



# Survey Mobile Field Software



## User Guide

From v2.1

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(TNL - TEBV)

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**11.4. Attorneys' Fees and Costs.** The prevailing party in any action to enforce this Agreement will be entitled to recover its attorneys' fees and costs in connection with such action.

**11.5. Notices and Reports.** Any notice or report hereunder shall be in writing. If to Trimble, such notice or report shall be sent to "Trimble Inc., 935 Stewart Drive, Sunnyvale, California 94085, U.S.A." to the attention of "General Counsel – Legal Notice". If to You, such notice or report shall be sent to the address You provided upon placing your order or at the time the Software has been first made available to You. Notices and reports shall be deemed given: (a) upon receipt if by personal delivery; (b) upon receipt if sent by certified or registered U.S. mail (return receipt requested); or (c) three (3) business days after being sent by a reputable international courier requiring signature for receipt, addresses to the party at its notice address. Either party may change its notice address by written notice to the other.

**11.6. Amendments; Waivers.** No supplement, modification, or amendment of this Agreement shall be binding, unless executed in writing by a duly authorized representative of each party to this Agreement. No waiver will be implied from conduct or failure to enforce or exercise rights under this Agreement, nor will any waiver be effective unless in a writing signed by a duly authorized representative on behalf of the party claimed to have waived.

**11.7. Entire Agreement.** This Agreement is the complete and exclusive statement of the mutual understanding of the parties and supersedes and cancels all previous written and oral agreements and communications relating to the subject matter of this Agreement. No provision of any purchase order or in any other business form employed by You will supersede the terms and conditions of this Agreement, and any such document issued by a party hereto relating to this Agreement shall be for administrative purposes only and shall have no legal effect. Notwithstanding the foregoing, if You have entered into a separate written license agreement signed by Trimble for use of the Software, the terms and conditions of such other agreement shall prevail over any conflicting terms or conditions in this Agreement.

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Trimble Inc., 935 Stewart Drive, Sunnyvale, CA 94085, U.S.A

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## Introduction

Spectra Precision Survey Mobile (SPSM) is an easy to learn and simple to use field software for surveyors who want to get their work done fast and efficiently. The user interface is designed to be simple and straightforward so surveyors can be productive immediately.

Sharing data between crews is seamless with importing and exporting capabilities. Surveyors can measure, stake out and calibrate a site in their coordinate system of choice after configuring their receiver settings.

The software is optimized for use on Android devices v4.3 and higher. Survey Mobile offers users the flexibility to use any Android supported device.

Survey Mobile is designed to be used with a Spectra Precision SP60 or SP80 GNSS receiver or with Nikon or Spectra Precision mechanical total stations.

## Installation

- Download the installation file (an apk file) from the Spectra Precision website.
- Copy the file to any folder on your Android device.
- Touch the apk file to start installing Survey Mobile.
- Enter the POPN (Proof-Of-Purchase Number) you have received by email following the purchase of the part number corresponding to Survey Mobile.

If you don't have a POPN, you may install and run the software but with limited features (trial version):

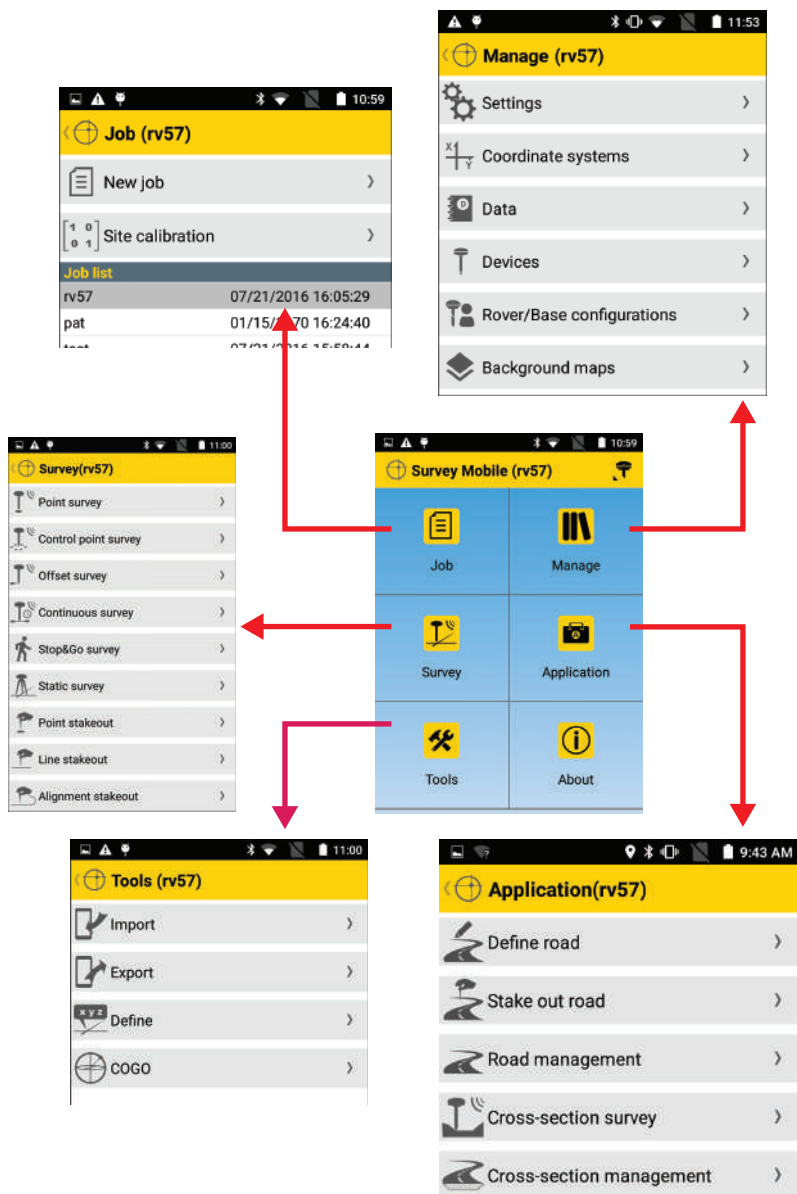
- Only one job can be created
- The number of points in the job is limited to 20
- There can only be one of each of these items in a job: lines, arcs, transitions, alignments, cross-sections, roads, dxf files and traverses.
- Only the first 20 stations of a line, arc, transition, alignment or road can be staked out.

NOTE: The installed software version is shown at the bottom of the splash screen when launching the application.

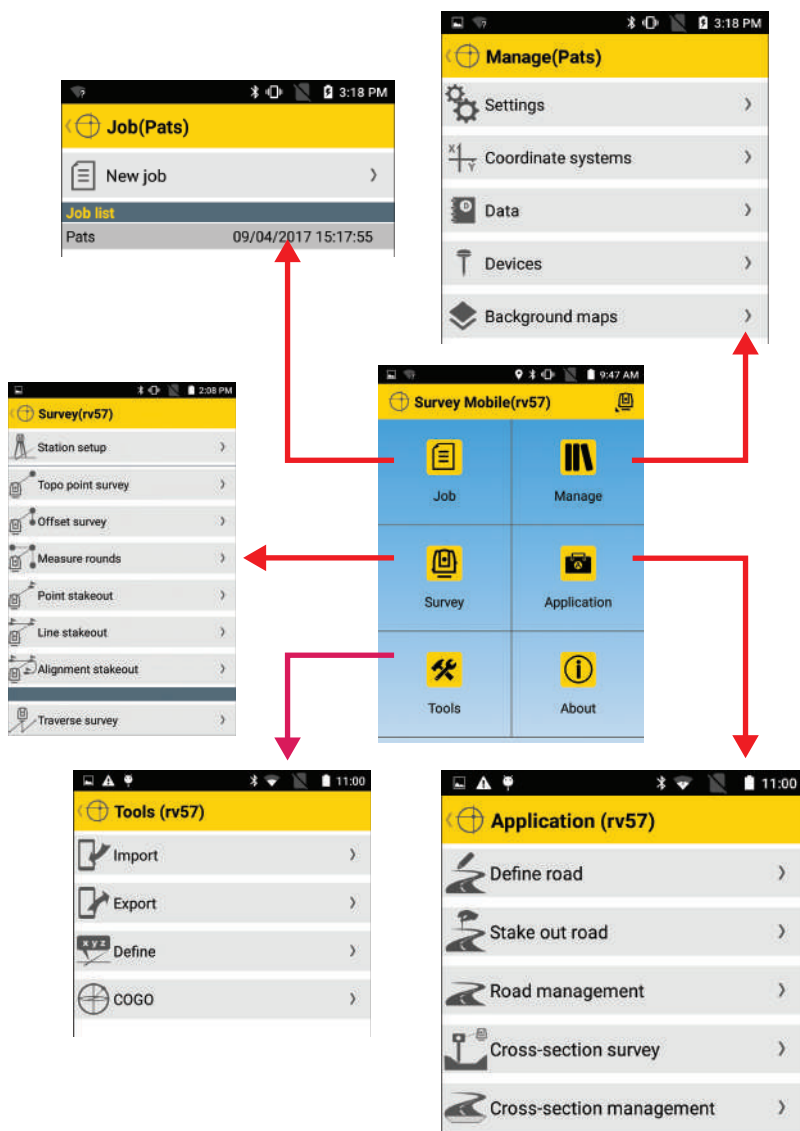
## Survey Mobile Main Menu & Submenus

See diagrams below.

## Survey Mobile Connected to a GNSS Receiver:



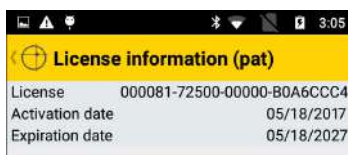
## Survey Mobile Connected to a Mechanical Total Station:



## Switching from the Trial to the Official Version

Survey Mobile is currently running in trial version. But you recently bought a license from Spectra Precision, resulting in a license key given to you to enable the official version of the software. Follow these steps to install the official version:

- Launch Survey Mobile (in trial version)
- From the Survey Mobile main menu, touch **About**. This opens the **About** screen.
- Touch the **License** line.
- Type in your personal license key and then touch **Login** to install the license. Survey Mobile then goes back to the **About** screen. The **License** line now reads “**Official version**”.
- If you touch the **License** line again, you will read the license key you have just keyed in, as well as the activation and expiration dates of your software (see example below).



NOTES: From the license page (from the main menu, select **About**, then touch the **License** line), you may return to the trial version by touching **Use Trial version**). Do this **ONLY** if for some reason, the license activation at some point fails. By switching back to trial mode, you will then be able to save all your data.

After a license has expired, you don't need to switch back to trial mode. Just enter the new license code once you've got it (touch the **New license** button and enter the code).

### Note on the User Interface

Buttons used in the user interface change color depending on the current status of the function they control:

- Yellow button: The button is usable (active)
- Gray button: Touching the button will have no effect (inactive)

So button colors indirectly give the status of the function the buttons control.

