is centered towards the top of your screen. The "move by" distances are with respect to the instrument man looking at the prism. This view is handy when using a non-robotic instrument.

In: This is the distance you need to move towards the instrument.

Out: This is the distance you need to move away from the instrument.

Right: Facing the prism, move right by this amount.

Left: Facing the prism, move left by this amount.

Cut: This is the amount you have to go down from the current rod position to the stake point's elevation.

Fill: This is the amount you have to go up from the current rod position to the stake point's elevation.

Orientation Reference = User Point

With the User Point orientation, you can use an existing point in your project as the reference. The view will be twisted so that the selected point is centered towards the top of your screen.

In: This is the distance you need to move towards your user reference point.

Out: This is the distance you need to move away from your user reference point.

Right: Facing your user reference point, move right by this amount.

Left: Facing your user reference point, move left by this amount.

Cut: This is the amount you have to go down from the current rod position to the stake point's elevation.

Fill: This is the amount you have to go up from the current rod position to the stake point's elevation.

User Point

If you are using the "User Point" Orientation Reference (see above) then use this to specify which point ID you want to use for the reference point. If you are not using the "User Point" orientation then this does not have any effect.

Attached User ID

Use this to add a value to the point number you're currently staking. For example if the point your staking is point 8, and this field is set to 1000. In the raw file it will show that you staked point 1008 and will also store the staked position as point 1008 in the project database.

Turn Instrument Mode

If you have a motorized instrument, including robotics, you can control how Layout turns the instrument during stakeouts. If you want Layout to compute the horizontal and vertical angle needed to stake your point, use the **3D (HA + VA)** option. If all you want is the horizontal angle to be turned, and the vertical left alone, select the **2D (HA)** option.

Robotic Staking

If you're using a robotic instrument and this is turned on, if you stake a point Layout will go into a dynamic staking mode. Using this mode will not force the instrument to turn to the stake point. It will go into a tracking mode and will dynamically tell you how far you're away from the stake point.

Cut and Fill Slopes

Use this to specify your cut and fill slopes when you're slope staking. The fill slope value will be used when the hinge point is higher than the calculated catch point and this will occur in areas that require a fill. The cut slope will be used when the hinge point falls below the calculated catch point. This will occur in areas that require a cut.

A Cut of 2:1 means you would have a cut of 1 unit for every 2 units traveled horizontally.

Fade Staked-Out Points

Place a check mark in this box if you would like to see laid out points displayed differently to non-laid out points. A laid out point will appear as a slightly greyed out inverted triangle. This is for you to make quick assessments of what has been done and what remains to be finished.

Display Point Layout Screen

Place a check mark in this box if you would like to see the Point Layout screen displayed. This screen will always be displayed if there are values in the Design Point Offset fields. This was done to ensure that you never layout a point with a forgotten (and wrong) offset.

Display Layout Result Screen

Place a check mark in this box if you would like to see the Layout Result screen displayed after laying out a point. This screen will always be displayed if the laid out point exceeds the layout tolerances.

Store Layout Point

Place a check mark in this box if you would like the laid out point to be stored along with the raw data. If no check mark is in this box then only the raw data is stored, and the Store Point dialog will not be displayed.

By default this is checked. What will happen is when you store a staked position using the store button on the stake toolbar you will be prompted with a screen allowing you to assign a point number and description to the new point that will be created.

The point description will default to the current description from the Automap Library, as shown on your topo toolbar. If you choose a different description from the library, then it will be retained for all consecutive stakeout points.

Furthermore, when this feature is turned on it will use the value in the Add Id field to determine the point number for the recorded staked position. For example if you staked point 19 and you have an Attached User Id = 1000, then Layout will automatically use 1019 as a point number. This can be changed by the user.

Show Staked-Stored Points

Place a check mark in this box if you would like to see the laid out point displayed on map. We provide you with the choice so that you can quickly see which points you have already laid out.

Use Layout List

Place a check mark in this box if you would to use the Layout list instead of laying out from the Points database. If you use a layout list, you will never have a measured point presented as a new point to lay out.

Find Next Nearest

Place a check mark in this box if you would like Layout to search in the Points database (i.e. not in the layout list) for the nearest point from the current position, and present it as the next point to be laid out.

Roading Options

Stationing Format

You can specify the format for your stations and specify if the alignment should force all components to be tangential.

Value	Stationing Format		
	0+000.000	**0+00.00**	**0.000**
10	0+010.000	0+10.00	10.000
100	0+100.000	1+00.00	100.000
1000	1+000.000	10+00.00	1000.000
10000	10+000.000	100+00.00	10000.000

Calculate Directions

The default is to **not** force imported alignment files to be tangential. **You will usually want to keep this turned off.**

System Options

Language Resource

This is used for multi-language support. If you have installed a non-English version of Layout, then set this option to your Language Resource file, for example "ResESM.dll" for Spanish (Mexico).

Tip of the Day & Application Tips

When turned on, a "Tip of the Day" will be displayed when Layout is started, and tooltips will be displayed when you hover over any button.

Turning this off will hide the "Tip of the Day" dialog and will disable tooltips on buttons.

Communication Trace File

When turned on it will create a test file displaying information about the shot data going back and forth from Layout and your instrument. It can be used to diagnose communication problems and should only be used in this situation. The text file will be named **tracets.txt** or **tracegps.txt**and will be located in your ...\MicroSurvey\Layout\Programs\ directory on your device.

Bluetooth Persist On

By default Layout always disconnects existing Bluetooth connections and also turns the power off for the Bluetooth radio in your data collector when you exit the program. The main reason we do this is to conserve battery power.

Some users prefer that power to the Bluetooth radio remains on no matter what. In this case, disable this feature. The default is OFF.

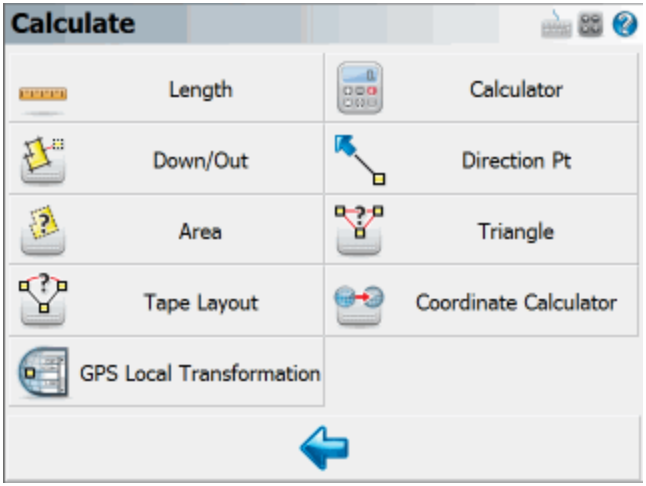
Calculate

Calculations Menu

Calculate Menu

Main Menu | Calculate

The calculation menu contains calculation based functions that can be used to compute points, lines and other data.



Triangle Calculator

Use this to compute a triangle solution using known angles or distances. Please refer to the Triangle Calculator topic for more information.

Coordinate Calculator

Use this tool to help you convert Geodetic coordinates to Cartesian coordinates. Please refer to the Coordinate Calculator topic for more information.

Length

Use this to measure the length and direction between points. Please see the Inverse topic for more information.

Calculator

Use this to display the RPN calculator. Please see the Calculator topic for more information.

Down/Out

Use this to calculate a point measured down and out from a line between points. Please see the Down/Out Offset topic for more information.

Direction Pt

This will open the Traverse / Intersect toolbar. You can enter in directions and distances and perform common intersections such as bearing / bearing, distance/distance and many more. Please see the Traverse / Intersection topic for more information.

Area

Use this to compute areas using points or lines in your project. You can also use this to compute predetermined areas. Please see the Area Calculator topic for more information.

Triangle

Use this to compute a triangle solution using known angles or distances. Please refer to the Triangle Calculator topic for more information.

Tape Layout

Use this to manually layout points using a simple measuring tape. Please see the tape layout topic for more details.

GPS Local Transformation

Use this to compute and apply a GPS local transformation also known as a site calibration. Please review the GPS Local Transformation topic for more details.

Length

Main Menu | Calculate | Length

This command will calculate for you the length between two points. It will display the horizontal / slope distance, direction, vertical distance and slope between the two points. You do not need to have a line drawn between the points to use the length command.

All length information is saved in the COGO History file called CogoCalcs.txt located in your project folder.

Traverse Length

Function

1. Start the length command and make sure the **Traverse Length** and **Line** options are selected.
2. Enter or choose the first point to calculate from, and press your enter key to continue on to the next point.
3. Now you can choose or enter the second point and press your Enter button to compute an answer.
4. The length information will be displayed in the results toolbar.
5. In the COGO history you will see the following information for the two points:

```
|--------------------------------
|INVERSE
|--------------------------------
|PNT 44 to 8 (HD 1352.84' @ NA 323°48'03.1")SD 1353.39' GR -2.85' VD -
|38.51'AR 323°48'03.1"
```

Your first length will calculate a right angle from north to the direction you calculated.

Multiple Lines

After you have specified two points, you can continue from point to point. You should notice that the point id previously in the 2nd point field will move to the 1st point field, and the cursor will remain in the 2nd point field allowing you to quickly enter in your next point.

If you continue calculating from point to point, the angle right will not be referenced to north, but the last leg you calculated. Essentially this is computing a clockwise angle between the current and last legs you calculated.

Perimeter Distance and Area

If you close back to the first point, a perimeter distance and enclosed area will also be computed.

Radial Length

You can compute radial lengths from a point.

Function

1. Start the length command and make sure the **Radial Length** and **Line** options are selected.
2. Enter or choose the 1st point to calculate from, and press your enter key to continue on to the next point.
3. Now you can choose or enter the 2nd point and press your Enter button to compute an answer.
4. The length information will be displayed in the results toolbar.
5. You can now continue computing radial lengths. The 2nd point field will remain activated allowing you to continue entering point numbers.

Radial Arc

You can compute the curve information for an arc defined by three points, PC (start), Radius Point, and PT (End)

Function

1. Start the length command and make sure the **Rad Arc** button is turned on.
2. Enter or choose the starting point for the arc in the Start field, and press your enter key to continue on to the next point.
3. Enter or choose the radius point in the Arc field, and press your enter key to continue on to the next point.
4. Enter or choose the end point for the arc in the End field, and press your enter key to compute an answer.
5. The length information will be displayed in the results toolbar.

Three Point Arc

You can compute the curve information for an arc defined by three points along the arc.

Function

1. Start the length command and make sure the **3 Pt Arc** button is turned on.
2. Enter or choose the starting point for the arc in the Start field, and press your enter key to continue on to the next point.
3. Enter or choose the point that falls on the arc in the Arc field, and press your enter key to continue on to the next point.
4. Enter or choose the end point for the arc in the End field, and press your enter key to compute

an answer.

5. The length information will be displayed in the results toolbar.

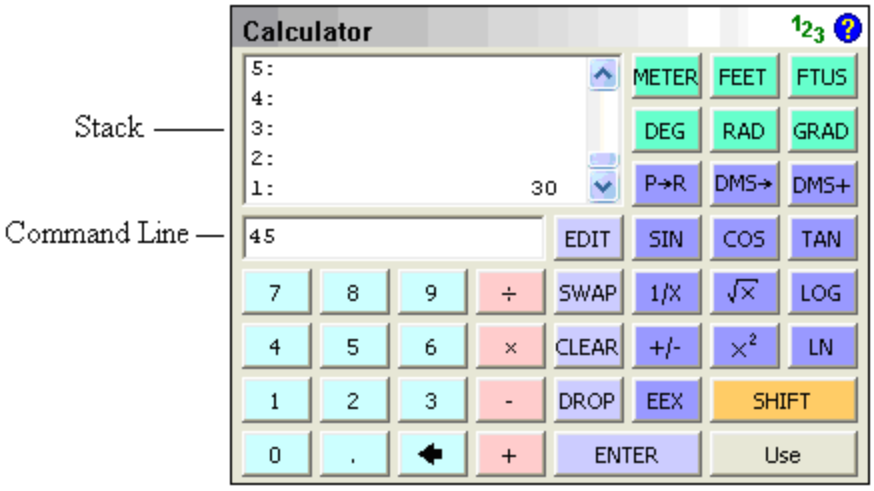
Calculator

Main Menu | Calculate | Calculator

Layout includes an RPN (Reverse Polish Notation) Calculator. RPN Calculators (such as the HP48) are stack based, where values are popped from a stack, and the results of the calculation are pushed back onto the stack. This type of calculator may seem foreign at first, so several examples of its use are included below.

The calculator can be launched several ways:

1. By tapping inside certain numeric entry fields to directly open the Calculator. This will copy whatever value is currently in that entry field into the calculator's command line, and the calculated value can then be automatically copied back into the field which the calculator was launched from.
2. By tapping inside most text and numeric entry fields to open the keypad, and then tapping the "Calculator" button on the keypad. This will copy whatever value was currently in that entry field first into the keypad and then into the calculator's command line. The calculated value can then be automatically copied back into the keypad and then to the field which the calculator was launched from.
3. Or it can be launched through the menu system.



The Stack

The stack is a series of memory storage locations for numeric data. Each location in the stack is called a Level. There are a maximum of 20 Levels available in the Stack.

As you push new values on the stack, the stack grows to accommodate them: the new data moves into level 1, and older data is pushed to a higher level. Data in level 1 will move to level 2, data in level 2 to level 3, and so on. Any data in level 20 will be bumped off the stack if new data is added, and is unrecoverable. As you pop data off of the stack, the number of levels decrease as data is automatically bumped down to lower levels.

The stack display always shows levels 1 to 5, and you can use the scroll bar to view the other levels up to level 20.

The Command Line

The command line is where you enter or edit data. You can enter up to 20 characters in the command line.

The command line is closely tied to the stack. You use it to enter or edit data and then process it, and the results are pushed onto level 1 of the stack.

Function

Numeric Entry

You can enter values using the keys provided on the calculator or use the numeric keys on your keyboard.

[0] - [9] - Types numeric data into the command line

[<--] - Types a backspace into the command line. You can also use the Backspace key on your keyboard.

Stack Operations

Functions are available to help you manipulate data that is currently stored in the stack.

[EDIT] - Pops data from level 1 of the stack into the command line, bumping all other data down one level.

[SWAP] - Switches positions of the data in levels 1 and 2 of the stack. Or you can highlight a level on the stack and pressing the Swap button will move the value to level 1.

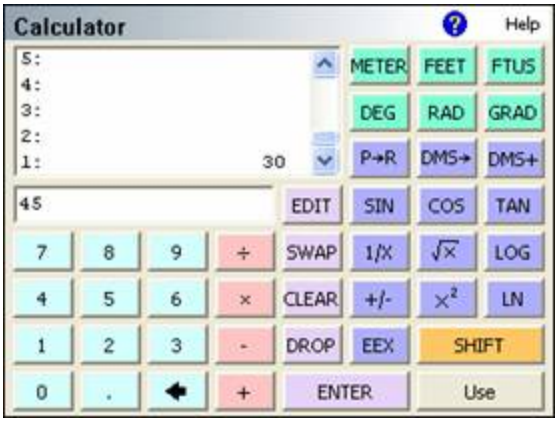
[CLEAR] - Deletes all data from the stack.

[DROP] - Deletes the data in level 1 of the stack, bumping all other data down one level.

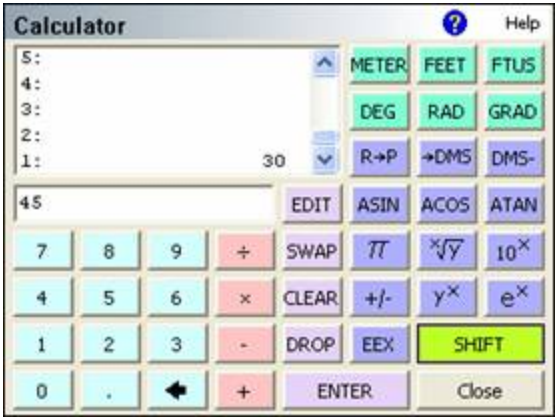
[ENTER] - Pushes data from the command line into level 1 of the stack, bumping all other data up one level. You can also use your keyboard's Enter key.

The Shift Button

[SHIFT] - This is used to show the reverse functions of each operation.



When the shift key highlighted in yellow, it Indicates that the shift key is currently depressed, press it again to un-shift



The OK/Cancel button

[OK] copies the value in level 1 of the stack back into the either the keypad or the numeric entry field which was double-tapped to launch the calculator, and closes the calculator.

[Cancel] closes the calculator, without copying the data anywhere

> **Note:**
> All data will remain on the Stack, and will be available the next time the calculator is re-started. On Exiting from Layout, all data on the stack is written out to a file called Calc-Stack.bin and will be automatically re-loaded when Layout is re-started.

Converting Units

[METER] , [FEET] , [FTUS]

Assigns a linear unit to the data in the Command Line, and places it on the Stack. If the Command Line is empty, then the unit is applied to the data currently in Level 1 of the Stack.

[DEG] , [RAD] , [GRAD]

Assigns an angular unit to the data in the Command Line, and places it on the Stack. If the Command Line is empty, then the unit is applied to the data currently in Level 1 of the Stack.

> **Note:**
> You do not need to press enter before pressing a unit button, it will automatically move whatever data is in the Command Line into Level 1 of the Stack.

Example: determine the metric equivalent of 15 feet:

[1][5] [FEET] [METER]

```
1:      4.572_m
```

Example: determine the gradient equivalent of 45 degrees:

[4][5] [DEG] [GRAD]

```
1:      50_grad
```

Basic Mathematical Operations

[+] , [-] , [x] , [/]

Performs a mathematical operation on the data in Level 1 and Level 2 of the Stack, or on Level 1 and the Command Line.

> **Note:**
> You do not need to press [ENTER] before pressing a math button, it will automatically move whatever data is in the Command Line into Level 1 of the Stack.

Example: determine the sum of 2 + 3

```
[2] [ENTER] [3] [+]
1:      5
```

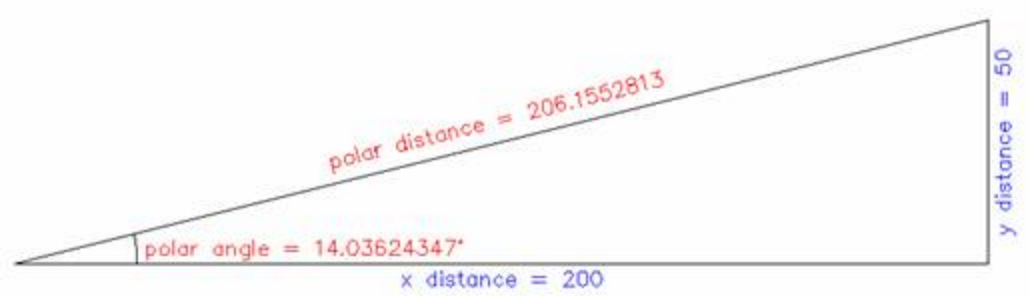
Advanced Mathematical Operations

> **Note:**

You do not need to press [ENTER] before pressing a math button, it will automatically move whatever data is in the Command Line into Level 1 of the Stack.

[P>R] , [R>P]

Convert data between Polar and Rectangular notation



Example: Convert 206 feet at 14° to Rectangular components.

```
[2][0][6] [ENTER] [1][4] [P->R]
2:      199.8809196
1:      49.83591049
```

Example: Convert x=200, y=50 to Polar components.

```
[2][0][0] [ENTER] [5][0] [SHIFT] [R->P]
2:      206.1552813
1:      14.03624347_°
```

[DMS>] , [>DMS]

Converts data between Degrees/Minutes/Seconds and Decimal Degrees

Example: Convert from 12° 34' 56" to decimal degrees

```
[1][2][.][3][4][5][6] [DMS->]
1:      12.58222222_°
```

Example: Convert from 12.3456° to degrees, minutes, seconds

```
[1][2][.][3][4][5][6] [SHIFT] [->DMS]
1:      12.204416
```

[DMS+] , [DMS-]

Add or subtract DMS angles

Example: 12° 34' 56" + 1° 2' 3"

```
[1][2][.][3][4][5][6] [ENTER] [1][.][0][2][0][3] [DMS+]
```

```
1:      13.3659
```

[SIN] , [COS] , [TAN] , [ASIN] , [ACOS] , [ATAN]

Trigonometric calculations

Example: Cosine of 12.3456°

```
[1][2][.][3][4][5][6] [COS]
1:      0.9768757205
```

Example: Cosine of 12° 34' 56"

```
[1][2][.][3][4][5][6] [DMS->] [COS]
1: 0.9759844006
```

Example: Arc Cosine of 0.3456°

```
[0][.][3][4][5][6] [SHIFT] [ACOS]
1:      69.78157371
```

[1/X]	Inverse of X. Example: 1/4 = [4] [1/X] = 0.25
[√x]	Square Root of X. Example: ROOT(9) = [9] [√x] = 3
[LOG]	Logarithm (Base 10). Example: LOG(1000) = [1][0][0][0] [LOG] = 4
[+/-]	Change Sign. Example: [3] [ENTER] [+/-] = -3
[x^2]	X Squared. Example: 3^2 = [3] [x^2] = 9
[LN]	Natural Logarithm. Example: LN(148) = [1][4][8] [LN] = 4.997212274
[EEX]	Scientific Notation. Example: 3x10^4 = [3] [EEX] [4] = 30,000
[pi]	Pushes pi onto the stack. Example: [SHIFT] [pi] = 3.141592654
[x√y]	X'th root of Y. Example: 3ROOT(8)= [8] [ENTER] [3] [SHIFT] [x√y] = 2
[10^x]	10 to the X. Example: 10^3 = [3] [SHIFT] [10^x] = 1000
[y^x]	Y to the X. Example: 2^3 = [2] [ENTER] [3] [SHIFT] [y^x] = 8
[e^x]	Exponent of X. Example: e^1 = [1] [ENTER] [SHIFT] [e^x] = 2.718281828

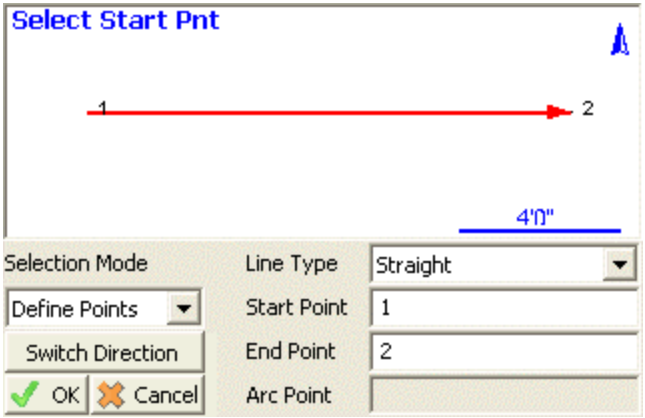
Offset Tool

Main Menu | Calculate | Down/Out

This routine allows you to calculate and draw points and/or figures, offset from other existing points, figures, or DXF entities in your project. You can calculate points on a line or down and out from a line, or offset complete figures.

Selection Mode

Press the "Select Line" button to go into Selection Mode. You will also automatically go into Selection Mode if a line is not yet selected when you start this command.



Whichever Selection Mode you use, the selected line will be highlighted in red in the map screen along with a direction indicator. If necessary, you can press the **Switch Direction** button to reverse the start and end of the selected line. Press OK to accept the selected line and proceed to the next step.

Selection Mode: Figure/DXF

Pick this mode to select an existing figure or DXF entity by selecting the desired figure from the map screen. You can select any of the following:

- Figures containing lines and/or arcs (but not curvey splines)
- DXF lines, arcs, and/or polylines (but not splines, splined polylines, or fitted polylines)

Selection Mode: Figure Segment

Pick this mode to select an individual line or arc segment from a complex figure, by selecting the desired segment from the map screen. You can select any of the following:

- a line or arc segment from a Figure (but not a curvey segment)
- (line or arc segments from a DXF polyline cannot be selected)

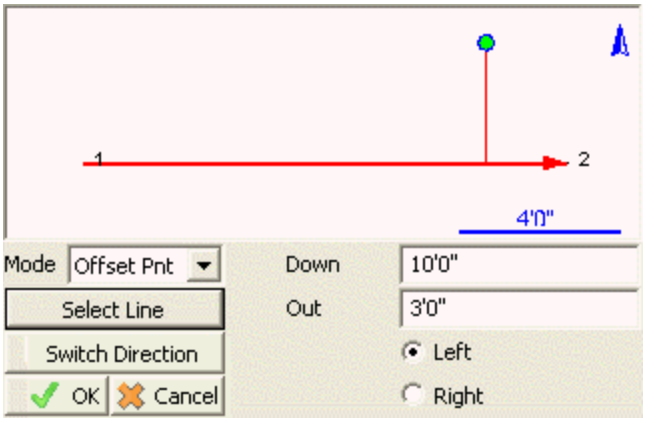
Selection Mode: Define Points

Pick this mode to select points in your project to define a line or arc. You can define the following line types:

- Straight Line: select a Start Point and End Point
- Arc (CW): select a Start of Curve Point, Radial Point, and End of Curve Point
- Arc (CCW): select a Start of Curve Point, Radial Point, and End of Curve Point
- Arc (3Pnt): select a Start of Curve Point, Point on Curve, and End of Curve Point.

Offset Point Mode

Use this mode to calculate a point measured Down and Out from the selected line.

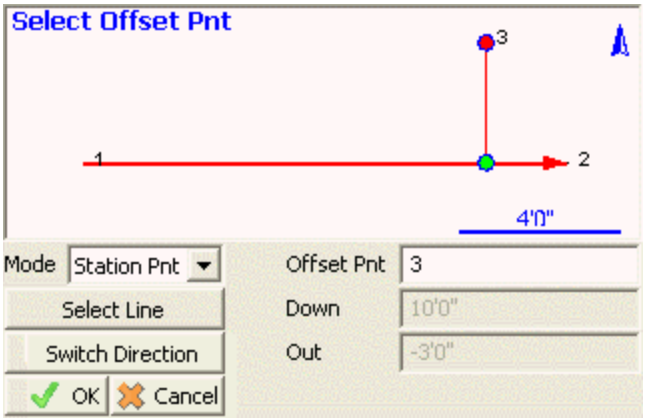


After selecting a line using any of the above Selection Modes, pick this mode and enter the Down/Out distances and the offset direction (left or right, looking down the line).

The calculated point will be previewed in green in the map screen. Press the **Save** button to store this point.

Station Point Mode

Use this mode to calculate the Down and Out distances to a selected point, and to calculate a perpendicular intersection point On the selected line.



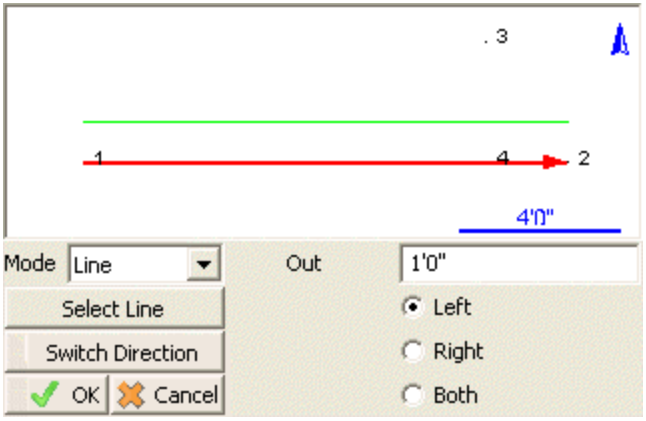
After selecting a line using any of the above Selection Modes, pick this mode and select the Offset Point by either typing in its Point ID or by selecting it from the map screen when the Offset Pnt field has focus.

The selected point will be highlighted in red in the map screen, and its Down/Out distances from the selected line will be displayed.

A perpendicular intersection point On the line will be calculated and previewed in green in the map screen. Press the **Save** button to store this point.

Line Mode

Use this mode to draw a new line or figure, offset from the selected line.



After selecting a line using any of the above Selection Modes, pick this mode and enter the distance and direction (left or right looking down the line, or both sides).

The offset line will be calculated and previewed in green in the map screen. Press the **Save** button to store this line. When a line is saved, points will be automatically stored at the start and end points, arc radial points if applicable, and polyline vertex points if applicable.

Direction Point

Main Menu | Calculate | Direction Pt

Layout includes a powerful COGO function that allows you to compute new points. The toolbar allows you to specify the solution type, point numbers, directions and distances. When you enter enough information to compute a solution it will be draw visually on the screen. Pressing the Store Pnt button will store the point that you just solved.

Input

You can type in the point ID, or select a point by tapping on the map screen.

The direction and distance fields support the direction and distance recall feature. To learn more about this, refer to these topics in the Calculating With Layout section.

If you are measuring distances with a Leica Disto, just double tap in the distance field and choose the "Disto Observation" option.

Disto Distances

If you have a Leica Disto, you can send distances back to the distance edit fields. Simply double tap the distance field and select "Disto Observation" which will then set Layout in a "waiting" mode. Take the measurement with the Disto, press the Bluetooth icon on the Disto, and the measured distance will be accepted by Layout.

Calculator

You can open our calculator by double-tapping the Direction or Distance fields then pressing Calculator on the Keypad screen.

Information

You can review the results of your calculation by pressing the "i" information button. For intersections with multiple solutions, the results of both solutions will be displayed.

Solution Methods

Method: Traverse

The traverse method allows you to define a direction and distance that you want to traverse. After you solve your point and store it, it will become the new start point.

Method: Direction - Distance

This will compute two solutions based on the values you input. To store the solution, simply press the **Store Pnt** button which will ask you what solution to use, in this case either **A** or **B**.

Method: Direction - Direction

Use this to compute a new point by computing an intersection using directions. After you enter your known values a solution will be displayed on the screen. To store the solution, simply press the **Store Pnt** button.

Method: Distance - Distance

Use this to compute a new point by computing an intersection using distances. This will compute two solutions based on the values you input. To store the solution, simply press the **Store Pnt** button which will ask you what solution to use, in this case either A or B.

Method: Interior Angle Traverse

Use this to compute a new point by turning an angle from another point. Enter the current (setup) and previous (backsight) points, then the interior angle and the distance. Positive angles will be interpreted as angle right; if you want to turn an angle left, enter the angle as negative. To store the solution, simply press the **Store Pnt** button. After the point is stored, the points will automatically leapfrog so you can continue traversing by just entering the next interior angle and distance.

COGO Results

Every calculation you make is written to the file called CogoCalcs.txt located in your project folder.

Triangle Calculator

Main Menu | Calculate | Triangle

The triangle calculator can be used to solve unknown sides or angle of a triangle given three know components.

You first need to select a Method for the triangle calculation. There are 5 methods available to choose from and you can decide what method to use based on your known triangle components.

- **Side-Side-Side**: Use this when you know the length of the three sides of a triangle.
- **Angle-Side-Angle**: Use this when you know two angles and the distance between them.
- **Side-Angle-Angle**: Use this when you know two angles and one side. The know side must not lie in between the two known angles.
- **Side-Angle-Side**: Use this when two sides and the angle between them are known.

- **Side-Side-Angle**: Use this when two sides and one angle that is not between the known sides are known. This method will produce two solutions.

After you choose the solution method and enter the known components of the triangle, press the **View Results** button to complete the calculation.

Area Calculator

Main Menu | Calculate | Area

The area calculator is used to compute areas.

When defining the boundary area, you can select points, lines and arcs from the map, or type the point numbers in manually. Lines and points from DXF files are also valid and can be selected using the Define Area toolbar.

Defining an Area

Define Area Toolbar (Points)

Select Point

The define area toolbar is used to help you define an area. If the first button is set to **Select Point**, the toolbar is in "point selection" mode and will only accept points picked from the map or point numbers that are typed in. This button acts as a toggle and will toggle between Select Point and Select Line.

Line

If you are defining a straight segment, then you should leave the **Line** button turned on. Simply select two points from the map, or enter the point numbers manually.

Rad Arc

Use this to define a curved segment where you know the start, radius, and end points. You need to first pick the start of the arc, then press the **Rad Arc** button to define the radius point. After doing so, the program will automatically switch back to the Line segment type which at that time you should select the end of the arc.

3 Pnt Arc

Use this to define a curved segment where you know three points on the arc. You need to first pick the start of the arc, then press the **3 Pnt Arc** button which will allow you to define two more points on the arc for a total of three points. The program will automatically switch back to the Line segment type after the third point is selected.

Remove Previous

Use this to remove segments that were defined for the area boundary. This will remove the segments one at a time starting with the last segment that was defined.

Define Area Toolbar (Line)

Select Line

The define area toolbar is used to help you define an area. If the first button is set to **Select Line**, the toolbar is in "line selection" mode and will only accept lines picked from the map. This button acts as a toggle and will toggle between Select Point and Select Line.

Switch Direction

Since this routine accepts Layout figures as well as DXF entities, at times you need to switch the direction of a DXF line so that it matches the direction that you are traversing around to define the area boundary. As you select lines from the map you will see a red marker appear at the end of the line.

Remove Previous

Use this to remove segments that were defined for the area boundary. This will remove the segments one at a time starting with the last segment that was defined.

Enclosed Area Calculation

To compute an area you need to press the **Define Area** button to define the boundary that will outline the area perimeter. It is important to note that you are not required to "close" the area by selecting the original starting point.

The green marker indicates the start of the area perimeter, where as the red marker indicates the last point on the perimeter. When ready to compute the area, simple press the exit button (red X) on the Define Area toolbar.

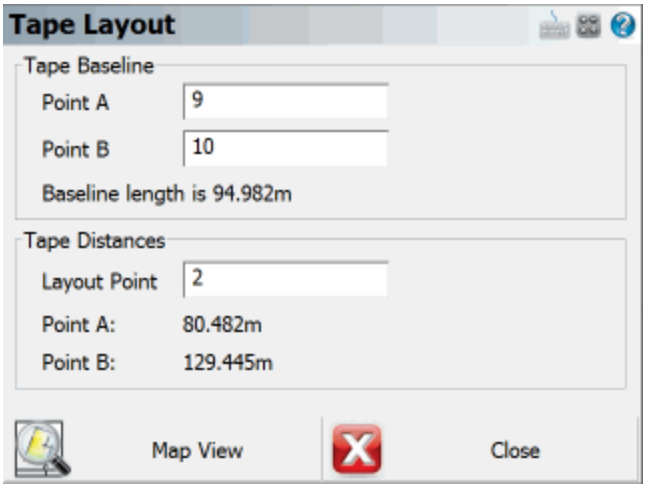
Tape Layout

Main Menu | Calculate | Tape Layout

The tape layout tool is used to manually layout points with a simple measuring tape. You must have two points that are common on the job site and in your layout project. From these known points you can then select the points you want to locate on the job site.

When you start the command you will see the tape layout screen. From here you specify the two points that you will be measuring offsets from. Enter the points by typing the number, or double

clicking the point field to bring up an options menu. Once you select the baseline points, a distance will be displayed for information purposes.



After you define the tape baseline points, you can then select the point that you want to locate. Once you select the layout point, the offsets to measure will be computed and displayed.

Map View

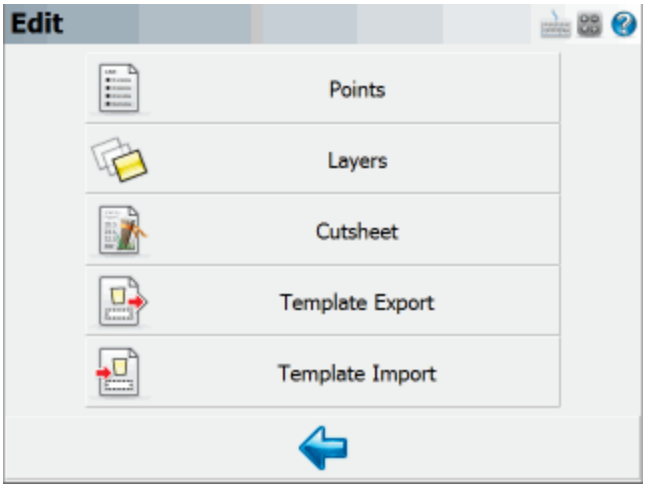
At any time you can press the Map View button to see a graphical representation of the baseline and offset line

Edit

Edit Menu

Main Menu | Edit Menu

This menu allows you to organize, manipulate and view the different data types that may be associated with your Layout projects.



Points

Use this to open the points database. From here you will find numerous tools that can be used to edit your points. Please see the Coordinate Database topic for more information.

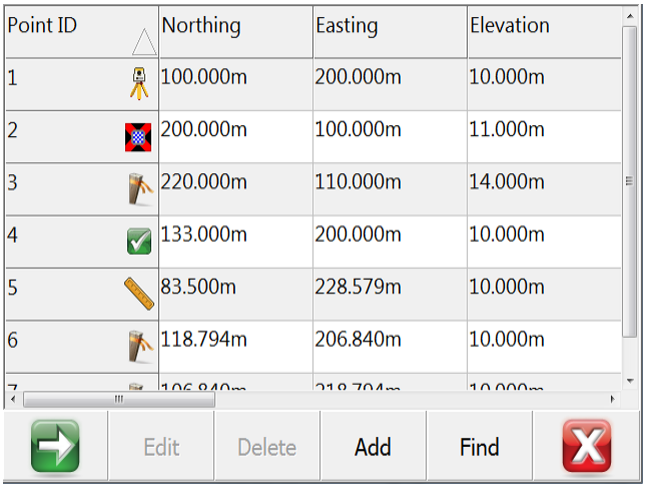
Layers

Use this to import DXF, LandXML, and georeferenced raster image files into your project, and to control the visibility of database layers and any files that you may have associated with your project. Please see the Map Data Layers topic for more information.

Point Database

Main Menu | Edit | Points

The point database dialog is used to review, edit, and manipulate your point data in your project database. The list will display all points currently stored in the database, and the data can be sorted by pressing the column headers.



Point ID (Survey Role) Icons

The instrument icon indicates your current occupied point.

The target icon indicates your current backsight point.

The checked stake icon indicates points that have been laid out.

The hub icon indicates control points, they can not be edited under any circumstances.

The user icon indicates user entered points, the coordinate can be edited.

The ruler icon indicates measured points, the coordinate can not be edited.

The 123 icon indicates calculated points, the coordinate can not be edited.

The stake and square icon indicates a Staked and Stored point. The Staked and Stored survey role is unique and not associated with LandXML schema.

Note:

To edit the coordinate of a measured or calculated point, you must first change its survey role to **user entered.**

Edit

Use this to edit the coordinates of a point that is highlighted in the list using the Store/Edit Points tool. Remember you must change the Survey Role to **User Entered**.

Add

Use this to open the Store Point screen to manually enter a new point.

Find

Use this to select multiple points, based on a single point ID, a point ID range, a point coordinate range, or point descriptions.

Statistics

Use this to display statistics of the coordinate database, including the total number of points, bounding minimum and maximum coordinate values, and point ID's in use, and point ID's not in use.

Layout

After selecting a point, press the **Layout** button to lay out this point. Pressing this button will take you to the Point Layout dialog.

Map View

Use this to display the currently highlighted points on the screen.

Average

Store / Edit Points

Main Menu | Edit | Points | Add

This is a multi use function that is used by many parts of the program. Essentially any time a point needs to be stored or edited, it will done via the store point screen. Depending on what it is you're doing, certain parts of the dialog will be disabled or not editable. Following is an explanation of what you should expect.

Point ID

Enter in the point number you would like to assign to the point. Note that by default it will display the next available point number. If you're editing an existing point, this field will not be editable.

Description

This is where you can enter a description for your point.

Elevation

Input your coordinate values in these fields when manually creating a new point using the add point function. If measuring a point, you can not manually enter or edit coordinates.

Note Button

Press this to enter a note or record an audio note for the point. See the Notes topic for more information.

Store Pnt (point) Button

Press this to store the measured point.

Store SS (side shot) Button

Press this to store the point as a side shot. You would typically use this when not measuring traverse points. You will not see this button when measuring with GPS.

Store TR (traverse) Button

Press this to store the point as a traverse point. You would typically use this when the measured point belongs to a traverse. You will not see this button when measuring with GPS.

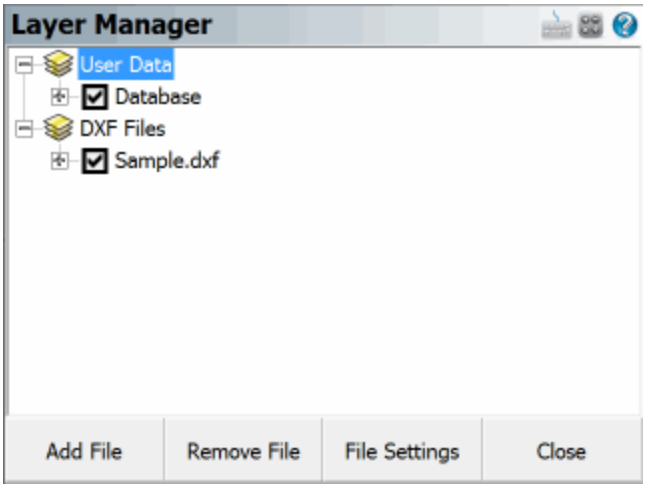
Cancel Button

Press this to cancel the measurement.

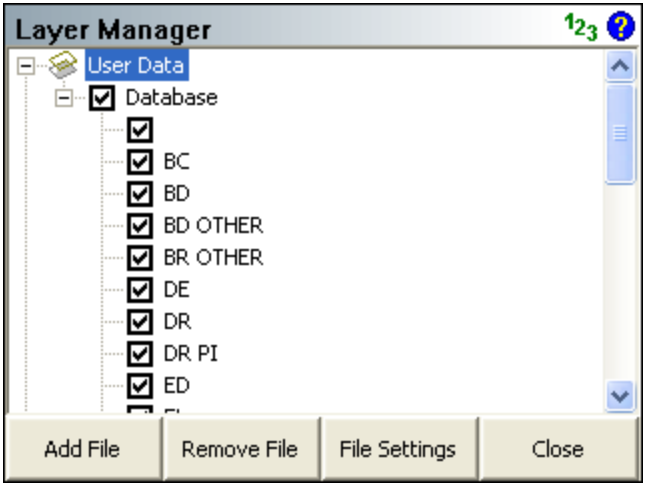
Map Data Layers Manager

Main Menu | Edit | Layers

Use this to load, unload, and control the visibility of DXF files, LandXML files, and JPG or TIFF raster image files that are associated with your project, and to control the visibility of your database layers.



User Data



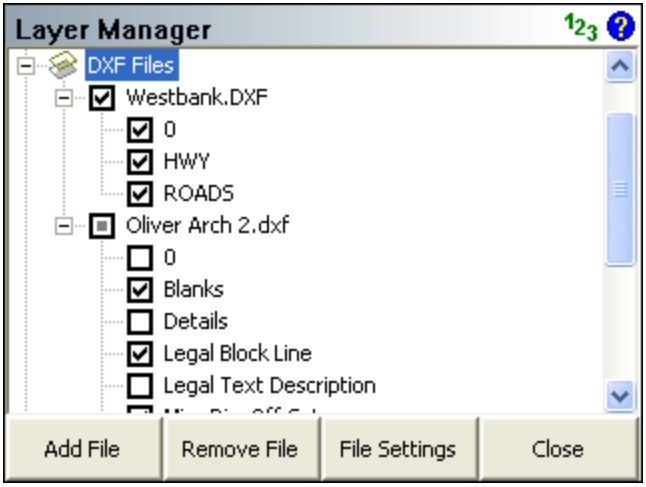
Layout uses the layer names specified in the Automap library to control the visibility of points and figures by their description.

You can control the visibility of the entire database (both points and figures) by checking or unchecking the Database option under the User Data section of the tree. If the box is checked, then the database is turned on and all of its layers will be visible; if unchecked, then the file and all of its layers is turned off and it will not be visible. If the box has another smaller square inside it, this means that some of its layers are turned on and other layers are turned off.

You can control the visibility of individual layers by expanding Database option under the User Data section of the tree, and checking or unchecking the box beside the name of the layer. If the box is checked, then the layer is turned on and entities on that layer will be visible; if unchecked, then the layer is turned off and entities on it will not be visible.

When you close the project, the layer status will be saved so that the next time the project is opened, the layer visibility will automatically be set the same as you had left it, so layers that were turned off will remain turned off the next time the project is opened up.

DXF Files



You can load multiple DXF files into your Layout project, and control the visibility of each of their layers independently from the others.

You can control the visibility of the entire DXF file by checking or unchecking the box beside the name of the DXF file, under the DXF Files section of the tree. If the box is checked, then the file is turned on and all of its layers will be visible; if unchecked, then the file and all of its layers is turned off and it will not be visible. If the box has another smaller square inside it, this means that some of its layers are turned on and other layers are turned off.

You can control the visibility of individual layers by expanding the name of the DXF file under the DXF Files section of the tree, and checking or unchecking the box beside the name of the layer. If the box is checked, then the layer is turned on and entities on that layer will be visible; if unchecked, then the layer is turned off and entities on it will not be visible.

When you close the project, the layer status will be saved so that the next time the project is opened, the layer visibility will automatically be set the same as you had left it, so files that were turned off will remain turned off the next time the project is opened up.

Add File

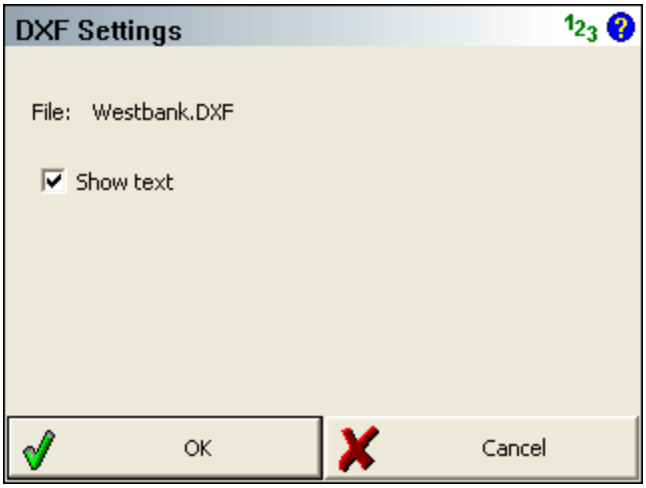
Press the Add File button to select a DXF file that you want to load into your project. You will be able to browse to and select any DXF file. Please see the Import DXF File topic for more information.

Remove File

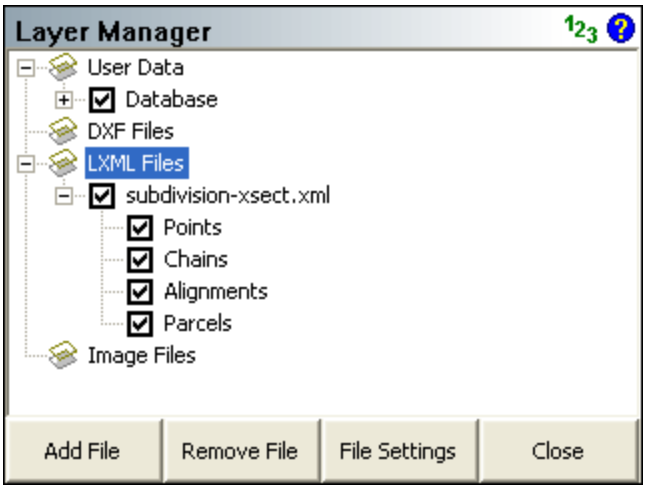
Highlight the DXF file that you want to remove from your project, then press the Remove File button. If a file is not highlighted, you will be reminded that a file must first be selected from the tree. This will turn off all layers from the selected file in your Layout project and disassociate the DXF file. It does not delete the DXF file.

File Settings

Highlight the DXF file that you wish to change the settings for, then press the File Settings button. You can enable or disable the display of text in the selected file. If your DXF file contains text, turning this off will improve performance of Layout. Pressing the OK or Cancel buttons will return you to the Layer Manager screen.



LandXML Files



You can load one LandXML file into your Layout project at a time, and control the visibility of its layers (points, chains, alignments, and parcels).

You can control the visibility of the entire XML file by checking or unchecking the name of the XML file, under the LXML Files section of the tree. If the box is checked, then the file is turned on and all of its contents will be visible; if unchecked, then the file and all of its layers is turned off and it will not be visible. If the box has another smaller square inside it, this means that some of its layers are turned on and other layers are turned off.

You can control the visibility of individual layers by expanding the name of the XML file under the LXML Files section of the tree, and checking or unchecking the box beside the name of the layer. If the box is checked, then the layer is turned on and entities on that layer will be visible; if unchecked, then the layer is turned off and entities on it will not be visible.

When you close the project, the layer status will be saved so that the next time the project is opened, the layer visibility will automatically be set the same as you had left it, so layers that were turned off will remain turned off the next time the project is opened up.

Add File

Press the Add File button to select a LandXML file that you want to load into your project. You will be able to browse to and select any XML file. Please see the Import LandXML File topic for more information. Note, you must first unload the currently loaded XML file before loading a different one.