Examples: After you have started raw data logging in static or Stop&Go mode, the **Start** button turns gray. Only the **Stop** button is yellow in this case (and reciprocally). After you have connected to a receiver via Bluetooth, the **Connect** button is

grayed. Only the **Disconnect** button is yellow (and reciprocally).

## Shortcuts **Main Menu Shortcut**

Making a long press on the Return button of your Android platform will take you to Survey Mobile's main menu.

## **Previous Screen**

Whenever you need to return to the previous screen, just touch this icon located in the top-left corner of the screen:



## **Point Survey Shortcut**

When you are ready to collect a point, you may alternately press the “**Volume -**” key of your Android platform (rather than touch the on-screen **Measure** button) to save the name and coordinates of that point.

## **Point Stakeout Shortcut**

After choosing the point you want to stake out, you may alternately press the “**Volume -**” key of your Android platform (rather than touch the on-screen **Start** button) to start walking to the selected point using the displayed guidance instructions.

From there, after you have arrived at the target, you can alternately press the “**Volume +**” key of your Android platform (rather than touch the on-screen **End and save** button) to save the point position and end the stakeout, or you can press the “**Volume -**” again (rather than touch the on-screen **End** button) to end the stakeout.

## **Grid vs. Ground Coordinates in Optical Surveys**

In optical surveys, all measurements made are “ground” coordinates. Now the coordinate system defined in a job will usually be a grid coordinate system. Be aware Survey Mobile will automatically save and export the measured ground coordinates into grid coordinates.

## Customized Templates for Import and Export

In GNSS surveying, the following customized template is available:

- Name, Code, Latitude, Longitude, Height

In optical surveying, the following customized template is available:

- Name, code, HA, VA, SD, HI, HT, SF

Where:

HA: Horizontal Angle

VA: Vertical Angle

SD: Slope Distance

HI: Instrument Height

HT: Target Height

SF: Scale Factor

## Automatic Naming

For repetitive actions, Survey Mobile will automatically increment the **Name** field so you don't need to edit this parameter every time. The incrementation rules are the following:

- If the first name you entered ends with a figure, Survey Mobile will increment this figure by one (+1) for the next point, straight line, arc or transition (e.g. PT100, then PT101, PT102, etc.). When the name is in the form "...9", then the next prompted name will be "...10".
- If the first name you entered ends with a letter, Survey Mobile will add a figure (starting with "1") at the end of the name for the next point, straight line, arc or transition (e.g. RET, then RET1, RET2, etc.).



Automatic incrementation of names occurs in the following cases:

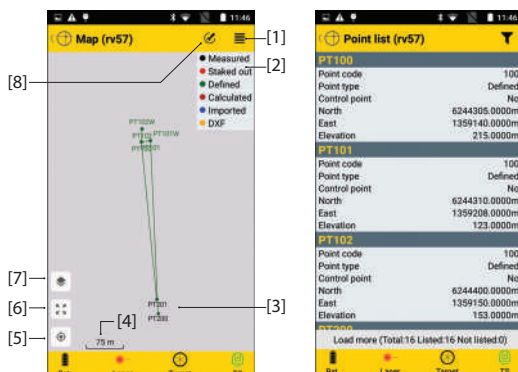
- When manually creating several points, straight lines, arcs or transitions in a row using the **Tools>Define** function.
- Within the **Survey** function when logging several points in a row.



## Map View & Points List View

When working within the Survey function (🔧), you can always take a look at the map or the list of the points present in your job. Exception is for Stop & Go and Static surveys in GNSS where there is no possible access to these two views. So as you are collecting points, you may:

- Touch  in the title bar to access the map view (below left).
- Touch  in the title bar to access the points list (below right).



[1]: Touch this icon to show or hide the color legend

[2]: Color legend

[3]: This cross shows your current location.

[4]: Current value of map scale. The map scale can be zoomed in up to 8 mm.

[5]: When your current location is shown, touching this button will drag your current location to the center of the map screen.

[6]: Touch this icon to adjust the zoom so that all the points, lines, etc. present in the job can be seen on the screen with the highest enlargement possible. The map screen indefinitely retains the map scale resulting from this action until you intentionally choose to use another map scale.

[7]: Touch this icon to add background maps (see note below).

[8]: Provides access to the Auto-scroll function. When activated, this function will bring the current location back to the center of the screen whenever it's about to go beyond any of the edges of the map screen.

NOTE 1: For the first four GNSS surveying functions, the Map screen shows additional buttons. See [page 62](#).

NOTE 2: To add background maps, see [page 98](#).

To return to the measurement screen when the map view or points list is displayed:

- Touch .

## About Line Stakeout

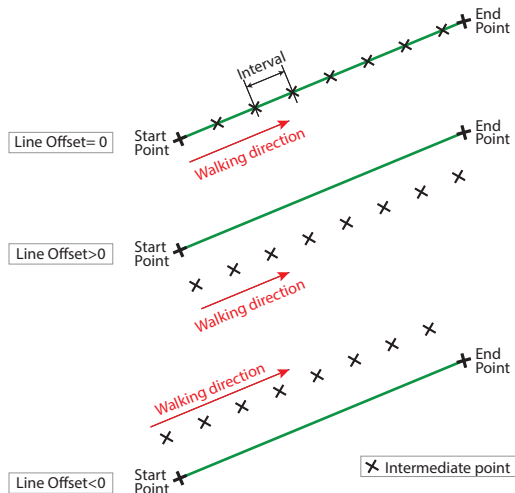
There are six important things to know about line stakeout:

1. A line that you stake out may be a straight line, an arc or a transition. At the beginning of this process, you choose which type of line you want to stake.
2. When you stake out a line, Survey Mobile will guide you successively to intermediate points along the line, from the start point to the end point.
3. The number of intermediate points depends on how you set the **Interval** parameter. For example, if you choose **Interval**= 2 meters, then Survey Mobile will guide you successively to points 2 meters apart along the line. You may decide to stake out the line by asking Survey Mobile to guide you exactly along this line, or on the contrary, by walking at some distance from it, along a virtual line parallel to it.

This is achievable by setting the **Line offset** parameter accordingly:

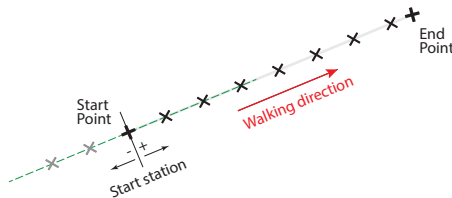
- **Line offset**= 0: Guidance provided along the “real” line.
- **Line offset**> 0: Guidance provided along a virtual line located to the left of, and parallel to the “real” line.
- **Line offset**< 0: Guidance provided along a virtual line located to the right of, and parallel to the “real” line.



Example of straight line stakeout:



4. In addition, there is a way of starting staking out the line on the start point, or somewhere on the line before or after the start point. This is achievable by setting the **Start station** parameter accordingly:
- **Start station**= 0+000.000: Stakeout will start at the line's start point.
  - **Start station**> 0+000.000 (e.g. 0+020.000): Stakeout will start somewhere on the line, between the start point and the end point (see diagram below).
  - **Start station**< 0+000.000 (e.g. -0+020.000): Stakeout will start outside of the line, on a point aligned with the line and located before the start point (see diagram below).

(Straight line stakeout example)

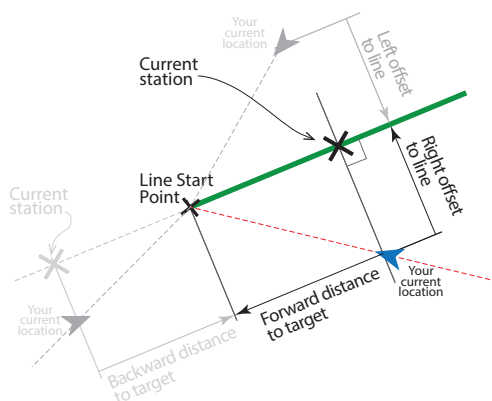


5. After staking out the first point on the line, which you can save or not, you will be using the following buttons to head for the next point:
-  : Will guide you to the next point in the direction from the start point to the end point. That point is distant from the previous one by the value given by the **Interval** parameter.
  -  : Will guide you to the next point in the direction from the end point to the start point. That point is distant from the previous one by the value given by the **Interval** parameter.

If necessary, you may also correct the **Start station** setting made while creating the line, by adjusting the **Line station** parameter.

6. While staking out a line, Survey Mobile will continuously provide the following additional information:
- **Right offset to line, Left offset to the line:** The distance from your current location to the line, along the perpendicular to that line.
  - **Current station:** Is the point located at the intersection of the line and the perpendicular to the line passing through your current location.
  - **Forward distance to target or Backward distance to target:** Distance to go to get to the target, projected to the line, respectively by walking forward, or by walking backward (you've gone past the target).

These parameters are illustrated in the example below where the operator is guided to get to the line's start point (Straight line stakeout example).





Jobs are required to perform GNSS surveys or optical surveys (using mechanical total stations). You don't need to create a job to perform GNSS post-processed surveys (i.e. Static and Stop & Go surveys).

When a GNSS receiver is used, a post-processed survey may run in the background while performing a real-time RTK survey.

## Creating a Job

During this step, you will name the job you want to create and define a standard or custom coordinate system for the job.

- In Survey Mobile's main menu, touch .  
A new screen is displayed prompting you to create a new job or, in the case a GNSS receiver is used, to enter the **Site calibration** function. Existing jobs, if any, are listed under the **Job list** banner.
- Touch **New Job**.
- As prompted, touch the dimmed **Input** word within the **Job name** field. The keyboard then shows up on the screen.
- Type in a name for the job (e.g. MyJob), and, depending on your device, touch **OK** or **Done** on the virtual keyboard to validate the new name.
- Define the coordinate system used in the job. By default, Survey Mobile will suggest you use the coordinate system of the last opened job, but you may also define a new standard, custom or unknown coordinate system:
  - To define a standard system, touch  within the **Coordinate system** field and then select the desired system from the drop-down list. Depending on the standard coordinate system you select, Survey Mobile may ask you to define a zone (**Zone** field), a geoid (**Geoid** field) and a shift grid (**Shift grid** field).  
Note the first two options available: 1) **Scale: 1.0**, which only makes sense in optical surveying and 2) **No datum, no projection**, which only makes sense in GNSS surveying (see explanations further below).  
If you select **Scale: 1.0**, choosing "**North azimuth**" for **Azimuth type** can only result in "**North and East**" **Grid direction** and choosing "**South Azimuth**" in a "**South and West**" grid direction.

When you touch **OK** to save the coordinate system you have defined, Survey Mobile will name the system by combining the selections you made for **Coordinate System**, **Zone** and **Shift grid** (if applicable). Just touch **OK** to agree.


Example: The coordinate system will be named “World wide/UTM\_3 North\_EGM96 (Global)” if you have selected successively:

Coordinate system: World wide/UTM


Zone: 3 North

Geoid: EGM96 (Global)

NOTE: Coordinate systems created that way are then made available at the top of the drop-down list attached to the **Coordinate system** field.