Remove File

Highlight the XML file that you want to remove from your project, then press the Remove File button. If a file is not highlighted, you will be reminded that a file must first be selected from the tree. This will

turn off all components of the selected file in your Layout project and disassociate the XML file. It does not delete the XML file.

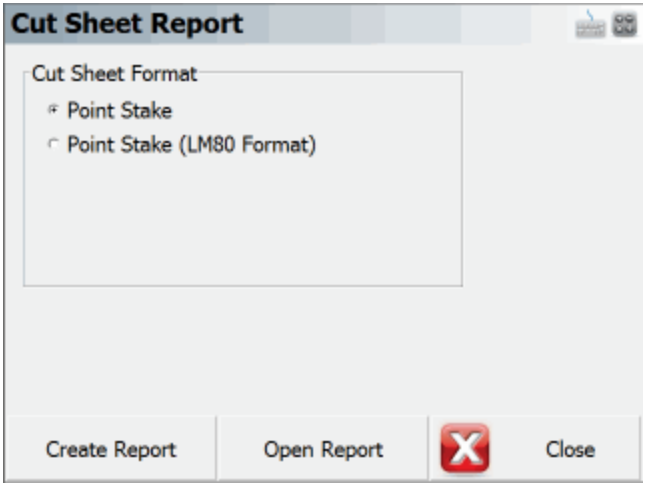
File Settings

The File Settings button does not apply to LandXML files.

Cutsheet Reports

Main Interface | Layout | Cutsheet

Layout includes a cut sheet generator. When you points or alignments, cut sheet records are recorded in the raw file.



The different cut sheet formats will be described below. To create a cut sheet, select the desired cut sheet format, then press the **Create Report** button, then choose the folder and filename for it. You can give it any extension (one will not be automatically added) but we recommend using either .CSV or .TXT. The extension you provide will not affect the contents of the file in any way.

If you've already created a cut sheet and want to open it to review it, press the **Open Report** button.

Layout automatically creates a (.CSV) comma separated value file for each cut sheet format you create. This file can be read into Excel, which will allow you to format it and print it. The records stored during staking follow the RW5 format so cut sheet records can be created using software packages that support this format.

Point Stake Format

If you've staked points using the Stake Point command you will be able to create a stake point cut sheet report.

Design Pt	As Built Pt	Cut(-)/Fill(+)	Design N	Design E	Design El	Delta N	Delta E	Design Desc	As Built Desc
17	5005	0	5007.202	5003.499	100.202	0	0	GRD	Design Pnt 17
19	5006	0	5006.076	5001.161	100.119	-0.007	0	GRD	Design Pnt 19
20	5007	0	5008.335	4998.831	100.061	-0.007	0	GRD	Design Pnt 20
51	5009	-0.001	5006.573	4992.566	99.815	-0.001	-0.001	GRD	Design Pnt 51
51	5010	-0.001	5006.573	4992.566	99.815	-0.001	-0.001	GRD	Design Pnt 51
30	5011	-0.425	4997.663	4996.693	99.815	-6.249	14.371	E/ASPH	Design Pnt 30
31	5012	-0.739	4996.107	4991.625	99.502	-7.805	9.302	E/ASPH	Design Pnt 31

LM80 Format: This option will format the cut sheet in the LM 80 format.

Offset Stakes Format

If you've staked points using the stake alignment command, you can create a cut sheet report for your station and offset stakes.

Station	Offset	Offset Length	Cut(-)/Fill(+)	Elevation	Grade	Description
1	Left	1.002	0	100.1662	100.1665	0+01.00 L 1.000
2	Left	0.984	0	100.0624	100.0619	0+02.00 L 1.000
2	Center	0.001	-0.001	100.0629	100.0619	0+02.00 C 0.000
2	Right	1.005	0	100.0622	100.0619	0+02.00 R 1.000
3	Left	1.001	-0.007	99.9643	99.9574	0+03.00 L 1.000
3	Right	0.006	-0.014	99.9715	99.9574	0+03.00 C 0.000
3	Right	1.002	-0.005	99.9619	99.9574	0+03.00 R 1.000

Slope Stake Format

If you've staked points using the slope stake alignment command, you can create a cut sheet report for your slope stakes.

Station	Offset Direction	Cut/Fill	Design Slope	Offset Length	Pt Name	Actual El	Design El	Ahead On Station	HD to Hinge Pt	VD to Hinge Pt	HD to Center Line	VD to Center Line	Observed Slope	Description
12	Left	Cut	1.00:1	N/A	81	99.984	100.24	-0.032	1.011	0.968	2.011	0.968	1.04:1	CP 0+012.000 L 1.000
6	Left	Cut	1.00:1	N/A	5000	100.15	100.15	-0.013	0.507	0.501	1.507	0.501	1.01:1	CP 0+06.00 L 1.000
6	Left	Cut	1.00:1	N/A	5001	100.15	100.15	-0.002	0.498	0.501	1.498	0.501	0.99:1	CP 0+06.00 L 1.000
6	Left	Cut	1.00:1	N/A	5002	100.14	100.18	0.017	0.521	0.501	1.52	0.501	1.04:1	CP 0+06.00 L 1.000
6	Left	Cut	1.00:1	1	5003	101.53	100.14	0.017	1.513	0.501	2.513	0.501	1.04:1	REF CP 0+06.00 L 2.000
6	Left	Cut	1.00:1	N/A	5004	100.14	100.14	-0.002	0.498	0.501	1.498	0.501	0.99:1	CP 0+06.00 L 1.000
6	Left	Cut	1.00:1	1	82	102.28	100.14	-0.002	1.39	0.501	2.387	0.501	0.99:1	REF CP 0+06.00 L 2.000

Point and Offset Stake Format

This type of report will display the same records as the Point Stake and Offset Stake reports, but combine them into a single report.

Station	Offset	Offset Length	Design Pt	As Built Pt	Design N	Design E	Design El	As Built El	Cut(-)/Fill(+)	Delta N	Delta E	Design Desc	As Built Desc
			17	5005	5007.202	5003.499	100.202	100.2018	0	0	0	GRD	Design Pnt 17
			19	5006	5006.076	5001.161	100.119	100.1191	0	-0.007	0	GRD	Design Pnt 19
			20	5007	5008.335	4998.831	100.061	100.0615	0	-0.007	0	GRD	Design Pnt 20
1	Left	1.002		5008	5011.787	5004.505	100.166	100.1662	0	0.001	-0.001		0+01.00 L 1.000
			51	5009	5006.573	4992.566	99.815	99.8163	-0.001	-0.001	-0.001	GRD	Design Pnt 51
			51	5010	5006.573	4992.566	99.815	99.8163	-0.001	-0.001	-0.001	GRD	Design Pnt 51
			30	5011	4997.663	4996.693	99.815	100.2405	-0.425	-6.249	14.371	E/ASPH	Design Pnt 30
			31	5012	4996.107	4991.625	99.502	100.2405	-0.739	-7.805	9.302	E/ASPH	Design Pnt 31
2	Left	0.984		5014	5011.047	5003.832	100.062	100.0624	0	-0.018	0.005		0+02.00 L 1.000
2	Center	0.001		5015	5011.719	5003.092	100.062	100.0629	-0.001	-0.001	0		0+02.00 C 0.000
2	Right	1.005		5016	5012.391	5002.352	100.062	100.0622	0	-0.006	0.001		0+02.00 R 1.000
3	Left	1.001		5017	5010.306	5003.16	99.957	99.9643	-0.007	0	-0.001		0+03.00 L 1.000
3	Right	0.006		5018	5010.978	5002.42	99.957	99.9715	-0.014	-0.007	0.002		0+03.00 C 0.000
3	Right	1.002		5019	5011.651	5001.68	99.957	99.9619	-0.005	-0.004	-0.001		0+03.00 R 1.000

Template Export

Main Menu | Edit Menu | Template Export

You can export and save line work (figures) and points to a file that can then be inserted into different projects. An example of how this feature can be used is when you have a building that is common to several projects. Instead of computing a new building in each project, you can do it just once, save it to a file, then insert it into your other projects.

When you start the command you will see the template export toolbar.

There are four options available for selecting the line work and points.

Window All

This option lets you window the objects. All points and line work contained within the selection window will be accepted.

Window Points

This option lets you window objects, but only coordinate points will be selected all line work is ignored.

Single All

Use this option to manually select objects in the map view to export. You can select points or lines / arcs. If you select a line, the points that define the line will be exported as well.

Single Points

Use this option to select point one by one in the map screen.

Save Template

When you're done selecting your objects, you can save them to a file by pressing the Save button. Choose a location for your template, give the file a descriptive name and save it. Template files have a ".tpl" extension.

Import Template

You can then import the template into any project by using the Template Import command.

Template Import

Main Menu | Edit Menu | Template Import

If you have a template file saved you can import it back into your project. When you start the command you will see the file browse dialog that allows you to find and open the template file. After which you will see the template import toolbar. If you need to create a template file, refer to the Template Export topic.

Select Insertion Point

After you select the template you can select the insertion point in the map screen, and also define a rotation for the template. A preview of the template will be displayed in the map screen in green, press Next to continue.

Select Origin Point

After you specify the insertion point, you can then choose the origin point. Select points (green dots) on the template preview to define a new origin position.

Insert Template

Once you are satisfied with the location and rotation of the template, you can save it into the current project by pressing the Insert button. New points and line work will be added to the project for you automatically.

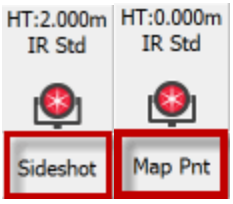
Setup & Check

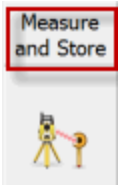
Measure Modes

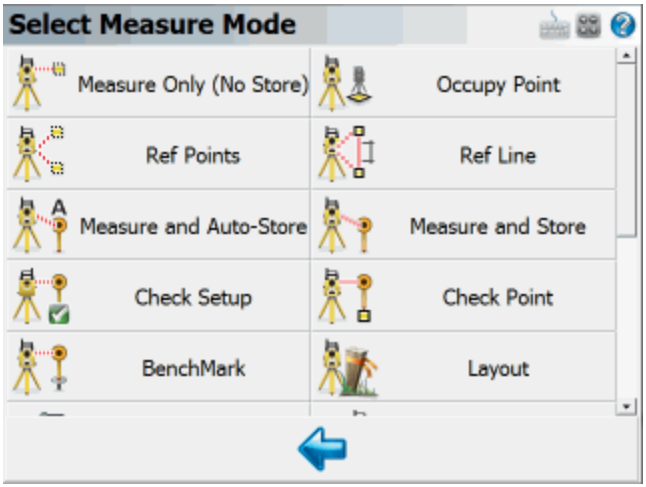
Instrument Toolbar | Measure Modes

These are commands built into Layout that will help you measure and map your points. The desired method must be selected before you begin a measurement.

For a faster way to get to this screen, you can also press the measure mode button which is located on the instrument toolbar.







Note: Several of these modes will not be available until you have setup an occupy point and measured a backsight via the Occupy Point, or Resection commands. Most of these modes will also not be available if you are using GPS.

Measure Only (No Store)

This will allow you to take a measurement without storing it. Please see the Measure Only topic for more information.

Occupy Point

Use this to define an instrument setup. Please see the Occupy Point topic for more information.

Measure and Store

This mode allows you to measure a point. After the measurement, it will allow you to review your measurement data and allow you to make changes to the point id and description before it is stored. Please see the Measure and Store topic for more information.

Measure Point and Auto-Store

This mode allows you to measure a point using the next available point id, and the description and line toggles specified on the main map screen. Using this is a very fast method for recording your measurements. Please see the following topic for more information.

Reference Points

This will start the multiple point resection routine to allow you to determine your current instrument position by measuring to known points. Please see the Resection topic for more information.

Reference Line

This will start the reference line routine. Please see the Reference Line topic for more information.

Check Point

Use this to display a check measurement to an existing point in your project. Please see the Check Shot topic for more information.

Check Setup

Use this to compare your backsight to your previously measured values. Please see the Check Backsight topic for more information.

Horizontal Angle Offset

This will start the angle offset routine. Please see the Horizontal Angle Offset topic for more information.

Vertical Angle Offset

This will allow you to compute the height of an object. Please see the Vertical Angle Offset topic for more information.

Distance Offset

This will start the distance offset routine. Please see the Distance Offset topic for more information.

Manual Distance

This will record a HA and VA for a shot, but the user can manually enter the distance. Please see the Manual Distance topic for more information.

Manual Entry

This will allow you to manually enter in a shot including HA, VA and SD. Please see the Manual Entry topic for more information

Two Line Intersection

This allows you to measure two baselines and Layout will compute the intersection point. Please see the Two Line Intersection topic for more information.

Line - Angle Offset

This allows you to measure two points to define a baseline, measure an angle, and Layout will compute the intersection point. Please see the Line - Angle Offset topic for more information.

Line - Distance Offset

This allows you to measure two points to define a baseline, then manually enter measured distances. These distances will be used to compute a new point based on the baseline. Please see the Line - Distance Offset topic for more information.

Line - Perpendicular Point

This allows you to measure two points to define a baseline, then you can select an existing point which will be used to compute a perpendicular intersection. Please see the Line - Perpendicular Point topic for more information.

Benchmark

Use this to check your current setup elevation, or compute a new one based on a known elevation. Please see the topic for more information.

Vertical Projection

This will allow you to compute points on a user defined vertical plane. Please see the Vertical Projection topic for more information.

Point Scanning

Use this to activate Point Scanning with your motorized reflectorless instrument. Please see the Point Scanning topic for more information.

Occupy Point

Occupy Point

Main Menu | Measure Modes | Occupy Point

Use this command to specify the instrument location and orientation. You will be asked to specify the point your instrument is occupying, an instrument height and if you will be assuming a backsight direction or sighting an exiting point. After you have established your setup and backsight, Layout will graphically show you your setup points.

Occupied Point Location

Backsight Point Location

Backsight Method: Direction

With the backsight method set to Direction you will be able to specify the point you want to setup on and specify a backsight direction.

When you go to measure you have the option of recording an angle and distance to the backsight, or the option of just recording an angle. If a distance is measured to the backsight you will have the option of storing a point for the backsight after you press the measure button.

Occupy Point

Type in an existing point number, or double tap in this field to open the keypad or to select a point from the map. You will be able to create a new point, pick one from a list, or pick one from your drawing.

Instrument Height

Use this to enter your current instrument height.

Backsight Direction

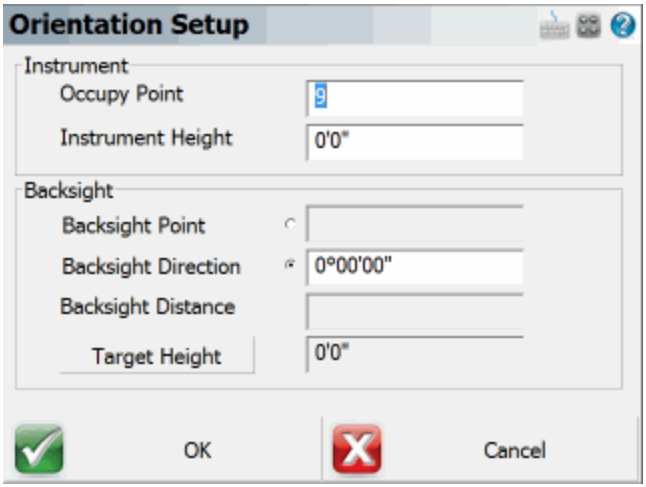
Use this to specify the direction that will be used by Layout. You can enter an azimuth or a quadrant bearing.

Target Height

Use this to enter your current target height.

Backsight Method: Point

Use this method to specify the points that will be used for the current instrument location and backsight.



Occupy Point

Type in an existing point number, or double tap in this field to open the keypad or to select a point from the map. You will be able to create a new point, pick one from a list, or pick one from your drawing.

Instrument Height

Use this to enter your current instrument height.

Backsight Point

Type in an existing point number, or double tap in this field to open the keypad or to select a point from the map. You will be able to create a new point, pick one from a list, or pick one from your drawing.

Backsight Direction & Distance

When you enter in your points Layout will display the inversed horizontal distance and direction between the points you entered.

Target Height

Use this to enter your current target height.

Measuring to the Backsight

Once you've established the backsight method, entered your points and instrument height you can move on to the next step by pressing the **Observe Backsight** button. You will be taken back to the map view where you will see the graphical position of your setup and backsight points. There are a few things you should take note of:

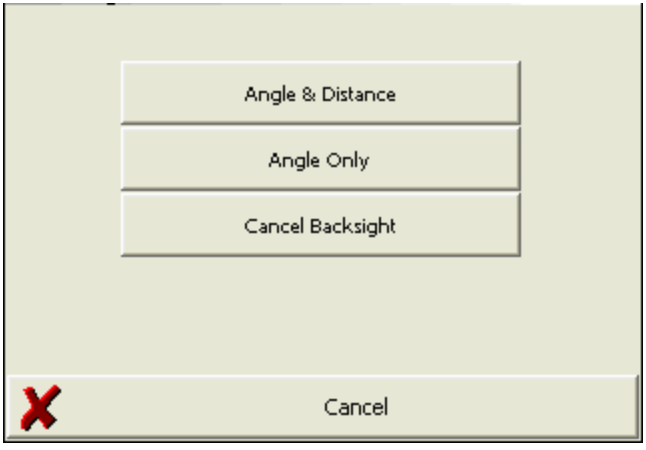
1. You can always tell what mode you're in by the "mode" text that appears near the top of your drawing. Since you're using the occupy point command you will see "Observe Backsight" near the top of the map area.
2. You have two measure modes available to you on the instrument toolbar. You can measure an angle and distance to the backsight, or measure only your current plate reading without measuring a distance. The two options are described in more detail in the Backsight Measure Mode topic.
3. You can cancel the setup by pressing the measure mode button and choosing "Cancel Backsight"
4. While in the backsight mode, you can use any of the controls from the information and display toolbar.
5. You can set the height of target by using the HT button on the instrument toolbar.
6. When you're ready to measure to the backsight, press the Measure button on the instrument toolbar.

Backsight Summary

After you have taken your measurement you will see a summary of your shot. From this screen you can choose to accept the shot or re-shoot it. You can also specify if you want the plate reading set to zero or a specific azimuth (if this is supported on your instrument). For more information see the Backsight Summary topic.

Backsight Measure Modes

Instrument Toolbar | Measurement Modes Button



When shooting to your backsight you have two options available and they can be accessed from the instrument toolbar using the measure mode button. The measure modes available are described as follows:

Angle & Distance

Specifying this will require you to measure a distance to the backsight either to a prism or reflectorlessly. It will also record the current plate reading on the instrument. Both the measure distance and plate reading will be used as the backsight reading in the raw file.

Angle Only

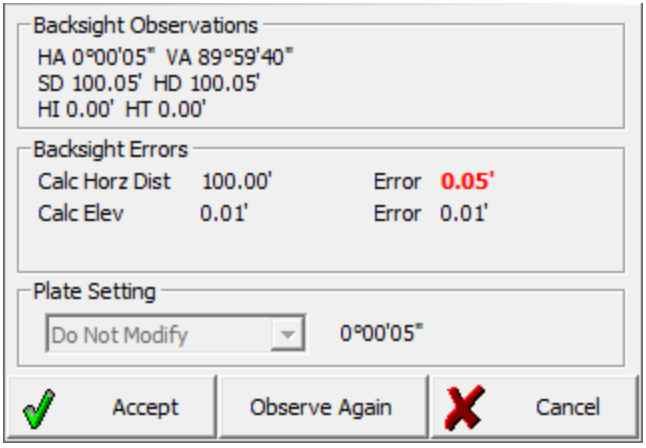
Specifying this will not require you to measure a distance to the backsight. All that will be recorded is the current plate reading on the instrument and this reading will be used as the backsight reading in the raw file.

Cancel Backsight

Use this to cancel your current backsight and occupy point command.

Backsight Summary

After you have taken your measurement you will see a summary of your shot. From this screen you can choose to accept the shot or re-shoot it. You can also specify if you want the plate reading set to zero or a specific azimuth.



Backsight Observations and Errors

If you specified the point backsight method you will see a comparison between what you measured and the theoretical inverse. If you used the measure angle only mode, or defined a backsight direction

you will not see a comparison as there isn't enough information available to compute the inverse.

Plate Setting

Finishing the Setup Routine

Accept

Once you've reviewed your backsight information you can complete it by pressing the **Accept** button. This will write a record to the raw file and exit the setup routine.

If you specified the direction backsight method you will be prompted to "Store the point observed at the backsight?" Press **Yes** to store a point for the backsight, or **No** to complete the setup without creating a new point at the backsight.

Observe Again

If you're not satisfied with the results or made a mistake you can re-shoot the backsight by using this button. Doing so will take you back to the main display where you can take another shot on the backsight.

Occupy Point Raw Records

When you accept your occupy point, points will be stored in the database for the setup and backsight if applicable. Also, the following records will be written to the raw file:

```
SP,PN2,N 918.0848,E 1057.3576,EL0.0000,--
--Orientation
LS,HI5.000,HR5.000
OC,OP1,N 1000.0000,E 1000.0000,EL0.0000,--
BK,OP1,BP2,BS145.00000,BC0.00000
BR,OP1,BP2,AR145.00000,ZE90.00000,SD100.00000
-- Orientation Notes (several comment lines)
```

Reference Points (Resection)

Main Menu | Measure Modes | Reference Points

Layout has a multi-point resection routine that can be used to compute a point for a setup. It will use a least squares solution to determine the coordinates from the measurements you make to your points. The goal at the end of a resection is to compute the unknown coordinates of the instrument's current location based on measurements made to other known points in the project.

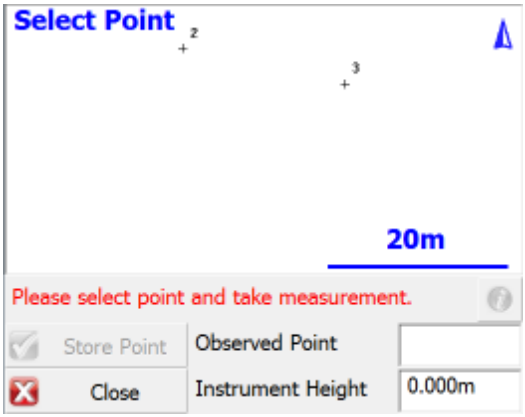
- As a minimum you need to have two points to resect to.
- You can shoot the resection point in the direct or reverse face.
- You can take multiple shots to the same resection point.

- There is no limit to the amount of points you can resect to.
- When you store your resection point, an occupy record will be created for you automatically.

Specify the Resection Reference Points

First Shot

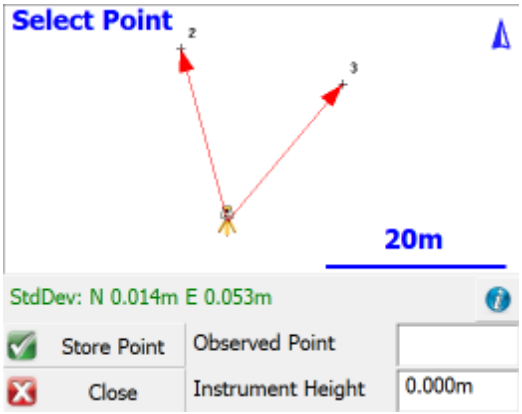
When you start the command you will see the reference point toolbar. Specify your instrument height and select a reference point to measure. After you select a point, you can press the **Measure** button to record a shot.



Second Shot

To record the second shot, simply select it from the map screen, then press the **Measure** button. A minimum of two points are needed to compute a position for the instrument, but you can shoot more points if needed to increase the accuracy of the instrument position. The estimated accuracy of the instrument location will be displayed for you on the toolbar. If the estimated error is within your own tolerances, then you can can go ahead and store the point by pressing the **Store Point** button. All successful solutions will be displayed with green text starting with the characters ***StdDev:***.

Press the **Close** button to cancel out of the routine. You may need to do this if the solution does not converge, and you need to restart the routine.



Three or More Shots

If you have more points to reference to you can continue measuring them using the same process as you did when you shot the second point. As you record more points you should notice that the standard deviations for the northing and easting will begin to get smaller.

Standard Deviation

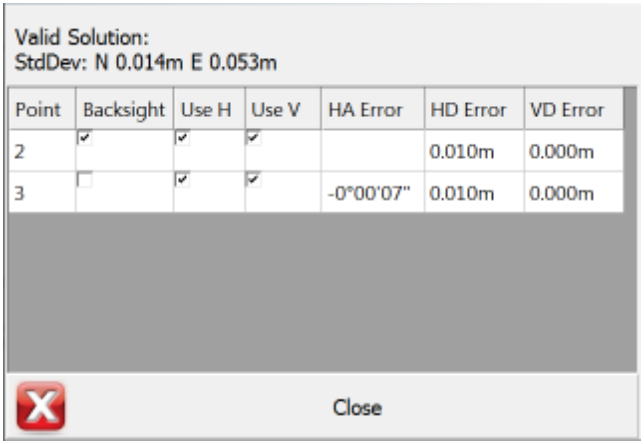
This is the computed precision for the overall geometry of the resection. Small errors indicate that the measured data "fits" very well with the geometry defined by the known points.

Large errors can indicate that bad measurements were recorded, either due to careless measurement practices such as not holding the prism pole straight or not carefully sighting the prism. Large errors can also happen if the geometry defined by the known points, is not "in the same place" as it was when the points were previously measured.

Please note that while the Standard Deviation relates to the quality of your resection, it is possible to have a low StdDev yet still have a high positional error. As such, it is important that you also look at the angle and distance errors shown in the Information screen when considering the overall accuracy of your resection.

Information (Horizontal and Vertical Filters)

You can enter this screen by pressing the **Information** button on the top right corner of the reference point toolbar. When you do, you will see a detailed summary of the measurements.



You can determine how each shot to the reference points should be used to compute the resection point. By default each observation you make will be used to compute both the horizontal and vertical position of the resection solution, but you can override this by setting the **Use H** and **Use V** options for each measurement.

Use H	Use V	Result
✔	✔	This shot will be used to compute both the horizontal and vertical position.
✔	✘	This shot will be used to compute only the horizontal position.
✘	✔	This shot will be used to compute only the vertical position.
✘	✘	The shot will be ignored in the computation.

You can also select which observation is to be your backsight point.

HA Error

The horizontal angle error is computed as follows. Using the computed resection point and the measured horizontal angle, a theoretical direction is computed to the reference point. This direction is then compared to the direction measured (plate reading) and the difference is noted in the HA Err column.

HD Error

The horizontal distance error is computed as follows. An inverse is made between the resection point and the reference point. This inversed distance is then compared to the measured distance and the difference is noted in the HD Err column.

VD Error

The vertical distance error is computed as follows. Using the resection elevation, and the observation to the reference point, a new elevation is computed for the reference point. This computed elevation is

then compared to the reference point's original elevation and the difference is noted in the VD column.

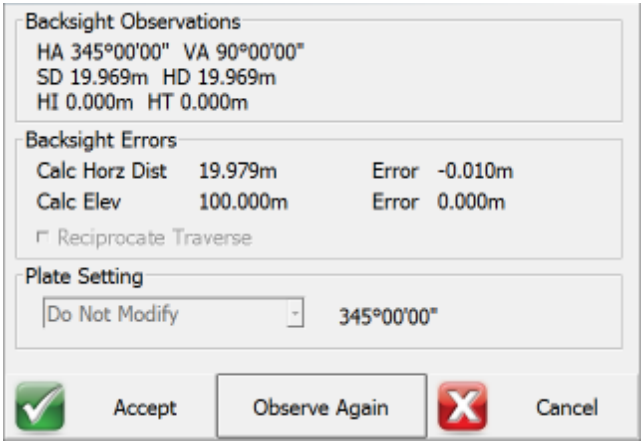
Resection Modes

At any time during the collection of your observations you can choose to shoot an **Angle & Distance** or **Angles Only** measurement. You can control this by pressing the measurement mode button on the instrument toolbar after you have started your resection.

Store the Resection Point

When you're satisfied with the resection point you can store its new position by pressing the **Store Pnt** button. This will then display the store / edit screen.

Finally you will see the backsight results screen.



The backsight point that will be stored will be based on which point you selected in the Information screen shown above, which by default is the first reference point you observed. You do not need to take another measurement to the backsight as it has the original measurement you made. At this point you can do the following:

- Confirm the instrument and target heights.
- Decide if you would like to sight it again and take another measurement.

Raw File Record

After your store you point, several records will be written to the raw file.

```
--Resection
SP,PN5000,N 1009.1534,E 1000.0000,EL100.3244,--
SP,PN6034,N 1006.1995,E 1002.8319,EL99.7321,--FS
SP,PN6035,N 1001.4706,E 1004.8775,EL99.7361,--FS
RS,PN5000,CR359.59590,ZE87.49010,SD9.1600
RS,PN6034,CR24.33000,ZE92.03450,SD6.8280
```

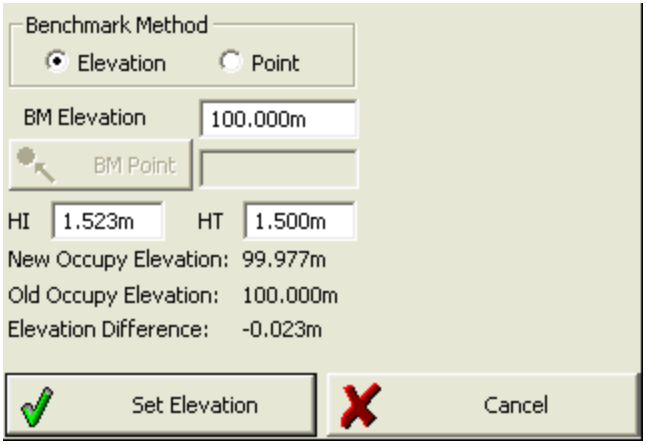
```
RS,PN6035,CR73.13080,ZE92.43050,SD5.1010
SP,PN6036,N 999.9998,E 999.9998,EL100.0011,--
OC,OP6036,N 999.9998,E 999.9998,EL100.0011,--
SP,PN5000,N 1009.1534,E 1000.0000,EL100.3244,--
BK,OP6036,BP5000,BS0.00039,BC0.00000
--Occupy Check
-- Observed Values: HA 0°00'00.0" VA 87°49'22.0" SD 9.160m HD 9.153m
-- Distance Calculated: 9.154m
-- Distance Error: -0.000m
-- BS Elevation: 100.324m
-- BS Elevation Error: 0.001m
```

Observe Benchmark

Main Menu | Measure Modes | Benchmark

Use this to check your current setup elevation or use it to establish an elevation for your setup. When you start the command you will be taken to the main interface and you will note that the measure mode will be set to **Benchmark.** If you need to cancel the operation you can do it by pressing the measure mode button and choose the **Cancel Benchmark** button.

When you're ready to record the shot press the **Measure** button on the instrument toolbar. You will then see the benchmark shot screen.



Calculating an Elevation

Benchmark Method: Elevation

Use this option if you want to manually enter the know elevation for the point you're basing your shot on. The elevation you enter will be used to calculate the elevation of the current setup. The difference

in the current and calculated elevations will be displayed towards the bottom of the screen. You can enter in your know elevation in the **BM Elevation** field.

Benchmark Method: Point

Use this option if you want to base the calculated elevation on an existing point in your project. The elevation of the point you choose will be used to calculate the elevation of the current setup. The difference in the current and calculated elevations will be displayed towards the bottom of the screen. You can choose your point by using the point chooser button.

HI

This is where you would enter your height of instrument. Note this value will be used to compute the new instrument elevation.

HT

This is where you would enter your height of target. Note this value will be used to compute the new instrument elevation.

Set Elevation

Pressing this button will update your current setup elevation with the one calculated by the Benchmark Shot routine. You will be asked to confirm that you want to update the elevation. Two records will be written to the raw file, a remote elevation (RE) and a store point (SP) record.

```
RE,OP1,FE0.000,ZE90.00000,SD10.0000,--Remote elev
SP,PN1,N 5001.0000,E 4978.0000,EL0.0240,--
```

Cancel

This will exit the routine and not save any changes.

Check Setup

Main Menu | Measure Modes | Check Setup

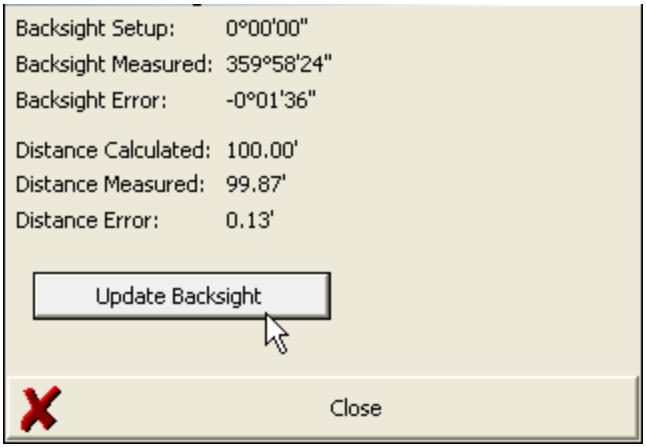
Use this to check your backsight. Layout will compare your newly measured value to the one that was stored for your current setup. You will be able to review difference and optionally update your current setup with the new shot to the backsight.

When you start the command you will be taken back to the map screen and the measure mode will be set to **Check BS.** You have two measure modes available when taking a check shot to your backsight. Please see the Backsight Measure Mode topic for more information.

Check Backsight Summary

When you're ready to record the shot press the **Measure** button on the instrument toolbar. You will be presented with a screen that compares your measured values to the ones that were stored for the

current backsight.



Update Backsight

Pressing this will create a record in the raw file updating your setup and backsight record with the shot information from your check shot. Several notes will also be written to the raw file summarizing your shot. When you choose to update the backsight, a new OC and BK record is saved as well as the shot information. You will also see the word (Updated) which indicates that the user selected the Update button.

```
OC,OP5,N 763.8748,E 1000.0000,EL0.0000,--
SP,PN1,N 1000.0000,E 1000.0000,EL100.0000,--start
BK,OP5,BP1,BS0.00000,BC0.00000
LS,HI0.000,HR5.000
--Backsight Check (Updated)
-- Observed Values: HA 0°00'00.0" VA 90°00'00.0" SD 163.12'
-- Backsight Setup: 0°00'00"
-- Backsight Measured: 0°00'00"
-- Backsight Error: 0°00'00"
-- Distance Calculated: 236.13'
-- Distance Measured: 163.12'
-- Distance Error: 73.01'
```

Close

Pressing this will exit the function and write several notes to the raw file summarizing your check shot.

```
--Backsight Check (Not Updated)
-- Observed Values: HA 0°00'00.0" VA 90°00'00.0" SD 236.10'
-- Backsight Setup: 0°00'00"
-- Backsight Measured: 0°00'00"
-- Backsight Error: 0°00'00"
```

```
|-- Distance Calculated: 236.13'                                    |
|-- Distance Measured: 236.10'                                      |
|-- Distance Error: 0.03'                                           |
```

Check Point

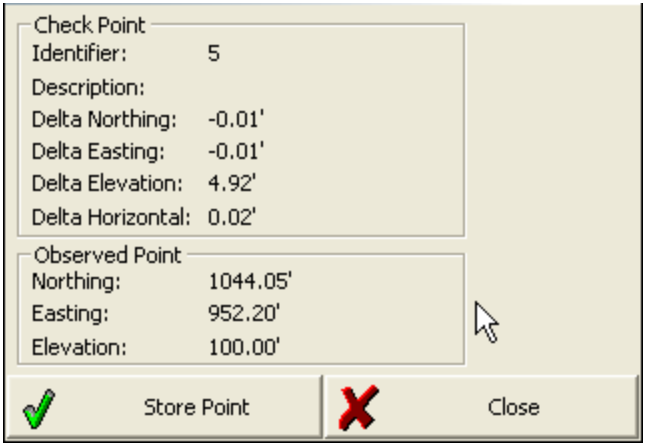
Main Menu | Measure Modes

GNSS Toolbar | Measure Modes

Use this to measure a check shot to an existing point. When you start the command you will see the point chooser appear where you can create a new point or pick an existing one from a list or from the screen. After you choose your point you will be ready to measure. You will note the measure mode will be set to **Check Pnt** and if you need to cancel the operation you can do it by pressing the measure mode button and choose to cancel it.

Check Point Summary

When you're ready to record the shot press the **Measure** button on the instrument toolbar. You will be presented with a screen that compares your measured values to the ones that were computed for the check shot point.



The deltas that are displayed are computed by subtracting the shot coordinates from the known coordinates. In other works if you add the deltas to the shot point coordinates you will end up at the known point.

Store Point

Pressing this will exit the function and write several notes to the raw file summarizing your check shot, and allow you to store the shot using the Store/Edit Point screen.

```
|--Check Point                                                      |
```

```
|-- Check Point ID: 110                                                    |
|-- Check Point dNorthing: -4.59'                                          |
|-- Check Point dEasting: -1.82'                                           |
|-- Check Point dElevation: -4.96'                                         |
|-- Check Point dHorizontal: 4.94'                                         |
|-- Observed Values: HA 45°00'00.0" VA 90°00'00.0" SD 23.00' HR 5.00'      |
|-- Observed Point Northing: 5016.26'                                      |
|-- Observed Point Easting: 5016.26'                                       |
|-- Observed Point Elevation: 95.00'                                       |
```

Close

This will exit the check shot function and not write anything to the raw file or storing a new point.

Measure and Store

Main Menu | Measure Modes | Measure and Store

If you like reviewing your shots prior to being stored in the database and raw file, then this is the mode you should use. When you press the measure button on the instrument toolbar, after the shot is measured you will see the store point screen prior to storing the point.

When you set this mode you will see the word on the measurement mode button.

When you take a shot using the measure button you will see the Store/Edit Point screen.

You can also confirm or change the Target Height used for this shot.

After reviewing the information you have three choices to make.

Store

Press this to store the coordinate in the database and create a sideshot record (SS) in the raw file.

```
|SS,OP350,FP3,AR0.00000,ZE94.50090,SD13.2700,--<No Desc>                   |
```

Cancel

Press this to cancel the shot and not store anything.

Note: For more information on the other buttons found on this screen please read the Store / Edit Points topic.

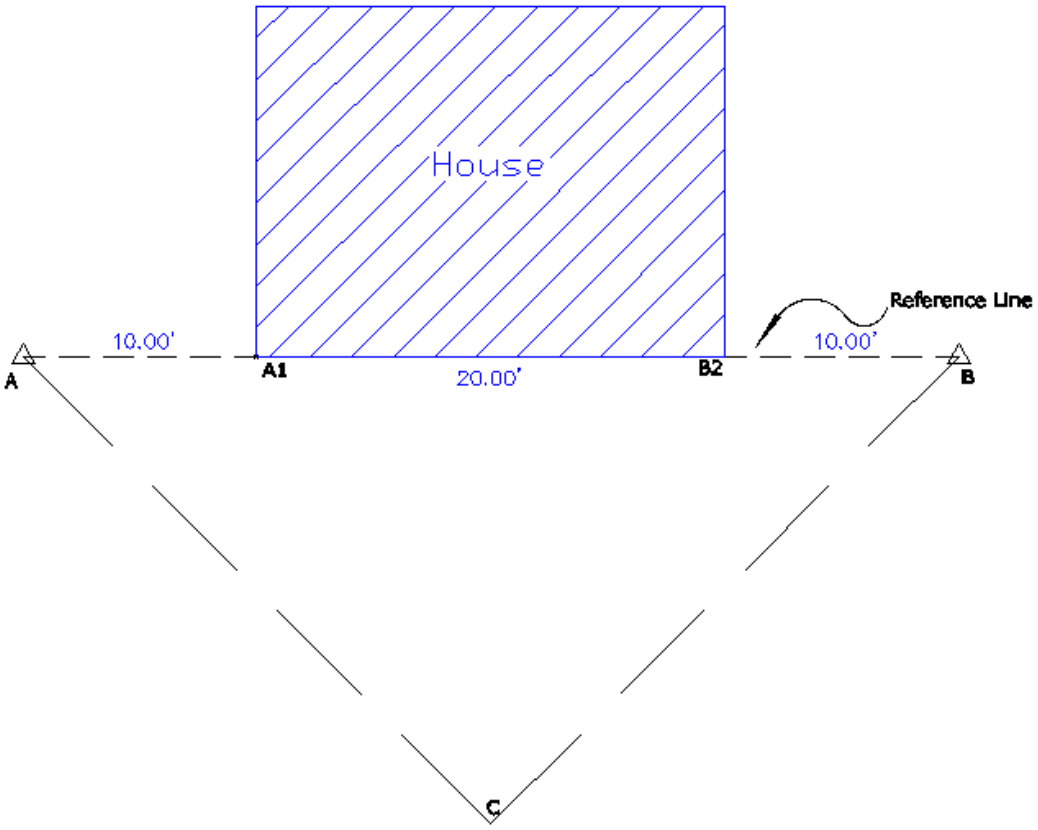
Reference Line

Main Menu | Measure Modes| Reference Line

The reference line routine is designed to help you get setup and running as quickly as possible. It is very common for surveyors to setup a job site for a contractor such that two points have been located along the projection of a wall. The offsets from these points to the wall corners are usually marked on

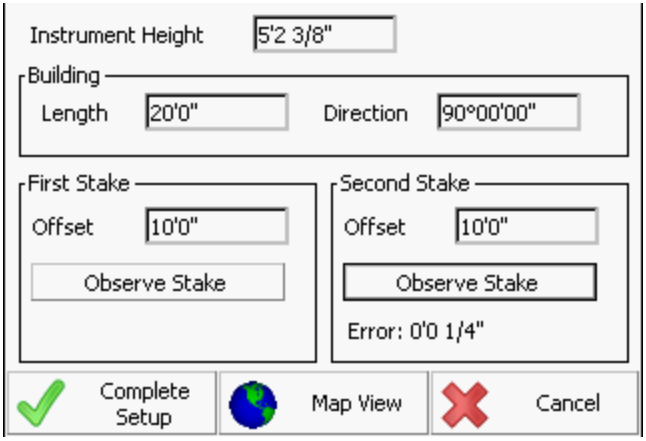
the stake, or given to the contractor. Using the two known points, the reference line routine will allow you to shoot the points with a total station after which Layout will automatically compute the building corners, and instrument location.

You can then use these points for layout, or other tasks such as entering a plan, or inserting a template. In our example we are going to assume that the points A and B have been located by a surveyor on the job site for us. After measuring points A and B, Layout will compute points A, A1, B, B2 and C for us.



Start Command and Enter Known Information

When you start the command you will see the reference line screen. On this screen we start entering the known information, such as the wall length and direction, instrument height and offsets from the known points.

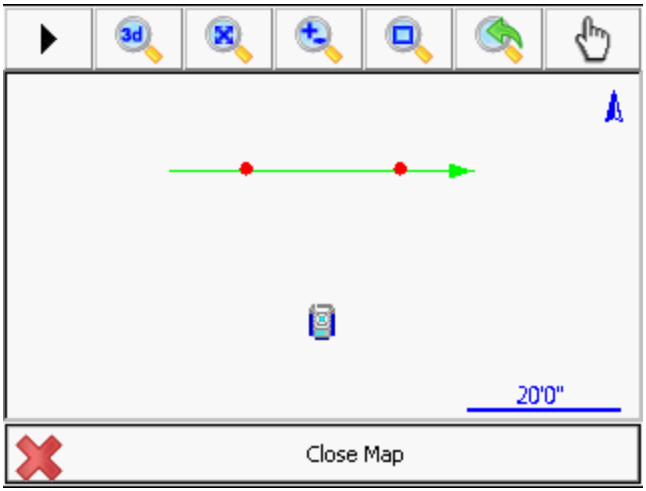


Observe Stake

After you enter the known information, it is time to measure the stake position with your total station. Press the Observe Stake button to measure the position of the stakes. After you measure the positions, the error in the last offset will be displayed to you on the reference line screen.

Map View

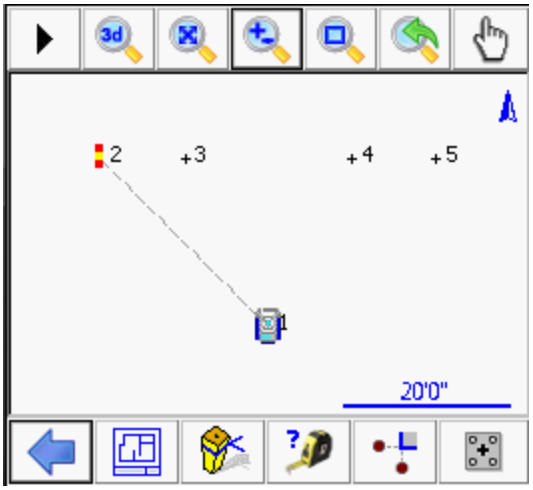
You can preview your solution prior to storing the points. This is a good way of visually confirming the solution before points are added to your project.



Complete Setup

When you are satisfied with the results you can complete the setup by selecting the Complete Setup button. When you do this several assumptions are made for you and are described as follows:

- The first point you measure to will be assigned a coordinate of 5000.0, 5000.0 and an elevation of 100.0. This point becomes the start of the reference line.
- The second point you shoot is used to compute a position for the instrument in relation to the baseline. Now that two points have been measured, the measured distance is compared to the theoretical distance. The error is then displayed on the reference line screen.
- Using the direction and distances specified for the wall length and offsets, points are computed for the building corners.
- The last point on the reference line which is the second measured point will be computed using the measured distance, not the theoretical distance.
- The first point you shoot will become the backsight for the setup.

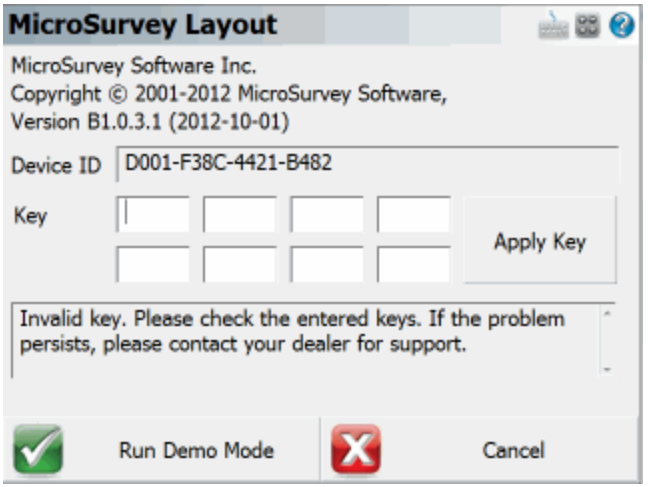


About Layout

About Layout

Main Menu | About

Use this to display information about the Layout version you have installed or view what modules you have registered.



You will also see your Device ID and a series of fields where you can input the Key Code you received from MicroSurvey.

You will see an area that will show you the status of your license, including any modules that you currently have licensed. If you want to use Layout in demo mode, press the **Run Demo Mode** button.

Please refer to the Registration & Demo Mode topic for further information.

DISTO REFERENCE

disto reference

Main Menu | Connect | Disto

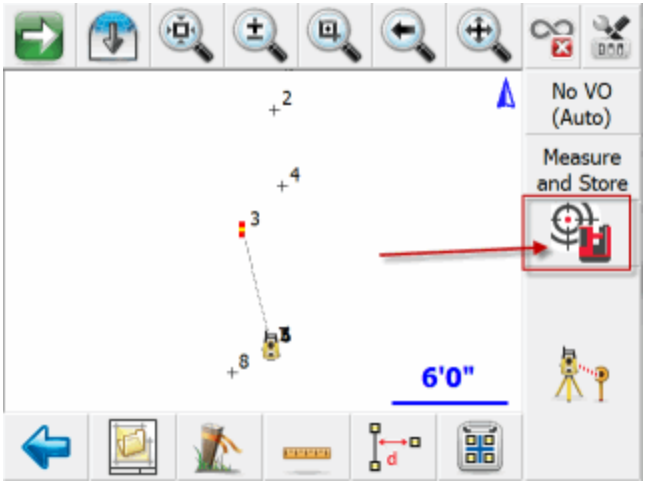
3D Disto

To use the 3D Disto you must have the 3D Disto application installed on your computer. You can then start the application, or Layout will start it automatically for you.

You must ensure that the 3D Disto application is running in GSI mode so that Layout can communicate with it. Please refer to the following connection guide for specific instructions on setting up and connecting to the 3D Disto.

When you install the 3D Disto application you will see a message appear notifying you what COM Port the 3D Disto is assigned to. You can use WiFi or USB cable for the connection.

Once you connect with Layout you will notice on the instrument toolbar a special button called the "Disto Focus" button. When you press this it will give focus to the 3D Disto application so you can use the viewfinder to graphically move and point the Disto at the location you want to layout or map.



Measuring

To measure a location simply press the measure button in Layout.