- To define a custom system, touch  within the **Coordinate system** field and then define this system. See all the details in *Customizing the Coordinate System Used in a Job on page 13*.
- If you don't know which coordinate system should be used, define an unknown coordinate system by selecting **No datum, no projection**. Then you will run a calibration based on known points in the area to determine a valid local coordinate system.
- If you leave the field empty (first option in the drop-down list attached to the **Coordinate system** field), then WGS84 will be used and the coordinates of all measured points will be expressed as latitude, longitude and height.
- If the geodetic file you select for your custom coordinate system is missing, a message will appear with the option to download the file.

NOTE: To delete a coordinate system you have created in Survey Mobile:

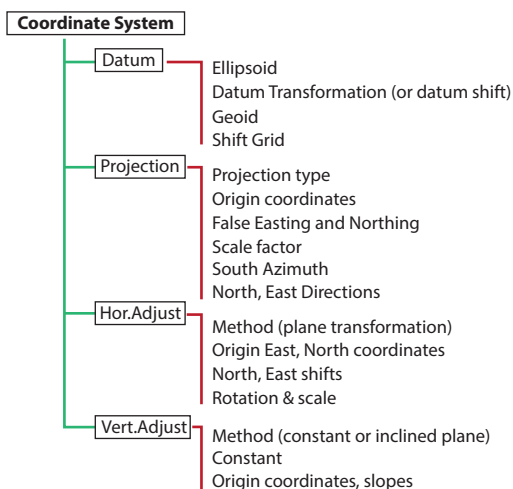
- In Survey Mobile's main menu, touch .
- Touch **Coordinate systems**. The screen lists the coordinate systems you created in the upper part of the screen.
- Keep the finger pressed on the name of the coordinate system you want to delete, and then select **Delete**. This will delete the coordinate system unless it is used in one of your jobs in which case the delete operation will be canceled.

- After both the job name and the coordinate system have been defined, touch the big yellow **OK** button to create the job and open it in Survey Mobile (the name of the job is shown between brackets in the title bar).  
The name of the new job is also added to the list of existing jobs shown under the **Job list** banner.


## Customizing the Coordinate System Used in a Job




You may define a custom coordinate system in three different ways:

- Either from scratch:
  - Touch **+** within the **Coordinate system** field and enter all the system's parameters (see diagram below). Parameters are arranged in four different tabs).





**NOTE:** **Datum type** and **Ellipsoid type** can both be set to “blank” (first option in the corresponding scroll-down list) so you can enter a custom ellipsoid and a custom datum transformation. To deselect the chosen option in **Geoid** or **Shift grid**, select the first option (“blank”) in the corresponding scroll-down list.


- Once done, name the system and touch  in the title bar to save the system definition.
- Or you may first select a standard system and then derive your custom system from it:

- Touch  within the **Coordinate system** field and select the standard system from which to derive your custom system.
- Then touch  within the **Coordinate system** field and change only the parameters that make the custom system different from the standard one you selected.
- Once done, name the system and touch  in the title bar to save the system definition.
- Or, after having selected a standard or custom coordinate system as explained above (a system necessarily including a projection), you may use the **Site Calibration** function to “adjust” the coordinate system (see *Site Calibration in GNSS Surveying on page 65*).


NOTE: Creating a coordinate system is also possible, outside of any open job, using the following procedure:

- From the main menu, touch  and then **Coordinate systems**.
- Touch  located in the title bar, then name and define all the parameters of the new coordinate system.

## Opening an Existing Job

- In Survey Mobile’s main menu, touch . A new screen opens on which all existing jobs are listed under the **Job list** banner.
- Touch the name of the job you want to open.  
A new screen is displayed providing a summary of this job (e.g. job name, coordinate system used, possibly the name of the particular area covered by the coordinate system).
- Touch the big yellow **Open** button to open the job. The name of that job is shown between brackets in the title bar.


## Editing or Deleting an Existing Job

- In Survey Mobile’s main menu, touch . A new screen opens on which all existing jobs are listed under the **Job list** banner.
- Hold your finger pressed on the name of the job you want to edit or delete until a menu pops up.
- Select **Delete** to delete the job or **Modify** to edit the job.



- If you select **Delete**, please confirm you really want to delete the job.
- Selecting **Modify** allows you to edit the properties of the coordinate system used in the job. If you change the coordinate system, Survey Mobile will warn you that this may cause errors in the job. The decision is yours to continue or give up.

## Closing a Job

- In Survey Mobile's main menu, touch . A new screen opens on which all existing jobs are listed under the **Job list** banner.
- Hold your finger pressed on the name of the job you want to close until a menu pops up.
- Select **Close** to close the job.

## Importing Points into the Open Job


For import operations other than with "Survey Mobile point" format, please refer to *Other Import / Export Functions* on page 96


### Where to Post the Files Before Importing Them


The files you wish to import should always be moved to the following folder before you can import them:

Internal memory/SurveyMobile.Droid/Import/  
or  
SD memory card/SurveyMobile.Droid/Import/

### Importing Point Files in Survey Mobile Point Format

- Open the job where to import data.
- In Survey Mobile's main menu, touch , then **Import**.
- Touch **Survey Mobile point**.
- Touch **File type** and select one of the available import formats (txt or csv).

You may touch  in the **Template** line to view each and every parameter field making up the selected template.

Then touch  to go back to the previous screen.


- In the lower part of the screen, select the file you want to import.


NOTE: You can view the file content at this point. Hold the finger pressed on the file name, then select **Open file** and choose an application to view the file.

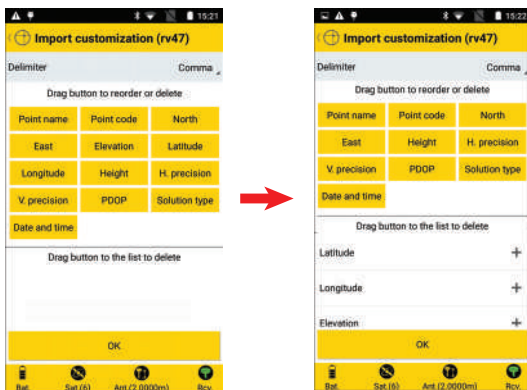
- Define the content of the file you want to import by selecting a template (**Template** field). Several templates are possible:
    - **Default template:** If you choose the “**Default template**”, the imported file is assumed to provide data in that order:
 

**GNSS:**  
 [1] Point name [2] Point code [3] North [4] East [5] Elevation [6] Latitude [7] Longitude [8] Height [9] H. precision [10] V. precision [11] PDOP [12] Solution type

**Optical:**  
 [1] Point name [2] Point code [3] North [4] East [5] Elevation [6] H. angle [7] V. angle [8] Slope distance [9] Instrument height [10] Target height [11] Scale factor
- When you make this choice, remember Survey Mobile will only pick the NEE or LLH coordinates for each point, never both. It is therefore your responsibility to choose which coordinates you would like to import. This choice is made by setting the additional **Coordinates provided as** parameter accordingly.
- Two other templates may be used, which the files to be imported should comply with when you select one of them:
 

**GNSS or optical:**  
 Name Code North East Elevation  
 Name Code Latitude Longitude Height
  - **Customized template:** Touch  to build a customized template. A new screen opens on which you can define, 1) the field delimiter (comma, space, tab, or semicolon), and 2) the content of the template: all the fields currently included in the template are shown at the top of the screen as yellow buttons. You can re-order the fields by dragging the buttons accordingly within the upper list.  
 You can also remove some of them by dragging the corresponding buttons to the lower list.

Conversely, by touching  next to a field name in the lower list, you will re-incorporate this field into the template as the last field in the template (see example below in GNSS).





Touch **OK** after you have defined your custom template.

- Touch the big yellow **Import** button to run and complete the import operation.

## Exporting Points from a Job

For export operations other than with “Survey Mobile point” format, please refer to *Other Import / Export Functions on page 96*

- Open the job from which to export points (see *Opening an Existing Job on page 14*).
- In Survey Mobile’s main menu, touch , then **Export**.
- Touch **Survey Mobile point**.
- Select the category, or categories of points you would like to export from the open job:
  - Touch  in the title bar. Survey Mobile suggests that you select points according to three different criteria: **Point Type**, **Point Library** and **Point Solution**.
  - For each of these criteria, check on the boxes corresponding to the points you want to export.
  - Touch **OK** when you are done with your selections. This takes you back to the previous screen.
- Touch **File type** and select one of the available formats (txt or csv) for the exported file.


- Define the content of the exported file by selecting a template (**Template** field). Several templates are possible:
  - **Default Template:** The content of the exported file will be as follows (same as import):
 

**GNSS:**  
 [1] Point name [2] Point code [3] North [4] East [5] Elevation [6] Latitude  
 [7] Longitude [8] Height [9] H. precision [10] V. precision [11] PDOP [12]  
 Solution type

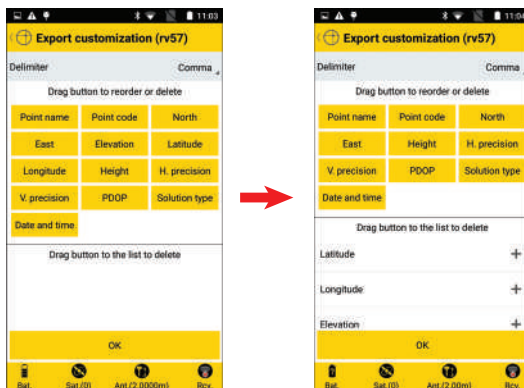
**Optical:**  
 [1] Point name [2] Point code [3] North [4] East [5] Elevation [6] H. angle  
 [7] V. angle [8] Slope distance [9] Instrument height [10] Target height  
 [11] Scale factor
  - Template with a fixed set of fields, which are, in this order:
 

**GNSS or optical:**  
 Name, Code, North, East, Elevation
  - Template with another fixed set of fields, which are, in this order:
 

**GNSS:**  
 Name, Code, Latitude, Longitude, Height

**Optical:**  
 Name, Code, HA, VA, SD, HI, HT, SF
  - **Customized Template:** Touch  to build a customized template. A new screen opens on which you can define, 1) the field delimiter (comma, space, tab, or semicolon), and 2) the content of the template: all the fields currently included in the template are shown at the top of the screen as yellow buttons. You can re-order the fields by dragging the buttons accordingly within the upper list.  
 You can also remove some of them by dragging the corresponding buttons to the lower list.

Conversely, by touching **+** next to a field name in the lower list, you will re-incorporate this field into the template as the last field in the template (see example below in GNSS).



Touch **OK** after you have defined your custom template.

NOTE: A “Date and Time” field is now available indicating the time when a point was measured. The format of this field is “yyyymmddhhmmss” where:


yyyy: Year (e.g. 2018)  
 mm: Month (01-12)  
 dd: Day (1-31)  
 hh: Hours (00-23)  
 mm: Minutes (00-59)  
 ss: Seconds (00-59)

- Name the export file.
- Touch the big yellow **Export** button to run and complete the export operation.

NOTE: You can view the content of already exported files (listed in the lower part of the screen): Hold the finger pressed on one of the exported file names, then select **Open file** and choose an application to view the file.

# Points, Straight Lines, Arcs, Transitions, Alignments, Traverses


## Defining Points

- In Survey Mobile's main menu, touch , then **Define**, then **Points**.



Field	Value
Point name	PT100
Point code	200
Control point	<input checked="" type="checkbox"/>
Point type	Grid_NEE
North	6244358m
East	1359172m
Elevation	137m

Add

- Complete the different fields to define a new point:
  - Point name and code.
  - Control point tag: check this box if the point you are creating is a control point (i.e. a point with accurately known coordinates in local grid).
  - Point type (type of coordinates):
    - Grid\_NEE (North, East, Elevation),
    - WGS84\_LLH (latitude, longitude and height),
    - or WGS84\_XYZ (WGS84 Cartesian XYZ coordinates),
  - Input point coordinates.
- Touch the big yellow **Add** button to save the point.  
NOTE: After the point has been saved, the point name shown on the screen is automatically incremented. This new name may be appropriate for the next point you want to create.
- If you've made a mistake while entering the properties of the point, you can still correct its definition right after pressing **Add**, using the procedure below:
  - Touch , hold the finger pressed on the point definition you want to edit, then select **Edit** from the pop-up menu. You can then make all the changes you want to the definition of the point.






Remember this procedure only applies to the point (or series of points, see NOTE below) you have just defined.

The general procedure to edit a point defined earlier is described on *page 27*.

NOTE: If you define several points in succession, then using the above procedure will allow you to edit not only the last point defined, but also all the points you've defined just before.

## Defining Straight Lines

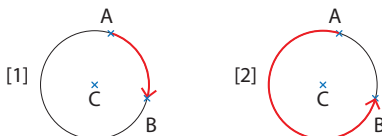
A straight line is a segment connecting two points. Points should have been created in your job before you can create straight lines.

- In Survey Mobile's main menu, touch , then **Define**, then **Lines**. This opens a new screen on which you can create a line. Define the following parameters:
  - **Line name:** Enter a name for the line.
  - **Line start point, Line end point:** Specify which point is the line's start point and then, which one if the line's end point. These points can be:
    - Directly picked from the open job (  )
    - Measured in the field (  )
    - Or created and added to the job (  ).
  - **Interval:** Choose a stakeout interval (represents a distance), that is, tell Survey Mobile how accurate you want the line to be staked out. For example, if the distance unit used is meters, and you choose 2 meters, then Survey Mobile will guide you along the line, taking you successively to points 2 meters apart.
  - **Start station:** Define the location where you wish to begin staking out the line (see also *About Line Stakeout on page 8*).
- Touch the big yellow **Add** button to create the line. A message indicates that the line has successfully been created. Survey Mobile stays on that screen suggesting that you create a new line (name incremented automatically).
- Touch  when you are finished creating straight lines.

## Defining Arcs Three Ways of Defining an Arc

Arcs may be defined using one of the following three methods:

1. **Two points and center point:** The two points are A and B and the center point is C. Points A and B are on a circle whose center point is C (see below).

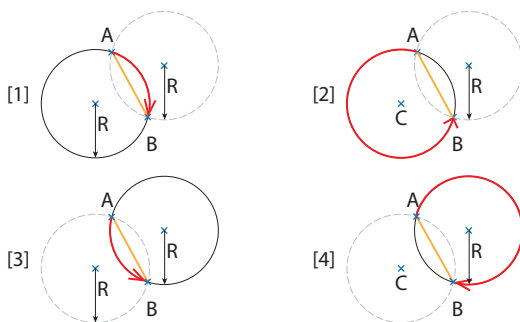


The start point of the arc is A, and the end point is B. Using the locations of A, B and C, Survey Mobile can deduce the radius of the circle.

To choose which of the two arcs is the one you want, you need to indicate whether the center point of the circle is to the right (case [1]) or the left (case [2]) of the arc, seen from the arc moving from A to B.

2. **Two Points and radius:** The two points are A (start point) and B (end point) and the circle radius is R.

Two circles and four arcs are possible.



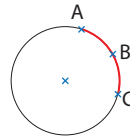
To indicate which arc you want, you should specify the directions of both the arc and the chord with respect to the matching circle center point, seen from the arc, moving from A to B along respectively the arc and the chord:

- Case [1]: Both arc and chord to the right
- Case [2]: Arc to the left, chord to the right
- Case [3]: Both arc and chord to the left
- Case [4]: Arc to the right, chord to the left


3. **Three points:** The three points are A, B, and C. There can only be one circle, then one arc, passing through the three




points (circle radius and center point location are unique in this case).



## Defining an Arc

- In Survey Mobile's main menu, touch , then select **Define**, then **Arcs**.
- **Name:** Name the arc you are defining.
- **Type:** Choose one of the available three methods to define the arc (see previously). On the screen example below, the second method has been selected).

Define arc(rv57)	
Name	A1
Type	Two points and radius
Direction	Left
Center point vs. chord	To the left
Start point	G1
End point	fds4
Radius	25m
Interval	3m
Start station	0+000.0000m
<b>Add</b>	

- Enter additional parameters, as required by the method you chose (directions, points, radius).
- **Interval:** Enter the distance along the arc for which you want Survey Mobile to collect points.
- **Start station:** Enter the distance along the arc where you wish to start surveying the arc (0+000.0000 m by default).
- Touch the **Add** button to create the arc. A message indicates that the arc has successfully been created. Survey Mobile stays on that screen suggesting that you create a new arc (name incremented automatically).
- Touch  when you are finished creating arcs.


## Defining Transitions

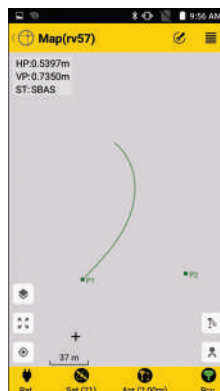
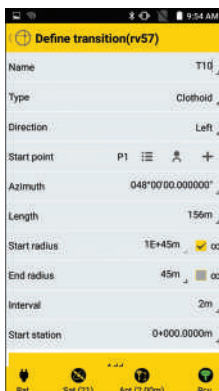
### Two Types of Transitions

Transitions are used to connect a straight line to an arc or vice-versa. To smoothly connect a transition to a straight line, the transition's radius should be infinite at the junction point, and to connect a transition to an arc, the transition's radius should be equal to that of the arc at the junction point. Two different algorithms may be used for a transition:


- **Clothoid:** This curve supports infinite or non-infinite radius values at either end of the transition, but these values cannot be both infinite at the same time as this would amount to creating a straight line transition.
- **Cubic parabola:** Only an infinite radius can be used at the beginning of a cubic parabola transition.

### Defining a Transition

- In Survey Mobile's main menu, touch , then select **Define**, then **Transitions**.
- **Name:** Name the transition you are defining.
- **Type:** Choose one of the available two methods to define the transition (see previously). In the example below, the first method has been selected (setting on the left, resulting transition on the right, as seen on the map screen).





- Enter additional parameters, as required by the method you chose (direction, azimuth, length, radiuses, etc.).
- **Interval:** Enter the distance along the transition for which you want Survey Mobile to collect points.
- **Start station:** Enter the distance along the transition where you wish to start surveying the transition (0+000.0000 m by default).

- Touch the **Add** button to create the transition. A message indicates that the transition has successfully been created. Survey Mobile stays on that screen suggesting that you create a new transition (name incremented automatically).
- Touch  when you are finished creating transitions.

## Defining Alignments


Alignments are as defined in the *Roads* chapter (see *Horizontal Alignment* on page 106 for more details).

- In Survey Mobile's main menu, touch , then select **Define**, then **Alignments**.
- Select the way you want to define your alignment, i.e. through elements or through intersection points.
- **Name:** Name the alignment.
- **Interval:** Enter the distance along the alignment for which you want Survey Mobile to collect points.
- Enter successively the different elements or intersection points making up the alignment:
  - For elements: first start point name, start azimuth and start station, then for each element: element type (straight line, arc, transition) and length.
  - For each intersection point: point type (start point, intersection point or end point), point name and station.
- Touch  located in the title bar to save the alignment once its definition is complete.

## Defining Traverses

Traverses are as defined in the *Important Things to Know in Optical Surveying* chapter (see *Traverse Survey* on page 77 for more details).


This function, which is available only if Survey Mobile is connected to an optical instrument, allows you to create a traverse and just define its start point. That means you will need to open this traverse within the Traverse Survey function to add more points to it (see page 91).

- In Survey Mobile's main menu, touch , then select **Define**, then **Traverses**.
- **Traverse type:** Choose one of the three available traverse types.
- **Traverse name:** Name the traverse.

- **Start Point:** Specify or create the start point of the traverse
- **Backsight of start point:** Specify or create the backsight point used to perform the station setup when starting surveying the traverse.
- Enter the meteorological parameters (temperature, pressure, PPM, refraction) and whether Earth curvature should be taken into account or not.

- Touch **OK** to save the traverse. After saving the traverse, Survey Mobile returns to the **Tools** menu.

## Listing/Deleting Points, Straight Lines, Arcs, Transitions, Alignments and Traverses

- In Survey Mobile's main menu, touch , then select **Data**, then the desired option. Survey Mobile lists all the points, lines, arcs, transitions, alignments or traverses created in the job. By holding the finger on one of these, you have access to a new menu allowing you to delete it. In the points list, if the list does not fit on the screen, you may also select **More** from the same menu so you can see further down in the list. At the bottom of the points list, there is also a button allowing you to delete all the points in one operation.

(See below examples of points list and lines list.)





Point list (rv57)		Line list (rv57)	
<b>PT100</b>		<b>L1</b>	
Point code	100	Line start point	PT100
Point type	Defined	Line end point	PT101
Control point	No	Interval	2.0000m
North	6244305.0000m	Length	68.1836m
East	1359140.0000m	Azimuth	085°47'40.714763"
Elevation	215.0000m	<b>L2</b>	
<b>PT101</b>		Line start point	PT100
Point code	100	Line end point	PT102
Point type	Defined	Interval	3.0000m
Control point	No	Length	95.5249m
North	6244310.0000m	Azimuth	006°00'32.421446"

NOTE 1: In the list of points, the coordinates of all user-defined points continue to be expressed in the system you initially chose to define them (Grid\_NEE, WGS84\_LLH or WGS84\_XYZ), So these coordinates may not always be expressed using the type of coordinates that the coordinate system selected for the job normally suggests.

NOTE 2: When listing traverses, Survey Mobile shows for each of them the traverse type, the number of points in the traverse and the names of respectively the start and back sight points.