Stakeout

To stakeout a location simply start any of the stakeout routines and commence the stakeout procedure. The 3D Disto will automatically turn to the point you are trying to locate. Press the measure button to calculate a position.

Additional Information

The following topics make use of the 3D Disto

- Pipe Through Wall
- Point on Floor and Ceiling
- Point On Wall

TOTAL STATION REFERENCE

Target List

The Target List is where you can create, edit, copy, and delete targets. The Target List comes with 2 default targets (Default Prism and Default Reflectorless) but you can create as many more as you like. All targets are saved in the Settings.xml file and is located in the Programs folder.

Click here for help on Leica Instrument Target List help.

You are not permitted to delete or edit a default target but you certainly can copy one and edit the copy.

New

Tap on this button to access the **New Target** dialog. Here you can create a new target.

Edit

Tap on a target to select it. Then press the **Edit** button to access the **Edit Target** dialog. Default targets can not be edited.

Delete

Tap on a target to select it. Then press the **Delete** button to delete the selected target. You will receive a warning message that you must acknowledge before deletion is complete. Default targets can not be deleted.

Copy

Tap on a target to select it. Then press the **Copy** button. This will open the **Edit Target** dialog and you can then edit the copied parameters.

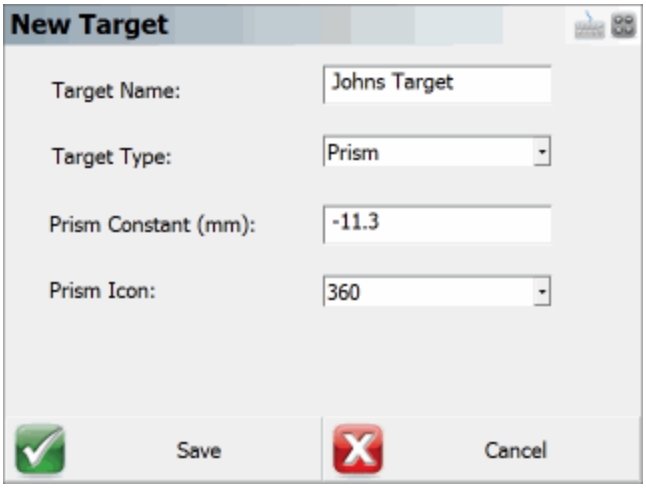
Close

Pressing this button returns you to the Target Manager screen.

New Target

Use this option to create a new target. Provide the new target with a unique name, a prism constant, and select an icon to reprsent your new target.

Click here for help creating a new Leica Geosystems target.



Target Name

Use this field to either edit or enter a new name for the target you are editing.

Target Type

There are two target types available to select. **Prism** is to be used when you are selecting a target that has a known offset. This can be a round prism, 360, mini, etc. **RL** stands for reflectorless and you should select this target type if you are using an instrument that is reflectorless capable and you do not wish to use a designated reflector.

Prism Constant (mm)

This defines the relation of the distance measurement to the mechanical reference point of the reflector. Your prism will have a published offset.

Prism Icon

Use this field to select an icon for your new target.

Save

Press this button to store your new changes to the Settings.xml file, and return you to the Target List screen.

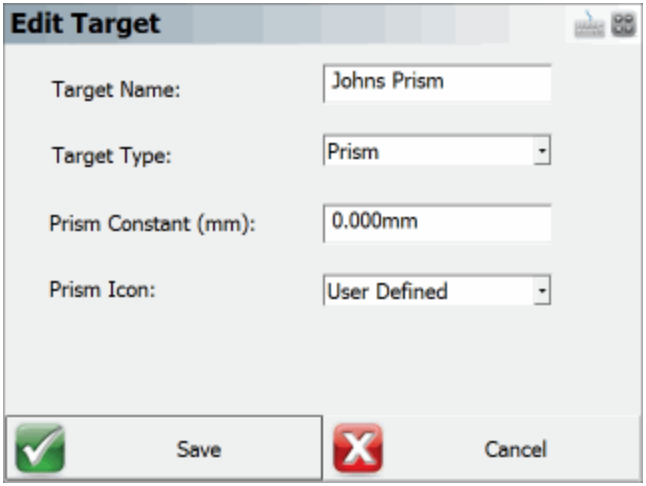
Cancel

Press this buton to cancel creating a new target. You will be returned to the Target List screen.

Edit Target

Use this option to edit an existing target. You will also see this display after you copy an existing target.

Click here for help on editing a Leica Geosystems target.



Target Name

Use this field to either edit or enter a new name for the target you are editing.

Target Type

There are two target types available to select. **Prism** is to be used when you are selecting a target that has a known offset. This can be a round prism, 360, mini, etc. **RL** stands for reflectorless and you should select this target type if you are using an instrument that is reflectorless capable and you do not wish to use a designated reflector.

Prism Constant (mm)

This defines the relation of the distance measurement to the mechanical reference point of the reflector. Your prism will have a published offset.

Prism Icon

Use this field to select an icon for your new target.

Total Station Reference

Conventional Total Station

When connecting to a conventional total station there are a few things you need to confirm before connecting to Layout.

You need to know what the communication parameters are set to on the instrument. Please take the time to find what the following settings are set to on the instrument: Baud Rate, Data Bits, Stop Bits and Parity.

Because of all the different instruments available, we can not provide help on retrieving these settings from your instrument. Please refer to your owner's manual or contact technical support from your equipment manufacturer.

Total Station Profile

Once you know the settings, you can connect Layout to the instrument. If you just installed Layout you can start the program and follow the prompts until you get to the Instrument Selection screen. From there, select **Total Station** as the Instrument Type, and then press the **Add** button to create a new Instrument Profile. Name the profile for your instrument, and then press the **Edit** button to access the Total Station Configuration screen to configure your profile. From there choose the **Model and Communication** button to configure Layout.

You can also access this screen by going to the **Main Menu | Settings | Instrument Selection** and choose total station.

Select Make and Model

Layout uses a smart driver that will poll the instrument to see what commands it supports. Because of this you will see that in the Model section we don't list every instrument built by the manufacturer. If you're unsure of what make and model to choose visit our website and use the online helpdesk support center to do a search for your instrument.

Communication Settings

Confirm the settings so they match the settings from your instrument. If you don't know what the settings on the instrument are, you can always try the **Default Comm Settings** button.

Other Settings

On the Total Station Configuration screen, you can review the other options to set some additional parameters for your instrument.

Connect to Instrument

If you're not connected to the instrument you will see a status of "**Not Connected**" displayed above the Connect to Instrument button. When you're ready to connect make sure you have done the

following:

1. Powered on the instrument
2. Levelled the instrument
3. Compensated the instrument.
4. Connected the data cable from the instrument to your data collector.

Once you have done all four steps, you can press the **Connect to Instrument** button. If you see a status of "**Connected**" displayed above the Connect to Instrument button then you have successfully connected.

Getting Started

To start taking measurement you need to exit out the Total Station Configuration screen by pressing close button. Depending on the instrument you connected to you will have different options available. Please review the Instrument Toolbar topic for more information.

Tip: You can use the enter key on your device to take a measurement. For example, if your measurement mode is set to and you press the enter key, your instrument will take a measurement.

Robotic Total Station

When connecting to a robotic total station there are a few things you need to confirm before connecting to Layout.

You need to know what the communication parameters are set to on the instrument. Please take the time to find what the following settings are set to on the instrument: Baud Rate, Data Bits, Stop Bits and Parity.

Because of all the different instruments available, we can not provide help on retrieving these settings from your instrument. Please refer to your owner's manual or contact technical support from your equipment manufacturer.

Create Total Station Profile

Once you know the settings, you can connect Layout to the instrument. If you just installed Layout you can start the program and follow the prompts until you get to the Instrument Selection screen. From there, select **Total Station** as the Instrument Type, and then press the **Add** button to create a new Instrument Profile. Name the profile for your instrument, and then press the **Edit** button to access the Total Station Configuration screen to configure your profile. From there choose the **Model and Communication** button to configure Layout.

You can also access this screen by going to the **Main Menu | Settings | Instrument Selection** and choose total station.

Select Make and Model

Layout uses a smart driver that will poll the instrument to see what commands it supports. Because of this you will see that in the Model section we don't list every instrument built by the manufacturer. If you're unsure of what model and make to choose visit our website and use the online helpdesk support center to do a search for your instrument.

Communication Settings

Confirm the settings so they match the settings from your instrument. If you don't know what the settings on the instrument are, you can always try the **Default Comm Settings** button.

Other Settings

On the Total Station Configuration screen, you can review the other options to set some additional parameters for your instrument.

Connect to Instrument

If you're not connected to the instrument you will see a status of "**Not Connected**" displayed above the Connect to Instrument button. When you're ready to connect make sure you have done the following:

1. Powered on the instrument and radios
2. Leveled the instrument
3. Compensated the instrument.
4. Connected the data cable from the instrument to one radio, and your data collector to the other radio.

Once you have done all four steps, you can press the **Connect to Instrument** button. If you see a status of "**Connected**" displayed above the Connect to Instrument button then you have successfully connected.

Getting Started

To start taking measurement you need to exit out the Total Station Configuration screen by pressing the Connect button. Depending on the instrument you connected to you will have different options available. Please review the Robotic Instrument Toolbar topic for more information.

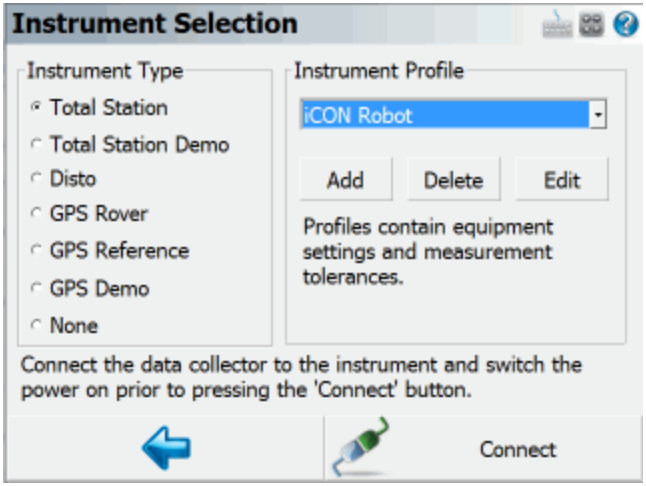
Instrument Selection

Main Menu | Connect

Main Menu | Project | Settings | Instrument

The Instrument Selection screen allows you to choose the type of equipment you will be connecting to Layout. An Instrument Profile can be created for each different instrument you will be working with, to make changing between different hardware a breeze. Once you have setup a profile for each different instrument you will be using, switching between them is a simple matter of selecting the appropriate profile and pressing **Connect**.

Note, this screen is not available if Layout is running onboard your instrument.



For all future projects you create with Layout, when you create a new or open an existing project you will see the Instrument Selection screen with the profiles you have already created. It will default to the last Profile you used, so if you are using the same instrument just press Connect. If you are using different equipment, just select the appropriate Instrument Type and Profile (or add a new profile if one does not yet exist for it), then press **Connect**.

Your profiles are stored in the file ...\MicroSurvey\Layout\Programs\MSURVEY.INI so once you have configured one data collector, you can simply copy this file onto your other data collectors to make the profiles available on them. This file should also be backed up for easy recovery.

Total Station

When you select Total Station mode, you will be able to Add, Delete, or Edit a profile to setup parameters for connecting to your conventional and robotic total stations, as well as laser devices. See the Total Station Configuration topic for more details about configuration for your total station.

For more information on connecting to your instrument please refer to the Conventional Total Station and Robotic Total Station topics.

Total Station Demo

If you choose this you will have to manually enter your shots. Manually entered shots are recorded in the raw file and points are computed based on the values you enter. A profile is not needed for this mode, just press Connect to begin using the Total Station Demo mode.

Disto

If you choose this option you can connect to Leica Geosystems laser distance tools. Please review the Disto Reference topic for more details.

GPS Rover / GPS Reference

When you set it to GPS Rover or GPS Reference you will be able to Add, Delete, or Edit a profile for your rover or reference receiver. When you edit a GPS Rover or GPS Reference profile, you will see the Configure Rover or Configure Reference screens. For more information about using Layout for GPS surveying, you should review the Starting GPS topic.

If you have not purchased the GPS module for Layout, then you will not have access to the GPS commands and you will see a "Requires GPS module license" message.

GPS Demo

When you set it to GPS Demo you will be able to Edit and Connect to a profile for a simulated rover receiver. When you edit the RTK Demo profile, you will see the Configure Rover screen. Feel free to play with the Tolerance Mode settings, but please do not change the Model and Communications settings. For more information about using Layout for GPS surveying, you should review the Starting GPS topic.

The GPS Demo will simulate connecting Layout to a GPS Rover receiver. The coordinates in the GPS Demo are located outside our office in Westbank, British Columbia, Canada, so to use the GPS Demo mode you need to set your Coordinate System Settings to UTM Zones, NAD83, UTM83-11, Ellipsoidal.

None

Use this option if you're not connecting anything to Layout and also don't need to manually enter any shot information. With this mode, the instrument toolbar will not be displayed in the map screen.

Edit Total Station Profile

Make and Model Settings

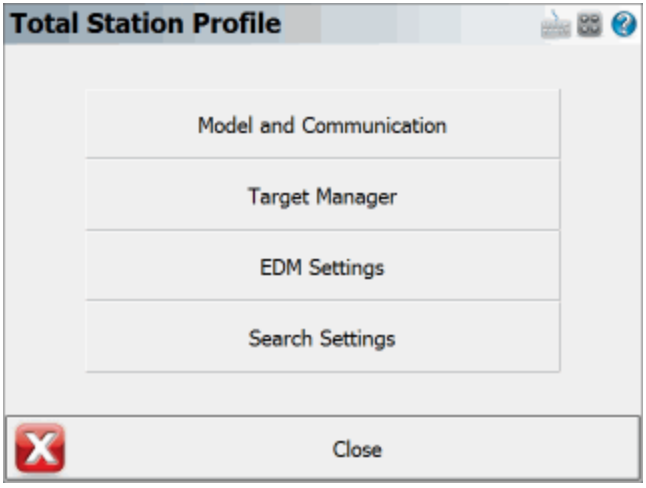
Layout includes instrument and GNSS drivers for most popular brands. This list of supported hardware is constantly changing and for a complete list of supported hardware, please visit the following

webage: http://www.microsurvey.com/products/fieldgenius/hardware_table.php

Total Station Profile

Main Menu | Connect | Edit Total Station Profile

This screen will help you configure your total stating settings such as the make and model of instrument you plan on using and set any desired parameters you may need to use with your instrument. This option will only be available if you specified **Total Station** in the Instrument Selection screen and then **Edit** a profile.



Model and Communication

This allows you to specify the make and model of instrument that will be connected to Layout. You can also specify the communication settings such as baud rate and com port. See the Model and Communication topic for more information.

Target Manager

This allows you to create, copy, and delete targets in Layout. You can define a unique backsight and foresight target for example. See the Target Managertopic for more information.

EDM Settings

This allows you to specify if you will be using prism offsets in Layout and allows you to specify tolerances that will be used to ensure your EDM measurement meet your criteria. See the EDM Settings topic for more information.

Search Settings

When using a robotic instrument, you can specify search window parameters. See the Search Settings topic for more information.

Model and Communication

Main Menu | Connect | Edit Total Station Profile | Model and Communication

This is where you can specify the make and model of instrument you will be connecting to, as well as specify your communication parameters.

Total Station Make

Use this to select the make of your instrument.

Total Station Model

Use this to select the model of your instrument.

Status

This indicates whether Layout is Connected or Not Connected to your instrument.

Port, Baud Rate, Data Bits, Stop Bits, and Parity

If you know the settings of your instrument you can set them here in Layout. They have to match exactly the ones on your instrument or you will get a communications error when you try to connect.

It is important to confirm these settings on your instrument when you're trying to connect Layout for the first time! Most connection problems occur because the user has specified parameters that don't match the ones on their instrument.

On many data collectors you can select Bluetooth as your communication port. If you select the Bluetooth port, the traditional serial communication options (Baud Rate, Data Bits, Stop Bits, Parity) will be replaced with a Bluetooth Search function.

> Please note that not all bluetooth-enabled devices will list Bluetooth as a Port option. In some cases you must configure and use a virtual COM port through Windows CE's internal Bluetooth Settings, for example COM6.

Bluetooth Search

If you set the port to Bluetooth, a **Bluetooth Search** button will appear. Press the search button to find the device you want to communicate wirelessly with. All devices within range will be listed, choose the one you want to use

The device you selected will be saved into your instrument profile for future use so you do not need to Search every time.

Bluetooth PIN

After initiating a Bluetooth connection, you will be prompted to enter the PIN (passkey) for the instrument you are connecting to. If your instrument does not need one just leave it blank and continue by pressing OK.

The PIN you enter will be encrypted and stored in your instrument profile.

RC Port

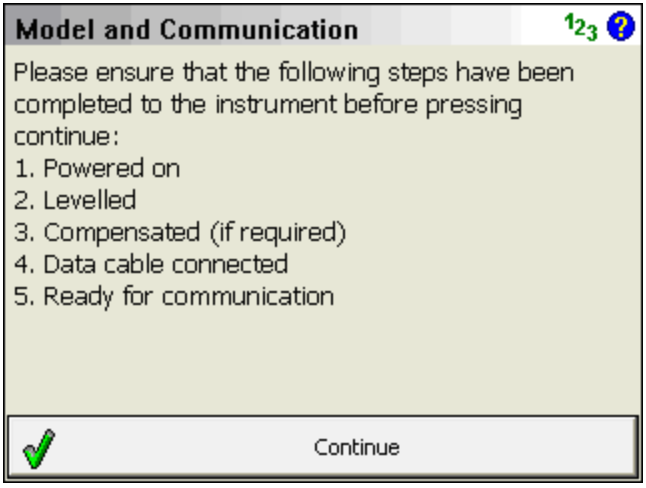
If you are connecting with a Topcon Robot, you can specify which port on your data collector the RC unit is connected to.

Radio Settings

Use this to set the communication parameters for your radios or other communication device, such as the channel or frequency. You can also use it to specify a direct connection to Layout instead of using radios. Please see the Radio Settings topic for additional information.

Connect

Use this to connect to your instrument after you have specified your communication settings. After pressing the Connect button Layout will display a reminder screen listing some items you should check before continuing.



When you press Continue on the screen and you see the following message, "No communication with instrument. Check settings, cables and power." read the No Communication topic for possible causes.

Layout connects successfully, the Status will change to "Connected", and if your instrument supports graphical representation of the level bubble, you will see the Check Level screen.

Radio Configuration

Main Menu | Connect | Edit Total Station Profile | Model and Communication | Radio Settings

Use this to specify if you want to connect to your robotic instrument using a direct connection or through the instrument's radios. If you're using a Topcon, you can specify your RC unit as the communication device.

Connection

Direct

This will allow you to connect directly to your instrument through an instrument cable.

This will allow you to connect to your instrument using external radios. Select your radio channel, if this option is available.

Note: If you are using radios with your instrument but this option is disabled or not available, then pick the Direct option instead.

RC

This will allow Layout and your instrument to communicate through the RC unit.

Settings

If you're using a Trimble or Geodimeter total station you will be able to specify the radio settings required to communicate with your instrument.

EDM Settings

Main Menu | Connect | Edit Total Station Profile | EDM Settings

From here you can specify EDM settings such as prism offsets and measurement modes.

EDM Settings

Mode

This list will display all the measurement modes supported by your instrument. These will be the same as the ones you're used to using and you can refer to your owner manual for more information on their specifications.

Time Out (s)

Use this to specify the length of time Layout will try to receive a measurement from your instrument. You may need to set this to a higher number if you're trying to receive measurement in wooded areas

or long sights.

Use Default Time Out

If this is checked on Layout will use a default time out value. If you would like to change it you need to uncheck it and update the **Time Out** field.

Minimum and Maximum

You can specify the minimum and maximum distance that Layout will accept as being valid. Example is if you set this the minimum to 10 feet and you measure 5 feet, Layout will not record the measurement and will display a "Distance out of range" error in the status toolbar.

Guide Light

If your instrument has guide lights you will be able to set their intensity modes here. Please refer to your owners manual for more information on the different intensities.

Prism Offsets

Foresight Prism Offset

Use this if you want Layout to control your prism offsets for your foresight shots. The values must be entered in millimeters. A positive value will be added to the distance that is measured, whereas a negative value will be subtracted.

All measurements other than the measurements to your backsight (reference measurement) are considered to be a foresight shot.

Note: If you specify a prism offset here, you need to make sure the prism offsets are set to zero on your instrument. Otherwise a double offset could be applied to your measurement which will produce incorrect answers.

When you first configure Layout with your instrument, you should take the time to confirm that the distances being measured are correct. You can do this by first measuring a precise distance between your current occupy point and a point that you can easily reference and take a measurement to. When you compare the distance measured by Layout to your manually measured distance, they should agree very closely.

Backsight Prism Offset

Use this if you want Layout to control your backsight prism offsets. The values must be entered in millimeters. A positive value will be added to the distance that is measured, whereas a negative value will be subtracted.

Under normal circumstances, you will set the backsight prism offset to be equal to what you defined for the foresight prism offset. The only time these would be different is in situations where you're using different prisms that have different prism offsets. This is very common with robotic total stations where a permanent prism might be setup on the backsight, and a 360° prism is used at the pole.

Typically these two configurations require different offsets be applied at the backsight and foresight shots. If you're unsure about your prism offsets, refer to your instrument's owners manual, or the dealer who sold you the instrument.

Note: If you specify a prism offset here, you need to make sure the prism offsets are set to zero on your instrument. Otherwise a double offset could be applied to your measurement which will produce incorrect answers.

When you first configure Layout with your instrument, you should take the time to confirm that the distances being measured are correct. You can do this by first measuring a precise distance between your current occupy point and a point that you can easily reference and take a measurement to. When you compare the distance measured by Layout to your manually measured distance, they should agree very closely.

RL (Reflectorless) Prism Offset

Most instruments when shooting reflectorlessly apply a zero offset to the measurement. Depending on the type of material you're measuring to, some materials require an offset be applied even though you're using a reflectorless EDM mode. For example, some reflective tapes used for these types of measurement require a small offset be applied. In this case you can specify this offset and Layout will automatically apply it during reflectorless measurements.

Note: If you specify a prism offset here, you need to make sure the prism offsets are set to zero on your instrument. Otherwise a double offset could be applied to your measurement which will produce incorrect answers.

Set Instrument to zero

If this is turned on, a prism constant of zero will be uploaded to your instrument. The offsets specified in the foresight, backsight and RL fields will be applied to the measurements when received by Layout. Turn this off if you don't want Layout to modify your instrument's prism offset. **Not all instruments support this feature.**

When you connect your instrument to Layout, special notes are recorded in the raw file regarding prism offsets.

If you have the ”Set Instrument” toggle turned on and your instrument supports this feature, Layout will set your instrument's prism offset to zero so no correction will be applied to the measurement. Then once Layout receives this uncorrected measurement, it will use the values you specified in the prism offset fields and adjust the distance accordingly. For example, if you specified an offset of 30mm, Layout will upload an offset of zero to your instrument and apply the 30 mm offset to the measurement after it is received. In your raw file you will see the following note:

```
¦--Layout Prism: 30mm Instrument Prism: 0mm                    ¦
```

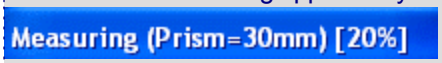
Most prism offset are specified in millimeters. Layout will make the necessary conversions so the proper adjustment is applied.

If Layout can't set the prism offset on your instrument, it usually can't read it either. Since a prism offset wasn't uploaded, we don't know what prism offset is set on the instrument. So we indicate this by writing to the raw file that the instrument prism offset is "unknown".

```
--Layout Prism: 30mm Instrument Prism: Unknown
```

When this happens you will usually want to confirm what offset are currently configured on your instrument in regards to prism offsets.

Special Notes:
- When using instruments that don't support uploading of prism constants, be sure not to double up your prism offsets by applying it in the instrument and Layout at the same time.
- Since prism offsets are so important, on the measurement progress meter you will see what offset is being applied to your measurement.



Reflectorless Settings

Std Dev:

This applies only to Trimble instruments. See your instrument guide for information on how the standard deviation affects your reflectorless measurements.

Search Settings

Main Menu | Connect | Edit Total Station Profile | Search Settings

When using a robotic or motorized instrument you can specify search settings for your instrument.

Search Modes

Some of Layout's search modes are common to all robotic instruments, but there are a few model specific ones. The modes available are:

Relative Window

This allows you to specify a "window" defined by measuring a point at the top right and bottom left corners. If you press the search button, the search limits will be relative to the direction the instrument is currently pointing. In other words if your **search window ranges** are 30° horizontal and 30° vertical, it will apply this to your current direction. So the search will be limited to an area 15° left, right, up and down from your current direction.

Absolute Window

This allows you to specify an absolute search "center" for your search window. This forces Layout to search in an absolute area defined by the angles set in the **search window center** fields.

Furthermore, the search window range parameters apply to the search window center. For example, let's assume you defined 180° as the horizontal search window center, and the horizontal search window range is 30°. Your instrument will be forced to search in an area 15° left and right of the 180° plate reading. So if your prism is situated at a circle reading of 210°, it would never find you as the instrument would never go past a circle reading of 195° (180+15) when searching.

RC-2 Fast Track

If you're using a Topcon instrument, you can set the search mode to RC-2. This will force the instrument to use the RC-2 system for the search.

PS Next (CW)

This setting will appear if your Leica instrument has the power search system. Settings it to this will force the instrument to search in a clockwise direction.

PS Next (CCW)

This setting will appear if your Leica instrument has the power search system. Settings it to this will force the instrument to search in a counter-clockwise direction.

PS Absolute Window

This setting will appear if your Leica instrument has the power search system. This will force the power search system to do a relative search based on the **search window range**.

RC-PR

If you're using a Sokkia SRX, you can set the search mode to RC-PR. This will force the instrument to use the RC system for the search.

Search Window Range

Use this to define the upper right corner and lower left corner of your search window. Pressing the measure button will step you through the procedure and it will calculate the horizontal and vertical search range. This range will be applied to the instrument's current direction when the user presses the search button.

Search Window Center

Use this to set an absolute center for your search window. The search window range parameters will be applied to the search window values that were measured. Pressing the measure button will step you through the procedure and it will calculate the horizontal and vertical search range.

Auto search for prism

If this is checked, then if your instrument has lost its lock on the prism, Layout will automatically initiate a search for the prism when the measure button is pressed. You will see the word "Search" on the lock button at the top of the robotic instrument toolbar while a search is in progress.

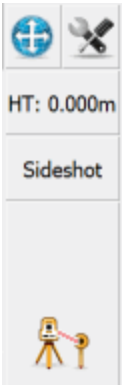
No Communication

When trying to communicate with your instrument you will see sometimes see a "*No communication with instrument. Check settings, cables and powe*r." error message if Layout can't make a connection with your instrument.

Usually this happens when your communication parameters are not the same on the instrument and in Layout. You need to check these settings again to make sure they're correct.

This can also happen if you have a bad cable. If you're using a robotic instrument you might have setup your radios incorrectly.

Instrument Toolbar



When you use Layout in either manual or total station mode, you will see the instrument toolbar beside the map area.

This toolbar allows you to control your instrument settings, EDM modes, measurement modes and target heights.

Auto-Center

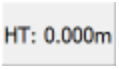
This toggles the auto-center feature on or off. If turned on, whenever you take a measurement, the map screen will always re-center on the measured point.

Instrument Settings

This opens the instrument settings screen where you can control specific settings for your total station such as EDM settings, Tolerance setting and Instrument Connection/Disconnection.

Measurement Mode

This opens the Measurement Modes screen where you can select what type of measurement you want to take. The current measurement mode is always displayed on this button - for example if you're using the distance offset mode it will display "Dist Off".



Target Height

This opens the Target Heights screen where you can change the current target height. The current target height is always displayed on this button.

Measure Button

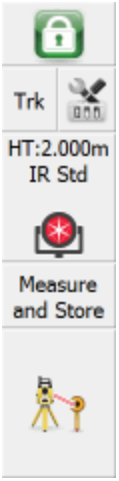
This triggers your total station to take a measurement.

If you are using a robotic total station, please see the Robotic Instrument Toolbar topic.

If you are using GPS, please see the GPS Toolbar topic.

Robotic Instrument Toolbar

When you use Layout in robotic total station mode, you will see the Robotic Instrument toolbar in the map area. Like the Instrument Toolbar, this toolbar allows you to control your instrument settings,access the Target Manager,change measure modes, and make a measurement. It also lets you search and lock onto the prism.



Lock Button

Layout uses a button to trigger the instrument to search for the prism and lock onto it. You can also use this button to turn the lock off.

The button when not locked on a prism will display a **No Lock** status with a un locked icon. To search for the prism, simply press the No Lock button.

After you have pressed the No Lock button you will see a **Search** icon on the button while the instrument searches for your prism.

When Layout finds a prism and locks onto it, the button will display a **Lock** icon. To stop the instrument from tracking, you can press the Lock button again to set it to a No Lock status.

If you're using multiple prisms and you want to force Layout to look for another one when you're locked onto a prism, double tapping the Lock button will force it to search for the next available prism.

Also during a search you can cancel the current search by pressing the Stop Search button on the search progress toolbar.

Cursor Tracking

This turns the cursor tracking feature on or off. If turned on, the current position of the target will be displayed on the screen in real time. You can only use this feature once you have specified an instrument setup using the Setup Occupy Point command.

Note: The cursor tracking position will use a coarse measurement to plot your position. When you are stationary, the cursor is a hollow triangle pointing towards the instrument. When you are moving, the cursor is a solid triangle pointing in the direction of travel.

Instrument Settings

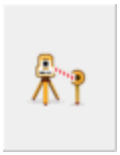
This opens the Instrument Settings Toolbar. On this toolbar you can control specific settings for your total station such as EDM modes.

Target Manager

Press this button to access the Target Manager. Here you can create, edit, copy, and delete targets.

Measurement Mode

This button will open the Select Measurement Mode screen, From here you can select what type of measurement you will be using. When you choose your mode, this button will display the mode you're using. For example, if you're using the Distance Offset mode, the button will display "Dist Off".



Measure Button

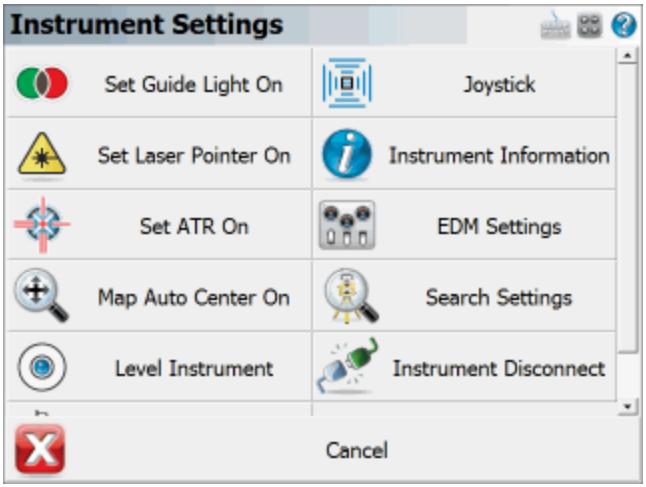
Use this to trigger your total station to take a measurement.

If you are using a conventional non-robotic total station, please see the Instrument Toolbar topic.

If you are using GPS, please see the GPS Toolbar topic.

Instrument Settings

Instrument Toolbar | Instrument Settings



Please note that not every instrument supports each of the following functions, so you may not see all of the following buttons when connected to your total station.

Level Instrument

This will open the Check Level screen, where you can check how level your instrument is.

Instrument Information

When this is pressed, we will display the current battery status of your instrument. Note, not all instruments support this.

EDM Settings

Use this to set the EDM mode for your instrument. Every manufacturer has different measurement modes available but we will list only those that your instrument supports. Please refer to your instrument manual for more information on the EDM modes your instrument supports. Any time you change your EDM Mode, Layout writes a comment into the raw file indicating which mode is being used.

Tolerance settings

This will take you to you measurement tolerance settings.

Set Angle

Use this to open the Set Angle screen where you can view the current angles and turn or flop your motorized instrument.

Auto-Center On / Off

Use this to automatically center the map when a point is shot. If turned on, whenever you take a measurement, the current prism location will always appear in the center of your map display.

ATR On / Off

Use this to turn on and off your instruments Auto Target Recognition feature.

Laser Pointer On / Off

This turns on and off the instrument's red laser pointer.

Guide Lights On / Off

This will turn on and off your instrument's guide lights.

Instrument Joystick

This is the Total Station Joystick function. When activated you will be able to move your motorized instrument to the left, right, up and down by using the joystick touch-screen. There are three speeds that can be activated: slow, medium, and fast. The smaller inside blue buttons activate the slowest turn mode, and the larger outside blue buttons activate the fastest turn mode. To stop the instrument from turning, simply press the red Stop button at the center. **The directions assume you are at the pole looking at the instrument.** Pressing the right buttons will turn the instrument to your right, pressing the up buttons will turn the scope up, etc.

Instrument Connect / Disconnect

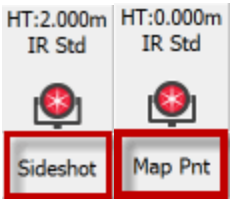
Use this to connect or disconnect Layout from the instrument. When you are connected to the instrument you will see the Disconnect Instrument button.

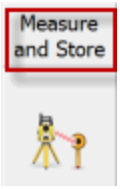
Measure Modes

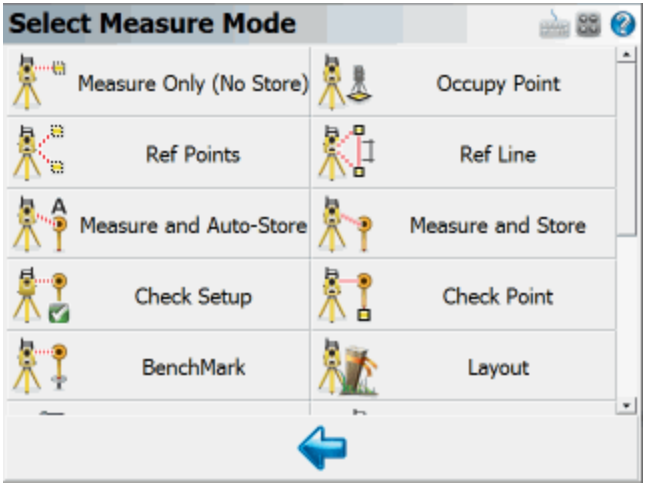
Instrument Toolbar | Measure Modes

These are commands built into Layout that will help you measure and map your points. The desired method must be selected before you begin a measurement.

For a faster way to get to this screen, you can also press the measure mode button which is located on the instrument toolbar.







Note: Several of these modes will not be available until you have setup an occupy point and measured a backsight via the Occupy Point, or Resection commands. Most of these modes will also not be available if you are using GPS.

Measure Only (No Store)

This will allow you to take a measurement without storing it. Please see the Measure Only topic for more information.

Occupy Point

Use this to define an instrument setup. Please see the Occupy Point topic for more information.

Measure and Store

This mode allows you to measure a point. After the measurement, it will allow you to review your measurement data and allow you to make changes to the point id and description before it is stored. Please see the Measure and Store topic for more information.

Measure Point and Auto-Store

This mode allows you to measure a point using the next available point id, and the description and line toggles specified on the main map screen. Using this is a very fast method for recording your measurements. Please see the following topic for more information.

Reference Points

This will start the multiple point resection routine to allow you to determine your current instrument position by measuring to known points. Please see the Resection topic for more information.

Reference Line

This will start the reference line routine. Please see the Reference Line topic for more information.

Check Point

Use this to display a check measurement to an existing point in your project. Please see the Check Shot topic for more information.

Check Setup

Use this to compare your backsight to your previously measured values. Please see the Check Backsight topic for more information.

Horizontal Angle Offset

This will start the angle offset routine. Please see the Horizontal Angle Offset topic for more information.

Vertical Angle Offset

This will allow you to compute the height of an object. Please see the Vertical Angle Offset topic for more information.

Distance Offset

This will start the distance offset routine. Please see the Distance Offset topic for more information.

Manual Distance

This will record a HA and VA for a shot, but the user can manually enter the distance. Please see the Manual Distance topic for more information.

Manual Entry

This will allow you to manually enter in a shot including HA, VA and SD. Please see the Manual Entry topic for more information

Two Line Intersection

This allows you to measure two baselines and Layout will compute the intersection point. Please see the Two Line Intersection topic for more information.

Line - Angle Offset

This allows you to measure two points to define a baseline, measure an angle, and Layout will compute the intersection point. Please see the Line - Angle Offset topic for more information.

Line - Distance Offset

This allows you to measure two points to define a baseline, then manually enter measured distances. These distances will be used to compute a new point based on the baseline. Please see the Line - Distance Offset topic for more information.

Line - Perpendicular Point

This allows you to measure two points to define a baseline, then you can select an existing point which will be used to compute a perpendicular intersection. Please see the Line - Perpendicular Point topic for more information.

Benchmark

Use this to check your current setup elevation, or compute a new one based on a known elevation. Please see the topic for more information.

Vertical Projection

This will allow you to compute points on a user defined vertical plane. Please see the Vertical Projection topic for more information.

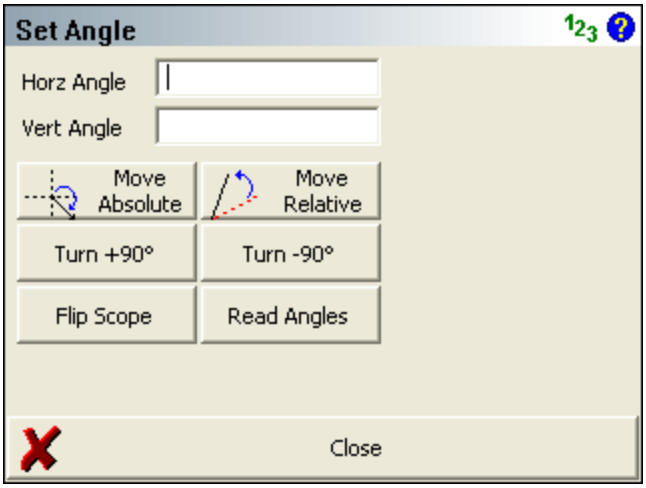
Point Scanning

Use this to activate Point Scanning with your motorized reflectorless instrument. Please see the Point Scanning topic for more information.

Set Angle

Instrument Settings toolbar | Set Angle

You can access this screen by pressing the **Set Angle** button on the instrument settings toolbar.



Horizontal and Vertical Angles

Use these two fields to enter in angles that will be used by the Set Angle buttons.

Move Absolute

Use this to turn the instrument to a plate reading that you've entered in the HA or VA fields. For example if you enter 45°30'30" for the HA and 90°10'00" for the VA, pressing the Absolute button will turn your instrument so the plate reading equals these values.

Move Relative

Use this to turn an angle to the right or left of the current instrument plate reading. Positive values will be added to the current plate reading, negative values will be subtracted. Enter your values in the HA and VA fields.

Turn +90°

Pressing this will force your instrument to turn 90 degrees to the right.

Turn -90°

Pressing this will force your instrument to turn 90 degrees to the left.

Flip Scope

This will plunge the scope and reverse the direction for you.

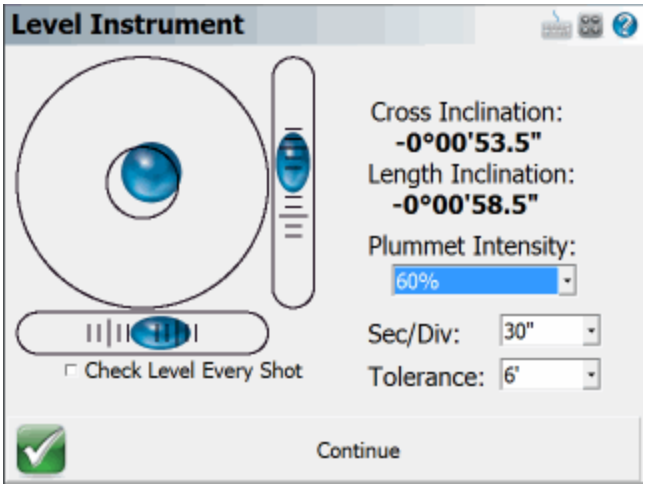
Read Angles

This will display the current horizontal and vertical angles as displayed on your instrument. This button acts as a toggle and if left on, will display the angle in real time.

Check Level

Instrument Settings | Level Instrument

If your instrument supports it, you can check to see how level your instrument is.



Plummet Intensity

If your instrument has a laser plummet or laser pointer, Layoutcan toggle those functions on or off. On some models of total station this feature is turned on automatically.

Division

You can now adjust the sensitivity of your display to show 20, 30, and 60 second intervals.

Tolerance

You can now set a tolerance for the level bubble sensor. If you exceed that tolerance then you will receive a warning message that indicates your instrument is out of level.

Check Level Every Shot

Use this option to force our software to check instrument level before every measurement. The default is off.

GPS REFERENCE

Create / Edit GPS Profile

Select GPS Profile

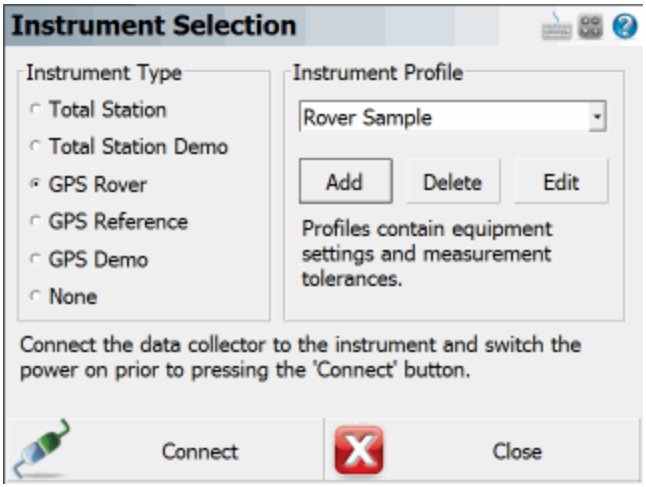
Main Menu | Connect

This is where you can create a new profile for each rover/base receiver you will be using.

There are two ways to get to this screen.

1. You can open the profile screen for your rover or base by going to Main Menu | Settings | Instrument Selection. This will display the Instrument Selection screen which contains the GPS Rover and GPS Reference profiles.

2. If you already have your instrument type set to GPS and you're currently in the map view, you can press the **Settings** button on the GPS toolbar. This will display the Instrument Selection screen which contains the GPS Rover and GPS Reference profiles.



Editing Profiles

On the Add Profile screen you can enter any name you wish for the profile. Profiles can be copied from one data collector to another, so you can have a "Master" profile file that is sent to all crews so they can quickly set up systems.

When you're ready to edit the settings for the profile you have selected, press the **Edit** button. This will display the GPS configuration screen for the selected rover or reference profile.

Refer to the GPS Configuration (Reference) or GPS Configuration (Rover) topics for more information on the settings available for your profiles.

Your profiles are stored in the file ...\MicroSurvey\Layout\Programs\MSURVEY.INI so once you have configured one data collector, you can simply copy this file onto your other data collectors to make the profiles available on them. This file should also be backed up for easy recovery.

Using Profiles for Connection

Once you've created your profiles, you can use them to connect to your receiver. Simply select the correct GPS Mode, either GPS Rover or GPS Reference, then select the profile you want to use in the profile list.

When you've physically connected the your data collector to your receiver, press the **Connect** button to start the connection process.

If it isn't successful you will see the following message "Could not detect GPS receiver! Please check configuration, cable and power." You can then press the Auto Detect Baud Rate button to force Layout to automatically try different baud rate settings. If this doesn't work you should review your profile settings and ensure that you have the correct COM port selected and that you have your data collector connected to the correct port on the GPS receiver.

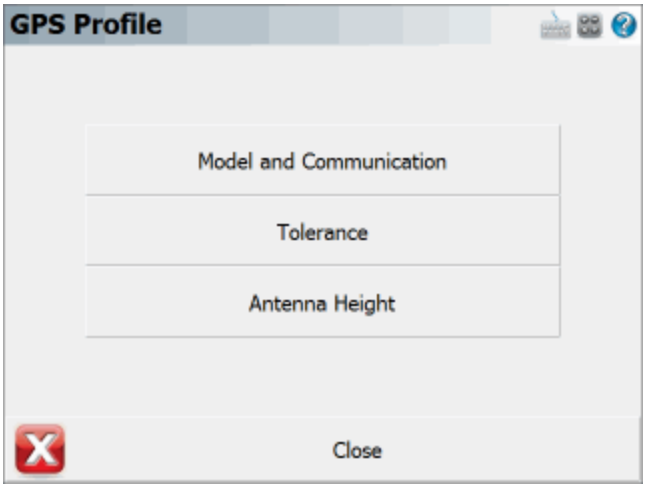
GPS Demo

The GPS Demo Mode contains a profile called "RTK Demo" which can be used to explore the GPS Capabilities of Layout without being connected to a receiver.

GPS Reference Profile

Main Menu | Connect | Edit Profile

The GPS Configuration for your reference unit is accessed from the Instrument Selection screen by selecting GPS Reference as the Instrument Type, then pressing the **Edit** button to configure your selected GPS Reference Profile.



Model and Communication

This is used to select the Make and Model of receiver, the port that the data collector is connected to and the mode that the current receiver will play in the RTK process. Please see the GPS Model and Communication topic for more information.

Tolerance

This is used to enter information about the location of the reference (base) station. Please see the GPS Tolerance (Reference) topic for more information.

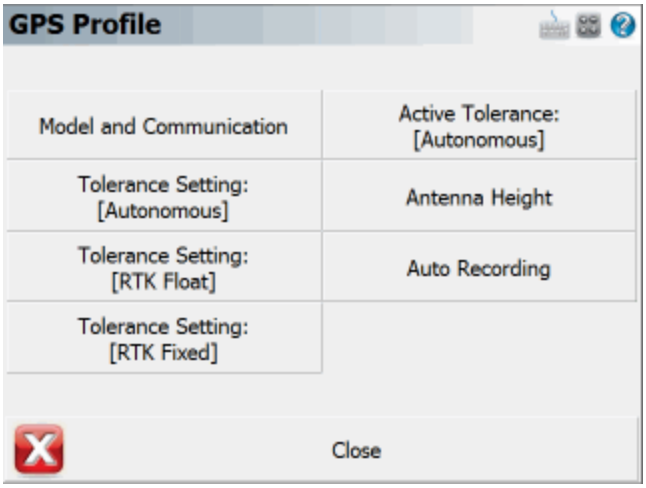
Antenna Height

The antenna settings are used to calculate or enter the height of the antenna phase center above the ground. Please see the GPS Antenna Configuration topic for more information.

GPS Rover Profile

Main Menu | Connect | Edit Profile

The GPS Configuration for your rover unit is accessed from the Instrument Selection screen by selecting GPS Rover as the Instrument Type, then pressing the **Edit** button to configure your selected GPS Rover Profile.



Model and Communication

This is used to select the Make and Model of receiver, and the port settings that the data collector will connect with. Please see the GPS Model and Communication topic for more information.

Tolerance Setting: [Description] (x3)

The three configurable tolerance modes are used to enter information used in computing the position of the rover once a measurement has begun. Please see the GPS Tolerance Modes (Rover) topic for more information.

Active Tolerance: [Description]

This displays the current tolerance mode, which can be changed at any time during your survey by selecting the GPS Settings button in the GPS toolbar. Please see the GPS Tolerance Modes (Rover) topic for more information

Antenna Height

The antenna settings are used to calculate or enter the height of the antenna phase center above the ground. Please see the GPS Antenna Configuration topic for more information.

Auto Recording

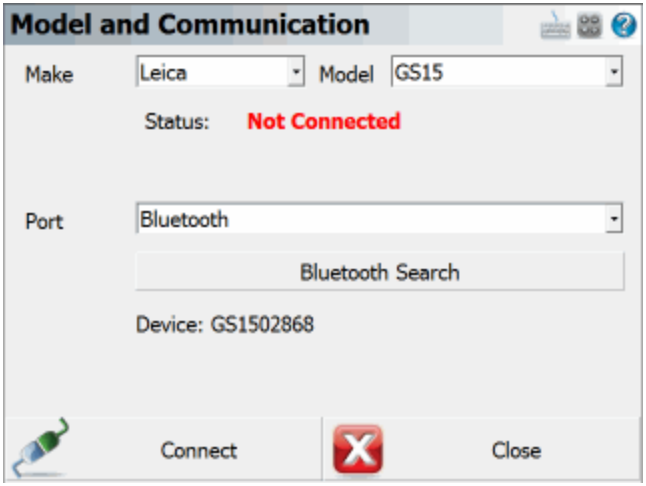
The Auto Recording settings are used for collecting data in a "Kinematic" mode. The receiver can automatically log a point every X distance or Y seconds. The user simply selects what option they prefer to use for logging Kinematic data and start the survey. Keep in mind while collecting data at higher velocities that Layout receives position updates from the GPS at a maximum rate of once per second.

GPS Model and Communication

Main Menu | Connect | Edit Profile | Model and Communication

The Model and Communication settings are used to select the Make and Model of receiver, the port that the data collector is connected to, and other communication parameters.

Cable Connection



Model

Specify the make and model of receiver you are connecting to.

Sensor Port

If your receiver has more than one data port, specify the port on the receiver that the data collector will be connected to.

Port

Specify the port on your data collector (usually COM1) that you will connect a cable between your receiver and this port.

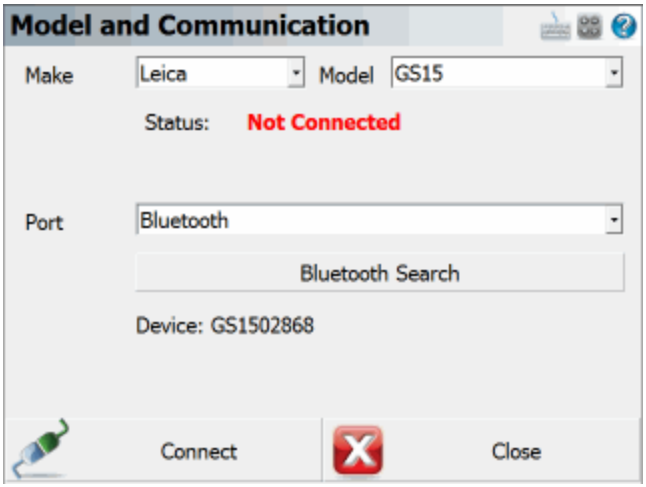
Baud Rate, Data Bits, Parity, Stop Bits

Specify the communication paramaters for the serial connection. If you're unsure of what baud rate your receiver is set to you might want to set the baud rate to Auto Detect. This will force Layout to check for communication using all the baud rate settings and if successful, it will set this baud rate in the profile.

Bluetooth Connection

Port

On many data collectors you can select Bluetooth as your communication port. If you select the Bluetooth port, the traditional serial communication options (Baud Rate, Data Bits, Stop Bits, Parity) will be replaced with a Bluetooth Search function.



Please note that not all bluetooth-enabled devices will list Bluetooth as a Port option. In some cases you must configure and use a virtual COM port through Windows CE's internal Bluetooth Settings, for example COM6.

Bluetooth Search

If you set the port to Bluetooth, a **Bluetooth Search** button will appear. Press the search button to find the device you want to communicate wirelessly with. All devices within range will be listed, choose the one you want to use

The device you selected will be saved into your instrument profile for future use so you do not need to Search every time.

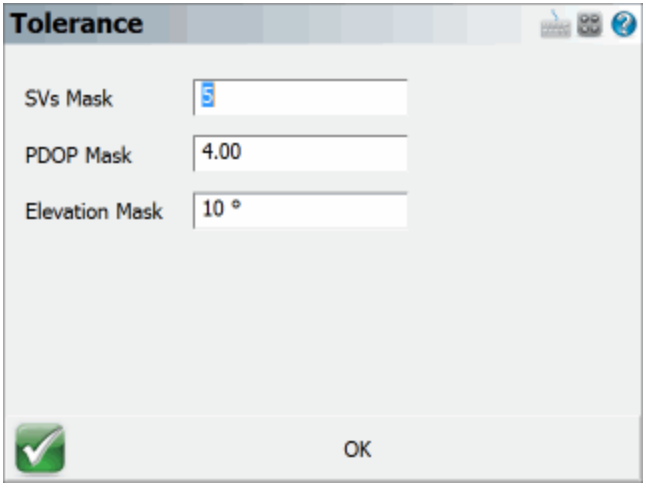
Bluetooth PIN

After initiating a Bluetooth connection, you will be prompted to enter the PIN (passkey) for the instrument you are connecting to. If your instrument does not need one just leave it blank and continue by pressing OK.

The PIN you enter will be encrypted and stored in your instrument profile.

GPS Tolerance (Reference)

Main Menu | Connect | Edit Profile | Tolerance Settings



SVs Mask

The SVs Mask setting is used to establish the minimum number of satellites that are necessary to produce a solution with a valid position. The SVs must also pass the elevation mask test to be included in this number for the calculation of the rover position.

PDOP Mask

The PDOP mask is used to control the acceptable geometry of the satellites used to compute the RTK position. If the PDOP value exceeds this number, the user will not be eligible to collect an RTK position.

Elevation Mask

The Elevation Mask is used to determine which satellites to use in computing the differential corrections to broadcast to the rover(s). Satellites below this value will not be used in the solution. Elevation mask angles are typically equal or less than the elevation mask set for the rover system.

Reference ID

The Reference ID will be used by the rover to determine which differential corrections it is receiving (if you have more that one reference station in use). This is useful information to know if one of the base stations goes down or experiences problems during an RTK session.

GPS Tolerance Modes (Rover)

Main Menu | Connect | Edit Profile | Tolerance Modes

The tolerances modes are used to enter information used in computing the position of the rover once a GPS measurement has begun.

You can define three different tolerance modes that can be selected from the GPS Tasks menu while surveying. Tolerance modes are used to ensure that certain criteria are being met every time you take a measurement. The reason for three different settings is to allow you to specify different tolerances for different types of measurements you might need to make. For example, control points would need to be measured more precisely then those used for topographic measurements.

Description

This is where you can assign a "friendly" description to your three tolerance modes to make them more easily identifiable to you - for example "Control Points" or "Topo Points".

Solution

Each observation must be of the specified solution type (or better). You can select from several Solution modes depending on your receiver make and model, these can be:

- Autonomous
- WAAS (Wide Area Augmentation System)
- DGPS (differential code solution)
- RTK Float (differential carrier solution)
- RTK Fixed (differential carrier solution)

Please refer to your GPS manufacturer's documentation for the solutions' respective positional accuracy.

Elevation Mask

The elevation mask is used to filter out satellites that are close to the horizon and are, thus, unreliable. Typical elevation mask angles can range between 10º and 20º.

PDOP

The PDOP (Position Dilusion Of Precision) mask is used to control the acceptable geometry of the satellites used to compute the solution. If the PDOP value exceeds this number, the user will not be eligible to collect a position. Typical PDOP masks are 5 or 6.

Satellites (SVs)

The Satellites mask is used to establish the minimum number of satellites that are necessary to produce a solution with a valid position. Each satellite must also pass the elevation mask test to be

included in this number for the calculation of the rover position.

Reference ID

The Reference ID is used to tell the Rover which reference station (base) to use for the differential corrections. If "Any" is selected, it will use the first correction set identified for all future position solutions.

Standard Deviation - Horizontal

Layout will use the instantaneous Standard Deviation values that your receiver is outputting to determine if the measurement can proceed. If the instantaneous Standard Deviation values are equal to or less than the values you've specified, then the measurement can proceed. Once this happens, Layout will start averaging the measurements and will compute and display averaged Standard Deviation values. These averaged Standard Deviation values must then remain equal to or less than the values you've specified for the entire duration of the measurement, for the measurement to be accepted as being within the specified tolerances.

This is your maximum acceptable horizontal standard deviation to be maintained during the point measurement.

Standard Deviation - Vertical

This is your maximum acceptable vertical standard deviation to be maintained during the point measurement.

Post Processing Tolerances

These settings apply when using FieldGenius to collect static data for later post processing.

Please note that Layout does not support collecting raw data on all GPS receivers, please refer to the Raw Data Logging topic for additional details including a list of receivers which support this function.

Usage

This option determines whether Layout should use Post Process mode to collect static data for later post processing.

Selecting **Always** instructs Layout to automatically switch into Post Process mode to collect static data for all points.

Selecting **Auto Start** instructs Layout to automatically switch into Post Process mode to collect static data for the point currently being measured, if the current solution masks are not met.

Selecting **Manual** allows you to switch into Post Process mode to collect static data for any point as it is being measured, but Layout will not do so automatically.

Time - Less than 5 SVs

This defines the duration of the static collection if the minimum number of satellites being tracked during the static session is 4 satellites. Default = 30 minutes.

If at any time the number of satellites drops below 4 (which is the minimum number of satellites required to post process a 3D solution), the internal clock timing the static session will reset to zero and begin again.

Time - Less than 6 SVs

This defines the duration of the static collection if the minimum number of satellites being tracked during the static session is 5 satellites. Default = 25 minutes.

Time - Less than 7 SVs

This defines the duration of the static collection if the minimum number of satellites being tracked during the static session is 6 satellites. Default = 20 minutes.

Time - Less than 8 SVs

This defines the duration of the static collection if the minimum number of satellites being tracked during the static session is 7 satellites. Default = 15 minutes.

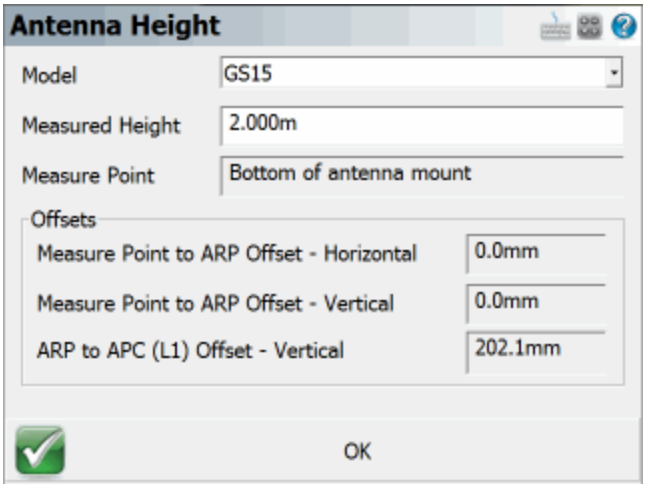
Time - 8 or more SVs

This defines the duration of the static collection if the minimum number of satellites being tracked during the static session is 8 or more satellites. Default = 10 minutes.

GPS Antenna Height

Main Menu | Connect | Edit Profile | Antenna Height

The antenna settings are used to calculate or enter the height of the antenna phase center above the ground. You can enter the true height (if it is known) or enter the measured height and any horizontal or vertical offsets and have Layout calculate the antenna height for you.



Depending on the model you've selected, manufacturer specific antenna offsets will be listed. If your specific antenna model is not listed, you can select "User Supplied" and specify appropriate offset measurements. For more detailed information about these offsets, refer to your users guide for your receiver.

The true height is simply computed by the use of Pythagoras' theorem:

$$TrueHeight = VerticalOffset + sqrt((MeasuredHeight)^2 - (HorizontalOffset)^2)$$

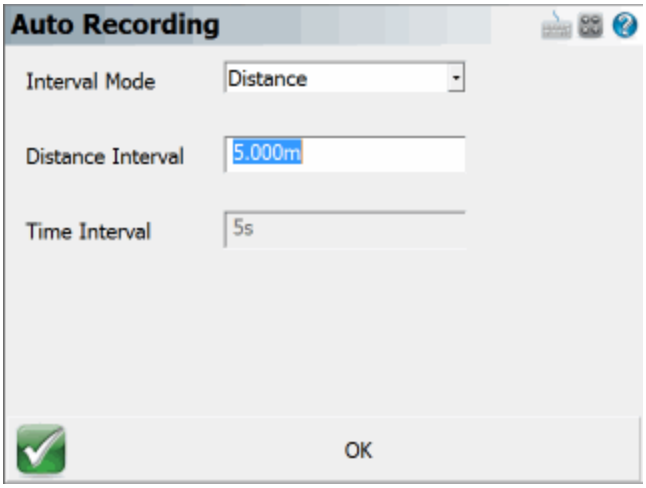
You can change the true or measured antenna height at any time, on the Store Point screen when storing your GPS shots.

GPS Auto Recording

Main Menu | Measure Modes

GNSS Toolbar | Measure Modes

The Auto Recording settings are used when collecting GPS data in a "Kinematic" mode. The receiver can automatically log a point every X distance or Y seconds. The user simply selects what option they prefer to use for logging Kinematic data and start the survey. Keep in mind while collecting data at higher velocities that Layout receives position updates from the GPS at a maximum rate of once per second.



Once configured, Auto-Recording is activated on the Rover Measurement Mode screen after pressing the Measure button:

Once activated, Auto-Recording is deactivated by pressing the Measure button again.

Reference (Base) Receiver Reference

Overview - Reference Receiver

Before you can start your GPS survey, there are a few things you need to confirm and setup.

Profile and Coordinate System Files

- You will need to determine and select the correct coordinate system and optional geoid model to use for your GPS survey work.
- Create a profile for your reference (base) and rover receivers. Profiles contain receiver settings such as baud rates and tolerance masks that are used by Layout. Refer to the Reference Configuration and Rover Configuration topics for more information.

Reference (Base) Connection Procedure

1. Main Menu | Settings | Instrument Selection
2. Choose **GPS Reference** as the type of instrument.
3. If you have not already done so, you need to create a profile for your reference receiver. If you have a profile already defined, select it now and then press **Connect**.

4. You will then be prompted with the Correction Link Settings where you can configure your radio settings. Press the **Connect** button to turn on your radio to prepare to begin broadcasting corrections.
5. If your profile is configured properly, you will see a message, "Press the measure button at any time to configure the reference receiver with a position and to enable the transmission of corrections." Select **Continue**.
6. You will now see the map screen. On the GPS Toolbar you can review information about receiver, sky plot list, display current position, and review DOP values.
7. When you're ready to program a position into the base receiver, all you need to do is press the **Measure** button on the GPS Toolbar. There are several different options you can use to program the position and they're described in more detail in the Program Reference Receiver topic.
8. After you program the receiver with a position you can disconnect the data collector.

Select Reference Position Modes

Main Menu | Measure Modes

GNSS Toolbar | Measure Modes

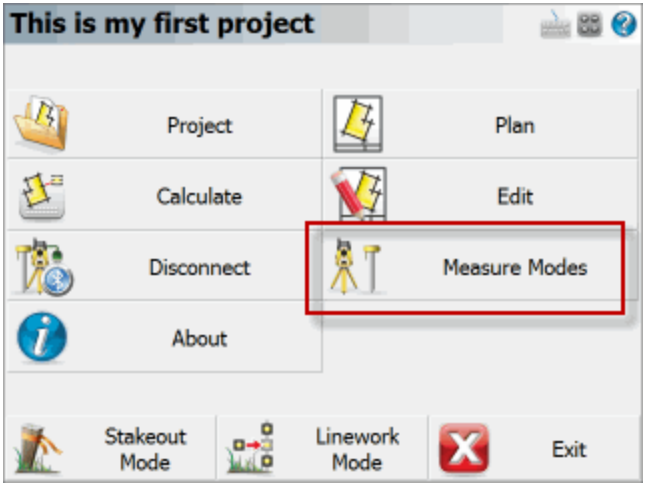
GNSS Measurement Modes - Reference (Base) Receiver

When you connect to a reference receiver you need to program a position into the receiver so accurate positions can be transmitted to the rover.

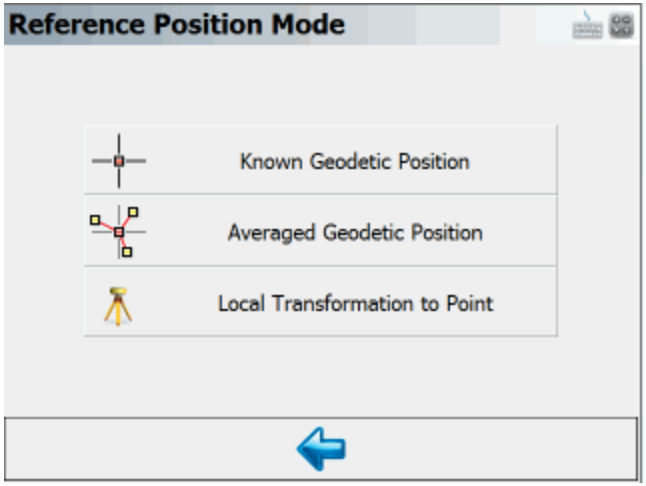
You can access three different measurement modes to program your receiver with a position by selecting the Measure Modes button in the main menu, or the measure modes button on the GNSS instrument toolbar.

Main Menu - Measure Modes

GNSS Toolbar - Reference Measure Modes



Selecting the Measure Modes button will display three options:



1. Known Geodetic Position
2. Averaged Geodetic Position
3. Local Transformation to Point

Please refer to the Reference Position Modes topic for more information about what the different modes can do for you.

Overview Reference Position Modes

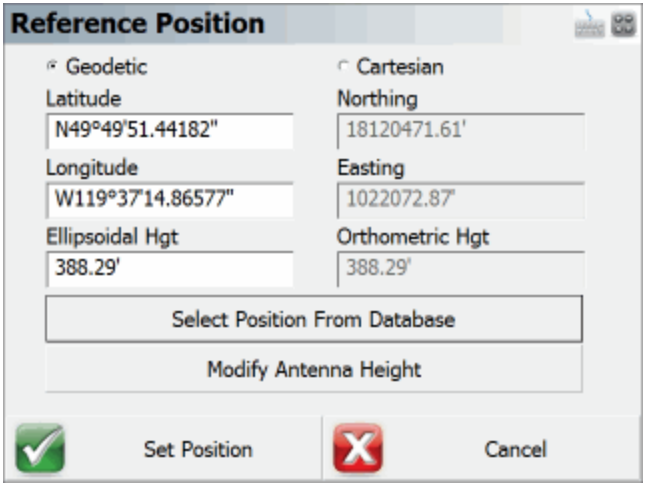
There are three different modes available for programming a position into your reference receiver.

When you're ready to program your base receiver with a position you need to select the reference position mode then to start the process press the **Measure** button on the GPS toolbar. Please review the following sections for a detailed explanation of how each mode is used.

Please see the GNSS Measurement Modes topic for details on how to access these modes.

Known Geodetic Position

Use this when you know the geodetic position of the point the base is setup on. You have two options, you can program it with a known Geodetic or known Cartesian Coordinate.



Geodetic Coordinates

Enter the know Latitude, Longitude and Ellipsoidal Height for your base setup. The coordinates you enter here will be programmed into the receiver.

Cartesian Coordinates

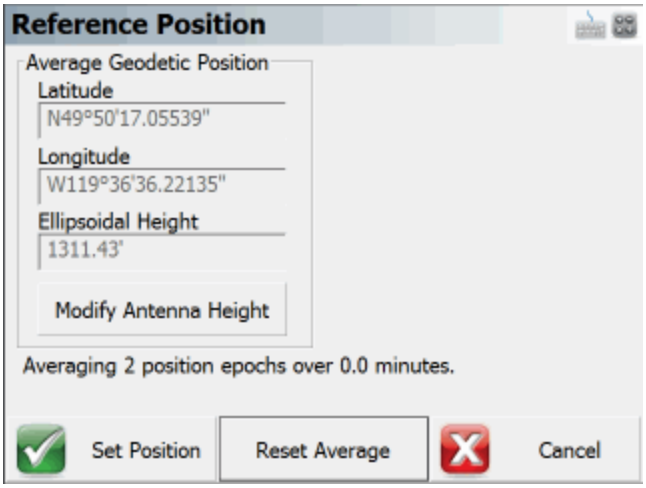
Cartesian coordinates can be SPCS, UTM coordinates or any other grid system as long as it matches the horizontal and vertical system you've defined in your GPS profile. You can not enter local coordinates as Cartesian coordinates! Doing so will cause a warning message to be displayed indicating that the coordinates you entered do not fall inside the GPS grid files you have loaded on your data collector.

Select Position from Database

This allows you to choose a point a number of different ways. The point you select must be a grid coordinate such as a SPCS or UTM coordinate.

Averaged Geodetic Position

Use this to measure and average an Autonomous Geodetic position.

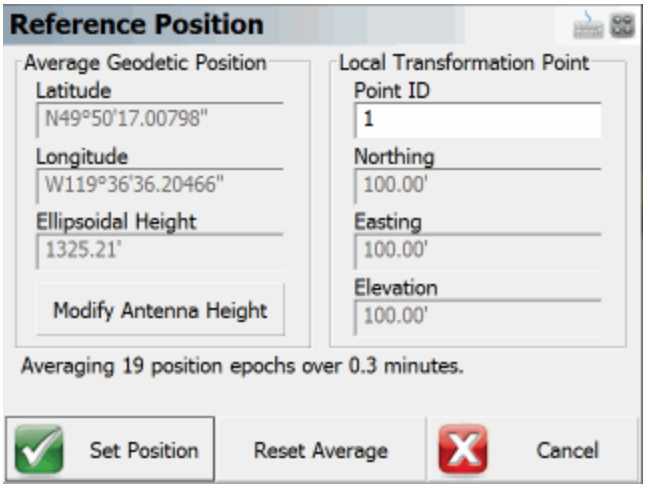


It is up to you to determine how many observations or the duration of time you want to wait before accepting the averaged position. At any time you can restart the process by pressing the **Reset Average** button.

If you press **Set Position**, your receiver will be programmed with the new position and you will have the option of storing a point's position in the database.

Local Transform to Point

Use this to compute a one point transformation so your GPS derived measurements can be referenced into a local system.



When this option is used, Layout starts receiving data and computes an averaged Autonomous position for the base receiver. The current position, how many epochs it has received and the total elapsed time is displayed on the screen.

It is up to you to determine how many observations or the duration of time you want to wait before accepting the averaged position. At any time you can restart the process by pressing the **Reset Average** button.

You then have to define a local coordinate that you want to localize to. It is assumed that the point exists in your project. If it doesn't, simply double tap the Point ID field which will open the point toolbar. You can use the new option to create a point or if it exists select it from the map or from the list.

When you press Set Position, Layout will save the averaged location into the point database. It will then compute a one point transformation which is simply a horizontal and vertical shift from the grid coordinate system into your local system, as well as a combined scale factor. All future GPS measurements will have your new transformation parameters applied automatically.

Rover Receiver Reference

Overview - Rover Receiver

Before you can start your GPS survey, there are a few things you need to confirm and setup.

Profile and Coordinate System Files

- You will need to determine and select the correct coordinate system and optional geoid model to use for your GPS survey work.
- Create a profile for your reference (base) and rover receivers. Profiles contain receiver settings such as baud rates and tolerance masks that are used by Layout. Refer to the Reference Configuration and Rover Configuration topics for more information.

Rover Connection Procedure

1. Main Menu | Settings | Instrument Selection
2. Choose **GPS Rover** as the type of instrument.
3. If you have not already done so, you need to create a profile for your rover receiver. If you have a profile already defined, select it now and then press **Connect**.
4. You will then be prompted with the Correction Link Settings where you can configure your radio or modem settings. Press the **Connect** button to turn on your radio or modem to begin receiving corrections.
5. With a successful connection you will see the map screen. The Measure button might say **"No Link"** to begin with, then switch to **"RTK Float"** and finally to **"RTK Fixed"**.
6. To record a position, simply press the **Measure** button on the GPS toolbar. Refer to the GPS Measurement topic for more information.

Rover Measurement Modes

Main Menu | Measure Modes

GNSS Toolbar | Measure Modes

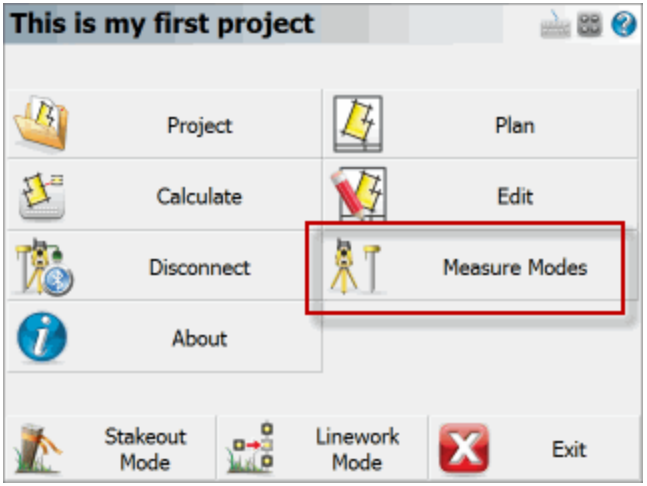
GNSS Measurement Modes - Rover Receiver

When you connect to a rover receiver you will have a choice of measurement modes available to you.

You can access three different measurement modes to program your receiver with a position by selecting the Measure Modes button in the main menu, or the measure modes button on the GNSS instrument toolbar.

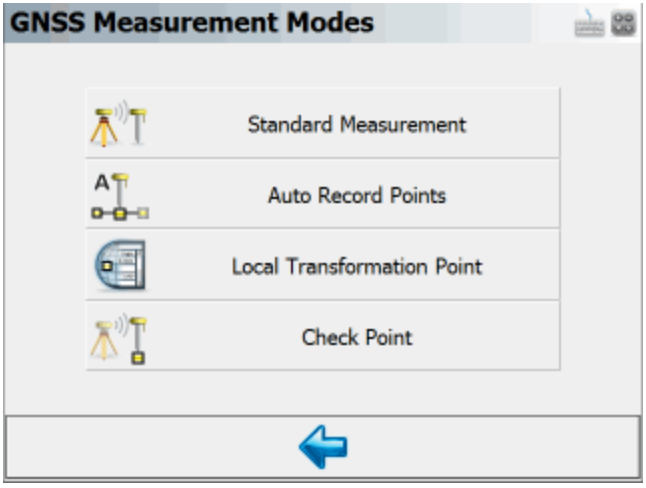
Main Menu - Measure Modes

GNSS Toolbar - Rover Measure Modes



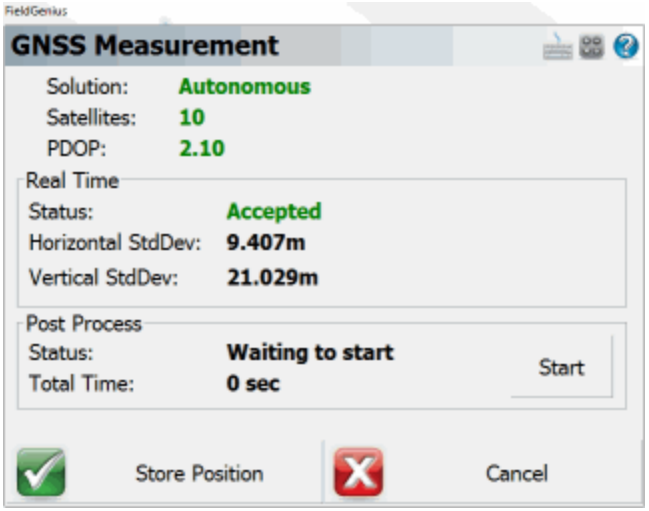
Selecting the Measure Modes button will display seven options:

1. Standard Measurement
2. Auto Record Points
3. Local Transformation Point
4. Check Point



Rover Measurement

When you have connected to your rover and you press the measure button on the GPS Toolbar you will see the GPS Measurement Screen



The measurement process works like this:

Once the satellites have been filtered out based on your tolerance settings, Layout will only begin collecting measurement data if all your tolerances are met. During the measurement process you might see that certain tolerances are not being satisfied, this is normal. Layout will continue monitoring the measurement data and will accept measurements that pass the mask criteria.

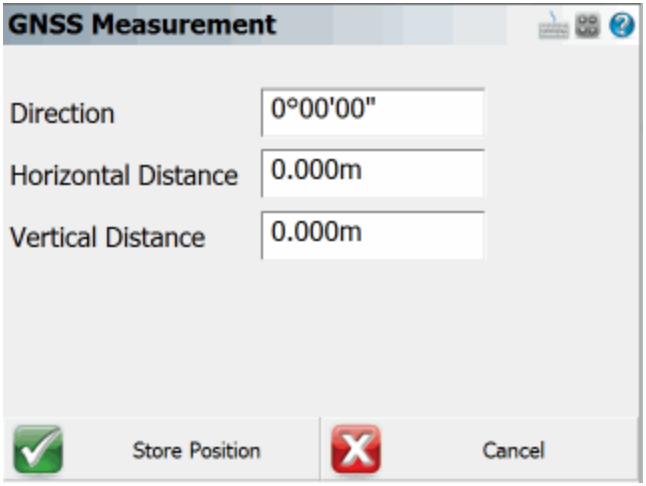
Once the tolerances have been met, the position status will change to an **Accepted** position. Prior to accepting the position, the user can look at the RMS values for the computed position and determine if they wish to accept or reject the measurement. Pressing Cancel will exit the measure function without storing any data. Pressing Store Position will accept the position and store it in the database. You can change your true or measured Antenna Height on the Store Point screen.

GNSS Measurement Mode Offset

Main Menu | Measure Modes

GNSS Toolbar | Measure Modes

When this mode is enabled after you complete the measurement you will be prompted to enter a direction, horizontal distance and vertical distance. These three entries will be used to compute a new position for the offset point.



Measurement Mode Local Transformation Point

Main Menu | Measure Modes

GNSS Toolbar | Measure Modes

Use For Local Transformation

To help you localize quickly, you can use this option. What will happen is after the measurement has been stored, we will automatically add this point to the GPS Local Transformation calibration point list. The point will be considered a measured point, and so you will be asked to define the control point that this point is to be constrained to.

Example: You've localized to a local system using a one point transformation so you can visually see in the map where your other points should be. You then decide to stake one of them so you can navigate to it. When you find the second point, you want to measure it's location and use it as one of the transformation points. Simply turn on the "Use for Local Transformation" parameter and Layout will automatically store the point's Cartesian position, and automatically add it to your transformation points list.

When you use this option, Layout will automatically ignore any transformation parameter you have defined and will store the ”raw” GPS derived measurement.

Please review the Local Transformation topic for more details.

Check Point

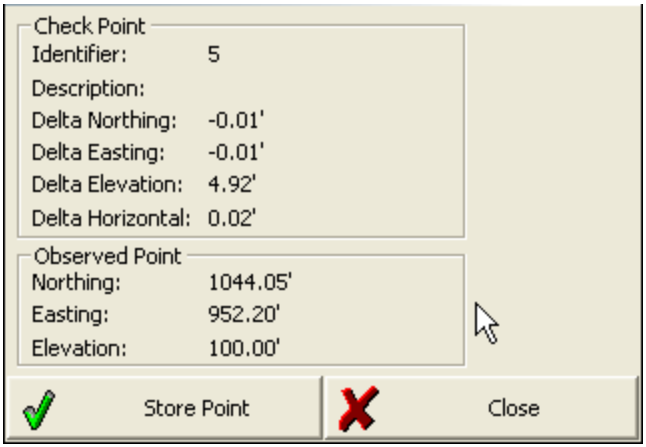
Main Menu | Measure Modes

GNSS Toolbar | Measure Modes

Use this to measure a check shot to an existing point. When you start the command you will see the point chooser appear where you can create a new point or pick an existing one from a list or from the screen. After you choose your point you will be ready to measure. You will note the measure mode will be set to **Check Pnt** and if you need to cancel the operation you can do it by pressing the measure mode button and choose to cancel it.

Check Point Summary

When you're ready to record the shot press the **Measure** button on the instrument toolbar. You will be presented with a screen that compares your measured values to the ones that were computed for the check shot point.



The deltas that are displayed are computed by subtracting the shot coordinates from the known coordinates. In other works if you add the deltas to the shot point coordinates you will end up at the known point.

Store Point

Pressing this will exit the function and write several notes to the raw file summarizing your check shot, and allow you to store the shot using the Store/Edit Point screen.

```
--Check Point
-- Check Point ID: 110
-- Check Point dNorthing: -4.59'
-- Check Point dEasting: -1.82'
-- Check Point dElevation: -4.96'
```

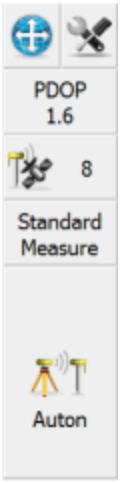
```
|-- Check Point dHorizontal: 4.94'                                          |
|-- Observed Values: HA 45°00'00.0" VA 90°00'00.0" SD 23.00' HR 5.00'       |
|-- Observed Point Northing: 5016.26'                                       |
|-- Observed Point Easting: 5016.26'                                        |
|-- Observed Point Elevation: 95.00'                                        |
```

Close

This will exit the check shot function and not write anything to the raw file or storing a new point.

Rover & Reference Common Tools

GPS Toolbar



Once the user has selected a GPS receiver and communication has been established, the GPS toolbar will appear on the main interface.

NOTE: You will only see the GPS toolbar if you selected GPS Reference, GPS Rover, or GPS Demo as your instrument type. If you have selected a GPS Profile but are not yet connected to the receiver, most of these buttons will be disabled.

Auto-Center

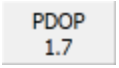
Single-tapping this button will re-center the display on the current position of your receiver.

Double-tapping this button will set the system into an auto-pan mode where the display will always be centered on the current position. When active, single-tapping this button once more will disable the auto-pan mode.

GPS Settings

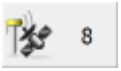
If you press this button while you are connected to a receiver, you will see the GPS Settings screen. At any time this button can be used to adjust or stop your GPS survey.

If you press this button without being connected to a receiver, you will see the Instrument Selection screen where you can edit your GPS profiles or connect to your receiver.



DOP Values

This displays the current DOP (Dilution of Precision) values. Pressing this button will cycle through the PDOP, HDOP and VDOP. The PDOP is the default setting as this is most often used to ascertain the quality of the satellite geometry.



Satellite Plot/Satellite List

This shows the total number of satellites the receiver is currently using in its solution. Press this to view a sky plot of the current SVs visible to the rover, or to access the Satellite List.

GNSS Measurement Modes Menu

This menu contains all the available measurement modes that can be used with your GNSS receiver. Please review the GNSS Measurement Modes topic for more details.

Measure

This is the measure button.

This button also indicates the current solution type. This tells the user if the solution is Fixed, Float, WAAS, DGPS or Autonomous. This button will also indicate to the user if the corrections from the reference station have been discontinued by denoting "No Link".

Please refer to the GPS Measurement topic for more information.

If you are using a conventional non-robotic total station, please see the Instrument Toolbar topic.

If you are using a robotic total station, please see the Robotic Instrument Toolbar topic.

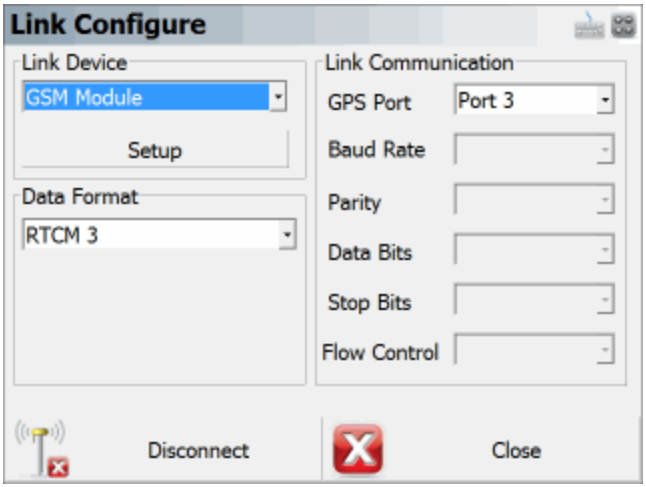
Correction Link

The Link Configure screen is used to configure the radio or GSM link for transmitting or receiving RTK corrections. The mode will vary depending on your receiver type. The Setup button allows the user to go into further device details including channels and frequencies for radios and GSM modems.

If you need to connect to a NTRIP caster, you can also access that in the setup screen.

Accessing Link Configure

To access this screen you need to first connect to a reference or rover receiver. Once connected you can access this dialog. Please review the Reference (Base) Receiver Overview or the Rover Receiver Overview topics for more details about work flow.



Mode

Select the appropriate Correction Link mode, such as Radio, Modem, or None.

Setup

When you press the Setup button on the dialog above, the Radio Setup or Modem Setup screen will appear. Choose the radio make and model from the pulldown and set the channel or frequency, the radio will be programmed by Layout to the channel or frequency selected (on some models). If you are using an NTRIP or GPRS server, enter your internet and server credentials here.

Enable WAAS Option

The option to enable WAAS solution is available depending on your receiver type. Layout will indicate if WAAS is available for the selected receiver type.

Message Type

The message type is used in determining what data streams are sent from the reference station to the rover. They can be RTCM, CMR or a proprietary format.

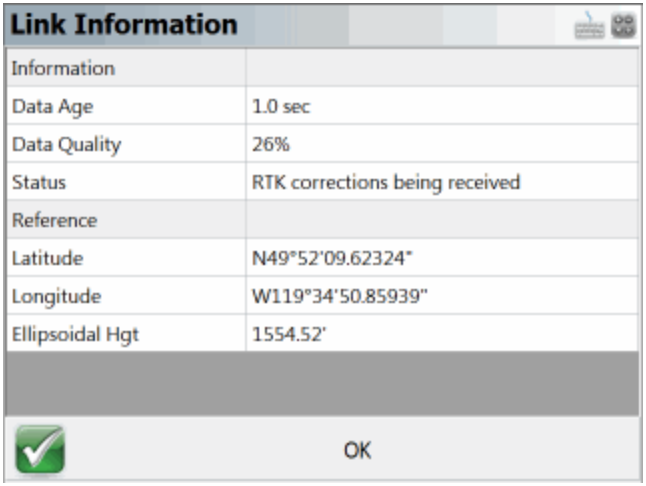
Communication Parameters

The communication parameters are used for interaction between the receiver and the communication device. Refer to the communication device's documentation for additional instructions and settings.

Correction Information

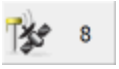
GPS Toolbar | Settings | Link Information

The Correction Information screen is accessed from the GPS Settings screen. It displays information about the correction message being received by your receiver via a radio link from a base receiver, or via a cellular modem link from an NTRIP or GPRS server.



For information on configuring your correction link please see the Correction Link topic.

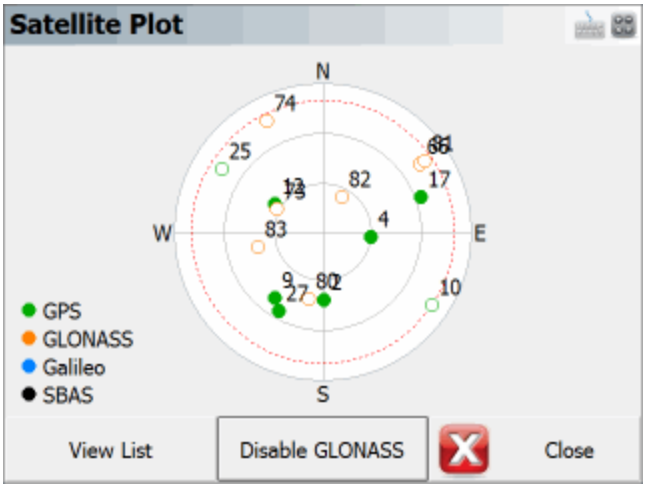
GPS Satellite Plot



To access this screen, press the Satellite button on the GPS Toolbar.

The Satellite Plot screen is a graphical representation of the current GNSS satellite constellation. It shows all visible satellites including both GPS and Glonass. Those satellites being used in the current solution are indicated with a black dot, and those being ignored are indicated with a white dot.

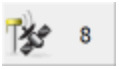
Each satellite is displayed with its PRN (identification) number, and the Elevation Mask specified in your current Tolerance Mode is indicated by a red dashed line.



Press the **View List** button to open the Satellite List screen.

Press the **Close** button to return to the map screen.

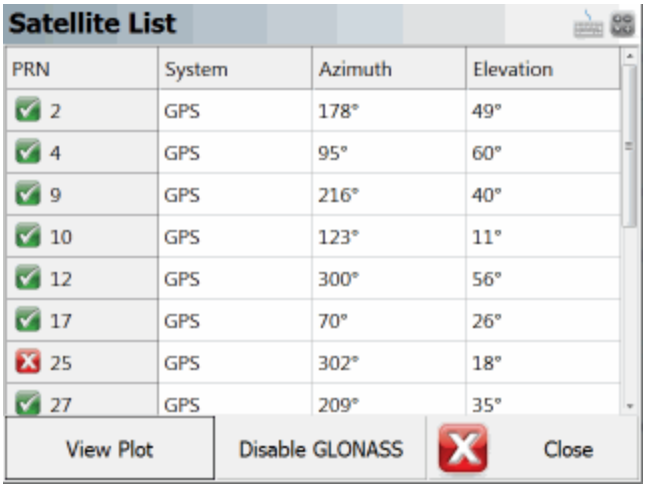
GPS Satellite List



To access this screen, press the Satellite button on the GPS Toolbar, then press the **View List** button on the Satellite Plot screen.

The Satellite List screen displays information on the current GNSS satellite constellation. It shows all visible satellites including both GPS and Glonass. Those satellites being used in the current solution are indicated with a checkmark, and those being ignored are indicated with an X.

Each satellite is displayed with its PRN (identification) number, Azimuth and Elevation, and Signal-to-Noise Ratio.

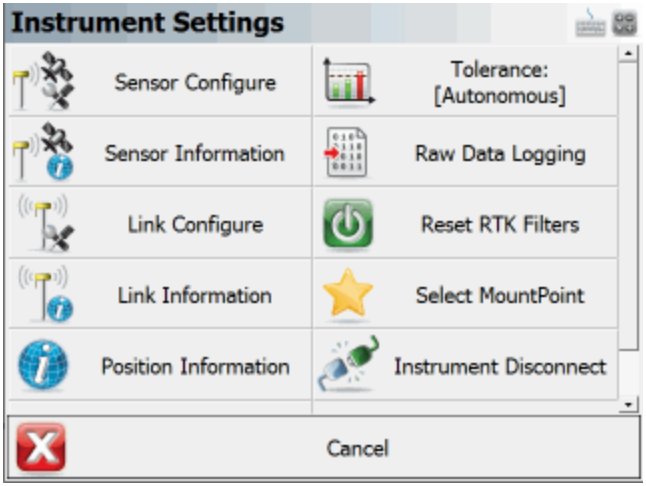


Press the **View Plot** button to open the Satellite Plot screen.

Press the **Close** button to return to the map screen.

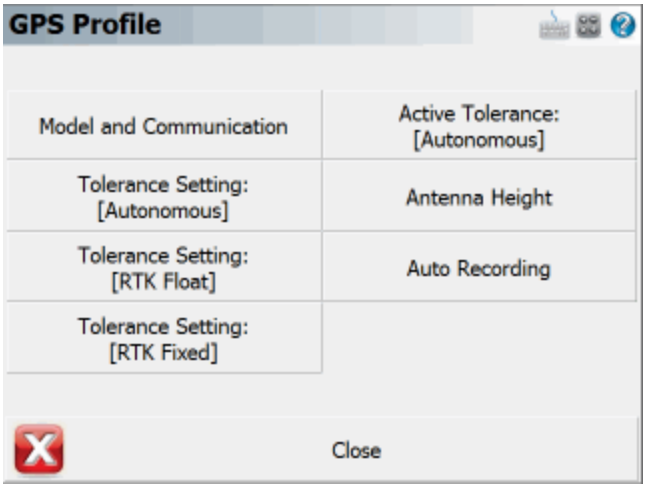
GPS Settings

The GPS Settings screen is accessed from the GPS Toolbar.



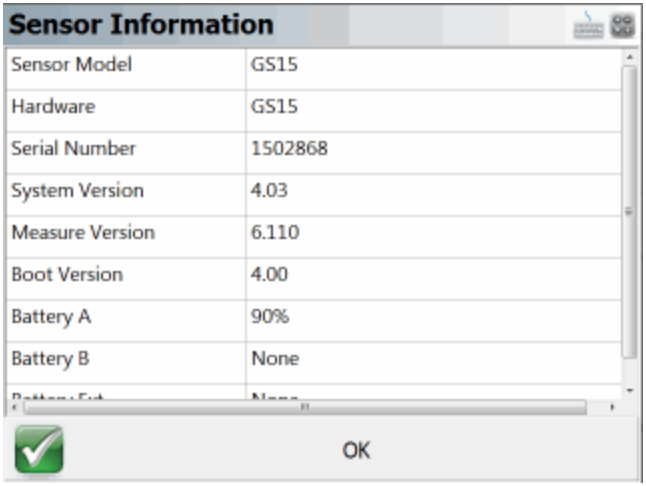
Sensor Configure

This will allow you to make changes to most of the settings in your reference or rover profile, including configuring the three tolerance modes, selecting the active tolerance mode, configuring the antenna height, and configuring the auto-recording options. (The Model and Communication options cannot be configured while you are connected to your GPS receiver.)



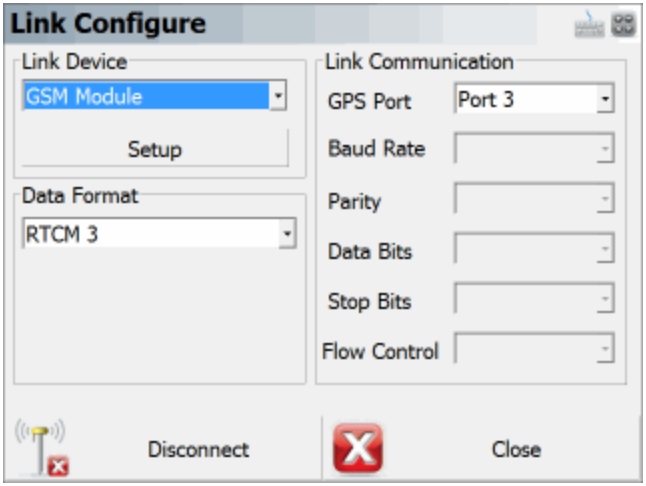
Sensor Information

The Sensor Information screen displays detailed information about the hardware you are connected to.



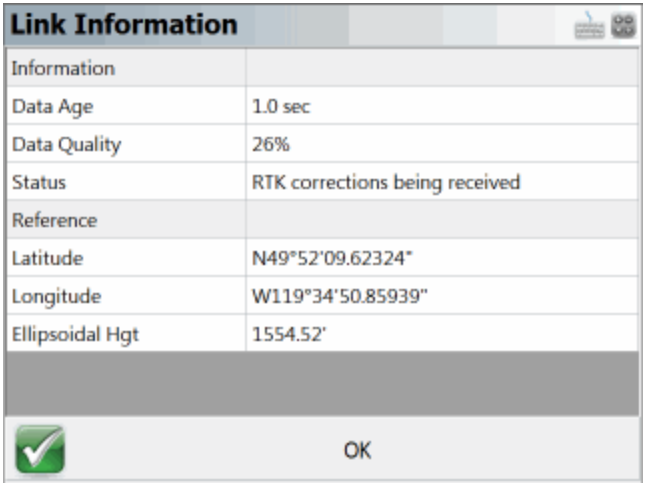
Link Configure

This turns on your GPS Receiver's radio or modem to begin receiving RTK corrections, from either a base receiver or an NTRIP or GPRS server.



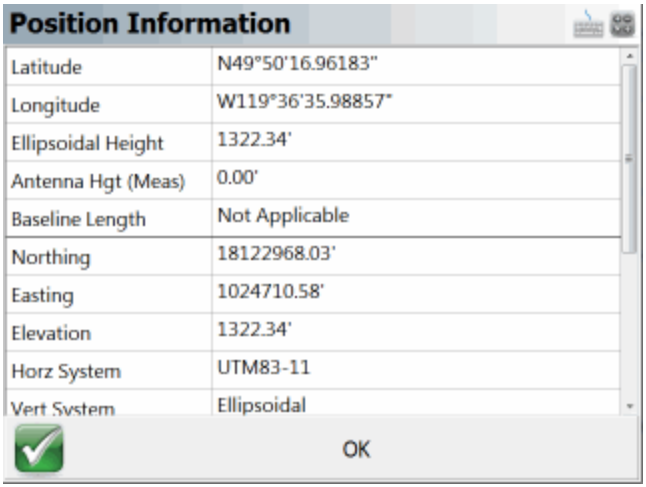
Link Information

The Link Information screen displays detailed real-time information about the correction message being received by your receiver via a radio link from a base receiver, or via a cellular modem link from an NTRIP or GPRS server.



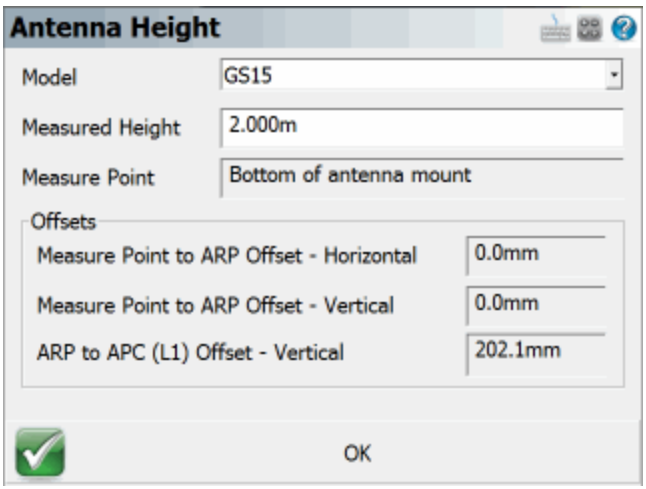
Position Information

The Position Information screen displays detailed real-time information about your current position.