## Editing Points

Definitions of points may be corrected if necessary using the procedure below:


- In Survey Mobile's main menu, touch , select **Data** then **Points**.
- Touch briefly the definition of the point you want to edit.
- Touch  located in the upper-right corner of the screen. Editable fields then appear in red characters.
- Correct the value of each of the fields you want to change and when you are done, touch the yellow **Update** button. Survey Mobile then prompts you to update the previous or next point in the list.
- Touch  when you are done with editing points. This takes you back to the list of defined points.
- Touch  again twice to return to the main menu.

## Interfacing Survey Mobile to a GNSS Receiver

### Connecting Survey Mobile to a Receiver via Bluetooth

- Make sure Survey Mobile is set to be connected to a GNSS receiver: On the main menu, you should see a GNSS receiver icon in the title bar. If not, touch the displayed icon (a total station icon) and select **Switch to GNSS**.
- Turn on the GNSS receiver and wait until it has initialized.

- On Survey Mobile, touch  located in the status bar. This opens the **Connect** tab on the **Receiver** screen.

- Touch  located within the **Device** field, at the far right. This causes Survey Mobile to start scanning for Bluetooth devices. A new screen is displayed on which you can see the message **Scanning...**

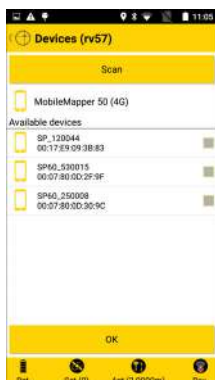
Every time a new Bluetooth device is detected, its Bluetooth ID is added to the list of available devices (under **Available devices**).

Should the scanning fail, you can still touch the big yellow **Scan** button to resume a new search phase.

- Enable the check box corresponding to the GNSS receiver you want to work with and then touch **OK**.

This takes you back to the previous screen where the Bluetooth ID of the chosen device now appears as the current selection in the **Device** field.

- Touch the yellow **Connect** button and then wait until the Bluetooth connection is established.



You may be asked to pair the two units the first time you make a Bluetooth connection with your receiver: either a large message window will pop up, or a more discreet notification will show up in the Android task bar. In both cases, just accept the pairing request.

The receiver status icon in the status bar tells you when the Bluetooth connection with the receiver is active:

Icon	Bluetooth
	Inactive
	Active

## Setting a Rover

Survey Mobile offers four different possibilities to allow the GNSS receiver to operate as a rover providing precise positions:


- **RTK Radio:** Corrections come from a radio transmitter via a radio link. The radio transmitter is connected to the base used.
- **RTK Network:** Corrections come from a VRS network via an NTRIP or Direct IP connection.
- **RTK Bluetooth:** Corrections come from an SP60 or SP80 base over a Bluetooth connection. Only SP60 will offer a long-range Bluetooth connection.
- **RTX:** Corrections come from a Trimble RTX service which broadcasts them either via the Internet or via satellites operating in the same frequency band as GNSS satellites. Supported services include CenterPoint, FieldPoint, ViewPoint and RangePoint.

**IMPORTANT:** When using a Trimble RTX service, the computed position will always be expressed in the current epoch of the ITRF2008 system.

The table below lists the hardware requirements for each of these options.

Option	Requirements
RTK radio	Radio receiver, ideally integrated to GNSS receiver (e.g. SP60 or SP80 with radio module)
RTK Network	SIM card with suitable subscription for mobile data acquisition. Inserted in the data controller (SP60) or in the GNSS receiver (SP80).
RTK Bluetooth	None
RTX	<p>Hardware requirements:</p> <ul style="list-style-type: none"> <li>• Via satellites: None</li> <li>• Via Internet: SIM card with suitable subscription for mobile data acquisition must be inserted in the data controller. Only the data controller may be used for an RTX Internet connection.</li> </ul> <p>In both cases, you also need to purchase a subscription to the chosen Trimble RTX service.</p>


Survey Mobile allows you to create and save different configurations to acquire corrections, based on either of the available options. That way, you can easily switch from one to another if you need to change the source of corrections while in the field.


NOTE: Go to  then select **Rover/Base Configurations**, then **Rover** to list the existing rover configurations. Any unused rover configuration may be deleted from your data collector by making a long touch on the configuration's name, and then by selecting **Delete**.

If you also operate your own base, please set the base first (see *Setting a GNSS Base on page 70*). Likewise, base configurations can be saved so you can easily re-use them when needed).

## RTK Radio

After activating the Bluetooth connection to the receiver (see *Connecting Survey Mobile to a Receiver via Bluetooth on page 28*), do the following:

- Touch  and then open the **Rover** tab.
- Enable the **RTK Radio** check box within the **RTK Radio** field and then touch this field. This opens the **RTK Radio** screen.
- Complete these fields:
  - **Link type:** Type of radio used on GNSS receiver side.  
If the radio is separate from the GNSS receiver, select “**External radio**”.
  - If it's embedded in the GNSS receiver, select “**Internal radio**” (typically SP60 or SP80 with a radio module option installed).

With “**Internal radio**” selected, touch  to access the configuration parameters of the radio (SP60/SP80 internal radio):

- **Protocol:** Up to 7 different protocols available,
- **Air link speed:** 4800 to 19200 Bd,
- **Sensitivity:** Low/Medium/High/Off,
- **Scrambling:** On/Off,
- **Forward error correction (FEC):** On/Off,
- **Power:** Power radiated by the radio when used as a transmitter (500 mW or 2 W).




In most countries, you would typically choose, respectively, “Transparent FST”, “9600 Bd”, “Medium”, “Off” for both scrambling and FEC, in order to comply with the radio-frequency regulations in force. Ask your local dealer for more information.



- **Radio frequency:** Only if “Internal radio” is selected. Select the same frequency as the one used by the base. This frequency should be chosen from the list of available frequencies.
- **Port, Baud rate, Data bits, Parity, Stop bits:** Only if an external radio is used. Tell Survey Mobile which port on the GNSS receiver is used to communicate with this radio. Enter the different parameters used in the serial connection between the GNSS receiver and the radio.
- Touch the big yellow **OK** button to save all the entered parameters. This takes you back to the previous screen.
- Use the **Name** field to enter a name for the configuration you have just defined, then touch **Save** to save it.
- Touch **Start** and wait until a message tells that the whole system is ready for use.

## RTK Network


After activating the Bluetooth connection to the receiver (see *Connecting Survey Mobile to a Receiver via Bluetooth on page 28*), do the following:

- Touch  and then open the **Rover** tab.
  - Enable the **RTK Network** check box within the **RTK Network** field and then touch this field. This opens a new screen.
  - Complete these fields:
    - **Link type:** Choose “**Controller Internet**” for SP60, “**Internal Internet**” for SP80,
    - **IP, Port:** Enter the base IP address,
    - **User, Password:** Enter your credentials allowing you to receive corrections from the VRS network.
  - Touch  in the **Mount point** field to download the NTRIP source table and then choose one mount point from the scroll-down list attached to this field.
- NOTE: Touch  if you want to cancel this operation.
- Touch the big yellow **OK** button to save all the entered parameters. This takes you back to the previous screen.
  - Use the **Name** field to enter a name for the configuration you have just defined, then touch **Save** to save it.
  - Touch **Start** and wait until a message tells you that the whole system is ready for use.

## RTK Bluetooth


This operating mode is made available only if the connected GNSS receiver is a Spectra Precision SP60 (SP80 is also possible but offers a shorter coverage).

After activating the Bluetooth connection to the receiver (see *Connecting Survey Mobile to a Receiver via Bluetooth on page 28*), do the following:



- Touch  and then open the **Rover** tab.
- Enable the **RTK Bluetooth** check box within the **RTK Bluetooth** field and then touch this field. This opens the **RTK Bluetooth** screen.
- Touch the **Scan** button to search for the SP60 receiver within range operated as a base and delivering RTK corrections over its long-range Bluetooth device.
- Select this SP60 once Survey Mobile has found it and then touch **OK**.
- Select it again and touch **OK** again.
- Name the rover configuration and touch **Save** to save it.
- Touch **Start**. **Starting...** is displayed for a while. When the long-range Bluetooth link starts running, both the rover and base emit a beep. Wait until an RTK position is reported to be computed before starting your job.

## RTX

After activating the Bluetooth connection to the receiver (see *Connecting Survey Mobile to a Receiver via Bluetooth on page 28*), do the following:

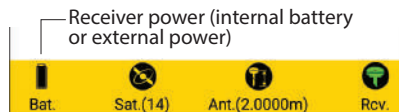
- Touch  and then open the **Rover** tab.
- Enable the **RTX** check box within the **RTX** field and then touch this field. This opens the **RTX** screen.
- Complete these fields:
  - **Link type**: For SP60, choose “**Controller Internet**” (corrections via Internet) or “**RTX satellite**” (corrections via satellite). For SP80, you can only select “**Controller Internet**” (corrections via Internet),
  - **Stream** (only if **Link type**= **Controller Internet**): Choose the type of correction data received via the Internet (RTXAUTO and RTXIP can be used whatever the continent on which you are; RTXEU is for Europe only, RTXNA for North America only).

## Loading a Previously Saved Configuration





- Touch  and then open the **Rover** tab.
- Touch  within the **Name** field. This opens a new window listing all the saved configurations.
- Select the configuration you wish to use. As a result, this configuration is loaded to Survey Mobile as the current configuration which the GNSS receiver uses right away to acquire RTK corrections.

## Battery Icon

The battery icon shown in the left-hand corner of the status bar describes the state of the power supply used to power the GNSS receiver Survey Mobile is connected to.



The table below shows what the battery icon may typically look like.


Icon	Meaning	Icon	Meaning
	Survey Mobile not connected to any GNSS receiver		GNSS receiver powered from its internal battery (more than 50% remaining charge)
	GNSS receiver powered from an external power source		GNSS receiver powered from its internal battery (less than 50% remaining charge)

The exact percentage of remaining charge can be read on the screen by touching the battery icon. This opens a new screen on which you can read the percentage.

If the receiver is connected to an external DC power source, the screen will always indicate 100% of remaining charge.


## Other Useful Information about the Receiver

Useful information about the GNSS receiver is available at any time:

- Touch  and then open the **Status** tab. This tab provides status information about the receiver power supply, the current coordinates of computed position, the base used and the satellites tracked and used. See the two examples below (with RTX position solution on the right).

Receiver (test14)	
Connect	Rover
Position	
Latitude	047°17'56.259558"
Longitude	-001°30'32.592120"
Height	88.3033m
Horizontal precision	0.0108m
Vertical precision	0.0180m
PDOP	1.3
Solution type	RTKFixed
Correction age	1s
Base information	
Latitude	047°17'56.261640"
Longitude	-001°30'32.591880"
Height	88.3320m
Antenna height	0.0000m
Baseline	m
Satellites tracked:25	
GPS	11
GLONASS	9
Beidou	2
Galileo	3
QZSS	0
Satellites used:11	

Receiver (test14)	
Connect	Rover
Position	
Latitude	047°17'56.260761"
Longitude	-001°30'32.590705"
Height	88.2901m
Horizontal precision	0.0214m
Vertical precision	0.0440m
PDOP	1.3
Solution type	RTX
Correction age	8s
RTX	
RTX Latitude	047°17'56.277648"
RTX Longitude	-001°30'32.569692"
RTX Height	88.2983m
Reference frame	ITRF2008
Epoch	2017.2
Tectonic plate	Eurasia
RTX position type	CenterPointFastInit
Base information	
Latitude	000°00'00.000000"
Longitude	000°00'00.000000"
Height	m
Antenna height	m

- Touch  and then open the **Properties** tab. This tab provides information about the receiver serial number, firmware version and lists RTX subscriptions, if any.