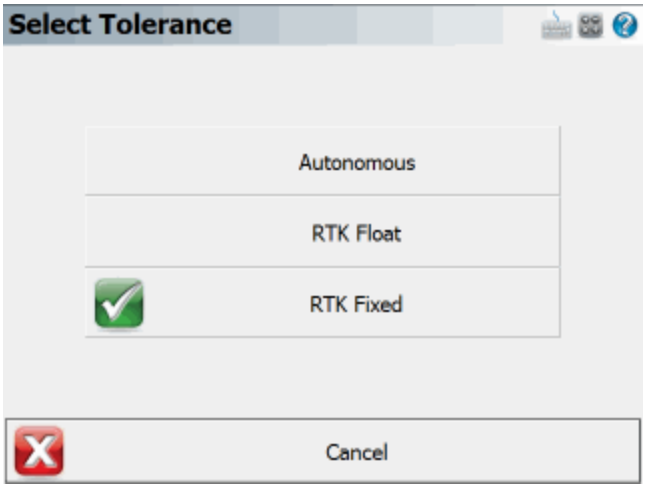
Antenna Height

The Antenna Height screen allows you to configure the antenna height of your GPS receiver.



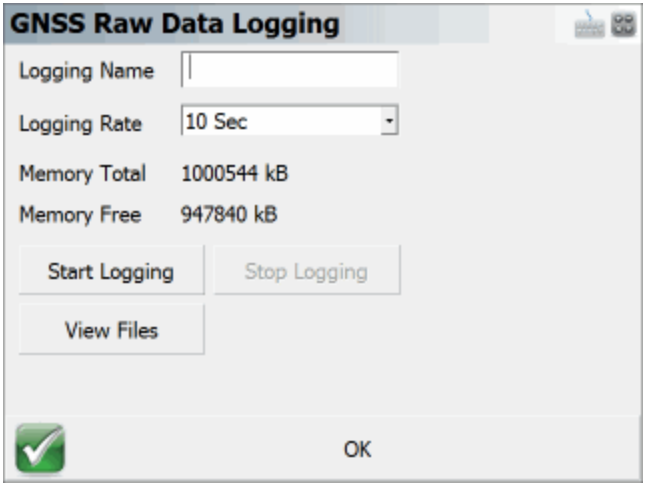
Active Tolerance Mode

This button indicates which of the three tolerance modes setup in your Rover Profile is currently being used. Press this button to select the active tolerance mode. To configure the three tolerance modes, see the "Sensor Configure" button described above.



Raw Data Logging

The Raw Data Logging screen is used to start and stop raw data logging on your GPS reference or rover receiver, for later post-processing.



Reset RTK Filters

Use this to reset the RTK solution in your receiver, to force it to recalculate a new solution and resolve any ambiguities again from scratch. This has the same effect as inverting your receiver to reset the solution.

Select Mount Point

Use this to select a different mount point from the NTRIP caster you are currently connected to.

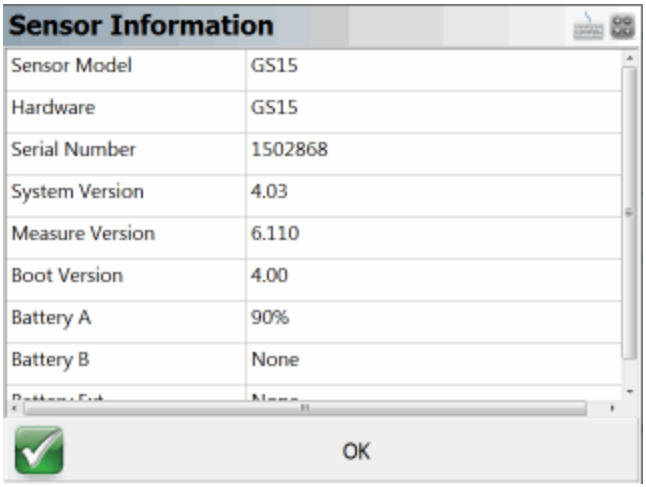
Instrument Disconnect

Use this to disconnect from your receiver. If you are connected to a reference receiver, corrections will continue to be transmitted after you disconnect.

Sensor Information

GPS Toolbar | Settings | Sensor Information

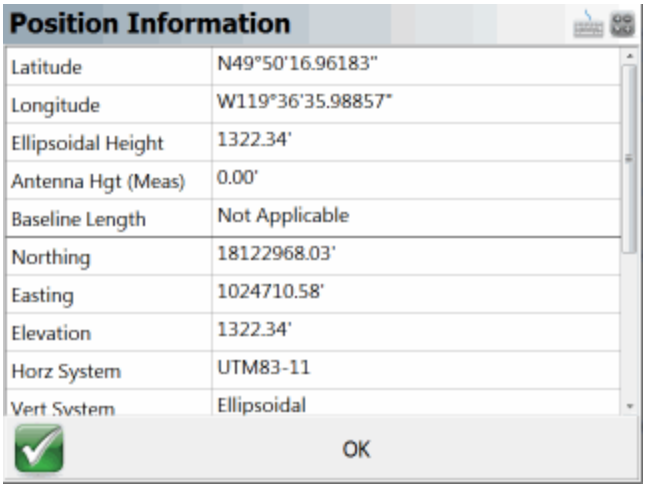
The Sensor Information screen is accessed from the GPS Settings screen. It displays information about the hardware you are connected to. The specific information available will vary by model, but typically you will see the make and model of your receiver, its serial number, battery status, firmware information, and more.



Position Information

GPS Toolbar | Settings | Position Information

The Position Information screen is accessed from the GPS Settings screen. It displays detailed information about your current position.



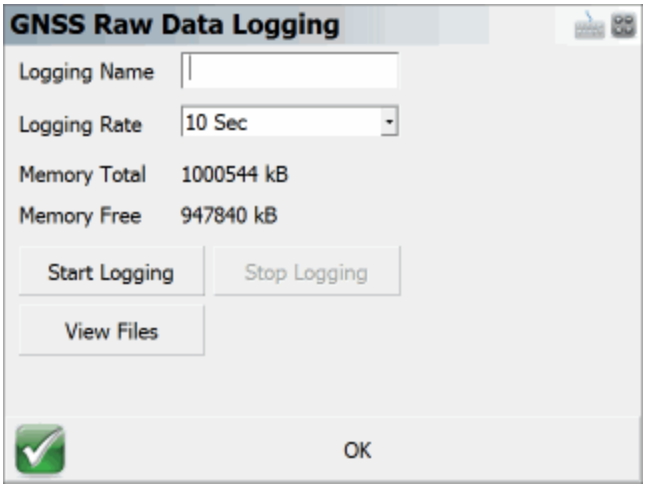
The following information is displayed and updates in realtime:

- Geodetic Position (Latitude, Longitude, Ellipsoid Height)
- Measured Antenna Height
- Baseline Length
- Cartesian Position (Northing, Easting, Elevation)
- Coordinate Systems (Horizontal and Vertical)
- Solution Type
- Standard Deviation
- PDOP
- Number of Satellites
- UTC Date and Time

Raw Data Logging

GPS Toolbar | Settings | Raw Data Logging

Use this to start and stop raw data logging on your GPS reference or rover receiver, for later post-processing of your point data. You can log raw data on the receiver while you carry on with your survey in Layout.



Note: Layout can not control the data logging on all models of GPS receivers. Currently, we support data logging on the:

Altus APS-3
Altus APS-3 Rev 2
Ashtech ProMark 500/800
GeoMax 10/20
Javad Triumph-1
Leica 1200
Leica GS15
Leica GS10
Leica SmartRover
Leica GPS900
Magellan PM500
NavCom SF-3040
NavCom SF-3050
NovAtel DL4
Pentax G3100-R1
Pentax SMT888-3G
Pentax SMT888-3G Rev 2
Prexiso G4/G5
Sokkia GRX1
Sokkia GSR2600
Sokkia Radian IS
Topcon HiPer
Topcon GR-3
Topcon Legacy
Topcon Odyssey
Trimble 4700/4800
Trimble 5700/R7
Trimble 5800/R8

Command Console

GPS Toolbar | Settings | Command Console

The Command Console screen is accessed from the GPS Settings screen. It allows you to send commands to your receiver to configure settings, or other related tasks.

You must determine the exact syntax to enter in the console and you can usually gather this information from your GPS manufacturer.

Send

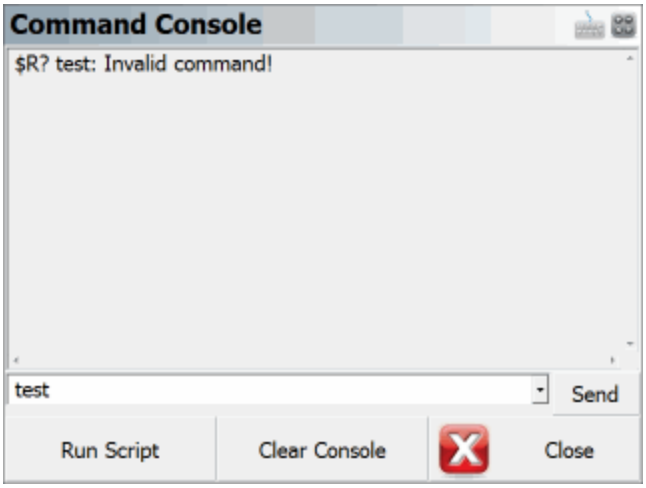
This will send the parameters that you've entered to your receiver.

Run Script

This allows you to import and read a text file that has a sequence of commands that you would like to upload to your receiver.

Clear Console

This will clear console of all parameters sent and received from your receiver.

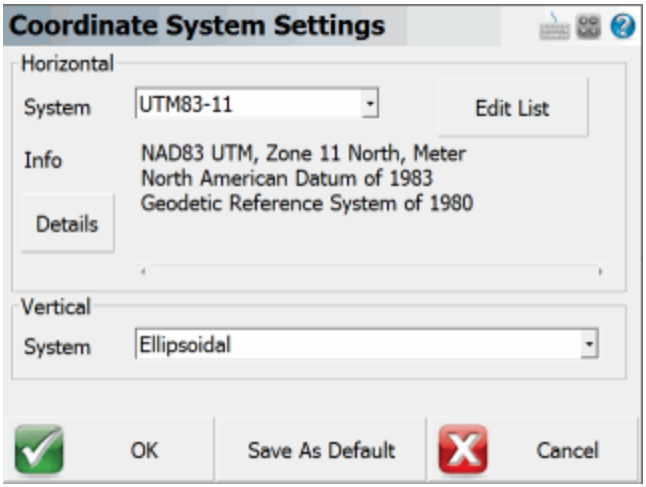


Coordinate Systems / Geoids

Coordinate System Settings

Main Menu | Project | Settings | Coordinate System

The datum settings are used to transform GPS derived curvilinear coordinates (latitude, longitude and ellipsoidal height) into Cartesian coordinates (northing/y, easting/x, and ellipsoid or orthometric height) for presentation on the drawing window and data storage.



Horizontal Group

This is where you define the coordinate system for your project.

Edit List

The **Edit List** button is used to create predefined or user-defined coordinate systems, create new coordinate systems, copy predefined systems, and edit or delete existing systems. When pressed, the Coordinate System List dialog will appear.

A **predefined coordinate system** is one that already exists and comes installed in Layoutby default, a **user-defined system** is one that you have created.

Details

This accesses a summary of all the parameters being used by the selected coordinate system. The following information is displayed:

1. What projection and parameters are being used?
2. What datum transformation method and parameters are being used?
3. What ellipsoid and parameters are being used? See section 4 for more details.

Vertical Group

This is where you define the vertical system also known as a geoid model for your project.

The default is ellipsoidal. If needed you can copy geoid seperation files (a.k.a geoid model) into the Layout mapping directory. Any new files you copy to the mapping directory can be selected here. Please review the Geoid Model topic for more details.

Save As Defaults

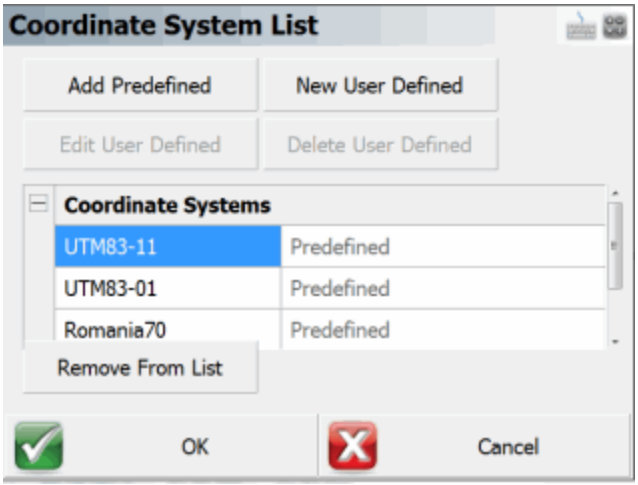
Saves the Horizontal and Vertical systems to the msurvey.ini file as defaults to be used for all new projects.

Select Horizontal Coordinate System

Layout ships with a default coordinate system definition of UTM NAD83 zone 11. You can change this at any time.

The Coordinate System List dialog is where you can select an existing coordinate system or create a new user-defined coordinate system and add them to a "favourites" list.

This list allows you to define the coordinate systems you uses most often for easy access from the Coordinate System Settings screen.



Add Predefined

Press this button to access a list of existing coordinate system. See the Add Predefined System section below for more details.

New User-Defined

This allows you to add a user-defined coordinate system to the coordinate system list. See the Add user-defined System section below for more details.

Edit User-Defined

This allows you to review and edit a user-defined coordinate system. Select a user-defined coordinate system from the list, and press the **Edit User-Defined** button. Doing so will display the Edit User-

Defined System dialog.

Some predefined coordinate systems are read only and can't be edited. You will see a warning message when attempting to copy or edit system that can not be editted.

Delete User Defined

Pressing the button will delete the selected user-defined coordinate system. You will need to confirm that you want to delete it from the database. Since there is no und, you may want to use the User Coordinate System Export routine to save a backup copy of your coordinate system before deleting anything.

Some predefined coordinate systems are read only and can't be deleted. They can however be removed from the favourites list by using the **Remove From List** button.

Remove From List

If you select either a user-defined or predefined coordinate system and press this button, the selected coordinate system will be removed from the coordinate system list. It isn't deleted or removed from the mapping database.

OK Button

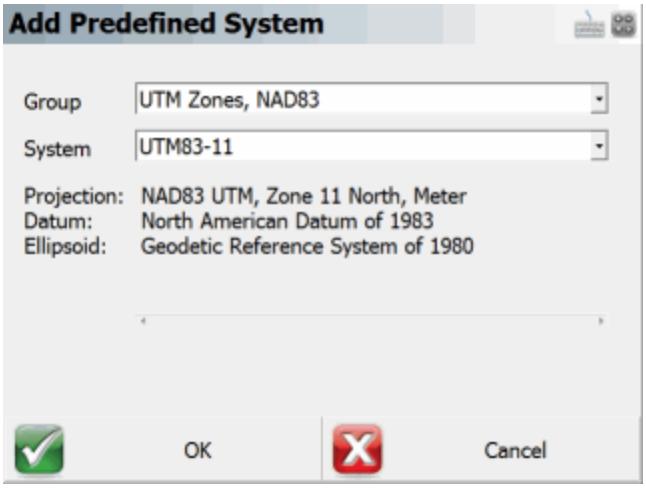
This will save the coordinate system favourites list to the msurvey.ini file.

Cancel Button

This will exit the dialog and will save nothing. You will be automatically returned to the Coordinate System Settings dialog.

Add Predefined System

When the **Add Predefined** button is selected you will be able to select an existing coordinate system from the mapping database.



Group and System Options

Coordinate systems are grouped into countries or mapping systems. Select the country or system that you are surveying in and then choose the coordinate system in the System drop down list.

Information Section

This section (below the System field) displays the projection, datum, and ellipsoid information related to this coordinate system.

Ok Button

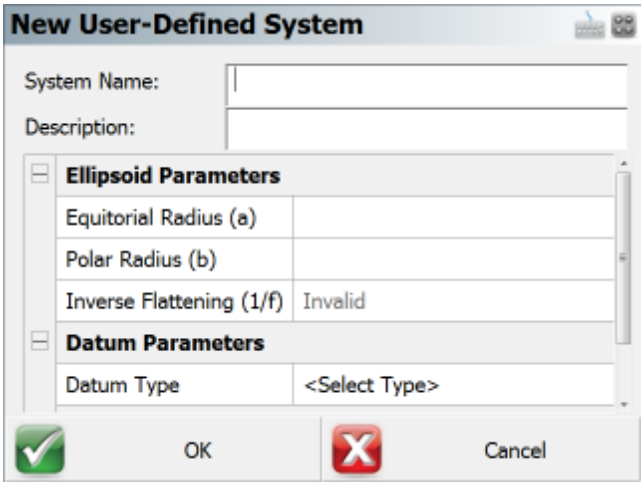
This will add the selected coordinate system to the favourites list.

Cancel Button

This will cancel without saving. User returned back to the Select Coordinate System dialog.

New/ Edit user-defined System

From this dialog you will either create a brand new coordinate system or edit an existing one you previously saved.



System Name and Description

Enter a name for your coordinate system and optionally enter a meaningful name that helps describe it. The system name must have colon in the name.

Ellipsoid Parameters

To define the ellipsoid for the coordinate system you must enter the known equatorial and polar radiuses for the ellipsoid. The Inverse Flattening is not editable and will be computed automatically and can be used a check.

- Equatorial Radius (a)
- Polar Radius (b)
- Inverse Flattening (1/f) - Always a read only value, automatically computed from the two ellipsoid radiuses.

Datum Parameters

There are 7 datum types to select from:

- Three Parameter
- Four Parameter
- Six Parameter
- Seven Parameter
- Bursa / Wolf

- DMA Molodensky
- None

If none is selected then no transformation parameters will be applied to the coordinate system transformation.

If a datum other than none is selected then the user will be able to enter the following parameters:

- Delta X (m)
- Delta Y (m)
- Delta Z (m)
- X Rotation (“)
- Y Rotation (“)
- Z Rotation (“)
- Scale (PPM)

Projection Parameters

The user can select one of nineteen projections.

- Lambert Conformal Conic (One Standard Parallels)
- Lambert Conformal Conic (Two Standard Parallels
- Transverse Mercator or Gauss Kruger
- Universal Transverse Mercator
- Albers Equal Area Conic
- Rectified Skew Orthomorphic, Azimuth at Projection Center
- Mercator Cylindrical Projection with Standard Parallel
- Mercator Cylindrical Projection with Scale Reduction
- Lambert Azimuthal Equal Area
- Lambert Azimuthal Equidistant
- Miller Cylindrical
- Oblique Sterographic
- Polar Sterographic
- Sinusoidal Projection, Optionally Interrupted
- Equidistant Cylindrical

- Cassini
- Robinson Cylindrical
- Bonne Pseidoconical
- Krovac Oblique Conformal Conic, Czechoslovokia

Typical projection parameters for most cases are:

- Scale Factor
- Central Meridian
- Origin Latitude
- Origin Longitude
- False Northing
- False Easting

Ok Button

This will save the user-defined parameters to the CS-MAP coordinate system database files (coordsys, datum and ellipsoid)

Cancel Button

This will cancel the current operation and nothing will be saved.

Automatic Backup

Whenever you add or edit a user-defined coordinate system, Layout will automatically create and save your parameters to a file named **user-coordsys-backup.csmap** to the mapping directory.

This backup file stores your user-defined coordinate systems. If you accidentally remove or overwrite your user-defined coordinate systems, you can re-import them from this backup file using the Import user-defined Coordinate System command.

Localization (Site Calibration)

Further coordinate transformations can be accomplished with the use of the Local Transformation function of Layout. For localizing on a user-defined coordinate system, see the GPS Site Calibration section below.

These settings are stored in your project's .ini file, allowing you to easily use different coordinate systems for different projects.

Additional Grid Shift Files and Geoids

Additional grid shift files or geoids can be downloaded from the MicroSurvey helpdesk.

World Geoid models we support can be found here.

World grid shift files we support can be found here.

Older Layout Mapping Files

Many of the horizontal datums and vertical geoid models require the use of "grid" files for coordinate computations. A desktop application has been provided with Layout to extract user-defined areas from the original files to create smaller more manageable files for the data collector.

See the topic on Datum Grid Editor for more information.

Datum Grid Editor

This is a desktop program that is installed on your desktop computer. You can start it by running "Datum Grid Editor" under the MicroSurvey\Layout program group on your system.

Special NOTE: Software versions newer than 2011 don't require the use of this program. All necessary files are installed with versions newer than 2011.

Versions Newer than 2011

As mentioned above if you are using a software versions newer than 2011 all necessary files for your coordinate systems are installed automatically for you with the following exceptions:

- Grid Shift Files - In some countries, or areas, the use of grid shift files are required to accurately compute a horizontal position. These additional grid shift files are not installed and need to be downloaded from the MicroSurvey website. Please review the Grid Shift Files topic for more information.
- Geoid Models - If you require orthometric heights you will need to download a geoid model for your area. Please review the Geoid Models topic for more information.

Pre 2011 Versions

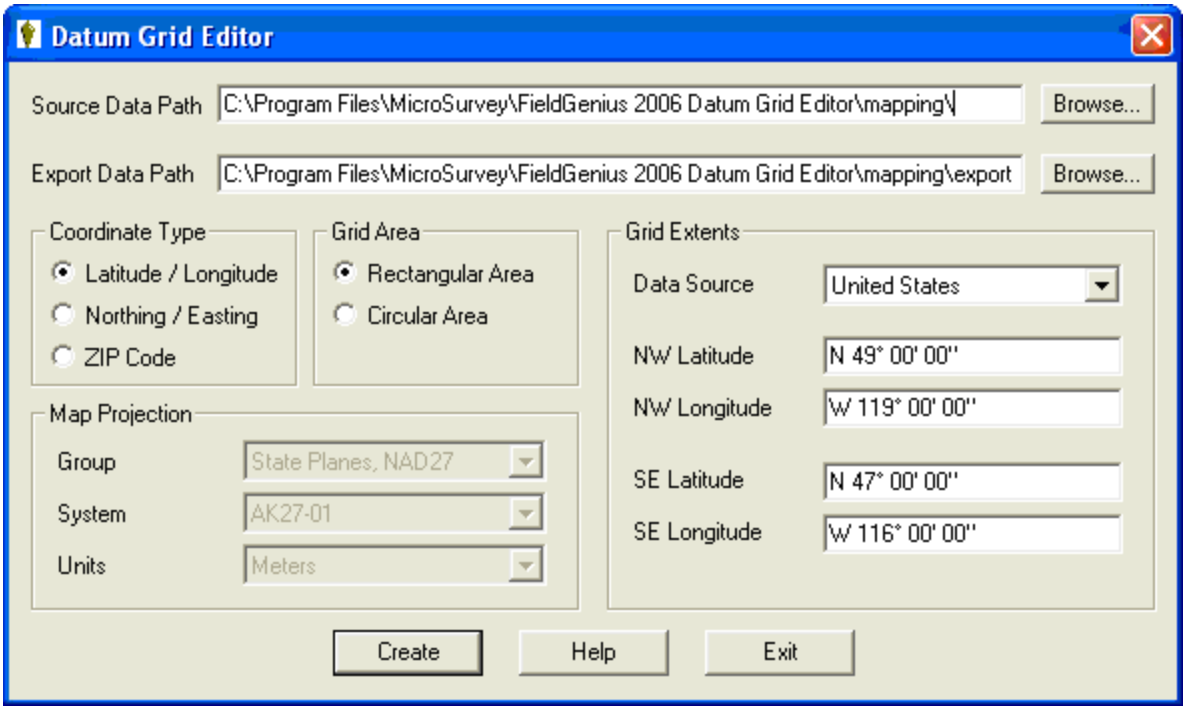
Older versions of our software (older than 2011) require the use of the Datum Grid Editor. The GPS module of Layout requires geodetic datum transformation grids and geoid model grids in order to precisely determine positions and calculate orthometric heights in the user's coordinate system.

Usually these grids are supplied by national organizations such as the National Geodetic Survey (USA) or the Geodetic Survey Division of Canada and the data files can be upwards to 15 megabytes in size.

Older data collectors are restricted in storage resources and cannot handle the large sizes of the grid files; therefore it is necessary to create smaller more manageable files. The Datum Grid Editor is a companion utility for Layout to build smaller sub grids from the original grids while preserving integrity.

The process of building sub grids needs to be repeated only when performing GPS surveys in locations which exceed the area of the original sub grids. The Datum Grid Editor is installed on the desktop machine and is available for download from our website www.microsurvey.com.

When it starts, you will see the following dialog:



Data Paths

Installation of the Datum Grid Editor utility will include recent grid data for both the United States and Canada. The edit box for the source data path will contain the installed path for the datum configuration files and the respective national grid data. Newly built grids will be written to the path defined by the edit box for the export data path. The installation process will have created a specific export path. Paths can be modified by changing the contents of the edit boxes or by pressing the adjoining browse button and selecting the path from the presented directory tree.

Coordinate Type

Coordinates for defining the extents of the user sub grid can be either geodetic (latitude and longitude) or Cartesian (northing and easting). The contents of the Map Projection section and Grid Extents section will reflect the selected coordinate type. You can also specify a ZIP code that will define the center of your sub grid.

Grid Area

The user sub grid extents can be entered as a rectangle where the diagonal corners of the northwest boundary and southeast boundary are used. Alternatively a central coordinate can be used with a bounding radius. Selection of either boundary method will be shown as parameters in the Grid Extents section.

Map Projection

If using Cartesian coordinates (northing and easting) for defining the boundary of the sub grid, it will be necessary to select the appropriate map projection for deriving geodetic coordinates used with internal computations. The group field contains various national and regional coordinate systems composed of map projection and related horizontal datum. Each group will be composed of zones or sub coordinate systems and will be updated in the system field as the group field is changed. Finally the linear unit can be selected for the coordinate entry.

Grid Extents

The data source from which the sub grid is to be built must be selected and is defined by national organization. All necessary grids and supporting files will be built for Layout including horizontal datum transformations, vertical datum transformations and geoid models. Be aware of the fact that the source data for both Canada and the United States extend beyond their political boundaries and therefore the choice of the source data is critical to avoid coordinate deviations.

The remainder of this section contains the boundary information for the user grid and its format will depend on the selected coordinate type and the selected grid area. Linear Cartesian coordinates do not need to be appended with a unit designator. Geodetic coordinates must be delimited with spaces to denote direction, degrees, minutes and seconds. Listed below are possible entries for geodetic coordinates with all being equivalent in value:

N 49 12 9.0 (direction, degrees, minutes, decimal seconds)

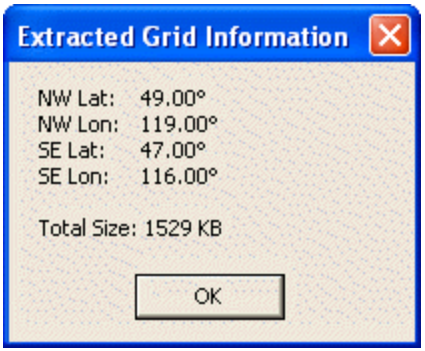
N 49 12.15 (direction, degrees, decimal minutes)

N 49.2025 (direction, decimal degrees)

Grid Creation

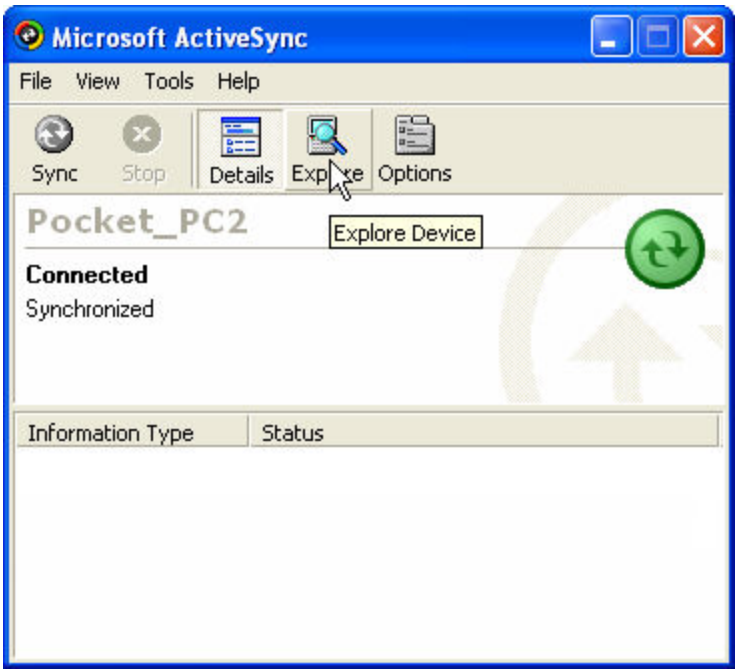
Once all parameters have been carefully selected, the sub grids can be produced by pressing the **Create** button. The time period for building the grids will depend on the area of the chosen grids and completion will be indicated by the following dialog which reiterates the grid extents and the total size of the sub grids and supporting files.

If the source path or export path described above are invalid, the appropriate message box will be presented to denote the error.

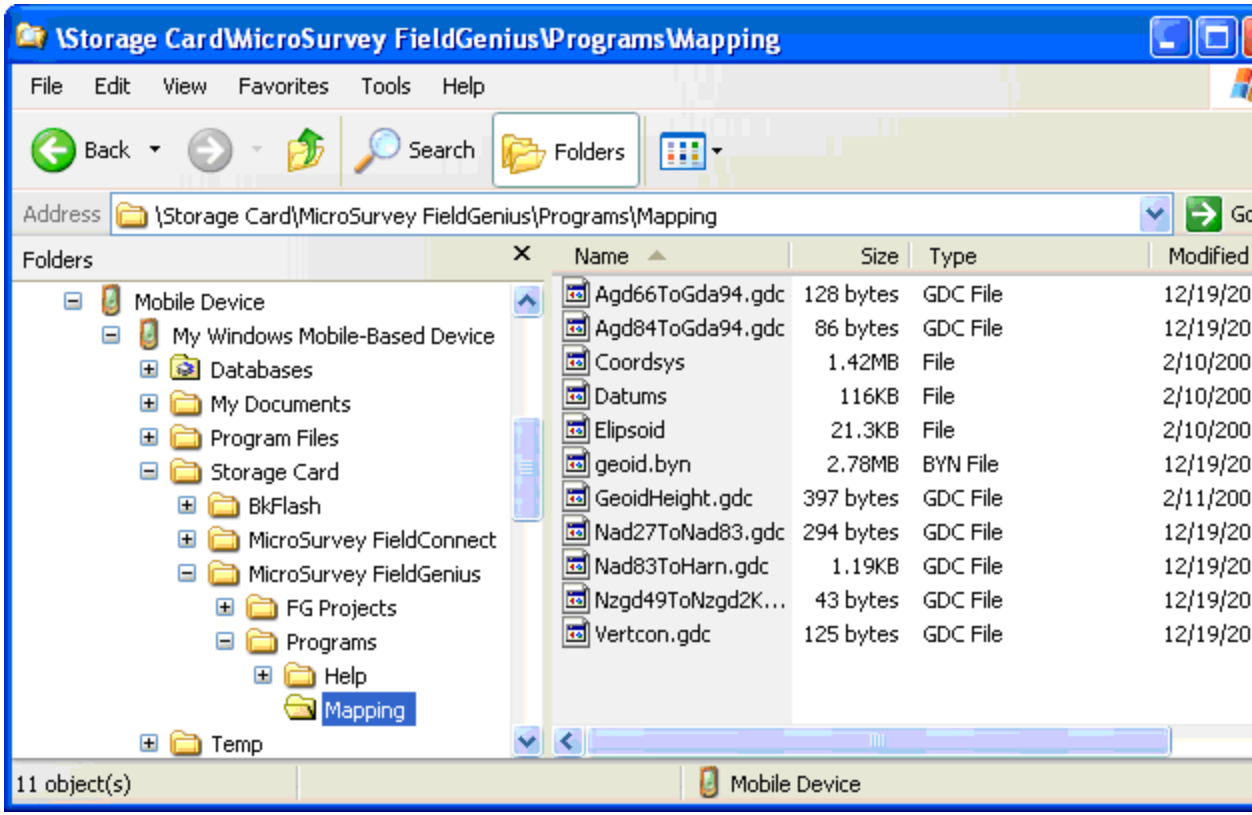


Transferring Data

The final step in creating sub grids is transferring the entire contents of the defined export path to the data collector. Microsoft ActiveSync provides easy access to **Explore** the contents of the data collector.



After cutting or copying the contents of the export path, use the explorer to paste the files into the ...\MicroSurvey\Layout\Programs\Mapping\ path on the data collector. If prompted to overwrite the existing files while pasting, respond with yes.



NOTE: the path shown may not exactly match your device. Make sure you know where Layout is installed in your data collector. It might be in SystemCF, C_Drive, Disk, Storage Card, SD Card, Built-in Storage, Program Files, or some other memory location.

Import / Export User Defined Coordinate Systems

User defined coordinate systems created by a user are saved in the binary mapping system files.

It is useful to be able to export these user created coordinate systems for the following reasons:

1. A backup of your user defined coordinate systems.
2. Allows you to share user defined coordinate systems with other crews.
3. Allows you to load user defined coordinate systems after installing a FieldGenius update.

Export

When you export the user defined coordinate systems you will be able to specify a directory to save the file to and a name for the file.

Exported files will automatically be saved with a CSMAP extension such as **mycoordinatesystem.csmap.**

All user defined coordinate systems in Layout will be exported to the file.

Import

You can import coordinate systems from a previously saved file.

When you import a file you will be asked to browse to and select the file you want to import. Once selected, Layout will check to make sure a user defined system doesn't already exist and if one does, you will be asked if you want to skip importing it, or overwrite the existing coordinate system.

Backups

Layout automatically creates a backup when you add or edit user defined coordinate systems. If you forgot to save your user defined coordinate systems, you may be able to restore them using a backup. Please see the Coordinate System topic for more details.

Geoid Models

Geoid models are used by Layout to convert ellipsoid heights to orthometric heights. Layout will by default use ellipsoid heights but you can define a geoid model to be used instead if orthometric heights are desired.

Geoid models are not installed by default and must be downloaded from the MicroSurvey website. Geoid models are available for most regions around the world.

Download Geoid Files

Canadian Geoid Models:

http://www.microsurvey.com/helpdesk2/index.php?/Knowledgebase/Article/View/490/0/canadian-geoid-models-download

United States Geoid Models:

http://www.microsurvey.com/helpdesk2/index.php?/Knowledgebase/Article/View/1040/0/usa-geoid-models

World Geoid Models

http://www.microsurvey.com/helpdesk2/index.php?/Knowledgebase/Article/View/479/0/world-geoid-models-download

Copy Geoid Files to Data Collector

Once you download the required geoid file for your area you will need to copy it to the data collector(s) that will be used . All geoid model files need to be copied to the installation directory in the mapping folder. For example: \MicroSurvey Layout\Mapping\.

Select Geoid Model

Once the necessary geoid model is copied to the data collector you have to define in your project which geoid model to use. You can define this by selecting the geoid model in the Vertical Systems section of the Coordinate Systems dialog.

Grid Shift Files

In some countries, or areas, the use of grid shift files are required to accurately compute a horizontal position. When projecting a dataset between two different datums, a transformation is required.

Both equation-based and grid-based transformation methods are supported FieldGenius. An equation-based transformation can use either a 3-parameter (dX, dY, dZ) or a 7-parameter shift (dX, dY, dZ, rX, rY, rZ, ds) to translate between coordinates. A grid-based transformation uses binary files and interpolations that calculate the differences between the two geographic coordinate systems.

We have created country specific grid shift files and these additional grid shift files are not installed by default and need to be downloaded from the MicroSurvey website.

Download Files and Instructions

Please review the following MicroSurvey Helpdesk article for instructions and country specific grid shift files.

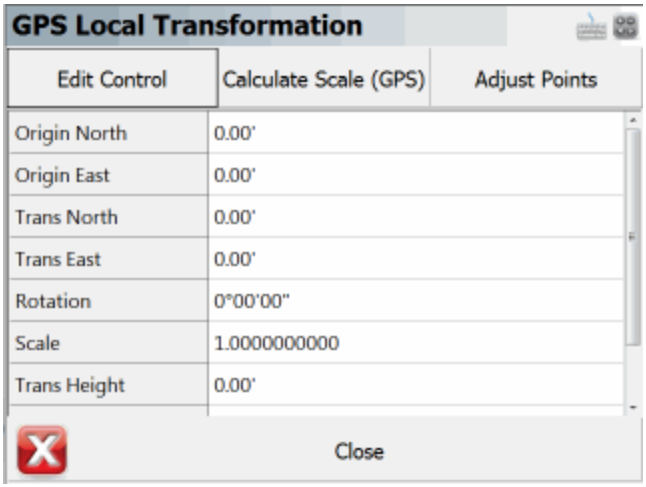
http://www.microsurvey.com/helpdesk2/index.php?/Knowledgebase/Article/View/499/47/country-specific-grid-shift-files

Site Calibration / Localization

GPS Local Transformation

Main Menu | Survey Tools | GPS Local Transformation

Layout includes a flexible localization utility. The first thing you need to do is specify the points that will be constrained. You can do this by using the **Edit Control** button. Once you've specified your constrain points, you can press the Calculate Parameters button to compute transformation parameters. The parameters will then be saved to the raw file when the OK button is pressed.



Control Points

You can think of the control points as a "fixed" coordinate system that you are wanting to transform your measurement to. For example if you are using a GPS receiver and you want to localize to a local system, your local points would be considered control points for the constraining. The points you derive with GPS need to be transformed, so these are the measured points.

All you need to do is press the **Edit Control** button to display the constrain point screen. Using the Add and Edit Control buttons you can define what points you want to use for control. You can then specify what point you want to constrain the control to, and you can also select what component of the measured point to use, either it's horizontal position, vertical position or both. An "X" indicates that the particular component should not be used in the transformation calculation.

Delta values are shown to help you determine how well your points match up with one another. Once you specify your constrain points, you can press the Calculate Parameters button which will compute the transformation parameters. The deltas shown are the differences between the control points and the measured points if the transformation parameters were applied.

When you're satisfied with the transformation parameters, the control point pairs and transformation parameters will be saved to the raw file upon exit.

Transformation Settings

Calculate Parameters

Use this to compute the transformation parameters. You have to have constrain point pairs defined before you will see anything calculated.

Calculate Scale (GPS)

When this is used it will compute the combined scale factor at your current position. This can be used while you're connected to either a base or rover receiver. The combined scale factor is computed by multiplying the map scale by the ellipsoid scale factor. The combined factor can then be applied to grid distances to get ground distances.

While programming the base, if you use the one point localization option to help you localize into a user defined local system, Layout will automatically compute a combined scale factor and a translation. For the most part, the scale factor will not change very much over the workable range of your RTK system. But if you want to update the combined scale factor you can.

Adjust Points

Use this to compute new coordinates for your GPS derived points. Each GPS observation you store is saved in the raw file as an EP record, which is essentially a WGS84 position. If you want Layout to compute new Cartesian or local coordinates for the GPS observations, you can. Simply press the Calculate Params button and Layout will scan your raw file and will recompute new coordinates using the EP records, and will apply your transformation parameters to the coordinates.

An example where this could be used is after you've measured some constrain points to help you localize to a user (local) coordinate system. After you compute your transformation parameters you will still have two coordinate systems, one with the local coordinates and one with the GPS (UTM or SPCS) coordinates. It is usually beneficial to transform the GPS derived constrain points so they are now in the local system.

Do Not Calculate Scale (Checkbox)

If this is checked, Layout will not compute a scale factor and will force it to a value of 1.0.

Do Not Calculate Vertical Slopes (Checkbox)

If this is checked then Layout will not compute any slope values.

Parameters

Origin North and East

This is the centroid of the measured coordinates, or simply the average northing and easting of your measured constrain points.

Trans North and East

If you move the measured points, so that the centroid of your measured points is equal with the origin of the local system. The translation north and east is the shift amount that needs to be applied to your measured points to move them into the local system.

Rotation

This is the rotation amount between your measured and local systems.

Scale

This is the scale difference between your measured and local systems.

If you turn on "Do not calculate scale" these values will be equal to 1.0.

Trans Height

This is the vertical shift that will be applied to the transformation. It is computed by averaging the elevation differences between your point pairs. Positive translation heights will be added while negative heights will be subtracted.

Slope North & Slope East

This is an indication of or much your measured system is inclined in the north and east directions. The value that is displayed is the slope of each direction. For example if the difference in elevation along the north axis of your measured system is 3 meters, and the length of it is 19 meters, the slope of the axis will be (rise over run) or 0.15789. Negative slopes indicate that it is inclined downward from the origin, and positive slopes are inclined upwards.

You should only use vertical slopes if you do not have a geoid model to use for your point's elevations. Use this feature with care as it can cause distortions in your elevations if it is used incorrectly.

You can force Layout to not compute these values by turning on the "Do no calculate vertical slopes" toggle.

Impact on new measurements

Once the transformation parameters have been adequately determined, all future GPS measured coordinates will automatically be transformed. All constrained point pairs will be saved along with the transformation parameters for the current project upon exiting the utility and will be saved to the raw file.

Notes:
- Only use a local transformation if necessary.
- GPS heights should be applied with a suitable geoid model. If possible only use vertical bias (Trans Height) because solving for slope North and slope East with inadequate control can severely distort the parameters.
- Use redundancy for confirming parameters.

Raw File Information

Whenever you compute transformation parameters, they're automatically written to the raw file when you exit the command.

Once the parameters are saved, they will automatically be read in again if you use the Transformation Command. Layout will always start at the top of your raw file and will process the calibration records as they're found.

The control points you define are saved as a CT record and will always have an associated RP record. RP records store the measured coordinate that you defined for the control point.

Following the calibration points are a HA and VA records which store the transformation parameters that were computed. Following is an example of what you might see in your raw file.

```
--Calibration Points
CT,PN15,DM4,RH6.708,RV0.000
RP,PN15,N 11.0000,E 30.0000,EL0.0000,--
CT,PN16,DM4,RH5.243,RV0.000
RP,PN16,N 30.0000,E 30.0000,EL0.0000,--
CT,PN17,DM4,RH6.708,RV0.000
RP,PN17,N 30.0000,E 11.0000,EL0.0000,--
HA,N 23.6667,E 23.6667,TH6.6667,TE6.6667,RT0.000000000,SC1.0000000000
VA,PV3,N 23.6667,E 23.6667,LZ0.0000,SO0.00000,SA0.00000,GN
```

An important thing to remember is that if any of the original measured points you used in the calibration change, you need to go back into the transformation command and edit the corresponding control point. You need to re-define the measured coordinates for the control point, then press the **Calc Parameters** button to update the transformation parameters.

Local Transformation

Due to a variety of reasons, it may be necessary to adjust position coordinates for distortions which can include scale, rotation, translation in northing and translation in easting. The flexibility of Layout's local transformation utility allows it to be used for a variety of applications and applied to positions derived from GPS or terrestrial observations. For GPS applications there are two possible reasons for the need of a transformation:

1. Translating from Local System to Plan System

   GPS receivers by default generate geodetic coordinates (latitude, longitude and ellipsoidal height) and the process of converting to Cartesian coordinates (northing, easting and orthometric height) or local system is done with existing well defined map projection systems such as Universal Transverse Mercator (UTM) or the State Plane Coordinate System (SPCS). Selection of the map projection in Layout is done within the Datum page of the GPS Configuration and a local zone is selected to minimize scale and meridian convergence distortion. Most land, boundary or property surveys are unique with regards to their generalized plane and coordinate origin for each project. The coordinate system for these surveys is often referred to as a plan system with coordinate magnitudes being kept small for ease of recording and

calculations. The majority of projects can suffice with a simple translation in northing and easting to produce plan system coordinates from GPS determined local system coordinates. The translation is easily determined by comparing a plan system coordinate and a local system coordinated for a single point.

2. Consideration for Scale and Rotation

Projects with larger extents need to take into consideration the curvature of the earth's surface which can be handled by the application of scale and rotation transformations plus the previously mentioned translations. In the case of mixing GPS observations and terrestrial observations it does become important to apply a transformation, especially in scale, due to the fact that there is a difference in distance between positions measured on the ellipsoid and the terrain surface. As seen in Figure 1, coordinates derived from GPS are always referenced to the surface of the ellipsoid as per the application of map projections. When the two points on the ellipsoid are projected upwards along the ellipsoid normals onto the earth's surface, they diverge, and a terrestrial distance observed between the points will be greater than the computed distance of the same two points on the ellipsoid. The effects of this zenith divergence becomes more evident as distance between the two points becomes greater and for larger terrain heights above the ellipsoidal surface.

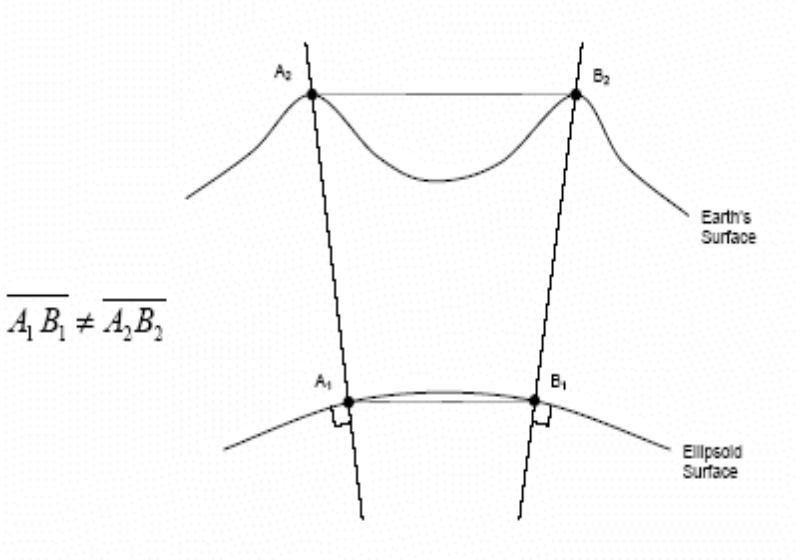


Figure 1. Divergence of Ellipsoid Normals.

Transformation Concepts

In order for the transformation parameters to be resolved, a sufficient number of control points are required with coordinates in both the plan system and local system. The determination of a four parameter transformation (two translations, scale and rotation) on a horizontal plane requires at minimum two physical points with each having two sets of corresponding coordinates as illustrated in Figure 2. Points A1 and B1 exist in what is termed the local system and are transformed into the plan system points of A2 and B2. The use of more coordinate observations will provide redundancy and the means to identify outliers for elimination. Solving for over constrained parameters is done with the application of least squares to provide the most rigorous minimization of residuals. Once transformation parameters have been resolved, newly observed or existing coordinates can easily be converted to the plan coordinate system.

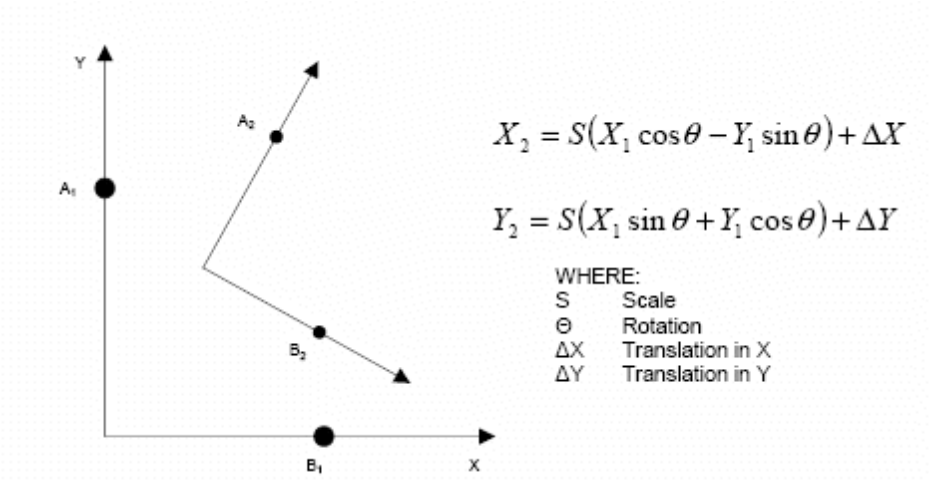


Figure 2. Horizontal Four Parameter Transformation.

The selection of control points for determining the transformation parameters are critical in reducing a colinearity condition along a particular axis. Colinearity will present itself if the control points are concentrated in a linear fashion as shown in Figure 3 (Poor Design) and thus weaken the parameters in a perpendicular direction. Control points should extend to the corners of the project boundary and be extended with equal distances in both horizontal directions.

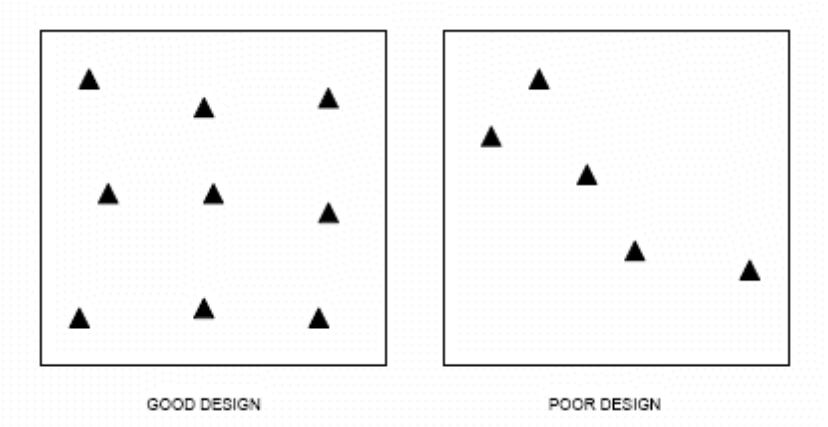


Figure 3. Transformation Control Design.

Vertical Transformation

The vertical transformation function of Layout operates independently of the horizontal transformation. A sloped plane is calculated from the residuals of the constrained point pairs to determine a vertical bias, slope in X and slope in Y. To determine a vertical bias at least one point pair must be constrained and for all three parameters to be determined at least three point pairs must be constrained.

The use of the vertical transformation function should be restricted to cases where a geoid model is not available or there is a know problem with an existing geoid model.

Local Transformation Example A

For this example the simple case of translating the GPS derived coordinates to the desired plan coordinates will be used. The example will demonstrate how Layout can be used to determine and apply the transformation parameters. A project is created consisting of four points in the plan system as denoted in Figure 4 and the corresponding coordinate listing shown in Table 1.

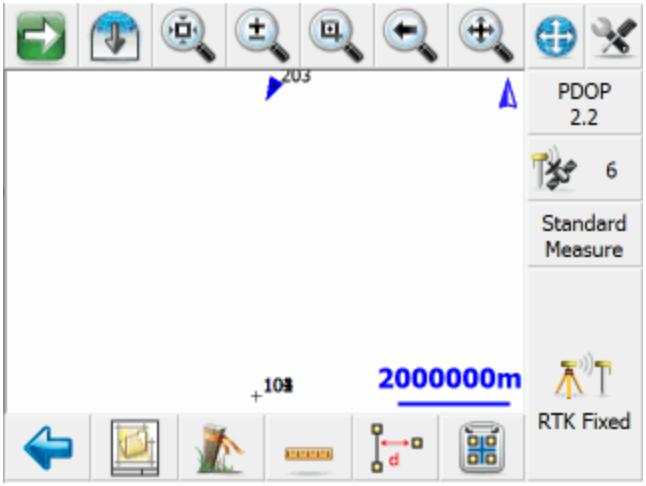


Figure 4. Layout Project with Points in the Plan System.

Point	Northing	Easting
101	1000.000 m	1000.000 m
102	1000.000 m	1200.000 m
103	1200.000 m	1200.000 m
104	1200.000 m	1000.000 m

Table 1. Plan System Points.

The GPS reference station will need to occupy a point within the project area which can be an existing plan system point (101-104) or a new point set up randomly somewhere in the project area. For either setup of the reference station, the GPS antenna should have an unobstructed view to the satellite constellation to ensure that the rover station operates at its full potential. If the reference station is unable to occupy a plan system point, the rover station can instead measure an existing plan system point with local system coordinates and for this example that case will be assumed. Using Layout to configure the GPS reference station, a suitable map projection is selected and the reference station position will be determined autonomously.

Once the reference station is operating and transmitting corrections, the rover station is used to measure plan system point 103 and the new local system point is assigned point number 203. Table 2 indicates the measured coordinates of point 203 in the local system which corresponds to point number 103 in the plan system. Figure 6 illustrates that Layout now has points in two different coordinate systems as indicated by the large separation.

Figure 6. Layout with Two Coordinate Systems.

Point	Northing	Easting
203	5523295.939 m	311585.808 m

Table 2. Local System Point.

Now that points exist in each of the coordinate systems the local transformation parameters can be determined and applied. Transformation Settings can be accessed from the **Main Menu | Survey Tools | GPS Local Transformation.** Initially the transformation parameters of translation in northing, translation in easting, scale and rotation will be null and any transformation will not be applied to GPS positions as indicated in Figure 7.

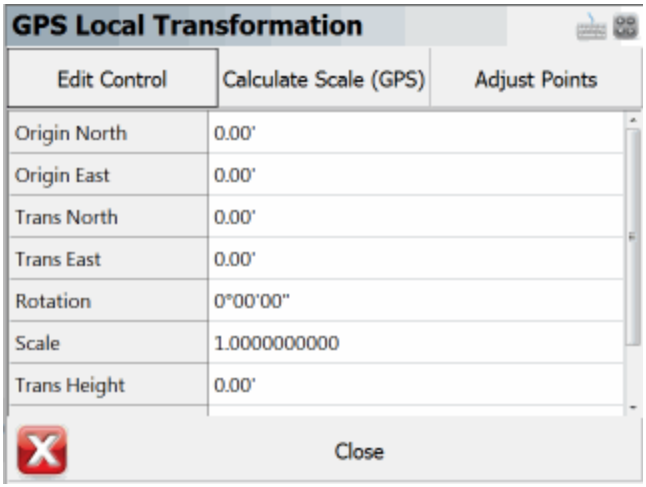


Figure 7. Layout Default Transformation Parameters.

From the Local Transformation Setup select the **Edit Control** button for the entry of control and measured point pairs to be used in the determination of the transformation parameters.

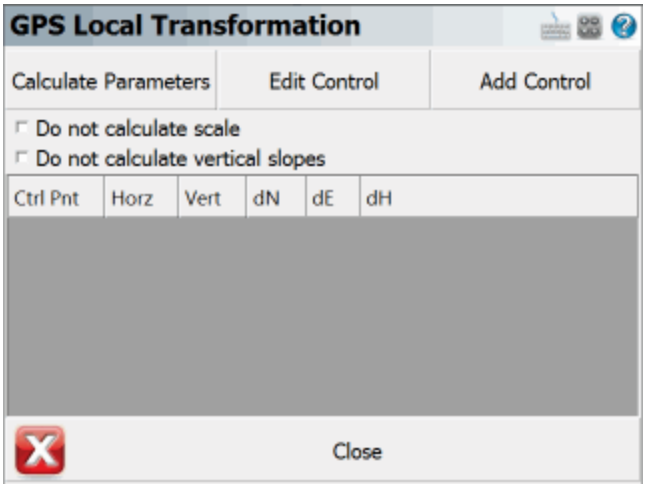


Figure 8: Layout Default Control-Measured Point Pairs.

Select the **Add Control** button to enter the control and measured points. As seen in Figure 9 point 203 is selected as a measured (local coordinate) point and corresponding point 103 is entered as a control system point. The check boxes for constraining to horizontal and vertical are left enabled.

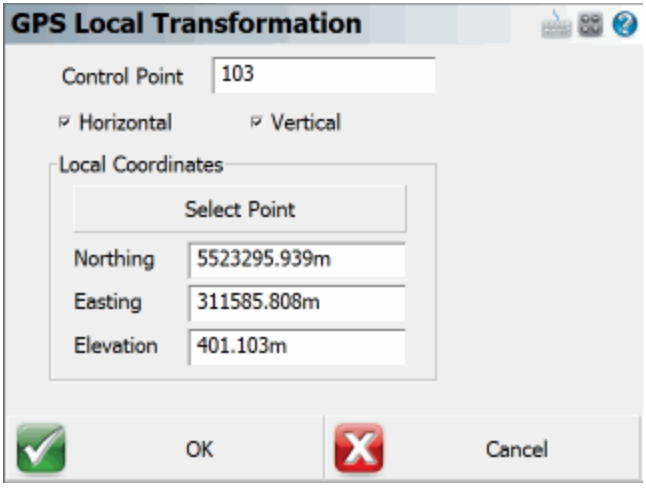


Figure 9: Layout Control Point Pair Definition.

Select the **Calculate Parameters** button to have Layout calculate new transformation parameters based on the control pair that has been added. The following tabular columns denote residuals in northing, easting and height and for this case are all zero due to the transformation being minimally constrained.

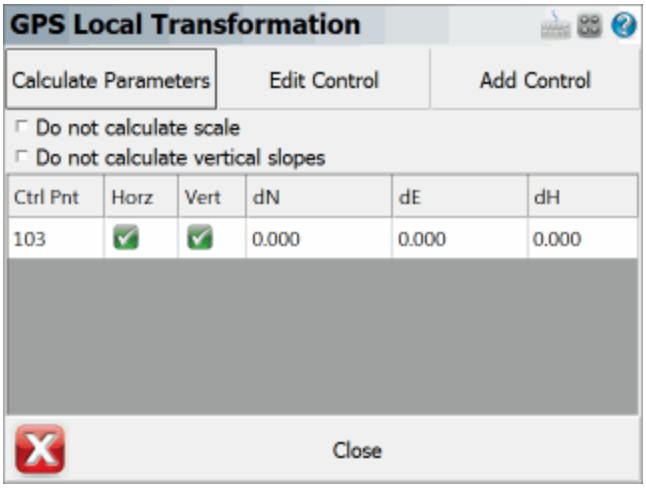


Figure 10: Layout Contrained Points for Transformation.

The calculated transformation parameters can be viewed by choosing **Close** and returning to the Parameters page. Since only one point pair is being constrained, the utility has only determined a translation in northing, translation in easting and vertical bias. The addition of more point pairs would allow for scale, rotation and slopes in X and Y to be determined.

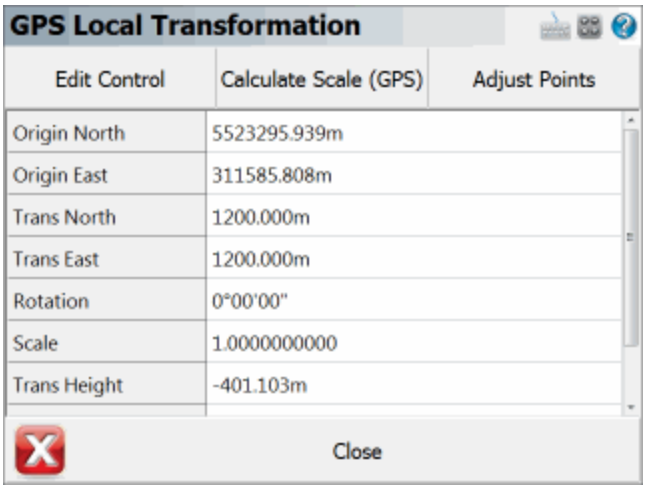


Figure 11. Layout Calculated Transformation Parameters.

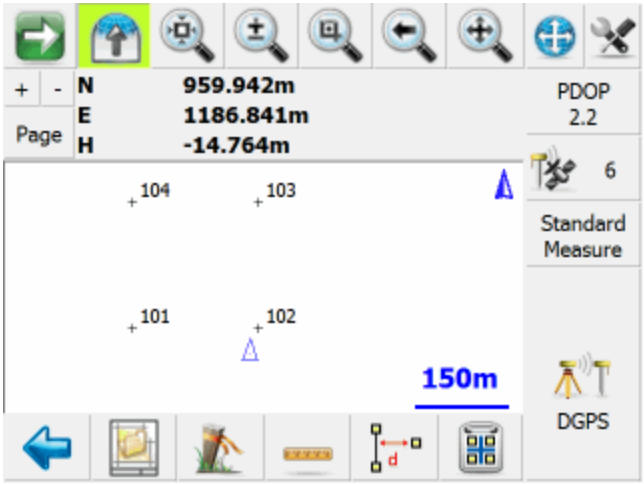


Figure 12. Layout Transformation in Effect.

The GPS measured observations at this point are still stored in the project database as a cartesian coordinate. It is sometimes beneficial to have Layout re-compute the coordinates for these points by using the Adjust button in the Transformation Settings screen. This will force Layout to scan your raw file and convert all the GPS derived points into your local system.

Local Transformation Example B

This example will investigate the process of transforming a set of existing terrestrially derived positions so that they are constrained to a set of GPS derived positions. The process of transforming points is reversed from previous discussions and will therefore imply that the GPS derived coordinates are in the plan system and the terrestrially derived positions are in the local system. Another consideration for this example is that the project area is relatively large and more than one point pair will require to be constrained to determine all four parameters and for redundancy. Determination of the transformation parameters will account for the geodetic implications of the earth's curvature and meridian convergence. The existing Layout project is illustrated in Figure 13 with the 100's series points having been established with a total station.

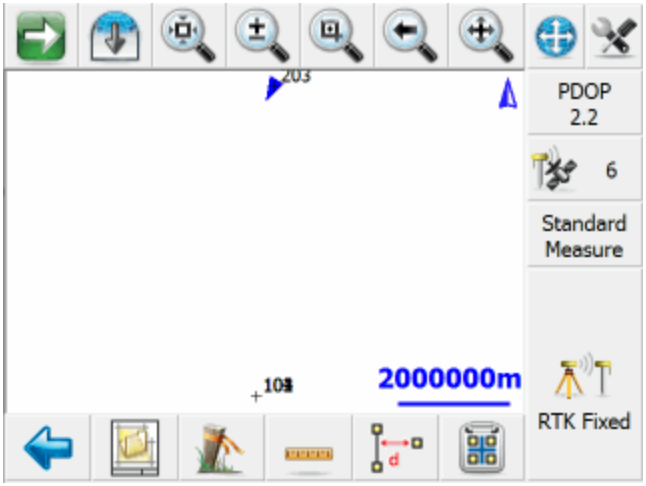


Figure 13. Layout Project with Points in the Local System.

The GPS reference station occupies a national geodetic control point and has been configured with the corresponding published coordinates. The GPS rover station is used to measure points 102, 104, 106 and 108 to establish coordinates in the plan system and these new points are respectively named 202, 204, 206 and 208 (Table 3).

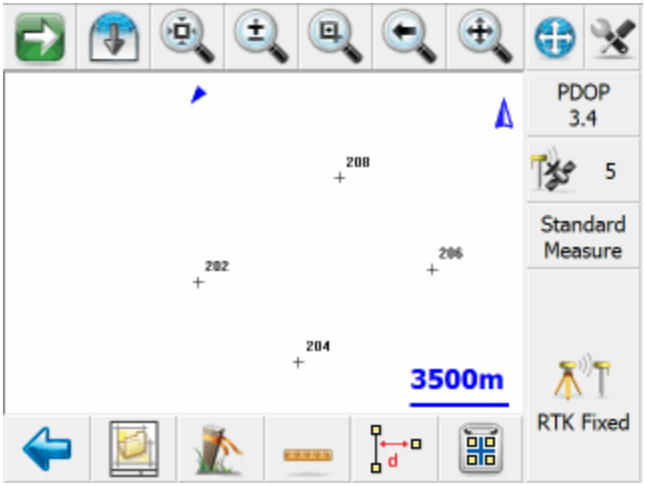


Figure 14. Layout Project with Points in the Plan System.

Local System (Conventional Points)				Plan System (GPS Points)			
Point	Northing	Easting	Height	Point	Northing	Easting	Height
101	10820.603	3060.696	383.133				
102	6765.098	1674.638	384.936	202	5516443.987	311551.600	384.94
103	3325.620	2136.657	384.589				
104	3941.646	5216.788	383.543	204	5513620.403	315093.864	383.55
105	3736.304	8810.273	383.299				
106	7227.118	9939.654	382.980	206	5516905.954	319816.969	382.98
107	11539.300	9323.628	381.795				
108	10461.255	6654.182	384.380	208	5520140.241	316531.321	384.37

Table 3. Coordinate Listing.

Now that coordinates have been established in both the plan system and local system, the Transformation Setup is started from the Point menu of Layout. Transformation Settings can be accessed from the **Main Menu | Survey Tools | GPS Local Transformation.** Figure 15 shows the Constrain page after the point pairs have been entered and their corresponding computed residuals. With four point pairs being used the horizontal transformation has a redundancy of two point pairs and the vertical transformation has a redundancy of one point pair. The residuals are within acceptable limits and do not necessitate the removal of point pairs.

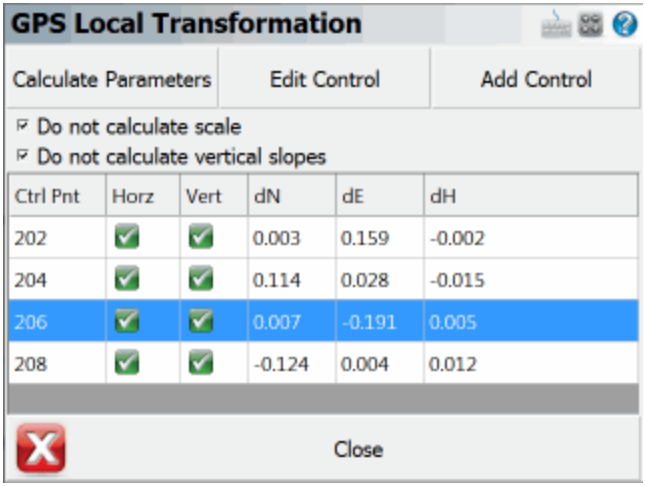


Figure 15. Layout Constrained Points for Transformation.

Viewing the Parameters page, as indicated in Figure 16, will provide feedback of the calculated horizontal and vertical transformation parameters.

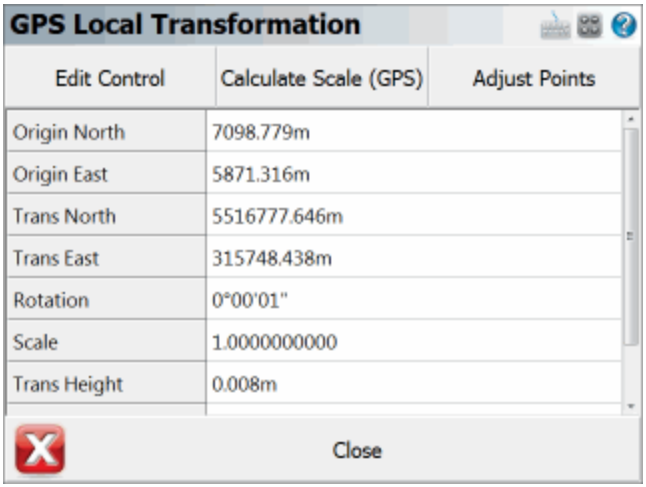


Figure 16. Layout Calculated Parameters.

Using the calculated transformation parameters the control system points (101–108) can be transformed. First you need to open the coordinate database by going to **Main Menu | Data Manager | Coordinate database.** Click the Find button and enter a point range 101-108 to select these points. The list of terrestrially derived points is entered as shown in Figure 17.

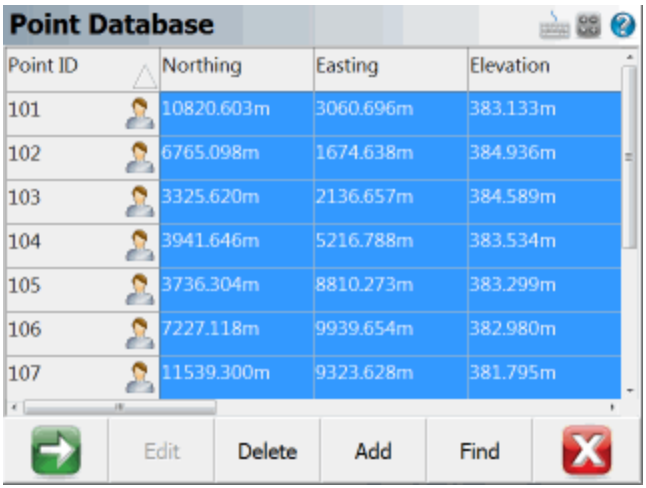


Figure 17. Transforming Existing Points to the Control System.

To apply the transformation parameters to the local points, go to the second set of buttons by pressing the **green arrow** and then the **Local Transform** button.

After successfully transforming the points 101 through 108 from the local system to the plan system which was constrained to the GPS point 202 through 208 the results can be seen in Figure 18. The diagram illustrates the matching of points 102, 104, 106 and 108 with corresponding points 202, 204, 206 and 208 respectively.

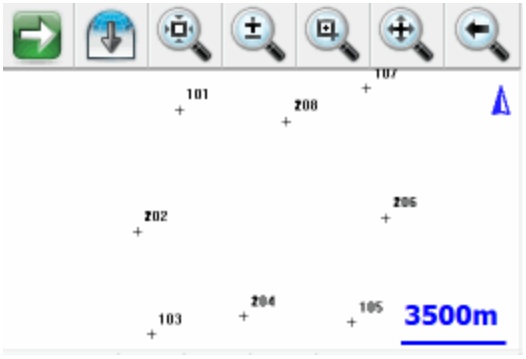


Figure 18. Results of the Transformation.

Local Transformation Example C

Two approaches can be used in applying the Local Transformation utility; parameters can be manually entered or automatically computed given a set of control points. The explanation of the use of Layout's Local Transformation is best described with an example of integrating GPS observations and terrestrial observations and using the utility to compute the parameters.

Terrestrial Observations

The example project has a local user defined system that was uploaded to the data collector. Below you will find the coordinate listing for this user coordinate system. For the rest of the example we will refer to this as the Plan System.

We will make the assumption that the plan system is to be held fixed, that is we want to transform our GPS derived UTM coordinates into the user (plan) system.

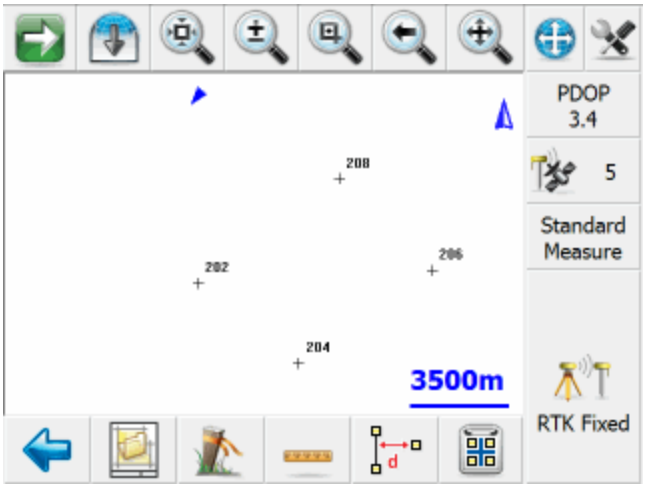
Point ID	Northing	Easting	Elevation	Description
100	4937.480	5033.487	399.387	
101	5009.092	4999.688	401.188	
102	5004.814	4977.172	400.850	
103	4975.631	4980.361	399.795	
104	4939.713	4990.346	399.552	
105	4914.671	4975.005	399.233	
106	4886.675	4988.968	398.049	
201	5002.175	4995.656	400.632	
202	5000.000	5000.000	400.665	
203	5007.341	5008.610	401.095	
204	5005.103	5020.902	400.946	
205	5013.644	4963.513	401.686	

GPS Observations

This project is going to be surveyed using a RTK system so measurement were made to some of the plan points and tagged with a new point number. The GPS derived coordinates are in the 1000 range. Their coordinates are listed below and for the remainder of this topic we will refer to this coordinate system as the local system.

Point ID	Northing	Easting	Elevation	Description
1000	5523156.277	311533.446	400.536	HUB:TEMP
1001	5523168.850	311529.902	401.204	NAIL
1102	5523164.198	311507.469	400.863	NAIL
1103	5523135.089	311511.178	399.787	NAIL
1105	5523074.026	311506.904	399.243	NAIL
1106	5523046.273	311521.362	398.068	NAIL
1202	5523159.787	311530.386	400.664	HUB
1203	5523167.281	311538.852	401.104	NAIL
1204	5523165.231	311551.178	400.957	NAIL
50	5523150.433	311520.031	399.906	MH

If you do a zoom extents in the project, you will see the two coordinate systems.



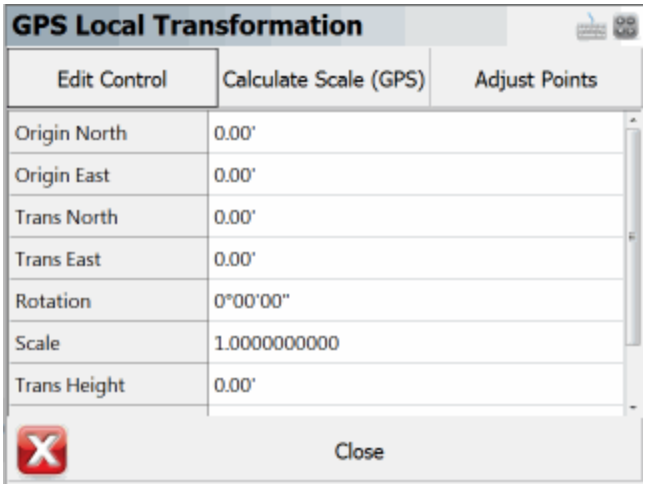
Adjustment Analysis

The program assumes the following:

The coordinates of the plan system are considered fixed and error free.

Equal weighting is applied to all "measured" coordinates in the local system that are used to calculate the solution

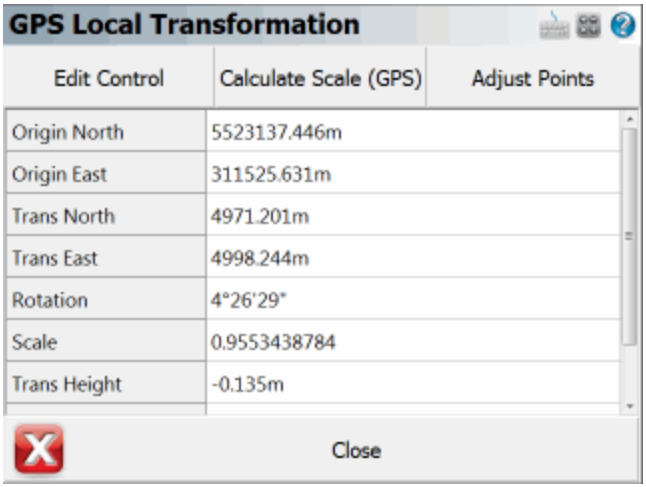
Completion of the gps observations to the control stations will produce a list of point pairs with the terrestrial determined points (100-205) being termed control points and the GPS determined points (1000-1204) being termed local points. The computed transformation parameters will provide the transformation to go from measured local points to resulting plan points. The transformation utility in Layout is started by going to the **Main Menu | Survey Tools | GPS Local Transformation** button.



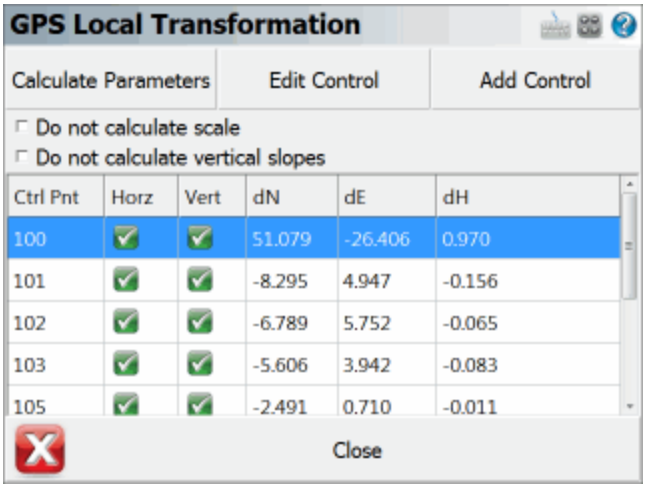
To begin computing the transformation you need to define the point pairs. You can do this by pressing the **Edit Control** button which will open the point pair's screen. Use the Add Control button to add control points to the list and to define the measured coordinate the control point should be constrained to. Note: Control points are points that reside in the plan system and are considered to be fixed.

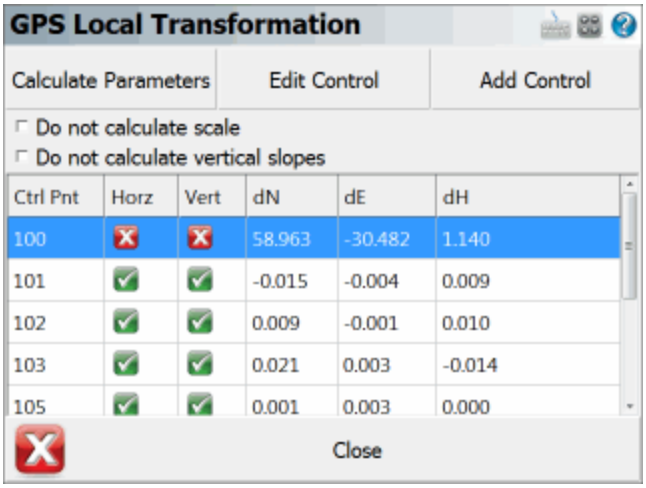
In this example, control points 100, 101, 102, 103, 105, 106, 202, 203, and 204 were paired with the measured local points 1000, 1001, 1102, 1103, 1105, 1106, 1202, 1203, and 1204 respectively.

After all of the control station pairs have been entered, you need to compute the transformation parameters. To update the grid of the constraint pairs so it displays the transformation parameters and residuals, press the **Calc Parameters** button. You will see the transformation parameters update with new values. Instantly we can tell that there is a mistake with one of the point pairs as the scale value should be closer to a value of 1.

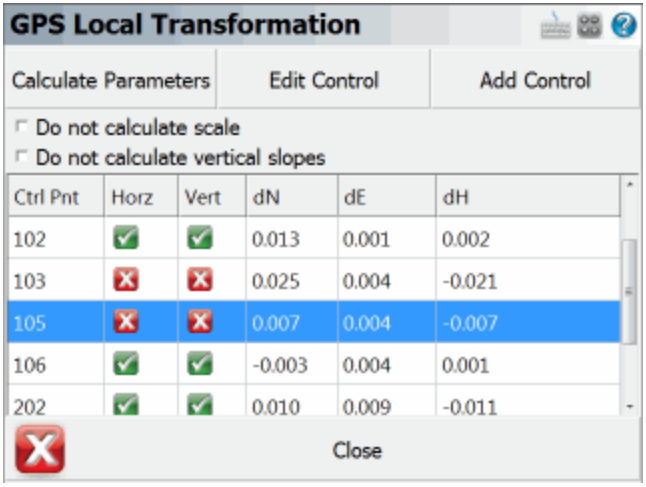


Upon returning to the control point list you will notice that the delta northing is large for the first point pair, so let's exclude it from the solution by turning off the green checkmarks. Highlight row 100 then press **Edit Control** and uncheck the Horizontal and Vertical options. Once you do this you will have to use the **Calc Params** button again to compute a new solution. In our example that helped tighten up the residuals.





Enabling or disabling constraints in either the horizontal or vertical components for determining the transformation parameters is done with the **Edit Control** button. The last three columns of dN, dE and dH represents the residuals between the control coordinates and the transformed local (measured) coordinates in northing, easting and height.

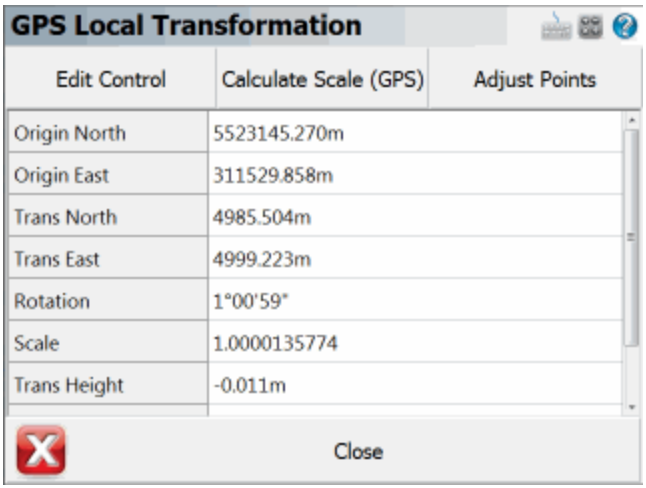


Since this network is over constrained, it is possible to reserve a couple of point pairs as check values in testing the parameters of the horizontal transformation. Pairs 103/1103 and 105/1105 have been randomly selected as test pairs and have been deselected as constraints in the horizontal and vertical component.

These two test pairs will not be used in the computation of the horizontal transformation parameters but the transformation parameters will be applied to the measured points (1103 and 1105) to produce the residuals as shown. In this case we see that the residuals are acceptable and thus it can be assumed that the determined transformation parameters are reliable.

Adjustment Results

Upon satisfaction of the applied constraints and relevant residuals, the transformation parameters can be viewed or modified. As indicated in Figure 9, the four horizontal transformation parameters (translation in northing, translation in easting, scale and rotation) and the three vertical transformation parameters (bias, slope in X, and slope in Y) are shown in the grid list.



When you press the **Calc Parameters** button it uses the point pairs that you've defined to calculate the transformation parameters. The values that are computed can be modified by the user. You can do "what if" scenarios by changing any of the values and checking the residuals on the control screen. You can always revert back to the default calculated values by pressing the **Calc Parameters** button again.

The number of horizontal transformation parameters can be decreased to three from four by fixing the scale to unity using the Do not calculate scale check box.

For the vertical component the determination of the parameters can be reduced to solving only for a vertical translation by toggling the parameter "**Do not calculate vertical slopes**". Upon enabling this, the parameters North Slope and East Slope will be automatically set to zero.

ROADING REFERENCE

Roads

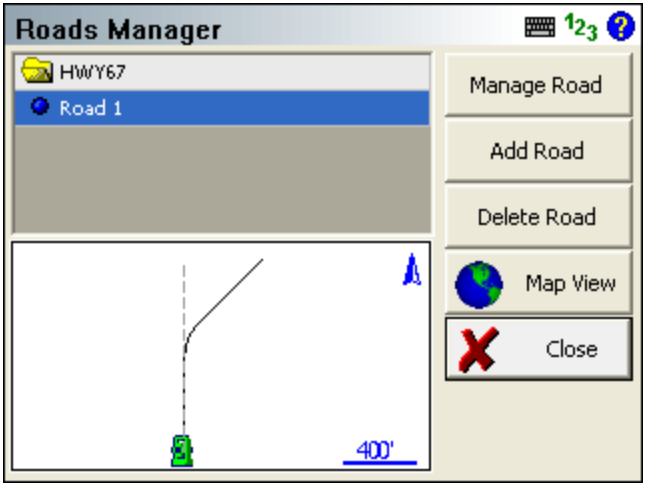
Roads Manager

Main Menu | Roads Manager

To stake an alignment you first need to define the geometry that defines the horizontal and vertical element. You can also define a template that will be used to define cross sections at specific stations along the alignment.

Layout can use the following three methods to define an alignment.

1. Manual Entry – You can manually enter the data to define the alignment.
2. Import XML – You can import a LandXML file that contains your alignment data.



By default you will see an alignment in the list with the current project name. A project can contain multiple roads, and each road can contain the following elements.

- **Horizontal Element:** This can contain straight tangents, curves and spirals.
- **Vertical Element:** This can contain grade breaks, parabolic curves and non-symmetrical curves.
- **Templates:** Template can contain horizontal and vertical offsets, as well as widening and super elevation data.

- **XML Cross Sections:** XML cross sections define specific stations along an alignment. These sections contain horizontal, vertical and template data. XML cross sections are created using desktop software which is then imported into Layout.

Manage Road

This option is only available once you've created a road using the New Road button or imported an XML file. To input or review alignment data, press the Manage Road button to access the Road Settings screen.

If you imported a LandXML file, or manually inputted a road you can stake it by pressing this button. As a minimum you need to have the following before the stake command will continue.

- XML Cross sections
- Horizontal C/L, Vertical Profile and template.
- Horizontal C/L and DTM Surface

Add Road

Use this button to create a new road. You can create as many roads as needed and they will be stored in an XML file that will reside is the project directory.

Delete Road

Use this to delete a road. You first need to highlight the road you want to delete, and then press the button to remove the road from the alignment. This road will be permanently deleted and can not be undone.

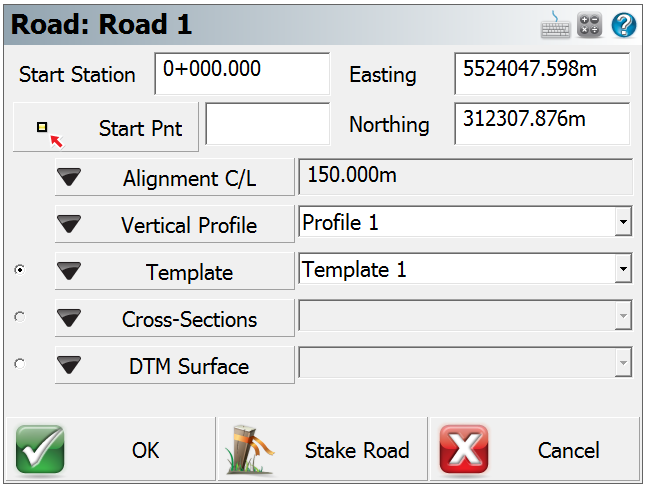
Map View

Use this button to display the map view. From this view you can use the zoom controls to zoom around your drawing so you can find important or relevant data for your alignment such as a POB point. Press the Close View button to return back to the Roads Manager.

Tell me more about ...
Road Settings
Manua Entry - Alignment C/L
Manual Entry - Vertical Profile
Manual Entry - Template
LandXML Cross Sections
Alignment DTM Surface
Alignment Staking - Part 1
Alignment Staking - Part 2
Alignment Slope Staking

Manage Road

The road settings screen is used to help you create, review or modify road elements.



From this screen you can do anyone of the following:

- Define start station
- Define start point or start coordinates
- Define the horizontal element
- Define the vertical profile
- Choose either a template or XML cross sections
- Choose an optional DTM surface

Define Start Station

Each road has to have a starting station defined. The starting station will place the station sign automatically for you after you enter the station. Stations generally are measured in 100 foot intervals when working in feet, and measured in 1000 metre intervals when in metric projects.

There are three station format settings that you can choose from: 0+000.000, 0+00.00, or 0.000. You can change this by going to the Main Menu | Settings | Options or by pressing the **Alignment C/L** button and selecting **Settings**.

Note: Positive or negative start stations are valid.

Define Start Point or Coordinates

Every road that you create needs to have a starting location defined. You have two options available to define this location.

Start ID

If you have a point stored in your project's database that is also the start point for the alignment, you can use this point as the start location. Simply enter the point number in the **Start Pnt** field, or use the point chooser to select it from the map. Once you've selected the point, the point's Northing and Easting values will be displayed. At this point, the elevation is not needed because the profile is what defines the elevations along the road.

When you use the point chooser or enter a point id, all that will happen is the coordinates for the point are written to the alignment file. The next time you open the alignment file, you will no longer see the point ID that was used, you will only see the coordinate values.

Enter Coordinates

If you don't have a point that defines the start location, you can define it by entering a Northing and Easting value. You have to leave Start ID field blank if you want to enter coordinates.

Manual Entry - Alignment C/L

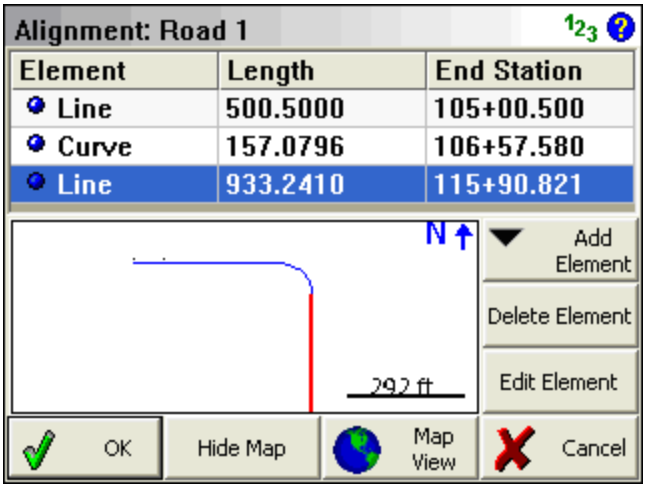
Main Menu | Roads Manager | Edit Road | Alignment C/L

To define the centerline data press the **Alignment C/L** button which will open a menu. On this menu select **Edit** to open the C/L Editor.

If you're entering a new road the C/L Editor will not have any elements listed. In the example shown below there are three elements defined; 2 tangents and 1 curve element. In the element list, it will always display the length of the element and its end station. Furthermore, all elements that are defined will be displayed in the Map so you can visually confirm that the geometry is correct.

Delete C/L Alignment

You can not delete a C/L Alignment once it has been created.



The C/L Editor can display a view of the map along the bottom. This view can be toggled on and off by pressing the **Show Map/Hide Map** button.

If you would like to zoom into or pan around the map, press the **Map View** button which will display zoom and pan controls. Press the Close View button when you want to return the C/L Editor.

Adding an Element

To add an element to a road you need to use the **Add Element** button. Once you press this you will see 5 options appear that will help you define the different elements supported by Layout.

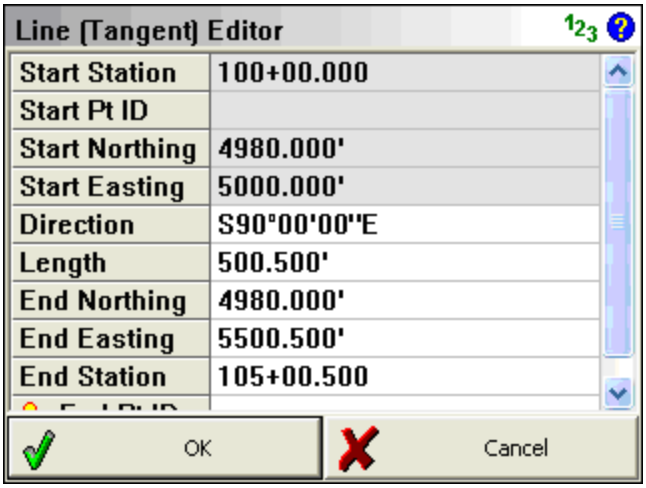
- Line (Tangent)
- Curve
- Spiral
- Spiral-Curve-Spiral
- Chain

Tip: When you're prompted for a distance or direction, you can always use the distance and direction recall features just like you would for COGO calculations.

Line (Tangent) Element

In the Line Element editor, gray fields indicate fields that can not be edited. All other non gray fields can be edited by the user. When you enter your known values and have confirmed their correctness, press OK to save these values, or press Cancel to exit without saving.

A tangent is defined by a direction and length. There are four ways you can define the tangent and they are explained in further detail below.



Direction and Length

If you know these two values, you can enter them in their respective fields. You will see that the end coordinates and end station will be computed automatically.

End Nothing and End Easting.

If you know the coordinates for the end of the tangent, you can enter them in the End Northing and End Easting fields. Once you've done this, the direction, length and end station fields will be updated automatically.

Direction and End Station

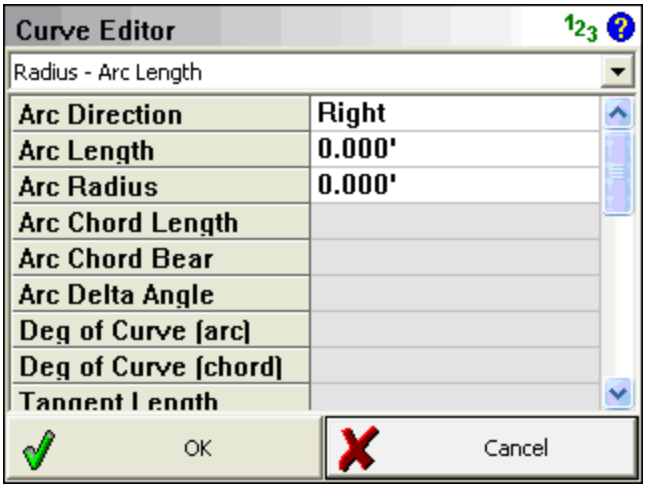
If you know the direction and end station of the tangent, enter these known values in their respective fields. Once you've done this, the length and end coordinate fields will be updated automatically.

End Point ID

If you have a point in the project database that defines the end of the tangent, you can enter the point number in the ID field, or use the point chooser to select it from the map. Once you've done this, the direction, length, end coordinates and end station fields will automatically be updated.

Curve Element

When you select this option your will see the curve editor with most of the fields being empty.



Define Known Data

You first have to define what known information you want to use to compute the curve. If you click on the drop down list you will see a list of all the options that can be used to compute the unknown values.

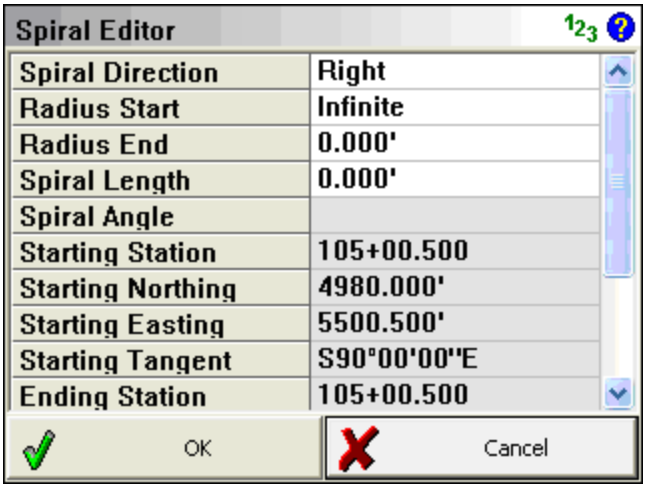
Enter the Known Data

Once you define the known data format, you will see grayed out fields which indicate they can't be edited. White areas indicate fields that can be edited, and these fields will match what you defined in the first step.

1. You always have to define the direction for the curve, either right or left.
2. Enter your know values.
3. You don't have to specify the PC point, the function will assume that you're beginning at the end of the last leg.
4. A PC Tangent direction will automatically be computed based on the previous tangent. You can always over ride this value if you need to define a non-tangent curve.
5. Press **OK** to save your inputted values, **Cancel** to exit without saving.

Spiral Element

When you select this option your will see the spiral editor. This will help you define a spiral segment for your alignment.



Define Known Data

To solve for this type of element you need to know:

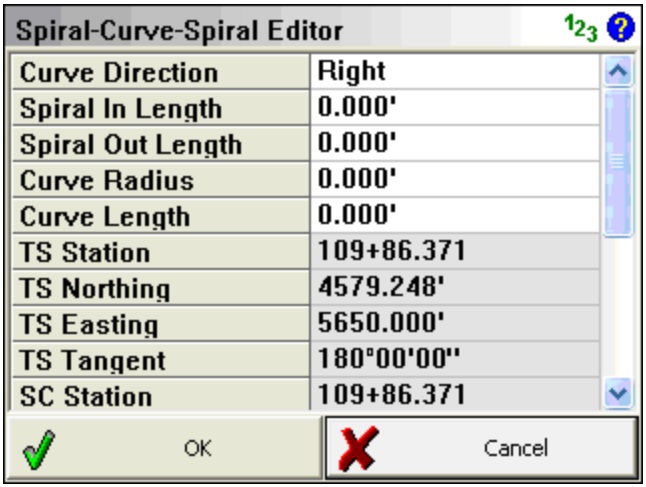
- Spiral Direction
- End Radius
- Spiral Length

In the editor, gray fields indicate fields that can not be edited. All other non gray fields can be edited by the user.

Press **OK** to save your inputted values, **Cancel** to exit without saving.

Spiral – Curve – Spiral

When you select this option you will see the Spiral – Curve – Spiral editor.



Define Known Data

To solve for this type of element you need to know:

- Spiral Direction
- Spiral In Length
- Spiral Out Length
- Curve Radius
- Curve Length

In the editor, gray fields indicate fields that can not be edited. All other non gray fields can be edited by the user.

Press **OK** to save your inputted values, **Cancel** to exit without saving.

Chain

Use this option if you want to select points or figures in your drawing to define the centerline and the profile (optional).

When you select the **Add Figure** option you will be taken to the map screen where you can select a figure.

You can also add points individually by using the **Add Points(s)** button.

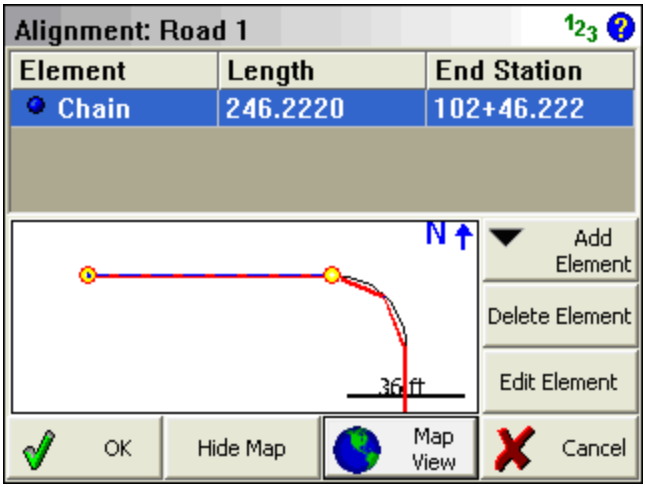
Press **OK** to save the chain, press **Cancel** to exit without saving.