# Interfacing Survey Mobile to a Mechanical Total Station

## Connecting Survey Mobile to a Total Station via Bluetooth



- Make sure Survey Mobile is set to be connected to a mechanical total station: On the main menu, you should see a total station icon in the title bar. If not, tap on the displayed icon (a GNSS receiver icon) and select **Switch to Optical**. By default, Survey Mobile is set to operate in GNSS mode.
- Turn on the total station and wait until it has initialized.
- Level the station. With total stations using Windows as user interface, you will have to run some pre-installed software to be able to level the instrument.

For example, on FOCUS 8, Run **External Connection**. Only after having leveled the total station will you be allowed to establish a Bluetooth connection between the total station and Survey Mobile.

- On Survey Mobile, touch  located in the status bar. This opens the **Connect** tab on the **Total Station** screen.
- Touch  located within the **Device** field, at the far right. This causes Survey Mobile to start scanning for Bluetooth devices. A new screen is displayed on which you can see the message **Scanning...**

Every time a new Bluetooth device is detected, its Bluetooth ID is added to the list of available devices (under **Available devices**).

Should the scanning fail, you can still touch the big yellow **Scan** button to resume a new search phase.



- Enable the check box corresponding to the total station you want to work with and then touch **OK**. This takes you back to the previous screen where the Bluetooth ID of the chosen device now appears as the current selection in the **Device** field.
- Touch the yellow **Connect** button and then wait until the Bluetooth connection is established.





You may be asked to pair the two units the first time you make a Bluetooth connection with your total station: either a large message window will pop up, or a more discreet notification will show up in the Android task bar. In both cases, just accept the pairing request. (The pairing code is “0530”.)

The icon in the status bar tells you when the Bluetooth connection with the total station is active:

Icon	Bluetooth
	Inactive
	Active

## Optical Status Bar

With a total station connected to Survey Mobile, the status bar shown in the lower part of the screen looks like this:



From left to right:

- **Battery icon:** Describes the charge state of the battery used to power the total station Survey Mobile is connected to.

The exact percentage of remaining charge can be read on the screen by touching the battery icon. This opens a new screen on which you can read the percentage.

- **Laser icon:** This icon acts as a switch. Touch this icon to turn on or off the visible laser of the total station. When the laser is active, the icon looks like this:




Turning on or off the visible laser will simultaneously change the target type to respectively prism or Direct Reflex.

- **Target icon:** Allows you to define the target used by the total station. The definition of a target includes the parameters below:
  - **Target type:** Prism or Direct Reflex.
  - **Laser:** This box allows you to turn on or off the total station's visible laser.
  - **Target height,** in the selected distance unit. Note that prism and Direct Reflex targets use independent and different heights (usually "0" for Direct Reflex targets, and "> 0" for prisms).
  - **Prism constant** (for prism target only), in millimeters.
- **Total station icon:** Shows whether Survey Mobile is connected to a total station via Bluetooth or not (see previous section).

### Other Useful Information about the Total Station

Useful information about the total station is available at any time:

- Touch  and then open the **Properties** tab. This tab provides information about the total station model, mode and serial number.

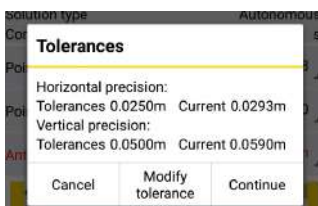
## Important Things To Know in GNSS Surveying


### Points vs. Control Points

For a “common” point, Survey Mobile assigns the last computed position delivered by the GNSS receiver to the surveyed point. The point position therefore results from a single measurement and the point is logged almost instantly. For a control point, Survey Mobile averages the successive positions delivered by the GNSS receiver over a user-settable period of time (controlled by the **Epochs** parameter). Only at the end of this time will Survey Mobile assign the averaged position to the control point. That position will statistically be more accurate than that obtained through a single measurement. Logging a control point therefore takes more time than logging a “common” point.

### Tolerances

- **Points:** Should the current horizontal and/or vertical precision be beyond the permitted tolerances when making a point measurement, then Survey Mobile would warn you (see example below). You can then choose whether you want to save the point measurement (**Yes**) or reject it (**Cancel**).



The tolerance values may be changed at this stage if needed. Touch **Modify tolerance**, enter the desired values, then touch .

- **Control Points:** When measuring a control point, the message “**Failed to measure point**” will show up if at least 40% of the measurements made are not RTK fixed solutions.

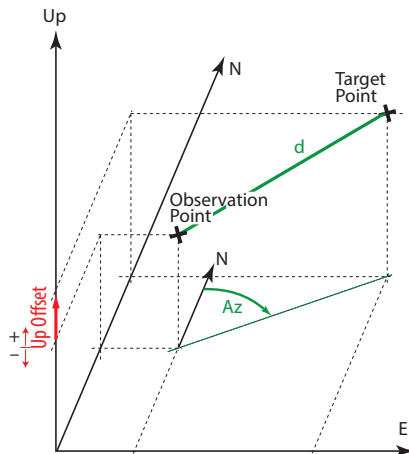


## Offset Points

The offset procedure is used when the point you want to measure (the “target point”) is inaccessible. In this case, you will rely on a point located nearby, called “observation point”. You will then have to describe the offset from the observation point to the target point. You should also make sure GNSS reception at the observation point you choose is good.

The method used to perform an offset point measurement is called **Distance-Azimuth Offset** (see diagram below). This method requires that you measure and provide Survey Mobile with the following two parameters:

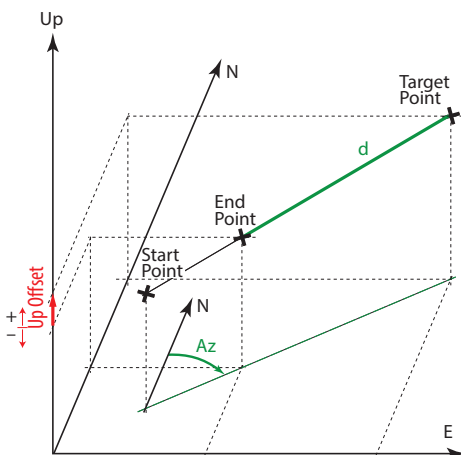
- d: Slope distance between observation point and inaccessible point (target point).
- Az: Azimuth angle from observation point to target point.



If unknown, the azimuth may be determined by Survey Mobile, directly in the field, **by specifying two points aligned with the target point** (see diagram below).

In this case you have two observation points instead of just one. These points are named as follows:

- **Start Point:** This is the point the farthest to the target point. This point should be occupied, making sure GNSS reception is good on this point.
- **End Point:** This is the point the closest to the target point and is located on the same line as the start and target points. You should occupy this point making sure GNSS reception is good at this point as well, and then you should measure the distance from this point to the target point using an external measuring tool (tape measure, etc.).



NOTE: The start and end points may be points stored in the job in which case you don't need to measure them but simply to mention their names to get their coordinates.

## Continuous Survey

Continuous survey allows automatic collection of points at regular intervals of time or distance as you walk within the working area. Each new collected point is named automatically.

For example if you use a time interval of 10 seconds, then the computed position will be picked every 10 seconds whatever the distance you will have traveled in the meantime. If you use a distance interval of 10 meters, then the computed position will be picked every 10 meters of distance (along a straight line) separating the last point measured from the next one, whatever the time it took to travel this distance.

In both cases, the position saved is the one of your current location at the time of point collection.

## About Static and Stop & Go Surveys

### Definitions

Survey Mobile allows you to perform two different types of post-processed surveys:

- **Static Survey:** GNSS raw data are continuously recorded with the receiver permanently installed on a point (static operation). You just have to start, and later stop, the raw data recording performed on that point.
- **Stop & Go survey:** GNSS raw data are continuously recorded as you walk along a trajectory, carrying your surveying system. When you stop walking for a while (typically on a point of interest), you mark the moment you start the static occupation and then the moment you start walking again.

### Conventions Used to Name Raw Data Files

When running Static or Stop & Go surveys, Survey Mobile automatically creates files to save the collected raw data. File naming is in the form:

For static surveys:

**G<Receiver ID1><Index><Year>.<Day>**

For Stop & Go surveys:

**GF<Receiver ID2><Index><Year>.<Day>**

Where:

G: File header (ATOM format) for static raw data

GF: File header (ATOM format) for stop&go raw data

<Receiver ID1>: The last 4 characters from the Bluetooth name of the connected receiver.

<Receiver ID2>: The last 3 characters from the Bluetooth name of the connected receiver.

<Index>: Rank in current day (A to Z, then AA to AZ) (A for file logged first)


<Year>: Last two figures of current year


<Day>: File extension. Day number in year (1-366)

Examples: "G0015A16.132" (static survey);

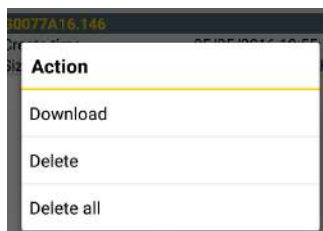
"GF015A16.133" (Stop & Go survey).

### Downloading G-Files from the Connected Receiver

- : Touch this button located in the right-upper corner of the screen after entering the Static or Stop & Go survey function. This opens a new screen listing all the G-files stored on the receiver.

At this stage you may touch  to have access to the Download directory in the internal memory or SD card (SurveyMobile.Droid/Download/) from which you can view or copy files from outside Survey Mobile.

- Hold the finger pressed on the name of the file you want to download until this menu is displayed:




- Select **Download**. Wait until this operation is complete.

NOTE: You can also use this popup menu to delete one or all the G-files stored in the receiver.

### Clearing the Receiver Memory

If you run out of receiver memory while being in the field, there is an emergency procedure that allows you to delete all the files from the receiver memory. Obviously you will not delete important files that have not been previously backed up at the office. So please think about the files still in memory before you use this procedure.

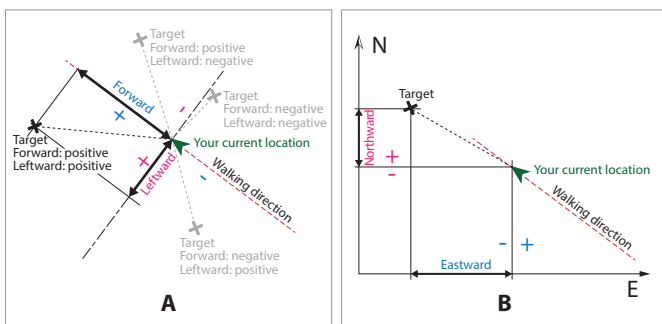
- In Survey Mobile, open the Static or Stop & Go screen.
- Touch  (located by the current value of memory size available).
- Confirm you want to delete all the files.


## Stakeout Guidance Options

Whether you are staking out a point, a line (i.e. a straight line, arc or transition) an alignment, a cross-section or a road, you may decide which type of guidance instructions you want on the screen as you move around in the field to your current target. Survey Mobile offers two sets of guidance instructions:

- **Forward and Leftward:** Components of the distance still to go, as measured taking into account the current walking direction (see diagram A).


- **Northward and Eastward:** North and East components of the distance still to go (see diagram B).



To make this choice, touch  in the title bar after you have selected the desired stakeout function.

# Surveying With a GNSS Receiver

## Preparatory Steps    Choosing Units, Number of Decimals and Tolerances

- In Survey Mobile's main menu, touch  and then **Settings**.

The new screen that opens (see below) allows you to choose:

- The units you want to use for distances (meters, feet, US survey feet), areas (square meters, hectares) and angles (Degrees, DDMSS, Radians, Gons).
- The number of decimal places you want Survey Mobile to provide for all distance, area and angle measurements.

NOTE: In some languages, the decimal point is displayed as a comma.

- The permitted tolerances in terms of horizontal and vertical precision, and of PDOP, for any real-time measurements made by the GNSS receiver.


Should these figures be exceeded, Survey Mobile would warn you so you can choose whether you want to keep or reject those measurements not meeting the criteria.



- **Filter instrument name:** When requested to scan for Bluetooth devices, Survey Mobile will either list the names of all the detected Bluetooth devices (case where the **Filter instrument name** option is disabled), or


on the contrary, with the option enabled, will only list the names corresponding to supported devices (i.e. those of Spectra Precision GNSS receivers).

- **Data order:** Setting this option allows you to arrange your lists of points, lines, etc. from the oldest to the latest (**Time in ascending order**) or the other way around (**Time in descending order**).

- Touch  located in the title bar to validate all your changes.

## Entering the Antenna Height

Whether the GNSS receiver Survey Mobile is currently connected to is used as a base or a rover, you need to set the height of its GNSS antenna.

- Start a Bluetooth connection with the GNSS receiver, as explained in *Connecting Survey Mobile to a Receiver via Bluetooth on page 28*.
- Touch . This opens the **Antenna** screen from which you can set the following parameters:
  - **Antenna Type:** A read-only parameter. This field indicates the model of GNSS receiver Survey Mobile is currently connected to.
  - **Measure to:** Indicate which point on the antenna is used as the reference point in the measurement of antenna height performed below.
 

“**Bottom of antenna mount**” is generally used at a rover. The resulting measurement is a vertical measurement which represents the true antenna height.

“**Slant measure mark**” is generally used at a base. The resulting measurement is a slant measurement which is not the true antenna height. But the GNSS receiver will automatically convert this measurement into the true value of antenna height.
  - **Antenna Height:** Enter the distance measurement you have made from the chosen antenna reference point (see above) to the survey point on the ground (max. permitted value: 999 m).
 

NOTE: The antenna height can also be changed when you are about to log a point.
- Touch the big yellow **OK** button to validate all you changes.

Antenna	
Antenna type	SP60
Measure to	Bottom of antenna mount
Antenna height	2m
Cancel	Continue


**IMPORTANT!** Survey Mobile wants to be sure you are always using the right values for these three parameters. That's why at the following steps, you will be asked to confirm or correct their values (see screen example) before Survey Mobile can go any further:

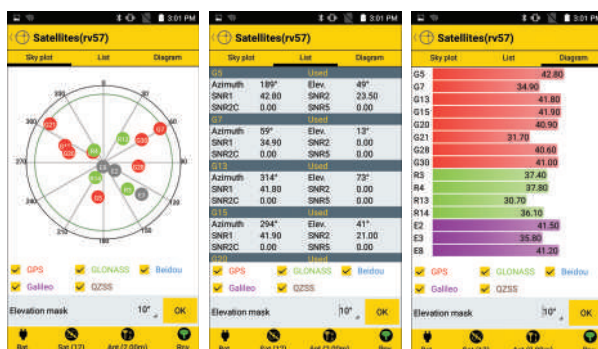
- When selecting **Point Survey**, **Control Point Survey** or **Offset Survey**.
- When selecting **Point Stakeout**, **Line Stakeout** or **Stake out road**.
- Before logging the start or end point of a line.
- Before logging a point within the site calibration function.
- Before logging a point within the COGO function.

### Checking/Setting GNSS Reception & Elevation Mask

Survey Mobile provides a view of all the GNSS satellites currently tracked so you can see at a glance how well your receiver is running at its current location.

On the same screen, Survey Mobile allows you to adjust the value of elevation mask, if required.

- Start a Bluetooth connection with the GNSS receiver, as explained in *Connecting Survey Mobile to a Receiver via Bluetooth on page 28*.
- Touch . Survey Mobile displays a polar view providing the current status of GNSS reception. Two other tabs (**List**, **Diagram**) are available so you can better assess the GNSS reception conditions. See screen examples below.



- To change the value of elevation mask shown at the bottom of the screen, just touch the current value and type in the desired value. Then touch **OK** to validate the new value.




NOTE 1: All GNSS constellations are tracked by default but you may deselect one (or more), if desirable, by clearing the corresponding check box shown on this screen.

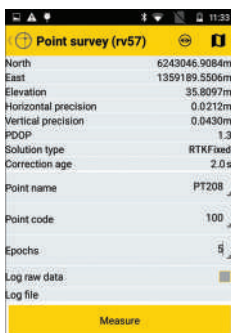
NOTE 2: The number of satellites being used for computing the position is indicated by the satellite icon. If however the mobile device's internal GNSS receiver is used, this number will always be "0" regardless of the number of satellites actually used.

## Point Survey

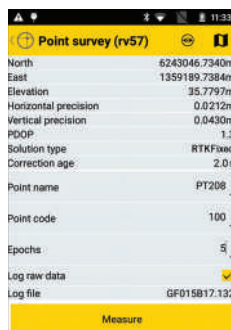
Assuming your system is now ready for use:

- In Survey Mobile's main menu, touch .
- Touch **Point survey**. Confirm or correct the antenna parameters then tap **Continue**. Survey Mobile opens a new screen from which you can log points.

The upper part of the screen shows the coordinates of your current position – as computed by the GNSS receiver – as well as accuracy-related figures (horizontal/vertical accuracies, PDOP) and the position computation status (solution type, correction age).



Point survey (rv57)	
North	6243046.9084m
East	1359189.5506m
Elevation	35.8097m
Horizontal precision	0.0212m
Vertical precision	0.0430m
PDOP	1.3
Solution type	RTKFixed
Correction age	2.0 s
Point name	PT208
Point code	100
Epochs	5
Log raw data	<input type="checkbox"/>
Log file	
Measure	



Point survey (rv57)	
North	6243046.7340m
East	1359189.7384m
Elevation	35.7797m
Horizontal precision	0.0212m
Vertical precision	0.0430m
PDOP	1.3
Solution type	RTKFixed
Correction age	2.0 s
Point name	PT208
Point code	100
Epochs	5
Log raw data	<input checked="" type="checkbox"/>
Log file	GF015817.132
Measure	

- Use the fields in the lower part of the screen to prepare a point measurement:
  - **Point name** and **Point code**: Enter a point name and optionally, a point code.
  - **Epochs**: Enter the number of epochs (in seconds) at the end of which the computed position will be saved. If you leave the field empty or equal to "0", Survey Mobile will perform an instantaneous measurement of the position. If you enter a number equal to or greater than "1", Survey Mobile will average the position over this period of time and will save the resulting averaged position as the point position.

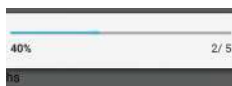
- **Log raw data:** Check this box if you wish to start a Stop & Go raw data recording before logging the point.

When checking the box, Survey Mobile will switch directly to the Stop&Go screen from which you can start data logging after having checked the different recording parameters.

After touching **Start**, Survey Mobile will come back to the previous screen where you can see the name of the raw file being logged (see screen above on the right).

Conversely, if this option is activated and you want to stop the data recording, clear the box and touch **OK** to confirm.

- Make sure you are standing exactly over the point, keep the pole vertical and stay at standstill.
- Touch the big yellow **Measure** button (or press **Volume-**). The point is being measured.



With **Epochs** set to 1 or more, a progression bar is displayed until all the measurements have been made (see example). If the measurement is successful, the point coordinates appear in blue characters at the top of the screen meaning they are being saved to the job. A sound can be heard at the same time meaning the point measurement is complete.


With **Epochs** set to 0 or empty, the progression bar sequence is skipped: the instantly measured position is saved right away, as the point coordinates appear in blue on the screen. A sound can be heard at the same time.

Survey Mobile then increments the point name (see *Automatic Naming on page 6*) and prompts you to log a new point.

- Log as many points as required using the above procedure.

## Control Point Survey

Assuming your system is now ready for use:

- In Survey Mobile's main menu, touch .
- Touch **Control point survey**. Confirm or correct the antenna parameters then tap **Continue**. Survey Mobile opens a new screen from which you can log a new control point.

The upper part of the screen shows the coordinates of your current position – as computed by the GNSS receiver – as well as accuracy-related figures (horizontal/vertical accuracies, PDOP) and the position computation status (solution type, correction age).



Control point survey...	
North	6243045.4473m
East	1359190.1840m
Elevation	37.9388m
Horizontal precision	0.0212m
Vertical precision	0.0430m
PDOP	1.3
Solution type	RTKFixed
Correction age	2.0 s
Point name	PT208
Point code	100
Epochs	12
<b>Measure</b>	

- Use the last four fields in the lower part of the screen to prepare a measurement: Enter a point name and optionally, a point code.

Use the **Epochs** field to specify the required averaging time before Survey Mobile delivers a position for the control point. The greater this value, the longer the time before Survey Mobile delivers a position (1 epoch= 1 second).

- Make sure you are standing exactly over the point, keep the pole vertical and stay at standstill.
- Touch the big yellow **Measure** button (or press **Volume-**). Survey Mobile starts averaging the computed position over the requested number of epochs.

A progress bar is displayed (see example below with 10 epochs requested) showing how long you still have to stay at standstill before the averaged position is delivered.



Control point survey...	
Epochs: 10	
Progress: 30%	3/10
<b>Measure</b>	


If the measurement is successful, the control point is then created and saved to the job. A sound can be heard meaning the control point measurement is complete.

Survey Mobile then increments the point name (see *Automatic Naming on page 6*) and prompts you to log a new control point.

- Log as many control points as required using the above procedure.