Note:

You should only select Tangent sections for a Chain. If you Add a Figure which contains arcs or splines, the chain will straight-line any curved segments, so the resulting Chain length and stationing will not be the same as the original Figure.

Chain Element

When you return to the road editor you will see that a chain element has been created. Chain elements differ from regular elements in that even though a chain can be made up of line and curve elements, it will appear in the list as a chain.

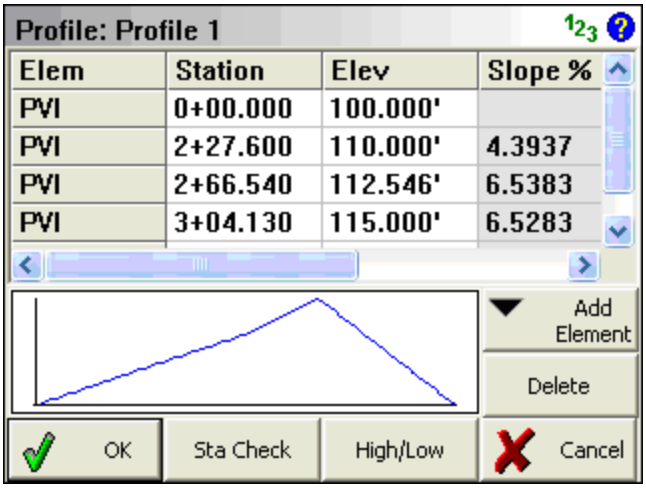


Auto Profile

After you press OK, you will be asked if you would like to create a vertical profile based on the chain point's elevation. If you select Yes, then you will be prompted for a Profile Name.

Vertical Profile

As mentioned above, a vertical profile can optionally be created automatically. If this option is chosen by the user, PVI points will be created for the profile. Each PVI point represents the points that make up the chain.



Manual Entry - Vertical Profile

Main Menu | Roads Manager | Edit Road | Vertical Profile

To create your vertical profile for your alignment, press the **Vertical Profile** button. When you do this you will see two options: New and Edit. Press **New** to create a new profile. If you want to edit an existing profile, then you need to select the profile, and then press the **Edit** button.

Delete Profile

You can not delete a profile once it is created.

Profile Editor Overview

When you create a new profile you will see the profile editor. The **Add Element** button is the command center for you profiles and it allows you to add profile elements:

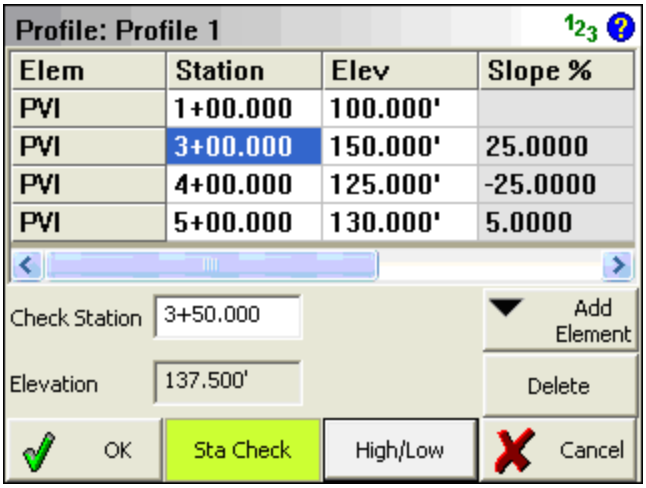
- PVI
- Parabolic Curve
- Unsymmetric Parabolic Curve

Once created, you can always edit and delete each element.

Station Check

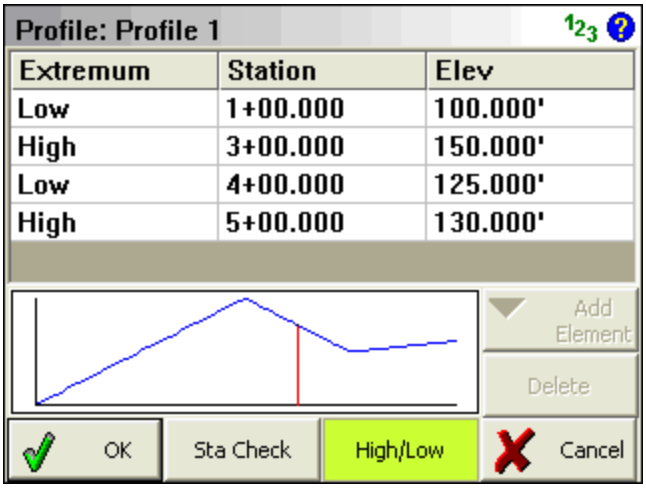
Use this button to calculate an elevation along your vertical profile at the station you define. In the example below you will see the station entered was 3+50, and the computed elevation is 137.50.

The station check button can be used with all vertical element types.



High / Low Display

When you use the High / Low button it will compute the high and low points for your vertical profile.

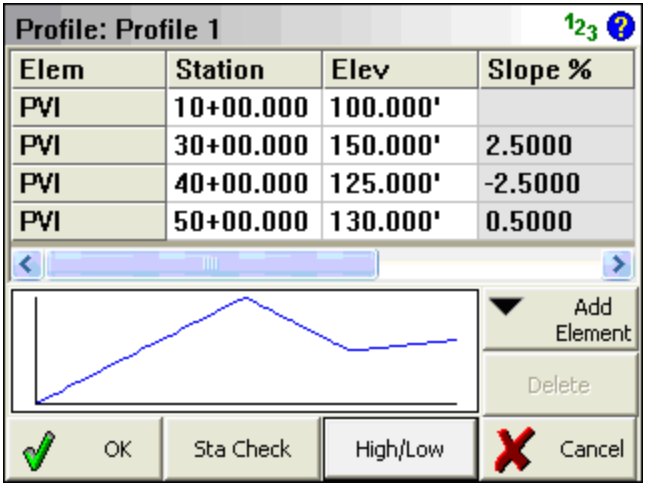


In the example above you can see that the high and low points are listed in the grid. This option can be used to display the high / low information for all vertical profile elements.

PVI Element

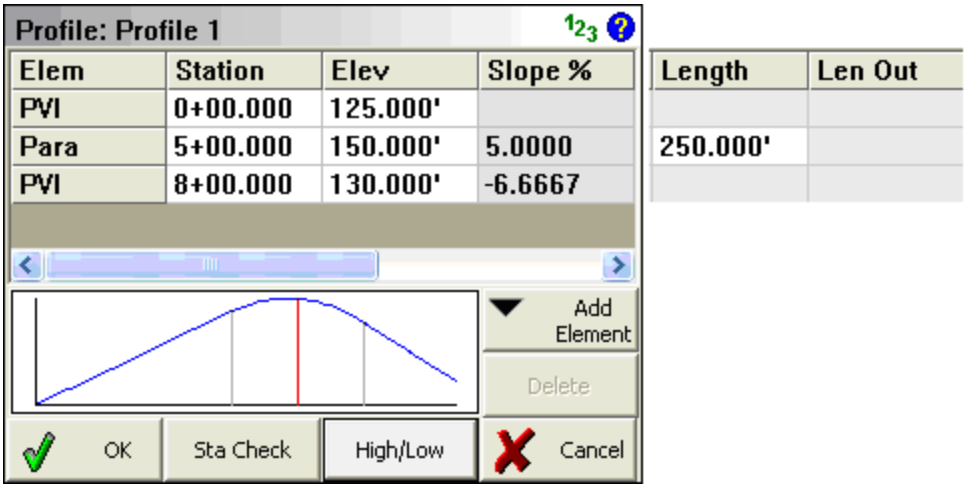
PVI elements are essentially straight grade segments that change direction at grade breaks. Each grade break (PVI) has to be defined by a station and elevation.

When you select to add a PVI element you will have two fields available where the station and the elevation at that station can be entered. Once you have a minimum of two PVI points, the slope of the line will be displayed.



Parabolic Curve Element

This option allows you to enter an equal tangent vertical parabolic curve. At a minimum you need to know the **PVI Station**, **PVI Elevation**, and **Curve Length** for your vertical curve. Furthermore if this is a new profile you need to define a PVI point before the vertical curve, as well as define a PVI, Parabolic, or Unsymmetrical Parabolic curve after the vertical curve. Elements are needed before and after the vertical curve element so the profile editor can calculate the tangents.



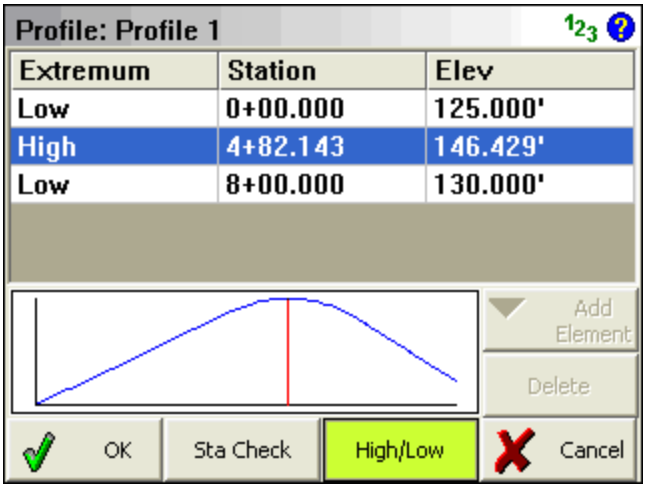
In the example you will see that a PVI was established for the beginning of the vertical profile. Then the PVI for the vertical curve was defined, as well as another parabolic curve. You will also notice that if you click a Para element, its location will be displayed in the display area.

Station Check

You can also do a station check on a parabolic vertical curve. Simply press the Sta Check button and enter the station you would like to compute an elevation for.

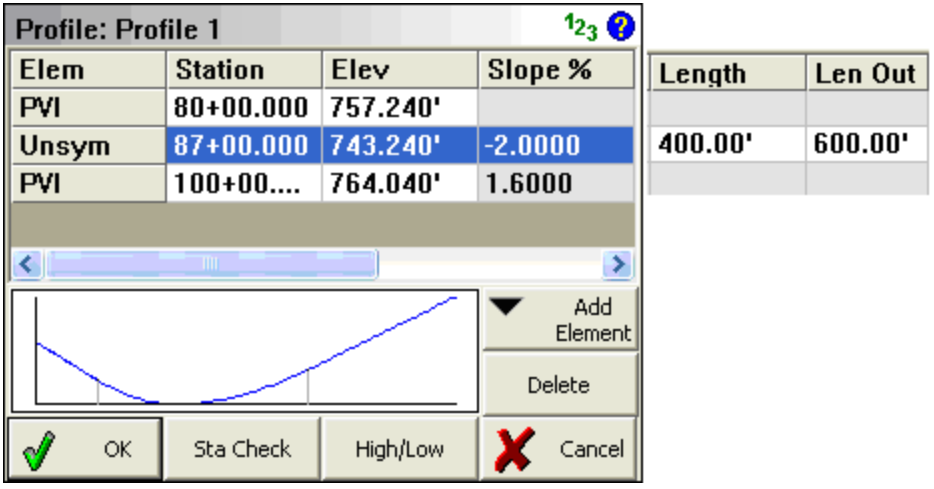
High / Low Calculation

With all vertical curves, the high or low point can be computed. For example, if we use the High/Low button to compute this information you will see the high point is at station 4+82.143 at an elevation of 146.429'.



Unsymmetrical Parabolic Curve Element

This option allows you to enter an unequal tangent vertical parabolic curve. As a minimum you need to know the **PVI Station**, **PVI Elevation**, **Curve Length In**, and **Curve Length Out** for your vertical curve. Furthermore if this is a new profile you need to define a PVI point before the vertical curve, as well as define a PVI, Parabolic, or Unsymmetrical Parabolic curve after the vertical curve. Elements are needed before and after the vertical curve element so the profile editor can calculate the tangents.



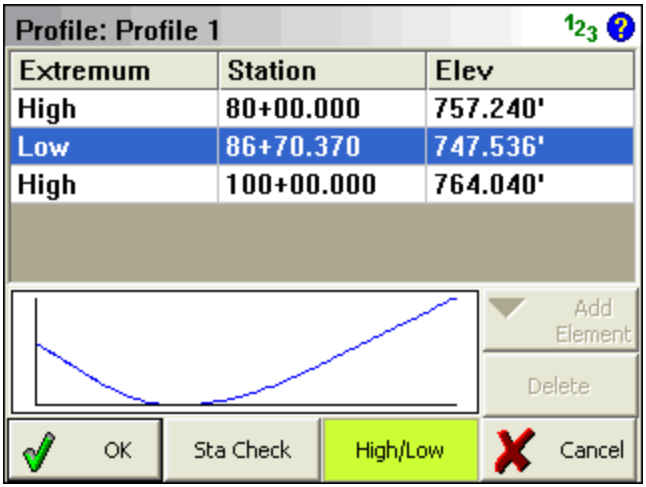
In the example you will see that a PVI was established for the beginning of the vertical profile. Then the PVI for the unsymmetrical vertical curve was defined, as well as another PVI element. You will also notice that if you click an Unsym element, its location will be displayed in the display area.

Station Check

You can also do a station check on an unsymmetrical vertical curve. Simply press the Sta Check button and enter the station you would like to compute an elevation for.

High / Low Calculation

With all vertical curves, the high or low point can be computed. For example, if we use the High/Low button to compute this information you will see the low point is at station 86+70.370 at an elevation of 747.536'.

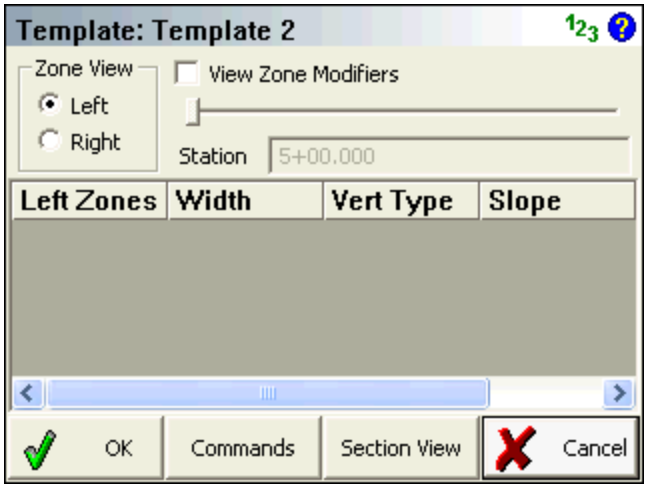


Manual Entry - Template

Main Menu | Roads Manager | Edit Road | Template

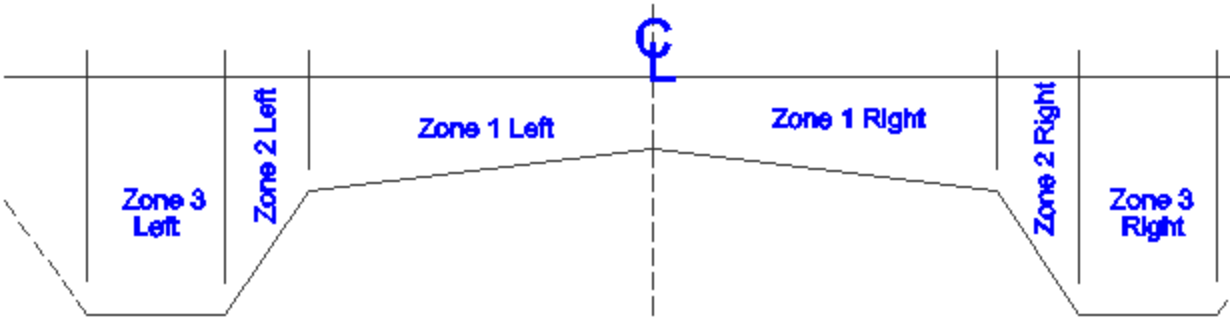
You can define templates that will be used to create a cross section along your alignment. You can create new templates, and edit existing ones you've created. Each template can have unlimited zones right or left of the centerline. Each template can contain zone modifiers that can help you define sections that need widening or superelevation.

When you create a new template you will be asked for a template name. After you enter the name you will see the Template editor.



Add Zones

Many software programs refer to templates as having segments, in Layout they are referred to as zones. Zones contain horizontal and vertical components, and these zones are located on the right or left of the template centerline.

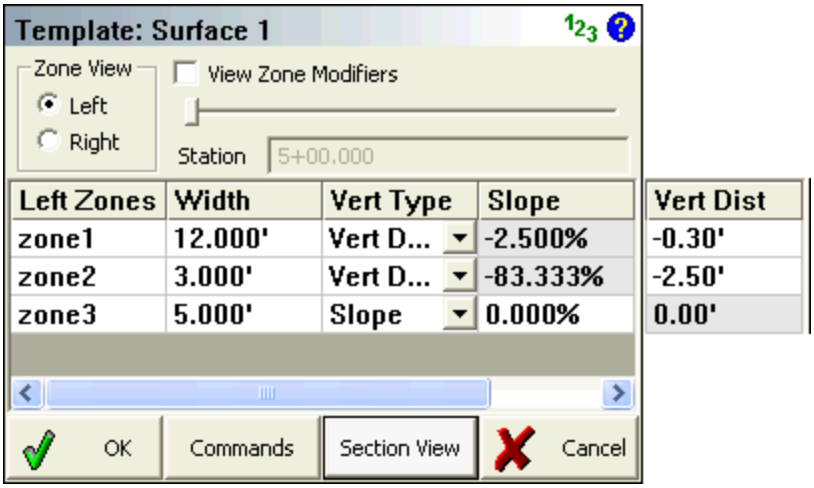


You first need to define what side of the centerline your zone belongs to: **Left** or **Right**.

Once you do that you can choose the **Add Zone** command from the **Commands** button.

When you select the add zone command you will see your first zone item appear in the grid area. You need to enter a horizontal width distance and then specify how you will be defining the slope for the zone. The slope for the zone can be defined by entering a slope value (%) or a vertical distance also referred to as a delta Z. In the example shown below you will see that three zones have been defined for the left side of the template.

By default all new zones are attached to the zone found furthest from the centerline.



Delete Zones

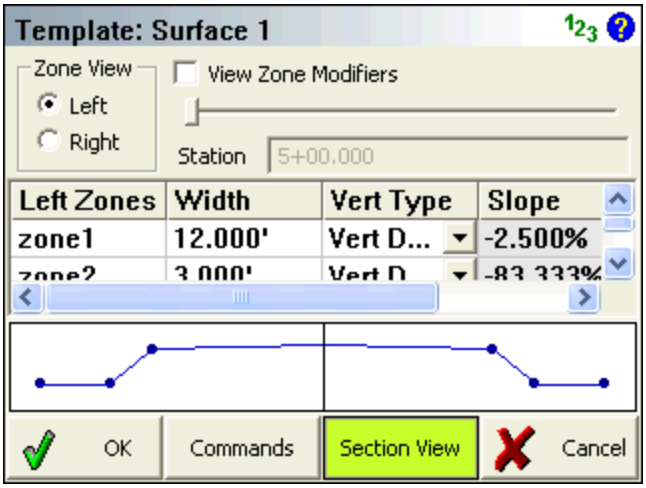
Any zone that is highlighted in the zone list can be deleted by using the **Delete Zone** command. There is no undo, so be careful when you use this command.

Clear All

At any time, you can clear the zone list so you can start over. To do this use the **Clear Zone** command. There is no undo, so be careful when you use this command.

Mirror Zones

There are two variations of this command. You can mirror your zones from left to right, or right to left. In our example from above, when the **Mirror Left to Right** command is used, the zones are duplicated on the right side of the template.



Note: Depending on what side you're displaying, you will only see the zones listed for that side of the template. To see the zones for the other side you need to change to the opposite side using the Left Zone and Right Zone buttons.

Move Zone

Zones can be shifted around by moving them in or out form the centerline. To do this, use the **Move In** and **Move Out** commands.

View Zone Modifiers

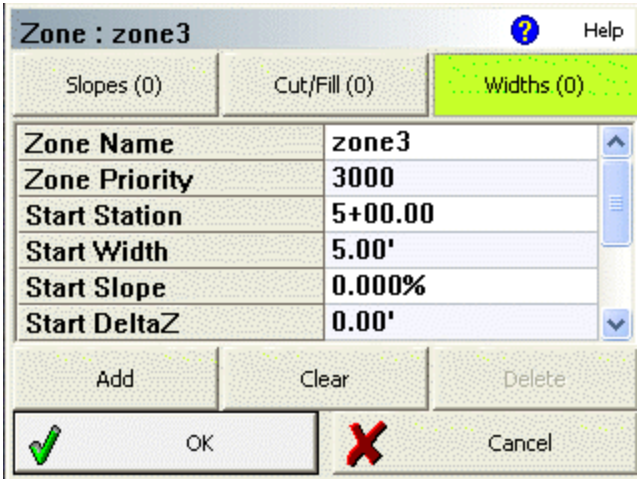
The template you define is a typical cross section for the entire alignment. You can define changes to the template at specific stations and these changes are referred to as **Zone Modifiers**. Zone modifiers modify the typical template to allow for deviations such as road widening and super elevations.

This tool is meant to be used when you've defined zone modifiers. Please see the advanced template editing for more information.

Advanced Zone Edit

Advanced editing of your zones is available to give you even more power and flexibility. Being able to modify the zones at specific stations, allow you to create template transitions, widenings and super-elevation transitions.

You first need to highlight the zone you want to modify in the zone list. Once you do that press the **Advanced Zone Edit…** command. This will then display the zone editor for the zone you've selected, in this example it is zone 3.



By default when you create a zone, the width, delta elevation and slope are used from the beginning of the zone to the end. The start and end stations are determined by start and end station defined in the horizontal alignment.

Slopes Modifier

When you use this button you will see the slope modifier page. On this page you can define different modifiers that change the slope or delta Z value for the zone.

Cut/Fill Modifier

When you use this button you will see the cut/fill modifier page. On this page you can define different modifiers that change the cut / fill value for the zone.

Note: This function is currently not implemented fully and is reserved for a future version. Cut/Fill Slope values from the hinge point can be set in the Options screen.

Widths Modifier

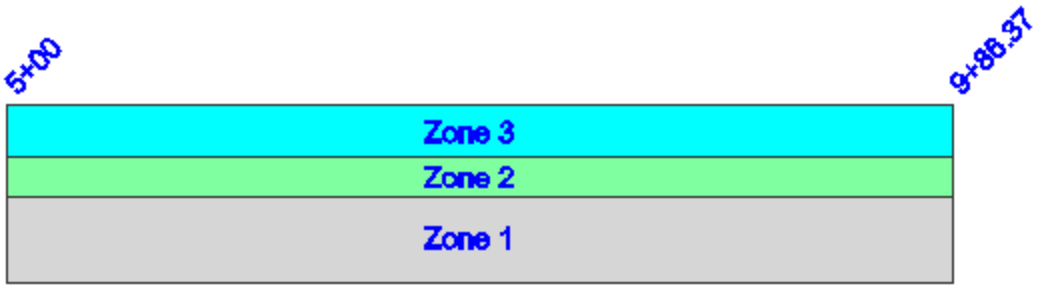
When you use this button you will see the widths modifier page. On this page you can define different modifiers that change the width value for the zone.

Advanced Template Editing

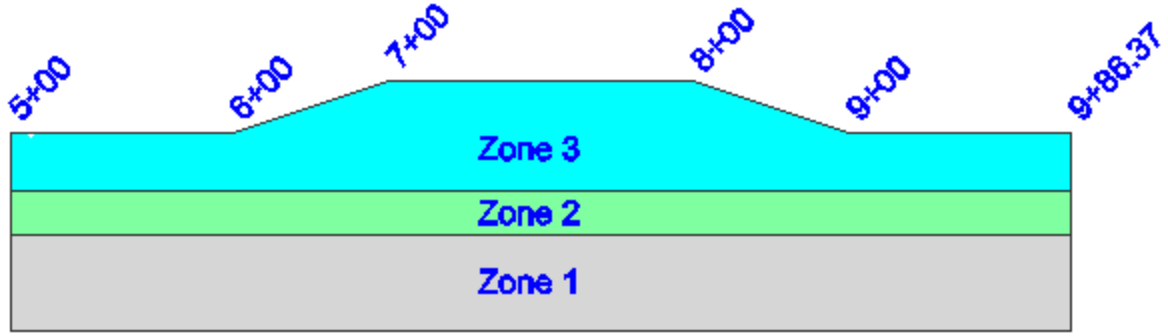
Advanced Zone Edit – Widening Example

In this example we will use the template example from the Template section. We want to widen the template at a specific station and change the grade of the template.

The original zone 3 has a constant elevation and width from beginning to end, but we want to modify it to include a section that has a slope and width difference.



The new zone 3 will look like the following example. From station 6+00 to 7+00 the width of the zone transitions from a width of 5' to 10' and the elevation transitions from 0 down to -2'. Then from station 8+00 to 9+-00 it transitions back to the normal width and grade.



Slope Modifier

First you need to highlight the zone that you want to add modifiers to.

Then select the **Advanced Zone Edit** command from the commands button. This will open the zone modifier screen for the zone. In our example, we'll be modifying zone 3 on the left side of the template.

To add slope modifiers, press the **Slopes (#)** button. From here you can press the Add button to add modifiers for the zone. The following table shows the information that would have been inputted.

You have to define if you are entering a relative vertical change, or want Layout to compute it for you using a slope percent and horizontal distance for the zone. You can do this by selecting the Vert Type and set it to Vertical Distance or Slope.

Start Station	Start Slope	Start Delta Z	End Station	End Slope	End Delta Z
6+00	0.0%	0.00	7+00	-20.0%	-2.00
7+00	-20.0%	-2.00	8+00	-20.0%	-2.00
8+00	-20.0%	-2.00	9+00	0.0%	0.00

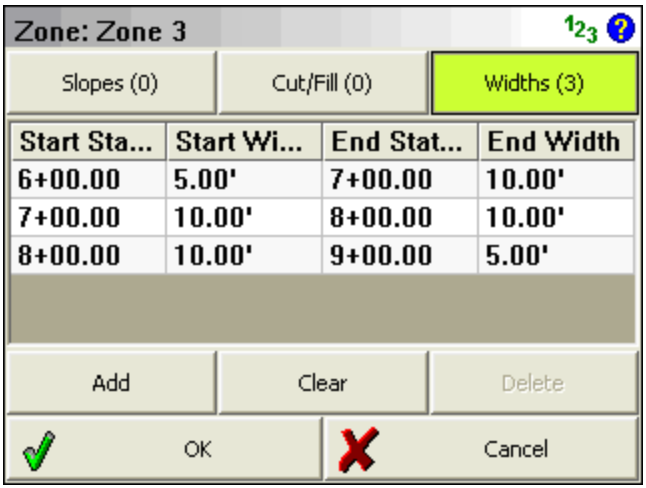
Press **Ok** to save the modifiers.

Widths Modifier

First you need to highlight the zone that you want to add modifiers to.

Then select the **Advanced Zone Edit** command from the commands button. This will open the zone modifier screen for the zone. In our example, we'll be modifying zone 3 on the left side of the template.

To add width modifiers, press the **Widths (#)** button. From here you can press the Add button to add modifiers for the zone. The following table shows the information that would have been inputted.

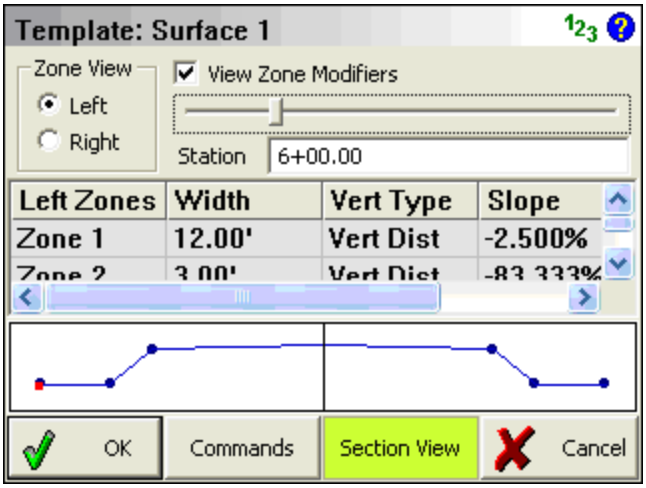


Press **Ok** to save the modifiers.

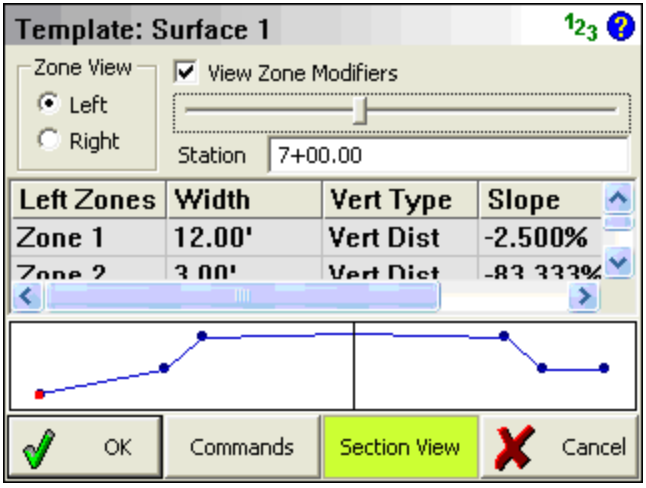
Checking Width Modifiers

At any time from the Template editor you can confirm that your modifiers are correct by using the station slider.

If we use our example from above, and want to preview the template at station 6+00, you can do so by entering it in the station field.



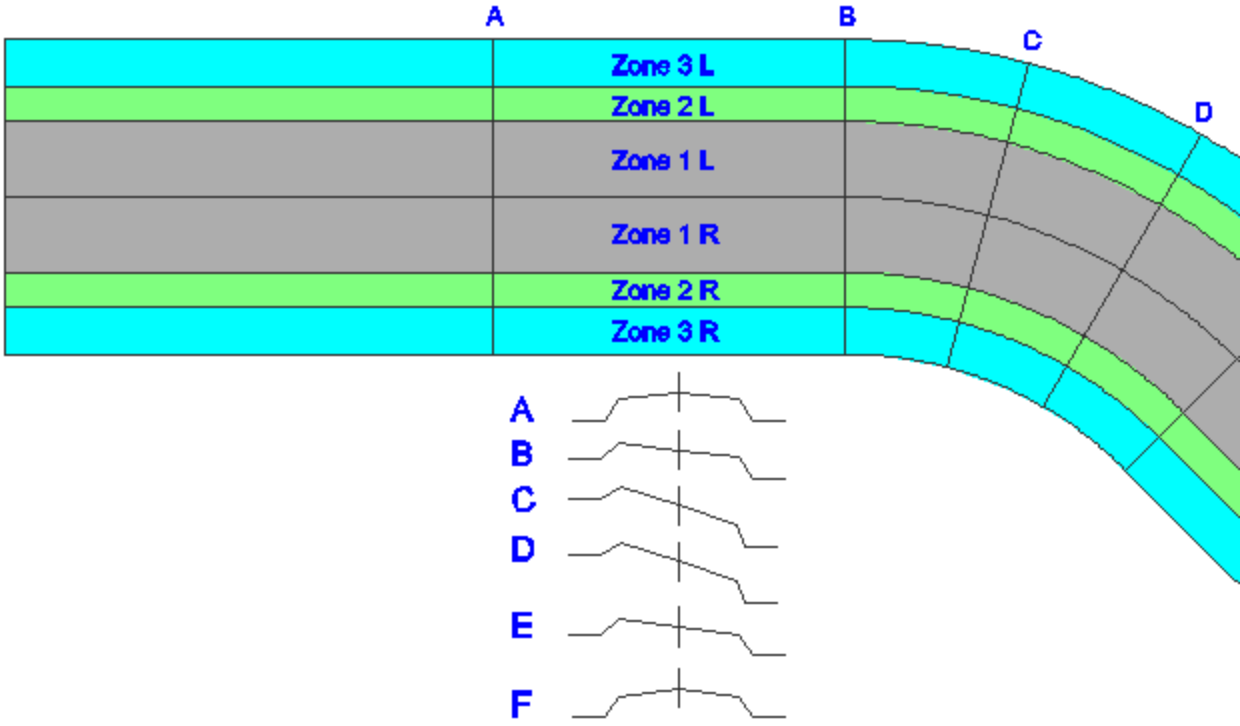
If we check station 7+00 you will see that the zone now extends further and drops down.



Advanced Zone Editing – Superelevation

In this example we will use the template example from the Template section. We want to add superelevation data to our template so it can be staked in the field. Layout can not calculate superelevations; you need to know what delta z or slope the zone should be transitioning for your superelevation section.

To do this we will be adding slope modifiers to Zone 1 L and Zone 1 R.



Labels A to F show the stations where we will be adding modifiers to modify the template so the road transitions from normal crown to full superelevation and back. **Note:** In this example the superelevation is exaggerated for ease of viewing.

Slope Modifier

First you need to highlight the zone that you want to add modifiers to.

Then select the **Advanced Zone Edit** command from the commands button. This will open the zone modifier screen for the zone. In our example, we'll be modifying zone 3 on the left side of the template.

To add slope modifiers, press the **Slopes (#)** button. From here you can press the Add button to add modifiers for the zone. The following table shows the information that would have been inputted.

Left Side Zone 1					
Start Station	Start Slope	Start Delta Z	End Station	End Slope	End Delta Z
900	-6.7%	-0.80	1000	6.7%	0.80
1000	-13.3%	-1.60	1078.54	13.3%	1.60
1078.54	-26.7%	-3.20	1157.08	13.3%	1.60
1157.08	-26.7%	-3.20	1235.62	6.7%	0.80
1235.62	-13.3%	-1.60	1300	-6.7%	-0.80

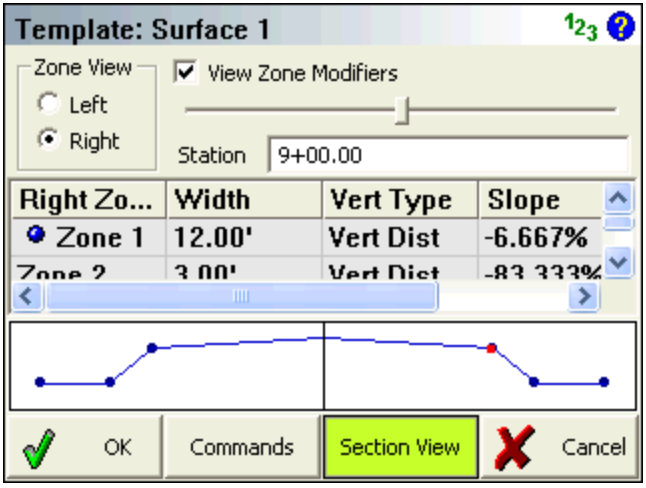
Right Side Zone 1					
Start Station	Start Slope	Start Delta Z	End Station	End Slope	End Delta Z
900	-6.7%	-0.80	1000	-13.3%	-1.60
1000	-13.3%	-1.60	1078.54	-26.7%	-3.20
1078.54	-26.7%	-3.20	1157.08	-26.7%	-3.20
1157.08	-26.7%	-3.20	1235.62	-13.3%	-1.60
1235.62	-13.3%	-1.60	1300	-6.7%	-0.80

Press **Ok** to save the modifiers.

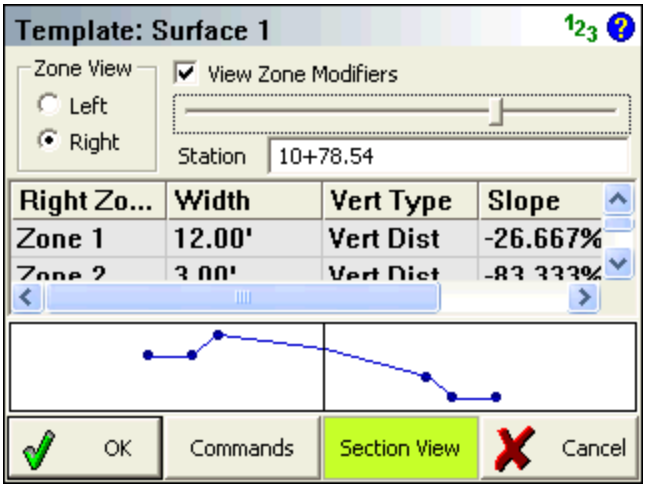
Checking Width Modifiers

At any time from the Template editor you can confirm that your modifiers are correct by using the station slider.

If we use our example from above, and want to preview the template at station 9+00, you can do so by entering it in the station field. You will see at this station we have a typical road cross section.



If we check station 10+78.54 you will see that we are at the full superelevation section.

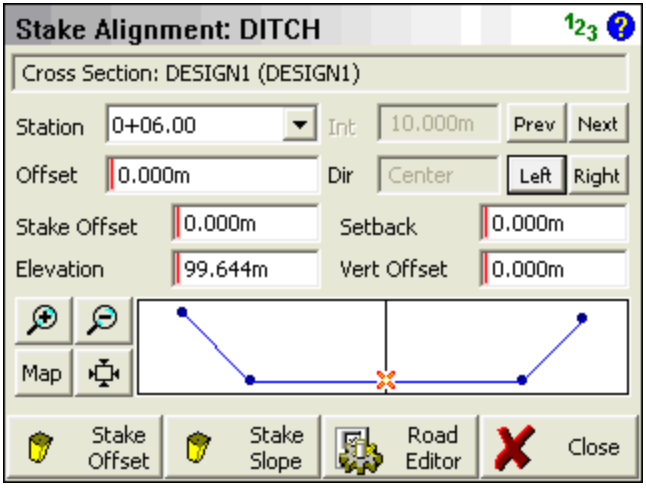


LandXML Cross Sections

Main Menu | Roads Manager | Edit Road | Cross-Sections

LandXML cross sections are created with desktop software such as Eagle Point, Caice, LDD and many others.

If you import a LandXML file that has cross sections in it, you can immediately go to the Roads Manager and select the road to stake. You will see the roads in the Cross-Sections list. Choose one, then press the Stake Roads button you will see the stake Alignment screen.



Please see the Stake Alignment section for more information about using this command.

Alignment DTM Surface

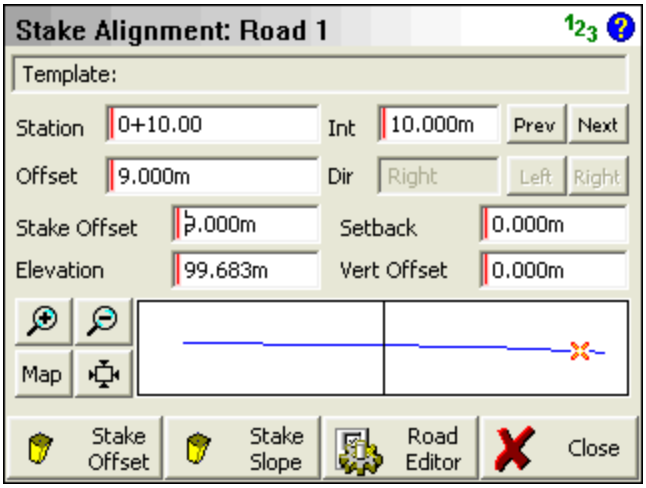
Main Menu | Roads Manager | Edit Road | DTM Surface

If you've imported a surface file, either through the QSB or LandXML importer, you can stake to the surface along a defined horizontal alignment.

All you need to do is define the alignment using the **Alignment C/L** button then select a surface from the surface drop down list found next to the **DTM Surface** button.

When you press the **Stake Road** button you will see the alignment screen. In the area where you would normally see your cross section or template, you will now see the surface at the stake station you have defined.

If you enter a Design Offset, it will compute an elevation based on the surface.



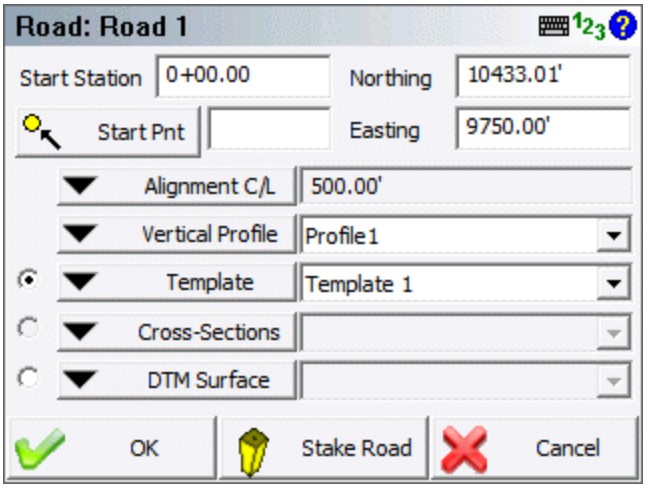
Alignment Staking - Part 1

There are two things that have to happen before you can stake a road.

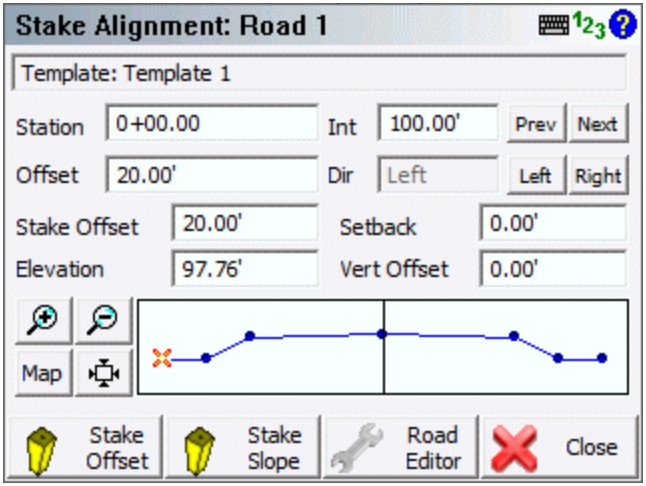
1. You have to create an alignment, vertical profile and a template. Or…
2. Import a LandXML file and use XML cross sections to stake from.

Stake from Alignment, Profile and Template.

If you've taken the time to define your alignment, you need to select the vertical profile and template that you want to stake from in the road settings screen.



Use the **Stake Road** button to start the road staking which will display the Stake Alignment screen.



Station and Station Interval

If you enter a station interval, it will move forward and back along the alignment by this amount when you use the **Prev** and **Next** buttons. This interval will start from the station that is currently entered in the Stake Station field.

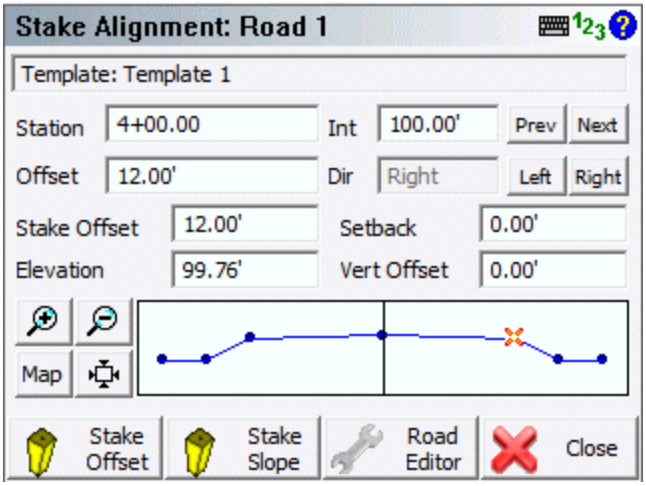
Stake Station

You can also manually enter the station you would like to stake by entering it in the Station field.

Design Offsets

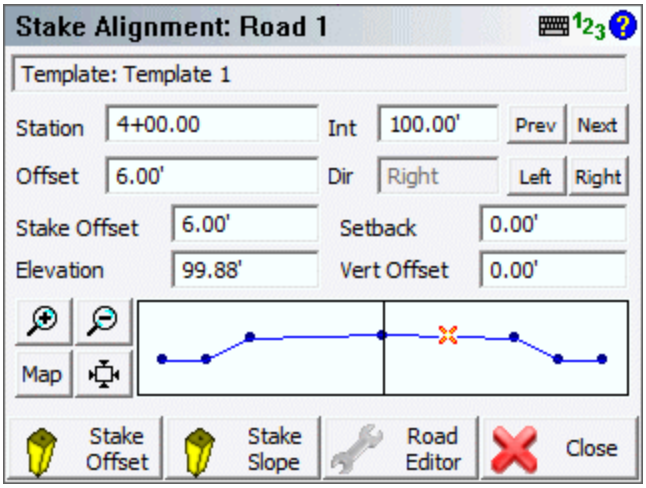
Move Along Template

You can move along the template by using the **Left** and **Right** buttons. As you do this the offset from the centerline will be displayed in the Offset field. Furthermore you will see what side of the template you're on by looking at the direction field. You will also note in the template preview, the "x" visually marks the design offset.



Define an Offset

You can define your own offset to stake by entering the value in the Offset field. To enter a Left offset, use a negative value.



Stake Offset and Setback

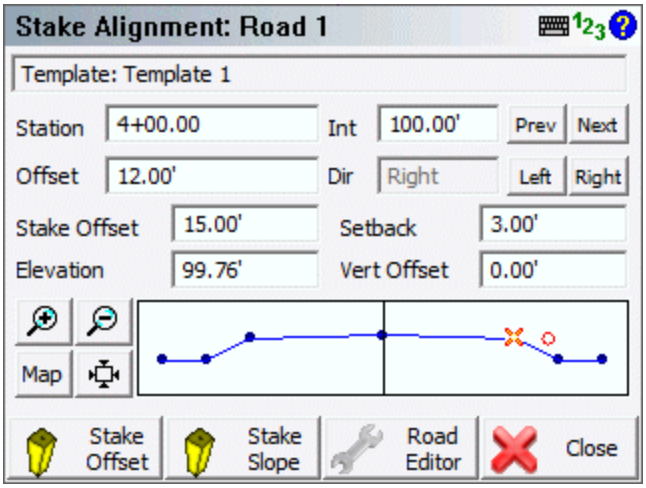
Stake Offset

By default the Stake Offset will equal the Offset value. The stake offset is designed to help you enter the offset that you want to stake your point at. Sometimes, the contractor asks you to stake a point at a certain distance from the centerline, this will help you do that.

Setback

The setback and stake offset fields work in conjunction with one another. You will note that as you enter a stake offset, a value is computed in the setback field. This value is computed by subtracting the Stake Offset from the Design Offset.

If you know that the offset or setback for a template point is to be a specific value, enter the value in the setback field; the stake offset field will update automatically.



You will note that when a setback or stake offset is defined, you will see an orange circle in the preview screen. This circle indicates the location of the setback.

Note: If you want to make sure that you're staking nothing but design points along the template, then make sure the Setback field is equal to 0.0.

Elevation and Vertical Offset

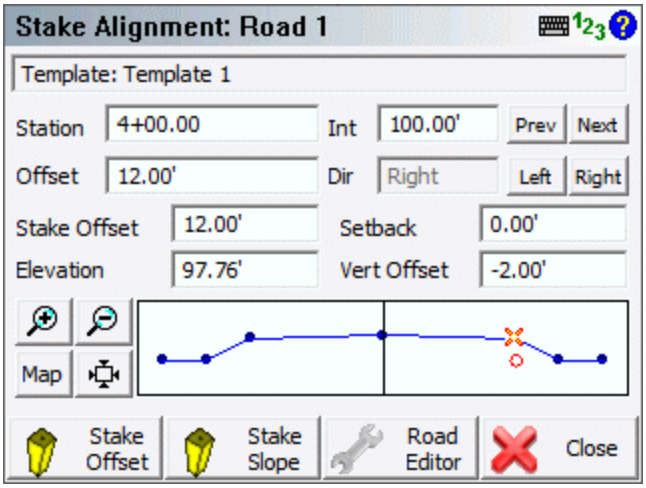
Elevation

The field will show you the computed elevation on the template at the design offset specified. This value can be changed to allow you stake a different elevation.

Vertical Offset

This field works in conjunction with the elevation field. If the user enters a different elevation than the one that was computed on the template, the difference between the elevations is shown in the vertical offset field.

If you know what the vertical offset is for the point you're staking on the template, you can enter it in this field. You will see the elevation for the point update to reflect the offset you defined.



In the template preview screen you will see an orange circle. This circle indicates the location of the vertical offset point that will be staked.

Note: If you want to make sure that you're staking nothing but design points along the template, then make sure the Setback field is equal to 0.0.

Template Preview

You can zoom into your template using the zoom controls. You can also pan the template by tapping on it and dragging it on the screen.

Use the Map button to display the location of the template along you alignment. This will be displayed in the map view window.

Stake Offset

Once you've defined that point you want to stake, you can select the **Stake Offset** button to start the staking process. When you press this button you will see the staking toolbar. For an explanation of the staking toolbar and alignment staking, please refer to the next section, Alignment Staking - Part 2.

Stake Slope

This is the **Stake Slope** toggle. Normally you will slope stake from the hinge point on the template, but it is totally up to you. The slope staking feature can be used from any point on the template.

Road Settings

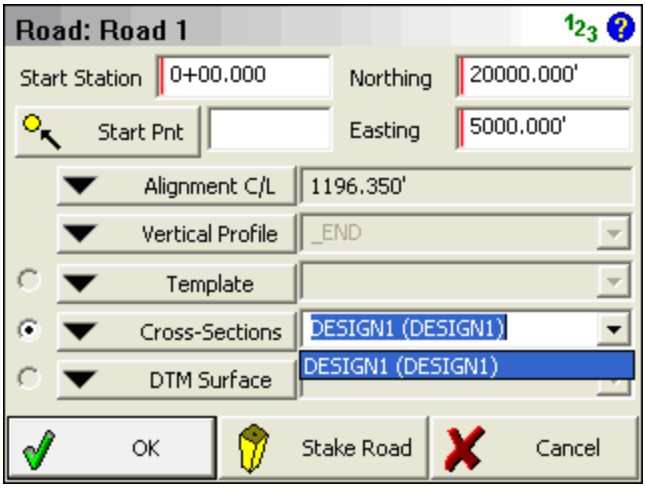
Press this button to return to the road settings screen.

Stake from LandXML Cross Sections

To stake cross sections from a LandXML file you first need to import it using the LandXML importer found in the Import Menu.

You can then select the alignment form the map screen to open the Roads Manager, or you can access it form the **Roads Menu**. In this menu you can select the alignment that has the cross sections, and then press the **Road Settings** button.

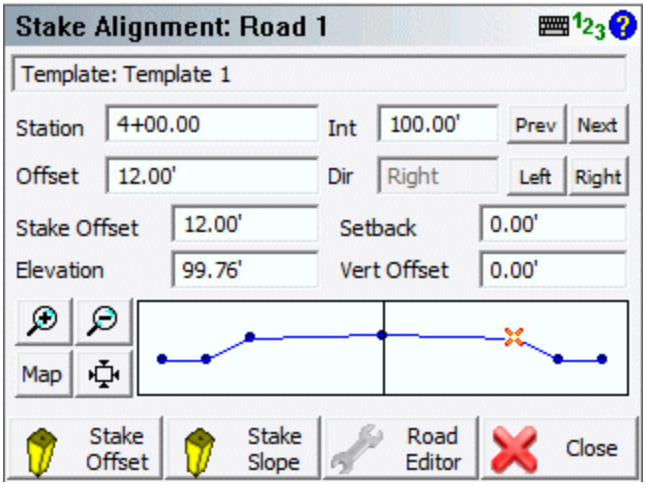
You then have to select the cross section that you want to use by selecting it in the cross sections field.



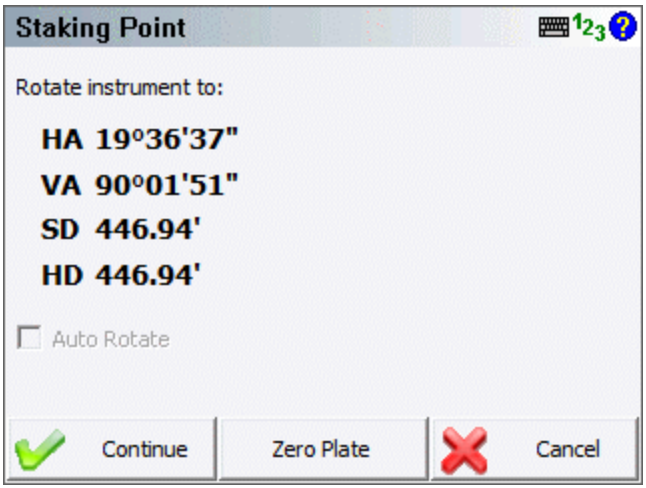
When you press the **Stake Road** button you will see the Stake Alignment screen which is described in detail above.

Alignment Offset Staking

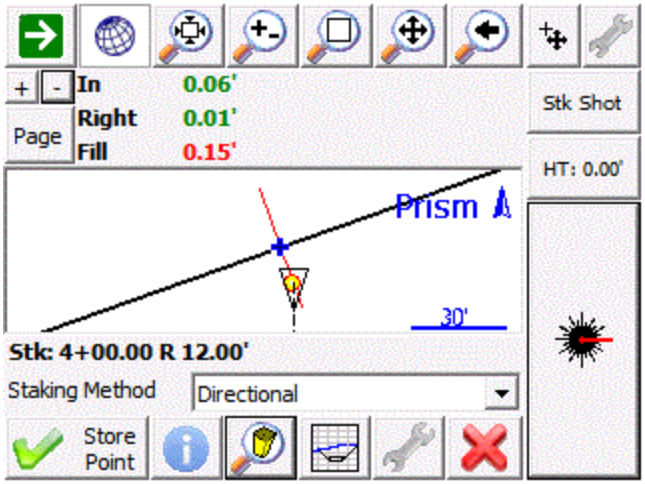
Continued from Alignment Staking...



From the stake alignment screen, when you press the **Stake Offset** button if you are staking with a robotic instrument or GPS you will immediately see the staking toolbar. If you are staking with a conventional instrument you will see the turn-to information first, directing you to the design point.



The alignment offset staking process is very similar to normal point staking. What is different is you will see the station/offset information about where the prism is in relation to the alignment and more importantly, to the point you're staking.



Staking Method

Turn an Angle: You will see the horizontal angles to the design point and to your actual measurement. This is useful for getting online (left/right) with a conventional total station.

Directional: You will see the move distances (In/Out/Left/Right or N/S/E/W, as well as Cut/Fill) guiding you from the actual measurement to the design point.

Radial: You will see a direction and distance guiding you from the actual measurement to the design point.

Stationing - Absolute: You will see the offset of the actual measurement along the alignment.

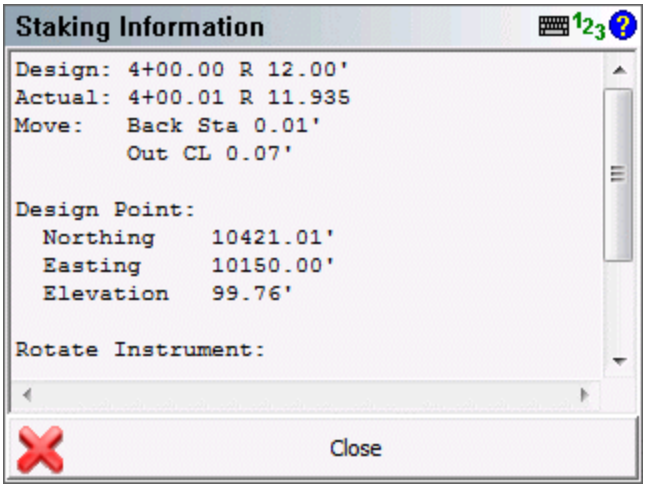
Stationing - Relative: You will see the move distances guiding you along the alignment from the actual measurement to the design point.

Staking Information

The **station/offset of the design point** is indicated directly on the staking toolbar, and also in the Staking Information screen which you can access by pressing the Info button in the staking toolbar.

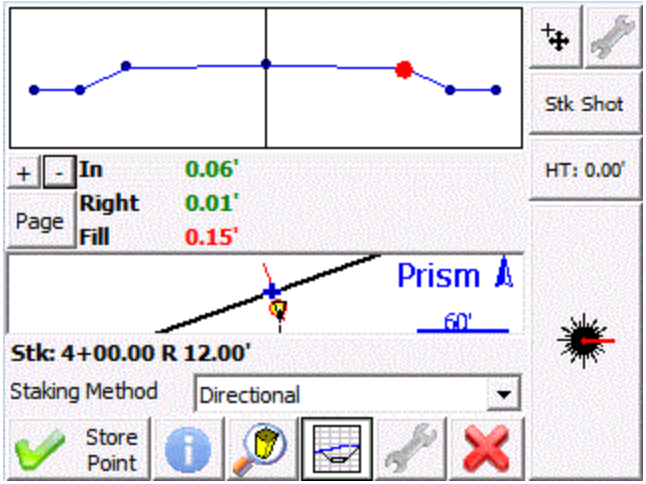
The **station/offset of the actual measurement** is available in the Staking Information screen.

The **move or rotate information** which will guide you from the actual measurement to the design point is indicated in the observation toolbar. You can press the Page button to toggle between various information if you do not see these values. If your measurement is within your defined tolerance of the design point then the text will be green, if not then the text will be red. This information is also available in the Staking Information screen. The type of information shown will vary based on your current Staking Method.



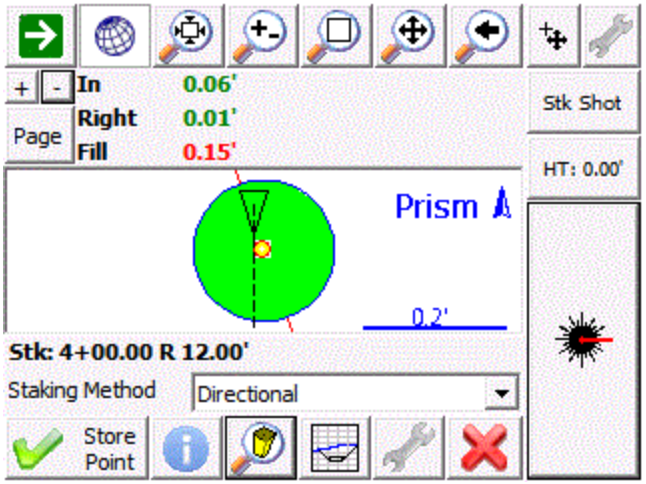
Template Preview

At anytime during your staking you can press the Profile button to see the actual rod position which will be shows as an orange circle, in relation to the template defined for the alignment.



Zoom Stake

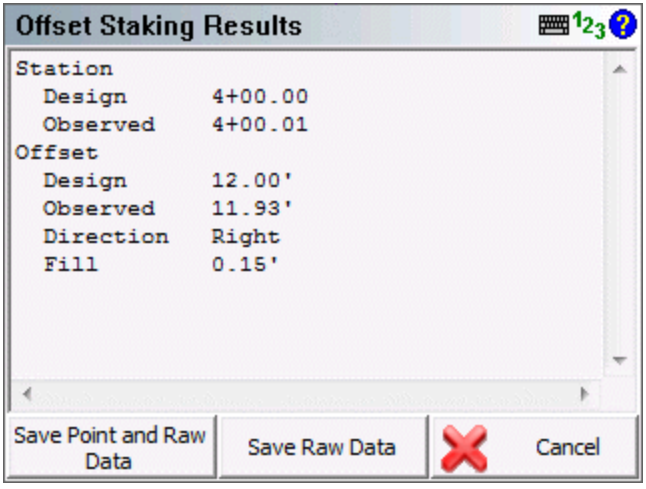
If you press the Zoom Stake button in the staking toolbar, you will be zoomed in to show you both the design point and the actual measurement. The green circular area surrounding the design point reflects the area where you are within the defined staking tolerances.



Store Point

When you are ready to store the stake point press the **Store Point** button. You will then see the results for your stakeout.

If you are using GPS to stake the alignment, then you will not see the Store Point button. Instead, press the Measure button to trigger a measurement and then store the resulting shot.



Press **Save Point and Raw Data** to store a point for this shot and to write your stake and cut sheet records to the raw file. By default the description for the stored stake point will equal the station and offset that was being staked.

Press **Save Raw Data** to write your stake and cut sheet records to the raw file, without storing a point.

If you press **Cancel**, nothing is stored or written to the raw file.

Records written to raw file

Following are the records that are written to the raw file when you store a point.

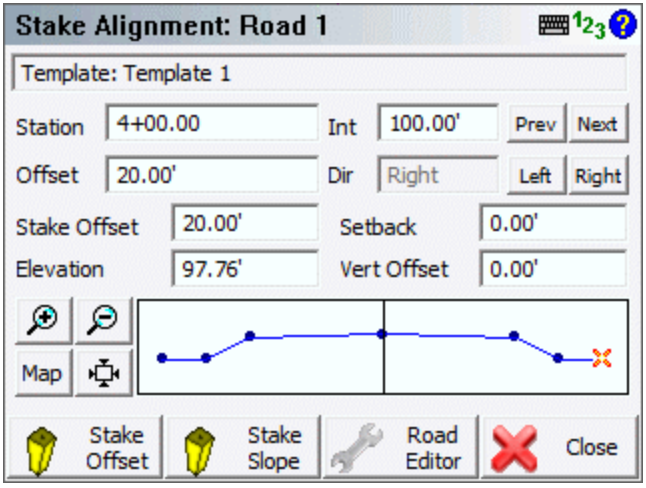
If you do not store a point then the SP (Store Point) record is not recorded as no point was stored in the database.

```
SP,PN4,N 20000.0068,E 5000.0099,EL100.1038,--0+00.00 C 0.000
CF,ST0.000,OD1,OL0.010,EL100.1038,GD100.0000
OE,ST0.000,OE0.010
DE,PN,N 20000.000,E 5000.000,EL100.000,--
SD,ND-0.007,ED-0.010,LD-0.104
SK,OP1,FP4,AR201.48000,ZE93.10000,SD269.6600,--0+00.00 C 0.000
```

Alignment Slope Staking

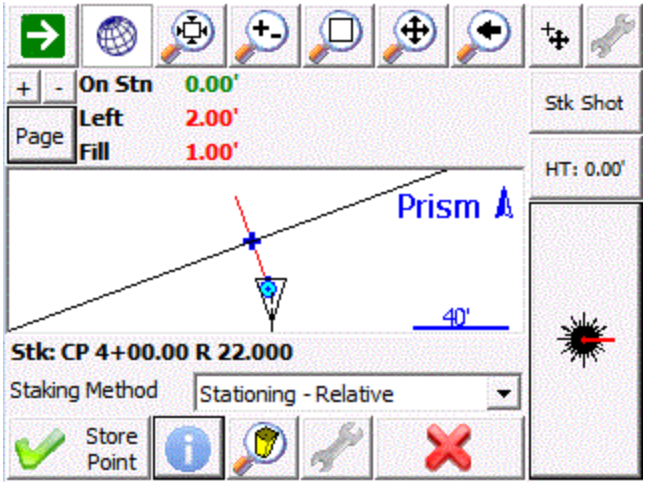
Continued from Alignment Staking...

When you're staking a point from a template, you can select the **Stake Slope** button from any point. However, you will usually slope stake from the hinge points on your template.

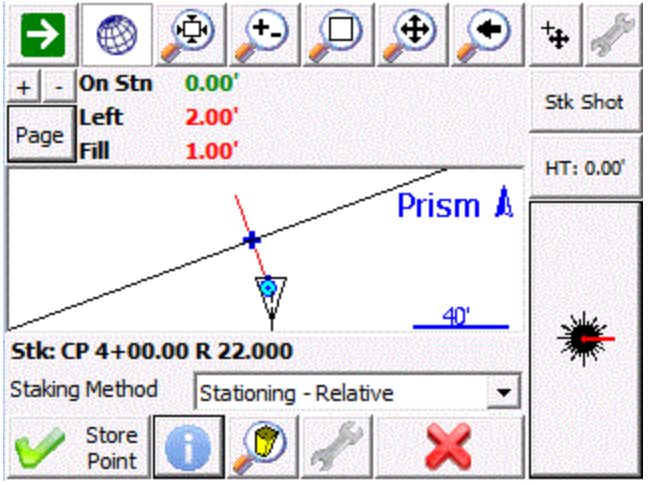


When you start slope staking and you measure your first shot, the program computes an intersection between a horizontal plane containing the measurement and the slope defined in the stake settings from the hinge point. Layout will then compute a best guess location for the catch point and will tell you how much you need to move. After you measure a second shot, Layout will create an imaginary

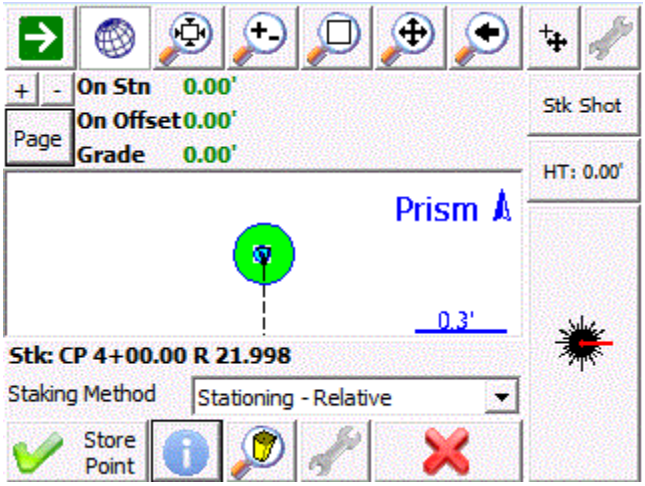
line between the two shots and intersects the slope from the hinge point. It then computes a new solution for the catch point.



At anytime during your staking you can press the Profile button to see the actual rod position which will be shows as an orange circle. You will also see the slope lines from the hinge point.

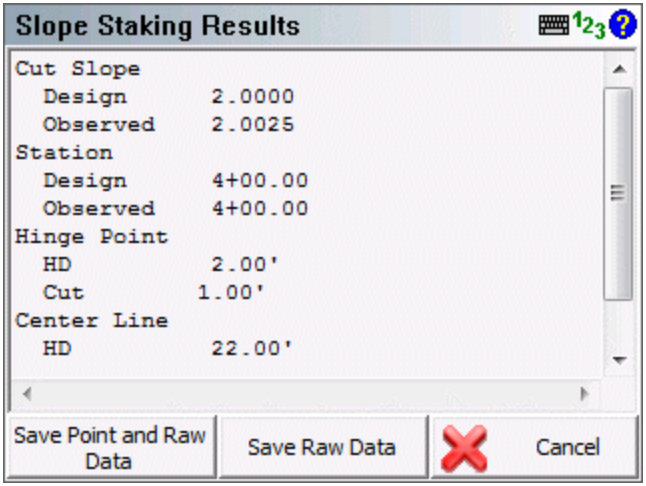


When you get near the catch point if you press the Zoom Stake button you will see a green circle in the map view representing the area within your specified staking tolerances.



Slope Staking Results

When you store your catch point position you will see the results screen. This screen will always report the following:



Cut or Fill Slope: The first line will always tell you if you staked a cut slope or fill slope. It will also display the design slope that was specified and record the actual computed slope that was staked.

Station: This will display the station of the template or cross section, and will show the actual station staked at the catch point.

Hinge Point: This is the distance from the rod position to the hinge point. It will also indicate the vertical distance from rod position to the hinge point. A cut indicates that the hinge point is lower; fill indicates that it is higher than the current rod position.

Center Line: This is the distance from the rod position to the centerline. It will also indicate the vertical distance from rod position to the centerline. A cut indicates that the centerline is lower; fill indicates that it is higher than the current rod position.

Save Shot

Press **Save Point and Raw Data** store a point for this shot and to write your stake and cut sheet records to the raw file. By default the description for the stored stake point will equal the station and offset that was being slope staked. An example of an auto generated description is **CP 4+00.00 R 22.000**. The CP stands for Catch Point.

Press **Save Raw Data** to write your stake and cut sheet records to the raw file, without storing a point.

If you press **Cancel**, nothing is stored or written to the raw file.

Records written to raw file

Following are the records that are written to the raw file when you store a point.

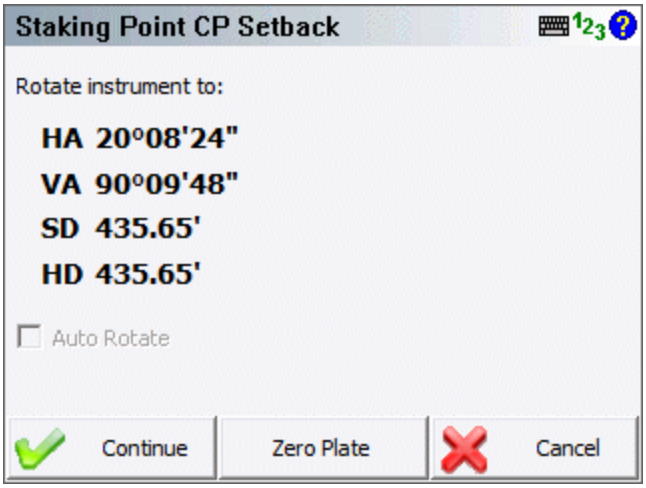
If you do not store the staked point, the SP (Store Point) record will not be recorded as no point was stored in the database.

```
SP,PN81,N 5002.9770,E 4997.8367,EL99.9829,--CP 0+12.00 L 1.000
SL,ST12.000,OD2,EL99.983,GD99.983,AS0.005,HH0.985,VH0.966,HC1.985,VC0.966,C-
T0,DS1.000000,OB1.019583
SK,OP100,FP81,AR282.28000,ZE90.16000,SD3.6800,--CP 0+12.00 L 1.000
```

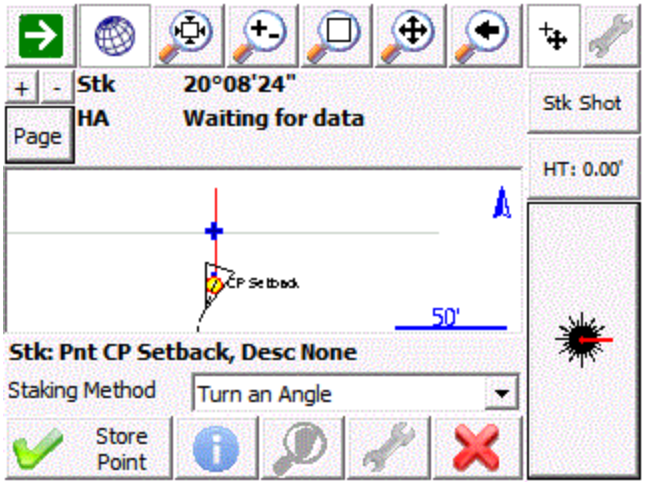
Slope Staking with Offset/Setback

In the Stake Alignment screen if you specify a stake offset or a setback distance, after you store your catch point position you will be asked if you want "Continue with staking the catch point setback?" If you press **No**, then this will be cancelled.

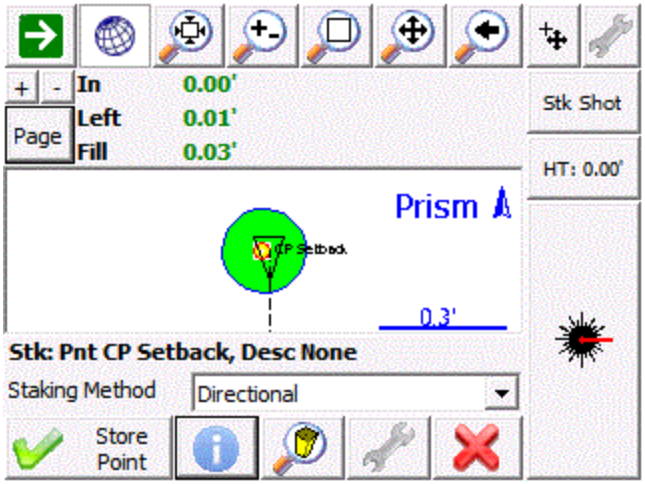
When you press **Yes**, you will then see the "Turn To" screen which will stake a position that is offset from the computed catch point. This offset will be equal to the offset you specified in the alignment screen.



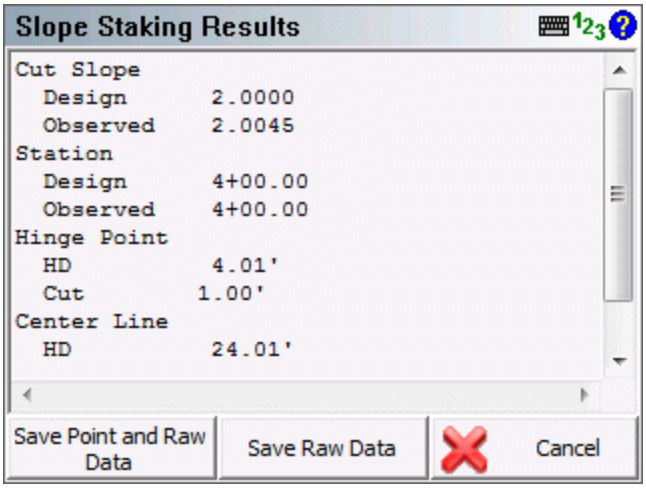
Now on the staking toolbar you will see the word **Stk: Pnt CP Setback** which indicates you're currently staking a slope stake setback point.



When you get to the offset position and store the point you will see the results screen once again. This time, the offsets to the hinge point and centerline will include the offset distance.



The vertical distances that are reported on the results screen are not computed using the current rod position. These values will be in relation to the actual catch point that was staked.



When you store the point you will see that the description that is auto generated for the point will be similar to the following example. **REF CP 4+00.00 R 24.00**

Records written to raw file

Following are the records that are written to the raw file when you store a point.

If you have the Store Staked Point toggle turned off in the stake settings screen, you will see that no SP record is recorded as no point was stored in the database.

```
SP,PN5004,N 5007.7522,E 5001.5139,EL100.1445,--CP 0+06.00 L 1.000
```

```
SL,ST6.000,OD2,EL100.144,GD100.144,AS-
0.002,HH0.498,VH0.501,HC1.498,VC0.501,CF0,DS1.000000,OB0.994169
SK,OP101,FP5004,AR353.45220,ZE90.23420,SD13.9200,--CP 0+06.00 L 1.000
SP,PN82,N 5007.2194,E 5002.2307,EL102.2842,--REF CP 0+06.00 L 2.000
SR,ST6.000,OD2,EL102.284,GD100.144,AS-
0.002,HH2.390,VH0.501,HC2.387,VC0.501,CF0,DS1.000000,OB0.994169,OL1.000
DE,PNCP Setback,N 5007.078,E 5002.253,EL100.144,--
SD,ND-0.141,ED0.022,LD-2.140
SK,OP101,FP82,AR351.10340,ZE82.00000,SD14.6850,--REF CP 0+06.00 L 2.000
```

CONNECTING TO COMPUTER

Connecting to Computer

Microsoft ActiveSync / Windows Mobile Device Center

Microsoft ActiveSync and Microsoft Windows Mobile Device Center facilitate communication between your PC and your handheld device.

If you are using Windows XP or earlier, **Microsoft ActiveSync** has to be installed on your computer so you can download data between your hand held and desktop computers. The current version (at time of printing) is ActiveSync 4.5. You may have to use an earlier version if you are running Windows 95 or 98. Check the web page noted below for more information.

If you are using Windows Vista, **Microsoft Windows Mobile Device Center** has to be installed on your computer, rather than Microsoft ActiveSync. The current version (at time of printing) is Windows Mobile Device Center 6.1.

Installing ActiveSync / Windows Mobile Device Center

Installing From Web

Microsoft ActiveSync or Microsoft Windows Mobile Device Center might already be installed on your computer; you can confirm this by looking for it in your Windows Start Menu.

If you do not have Microsoft ActiveSync or the Windows Mobile Device Center installed, you can download and install the latest version from Microsoft's website at this address:

http://www.microsoft.com/windowsmobile/activesync/default.mspx

Note: You may be asked to reboot your system once the installation is complete.

Installing From CD

Microsoft ActiveSync or Microsoft Windows Mobile Device Center might be already be installed on your computer, you can confirm this by looking for it in your Windows Start Menu.

If you do not have Microsoft ActiveSync or the Windows Mobile Device Center installed, and you don't have access to the internet, it can be installed from your Layout CD. You can browse into the Layout folder on your CD and run one of the following files:

MSASYNC.EXE (for Windows XP or earlier)

MSWMDC32.EXE (for Windows Vista 32-bit)

MSWMDC64.EXE(for Windows Vista 64-bit)

Note: You may be asked to reboot your system once the installation is complete.

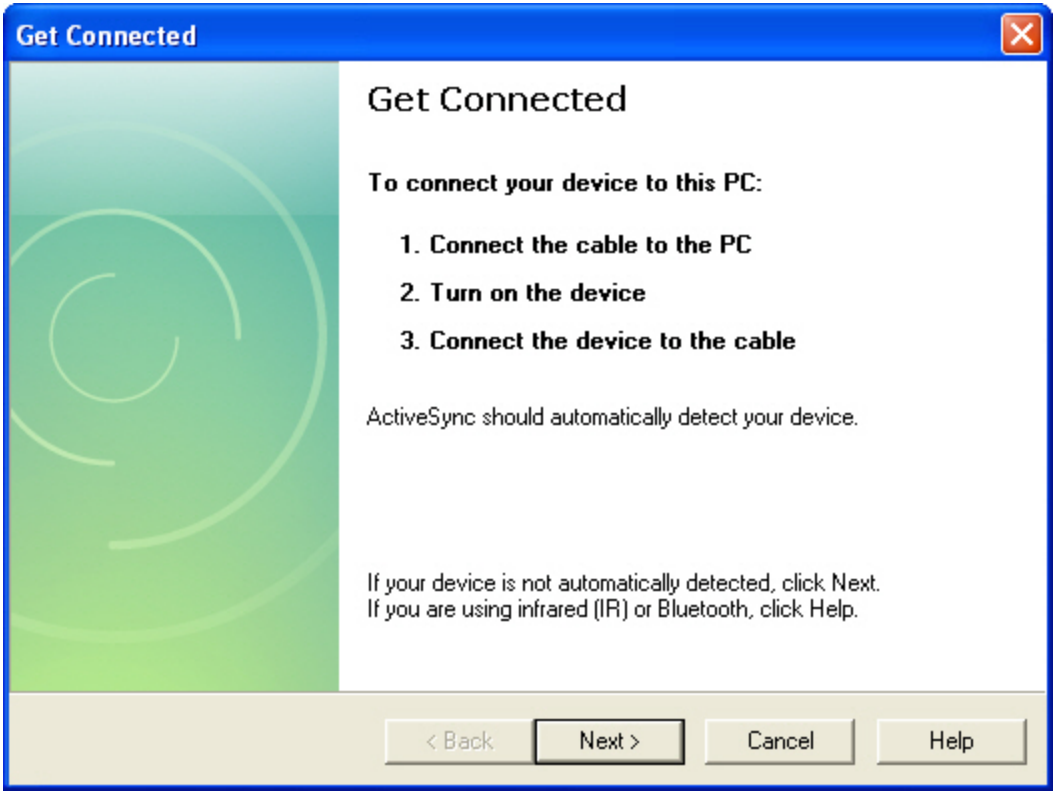
Connecting ActiveSync / Windows Mobile Device Center

Get Connected

We now need to establish a connection between your data collector and desktop computer as prompted by the ActiveSync or Windows Mobile Device Center Connection Wizard. The following screenshots are specific to ActiveSync, but the Mobile Device Center is almost identical.

After the install is complete, ActiveSync will display a Get Connected screen.

If ActiveSync was already installed, you can start it by going to your Start menu | All Programs | Microsoft ActiveSync. The Get Connected Wizard should appear. If it does not, go to the ActiveSync **File** menu and select **Get Connected**.



Connect your handheld data collector to your desktop or laptop computer using the supplied cradle and/or cables.

Power ON the data collector and click **Next** on the Get Connected Wizard. Some devices require you to tap a **PC Link** icon on the device while the Get Connected function is in operation.

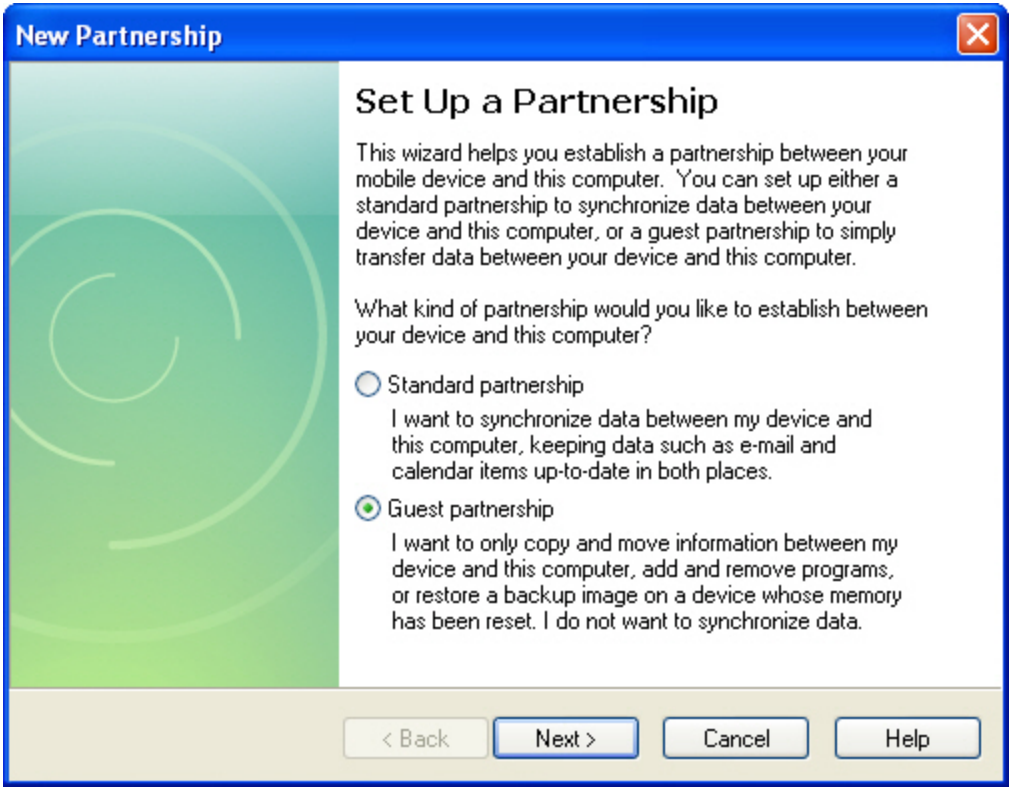
When communication is established, you will be prompted to set up a partnership between your data collector and the desktop computer.

Note: If your device does not connect as shown, turn the device off, and then back on again to retry

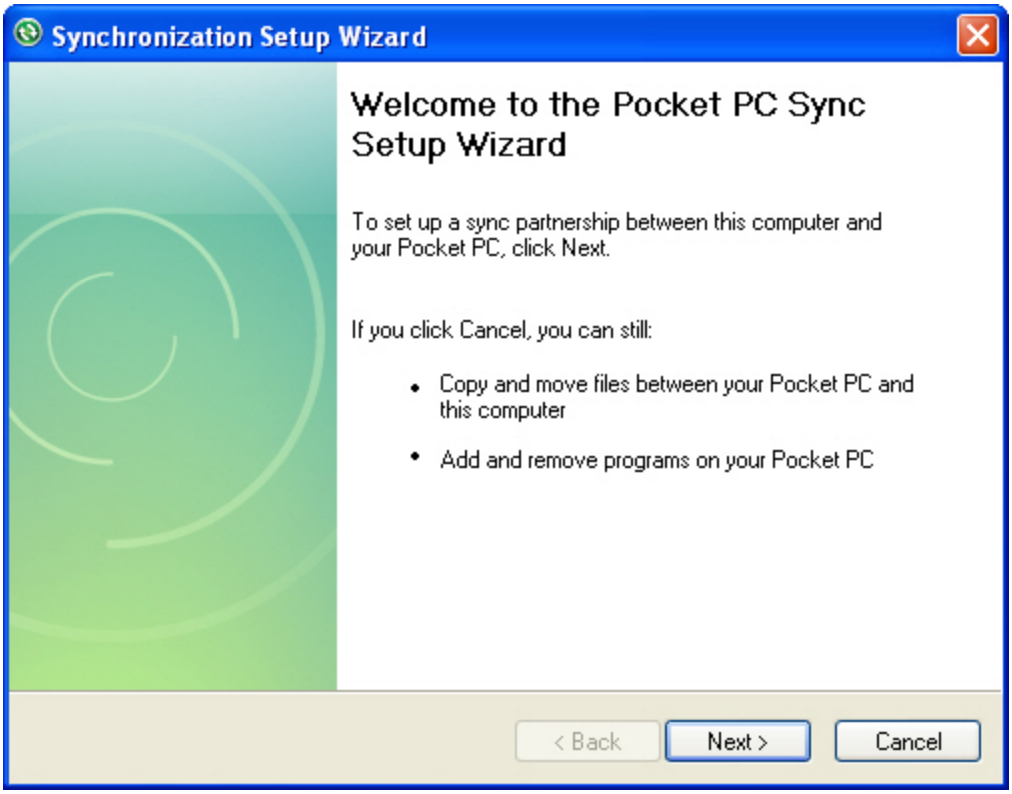
Establish a Guest Connection

After you successfully connect to your computer, you will be asked to setup a partnership. Choose **Guest Partnership** then click **Next** to continue.

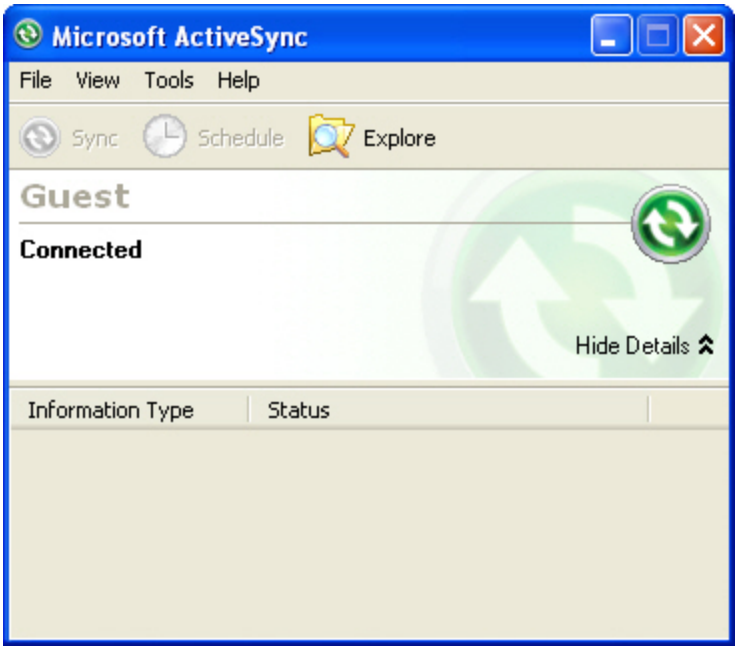
> **Note:**
> You can setup a Standard Partnership if desired, but this is not necessary and adds complexity. We recommend using a Guest Partnership.



Or if you are using a handheld device running Windows Mobile 5.0 or newer, you may instead see the Synchronization Setup Wizard, simply press **Cancel** to use a guest connection.



ActiveSync should now display as shown below:



You are now ready to move on to the next step - MicroSurvey Exchange Program

> **Note:**
> A small circular ActiveSync icon will appear in the lower right corner of your desktop (like the one at right in the above image). This will display in gray when ActiveSync is inactive but will change to green when your device is connected.

MicroSurvey Exchange

We provide a free transfer tool with Layout to help you copy projects to and from your data collector. The program is called MicroSurvey Exchange and it can be download from our website or installed directly off of the CD provided with Layout.

Once installed all you need is to connect your handheld computer to your desktop computer via an ActiveSync or Windows Mobile Device Center connection. ActiveSync is a Microsoft Windows product which establishes a serial or USB connection between your data collector and your computer.

Once connected, you can start the MicroSurvey Exchange program.

The program has been designed to streamline the transfer of projects and files back and forth between you data collector and computer.

For more details, please refer to the Help file included with the MicroSurvey Exchange program.

Synchronize with MicroSurvey Point Prep

To import your projects into your MicroSurvey Point Prep desktop product, please refer to the **Layout SyncWizard** topic in the MicroSurvey Point Prep help file.

RAW FILE REFERENCE

RAW File Reference

Raw File Record Types

To increase our compatibility with other data collectors and desktop systems, Layout uses the TDS RW5 raw file format. The raw file contains virtually all the measurements made in the field and is a complete history of what was recorded.

For more information on the raw data record format, or for additional record types, please review the Raw Data Record Specification document from Tripod Data Systems, Inc. It is available for download at www.tdsway.com

Conventional Raw Data Records

-- - Note or Comment Records

A comment in the raw file will be depicted with a record type of two dashes. Text found after the dash is the comment.

Comments are ignored during processing of the raw file and are used only for information purposes only. You can add a comment to the raw file by using the Add Comment button in the Survey / Traverse Menu.

```
-- This is a comment
```

BK - Backsight Record

A backsight record is written to the raw file when you complete an occupy point command. Please review the Setup Occupy Point topic for more information.

Field headers:

OP: Occupy point

BP: Back point

BS: Backsight

BC: Back circle

```
BK,OP101,BP100,BS0.00000,BC0.00000
```

CF - Cut Sheet

When you stake out a point, a CF record will be recorded in the raw file.

ST: Station
OD: Offset direction (ENUM)
OL: Offset length
EL: Elevation
GD: Grade (design)

DE - Design Point / Location

During a stakeout the point you're staking will be recorded in the raw file with as DE record.
PN: Point name (*design point, may be blank*)
N : Northing
E : Easting
EL: Elevation
--: Description (*design point description, may be blank*)

JB - Job Record

Every time a raw file is created or opened a JB record will be written to the file.
Field headers:
NM: Job name
DT: Date
TM: Time

```
JB,NMTraverse1,DT03-05-2004,TM14:07:52
```

LS - Line of Sight (Instrument and Target Height)

HI: Height of instrument
HR: Height of rod

```
LS,HI1.500,HR1.500
```

MO - Mode Setup Record

Every time a raw file is created or opened a MO record will be written to the file.
Field headers:
AD: Azimuth direction - (0 = North) (1 = South)

UN: Distance unit - (0 = Feet) (1=Meter) (2=US Survey Feet)

SF: Scale factor

EC: Earth curvature - (0 = off) (1=On)

EO: EDM offset (inch) (Default string "0.0") **Not used by Layout

AU: Angle unit - (0=Degree) (1=Grads)

```
MO,AD0,UN1,SF1.000000,EC0,EO0.0,AU0
```

OC - Occupy Point Record

When you complete the occupy point command an OC record will be written to the raw file. Please review the Setup Occupy Point topic for more information.

Field headers:

OP: Point number

N : Northing (the header is N space)

E : Easting (the header is E space)

EL: Elevation

--: Description

```
OC,OP101,N 1000.0000,E 1000.0000,EL10.0000,--
```

OF - Off Center Shot Record

When you use any of the offset shot commands an OF record will be written to the raw file. Two types of measurements will create offset records and they are the Angle Offset and Distance Offset measurement modes. Please see the Measurement Modes topic for more information.

Field headers:

AR: Angle right

ZE: Zenith

SD: Slope distance

OL: Offset length

HD: Horizontal distance

VD: Vertical distance

LR: Left/Right Offset

```
OF,AR90.00000,ZE90.00000,SD50.0000
```

```
OF,ZE60.00000,--Vert Angle Offset
OF,OL45.00000,--Right Angle Offset
OF,HD-10.0000,--Horizontal Distance Offset
OF,LR0.0000,--Left / Right Offset
OF,VD0.0000,--Elevation Offset
```

Offset shots will always contain the original measurement plus the offset information. You will also see a SS record accompany the OF records and it will contain the reduced measurement. Following is an example of a distance offset where an offset of -10 was entered:

```
OF,AR180.00000,ZE90.00000,SD50.0000
OF,HD-10.0000,--Horizontal Distance Offset
OF,LR0.0000,--Left / Right Offset
OF,VD0.0000,--Elevation Offset
LS,HI1.500,HR1.500
SS,OP1,FP5,AR180.00000,ZE90.00000,SD40.0000,--<No Desc>
```

RS - Resection

When you use the resection function a RS record will be recorded for each observation made to your control points. Please refer to the Resection topic for more information.

PN: Point number

CR: Circular reading

ZE: Zenith (or VA, CE)

SD: Slope distance (or HD)

```
RS,PN103,CR2.42220,ZE90.00000,SD25.0980
```

When you complete a resection the control points you used will be written as SP records and after the RS records you will see one final SP for the computed resection point. An example of a resection is shown below:

```
--Resection
SP,PN103,N 3135.070,E 1511.185,EL399.795,--:
SP,PN100,N 3097.874,E 1564.984,EL399.387,--:
LS,HI1.300,HR0.000
RS,PN103,CR2.42220,ZE90.00000,SD25.0980
RS,PN100,CR102.26120,ZE90.00000,SD56.3050
SP,PN999,N 3110.000,E 1510.000,EL398.291,--
```

SD - Stakeout Deltas

When you complete a stakeout by pressing the store point command a SD record will be written to the raw file. It is the difference between the design location (DE record) and the actual point staked (SP record).

ND: Delta northing

ED: Delta easting

LD: Delta elevation

SK - Stake Out Record

When you stake out a point and use the Store Point command a SK record will be written to the raw file. This is the raw observation that was recorded when you stored you stake point.

OP: Occupy point

FP: Foresight point

AR: Angle right

ZE: Zenith

SD: Slope distance

```
¦SK,OP251,FP10000,AR175.00000,ZE90.00000,SD6.0000,--Design Point: 342      ¦
```

SL - Slope Staking Record

ST: Station

OD: Offset direction (ENUM)

EL: Actual catch point elevation

GD: Grade (design elevation of the catch point based on the slope line)

AS: Ahead on station (positive when rod is beyond design station, negative when before station)

HH: Horizontal distance to hinge point (always positive)

VH: Vertical distance to hinge point (positive when rod is above hinge)

HC: Horizontal distance to center line (always positive)

VC: Vertical distance to center point (positive when rod is above center point)

CF: Slope used (ENUM)

DS: Design slope

OB: Observed slope

SP - Store Point

Many routines in Layout will write a SP record to the raw file. SP records contain coordinate information that can be used for setups, resections, etc…

PN: Point number

N: Northing

E: Easting

EL: Elevation

--: Description

```
SP,PN103,N 3135.070,E 1511.185,EL399.795,--:
```

SS - Sideshot

When you record a shot a SS record will be recorded in the raw file. Many other functions also create a SS record such as when offset and multi set shots are reduced.

OP: Occupy point

FP: Foresight point

AR: Angle right

ZE: Zenith

SD: Slope distance

--: Description

```
SS,OP1,FP7,AR176.11093,ZE90.00000,SD60.1332,--<No Desc>
```

GPS Raw Data Records

AH - GPS Antenna Height

DC: Derivation Code (ENUM)

MA: Measured antenna height

ME: Measure Method (ENUM)

RA: Reduced antenna height (to phase center)

BL - GPS Base Line

DC: Derivation

PN: Point Name
DX: Base line Delta X
DY: Base line Delta Y
DZ: Base line Delta Z
-- : Description (Feature Code)
GM: GPS Measure Method (ENUM)
CL: Classification
HP: Horizontal Precision
VP: Vertical Precision

BP - Set Base Receiver Position

PN : Point Name
LA: Latitude
LN: Longitude
HT: Ellipsoid Height
SG: Setup Group (default = 0)

CS - Coordinate System Identity

CO: Coordinate system option (ENUM)
ZG: Zone group (system) name
ZN: Zone name
DN: Datum name

CT - Calibration Point

PN: Point Name
DM: Dimensions used (ENUM)
RH: Horizontal residual
RV: Vertical residual

CV - RMS Covariance of GPR Position

DC: Derivation (ENUM)

SV: Minimum number of SV during observation
SC: Error Scale
XX: Variance X
XY: Covariance X,Y
XZ: Covariance X,Z
YY: Variance Y
YZ: Covariance Y,Z
ZZ: Variance Z

EP - Geodetic Position

When you save the location of a point, its geodetic position is also recorded.
TM: Time
LA: Latitude
LN: Longitude
HT: Ellipsoid Height
RH: Horizontal RMS returned from receiver
RV: Vertical RMS returned from receiver
DH: HDOP if receiver returns this info
DV: VDOP if receiver returns this info
GM: GPS Method (ENUM)
CL: Classification (ENUM)

HA - Horizontal Calibration (Adjust)

N : Origin north
E : Origin east
TH: Translation north
TE: Translation east
RT: Rotation about origin
SF: Scale factor at origin

GS - GPS Store Point

This is similar to a regular SP (store point) record but the GS indicates that it is create by GPS.

PN: Point Name

N : Local Northing

E : Local Easting

EL: Local Elevation

-- : Description

RP - Local coordinates of calibration point

N : Northing

E : Easting

EL: Elevation

-- : Description

VA - Vertical Calibration (Adjust)

PV: Type of vertical adjustment (ENUM)

N : Origin north (*may be blank*)

E : Origin east (*may be blank*)

LZ: Constant adjustment – translation Z (*may be blank*)

SO: Slope north (*may be blank*)

SA: Slope east (*may be blank*)

GN: Geoid Model Name

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