## Offset Survey

Please read *Offset Points on page 39* before starting. Then assuming your system is ready for use:

- In Survey Mobile's main menu, touch .
- Touch **Offset Survey**. Confirm or correct the antenna parameters then tap **Continue**. Survey Mobile opens a new screen from which you can log a point using the **Distance-Azimuth Offset** method.

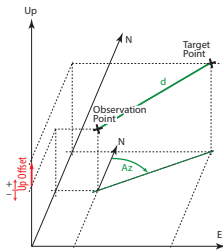
The upper part of the screen shows the coordinates of your current position – as computed by the GNSS receiver – as well as accuracy-related figures (horizontal/vertical accuracies, PDOP) and the position computation status (solution type, correction age).

- Use the last fields in the lower part of the screen to prepare your offset measurement. The **Type** row reads **Distance-Azimuth offset**, which is the name of the method used to perform the offset point measurement. For more information on this method, see *Offset Points on page 39*.



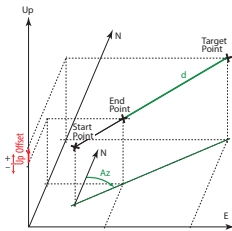
Offset survey (rv57)	
North	6243045.3642m
East	1359190.2998m
Elevation	36.6057m
Horizontal precision	0.0212m
Vertical precision	0.0430m
PDOP	1.3
Solution type	RTKFixed
Correction age	2.6s
Type	Distance-Azimuth offset
Azimuth to target point	002°37'29.000000"
Distance to target point	m
Up offset	m
Point name	PT214
Point code	Input
Epochs	Input

- Then follow one of the procedures below depending on whether you already know the azimuth or you need to measure two points to determine this angle.




**1st case:** The azimuth from the observation point is known or was previously determined using an external measuring tool (compass, etc.):

- Choose the observation point from where to make the offset measurement.
- Touch 000°00'00.000000 in the **Azimuth to target point** field and enter the known value of azimuth.
- Measure and enter the distance from the observation point to the target point (**Distance to target point** field) using an external measuring tool (tape measure, etc.).
- Measure and enter the height deviation between the target point and the observation point (**Up offset** field) (positive if target point higher than observation point).
- Enter a point name for the target point and possibly a point code.
- Touch the big yellow **Measure** button (or press **Volume-**). The point is being measured and then saved to the job. While the measurement takes place, the top of the screen shows point coordinates in blue characters. Mobile Survey then increments the point name (see *Automatic Naming on page 6*) prompting you to log a new offset point.



**2nd case:** Azimuth from observation point is unknown and you want to use Survey Mobile to determine this angle:



- Mark two points on the ground, both aligned with the target point.
- Touch . A new screen is displayed allowing you to calculate the azimuth. Survey Mobile needs to know the position of each of these points.

Start point	
Start point	PT100
North	6244305m
East	1359140m
Elevation	215m
End point	
End point	PT101
North	6244310m
East	1359208m
Elevation	214m

Calculate

This can be made: 1) either by entering manually the known coordinates of these points (if they are known), 2) by specifying the names of these points if they are stored

in the job, or 3) by occupying these points one after the other. In the latter case, do the following:

- Stand on the start point (the one the furthest to the target point).
  - Touch  to measure the coordinates of the point (you don't need to name the point).
  - Move to the end point.
  - Touch  to measure the coordinates of the end point (you don't need to name the point).
  - Still standing on the end point, touch the big yellow **Calculate** button. This calculates the azimuth angle and takes you back to the previous screen.
- Measure and enter the distance from the end point to the target point (**Distance to target point** field) using an external measuring tool (tape measure, etc.).
  - Measure and enter the height deviation between the target point and the end point (**Up offset** field) (positive if target point higher than end point).
  - Enter a point name for the target point and possibly a point code.
  - Enter the number of epochs (in seconds) at the end of which the computed position will be saved. If you leave the field empty or equal to “0”, Survey Mobile will perform an instantaneous measurement of the position. If you enter a number equal to or greater than “1”, Survey Mobile will average the position over this period of time and will save the resulting averaged position as the point position.
  - Check the **Log raw data** box if you wish to start a Stop & Go raw data recording before logging the point.  
When checking the box, Survey Mobile will switch directly to the Stop&Go screen from which you can start data logging after having checked the different recording parameters.  
After touching **Start**, Survey Mobile will come back to the previous screen where you can see the name of the raw file being logged (see screen above on the right)  
Conversely, if this option is activated and you want to stop the data recording, clear the box and touch **OK** to confirm.
  - Touch the big yellow **Measure** button. The point is being measured.



With **Epochs** set to 1 or more, a progression bar is displayed until all the measurements have been made (see example). If the measurement is successful, the point coordinates appear in blue characters at the top of the screen meaning they are being saved to the job. A sound can be heard at the same time meaning the point measurement is complete.


With **Epochs** set to 0 or empty, the progression bar sequence is skipped: the instantly measured position is saved right away, as the point coordinates appear in blue on the screen. A sound can be heard at the same time.

Mobile Survey then increments the point name (see *Automatic Naming on page 6*) prompting you to log a new offset point.

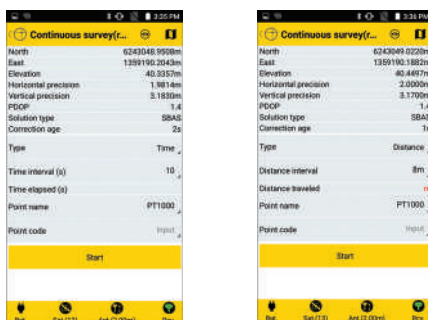


**IMPORTANT:** Once you have computed the azimuth, while occupying the end point, you may not stay on this point to measure the target point. You are allowed to move along the line formed by the start, end and target points provided that at all times you get an accurate position computation AND the slope distance and up offset to the target point you have entered are the ones seen from your current location (and not from the end point).

## Continuous Survey


- Get your equipment ready for Continuous operation and then turn it on. Typically the GNSS antenna or receiver is mounted on top of a range pole.
- In Survey Mobile's main menu, touch .
- Touch **Continuous survey**.
- Confirm or correct the antenna parameters then tap **Continue**. Survey Mobile opens a new screen from which you can configure and start the Continuous survey. The upper part of the screen shows the coordinates of your current position – as computed by the GNSS receiver – as well as accuracy-related figures (horizontal/vertical accuracies, PDOP) and the position computation status (solution type, correction age).

- Choose the type of continuous survey you want to perform (**Time** or **Distance**).



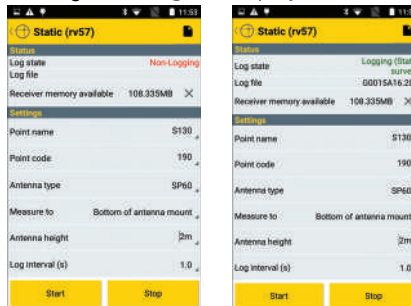
- Enter the corresponding interval (a time in seconds or a distance in the selected distance unit).
- Give a name and a code to the first point that will be collected. The point name will then be incremented automatically before collecting the next point whereas the point code will stay the same throughout the survey.
- Get ready to walk and then tap **Start**. Survey Mobile automatically starts counting the time elapsed or distance traveled since you tapped **Start**.
- Start walking within the working area and let Survey Mobile collect the points according to your request. You've got nothing else to do but walk as planned.
- When you are finished, tap **Stop**. Then confirm it's the end of the continuous survey.

## Static Survey

- Install your equipment on the point to be surveyed and then turn it on. Typically the GNSS antenna or receiver is mounted on top of a tripod or bipod.
- In Survey Mobile's main menu, touch .
- Touch **Static survey**. Survey Mobile opens a new screen from which you can start logging raw data at the chosen location.
- First enter the following settings (see screen below left):
  - **Point name**: Enter a name of the point where static occupation is going to take place.
  - **Point code**: Enter additional information about the point (optional).




- **Antenna type:** A read-only parameter. This field is automatically filled in with the name of the GNSS receiver Survey Mobile is connected to.
  - **Measure to:** Indicate which point on the GNSS antenna the antenna height measurement refers to.
  - **Antenna height:** Enter the value of height measurement made so that Survey Mobile can determine the real height of the GNSS antenna.
  - **Log interval (s):** Enter the raw data recording rate, in seconds.
- Then touch **Start**. Data logging starts after a few seconds (**Starting...** message is displayed in the meantime).



- Let Survey Mobile log raw data. During this time, the top of the screen shows the data logging and memory statuses as well as the name of the file where raw data are being stored (see screen above right). The file is named according to the convention presented in *Conventions Used to Name Raw Data Files on page 41*.
- After enough data has been logged, touch **Stop** to end the static survey.

## Stop and Go Survey

- Get your equipment ready for Stop & Go operation and then turn it on. Typically the GNSS antenna or receiver is mounted on top of a range pole.
- In Survey Mobile's main menu, touch .
- Touch **Stop & Go survey**. Survey Mobile opens a new screen from which you can start logging raw data in Stop & Go mode.
- First enter the following settings (see screen below left):
  - **Antenna type:** A read-only parameter. This field is automatically filled in with the name of the GNSS receiver Survey Mobile is connected to.

- **Measure to:** Indicate which point on the GNSS antenna the antenna height measurement refers to.
- **Antenna height:** Enter the value of height measurement made so that Survey Mobile can determine the real height of the GNSS antenna.
- **Log interval (s):** Enter the raw data recording rate, in seconds.



- Touch the yellow **Start** button. Survey Mobile starts logging GNSS raw data for your current location. A new screen is displayed showing the data logging status (“**Logging**”), the name of the opened raw data file and the amount of memory available on the receiver.

Survey Mobile prompts you to enter the following parameters for the first point you will occupy:

- **Point name**
- **Point code**
- **Occupation time (s)**, in seconds (typical values between 5 and 20 s).

NOTE: Enter “0” if you want to control manually the moment when you stop the occupation.




- Move to the first point you want to occupy and then, while staying static on this point, touch the yellow **Log point** button.


Keep static until Survey Mobile indicates the occupation time is up. You can check the progress of the occupation by watching the **Time elapsed (s)** parameter shown at the bottom of the screen.



Note that if you wish, you may shorten the occupation time by touching the yellow **Stop** button. This will instantly end the occupation time on the point.

- Resume the previous step for each of the points you want to occupy during your survey.
- Then when you are done, touch the yellow **Stop** button to end the Stop & Go survey.
- Touch  to return to the Survey menu.


## Point Stakeout

- In Survey Mobile's main menu, touch .
- Touch **Point Stakeout**. Confirm or correct the antenna parameters then tap **Continue**. Survey Mobile opens a new screen from which you can stake out a point.




The upper part of the screen shows the coordinates of your current position – as computed by the GNSS receiver – as well as accuracy-related figures (horizontal/vertical accuracies, PDOP) and the position computation status (solution type, correction age).

- Use the scroll-down list in the **Point name** field to choose the point from the open job that you want to stake out. The lower part of the screen shows information on the selected point (name, code, coordinates).

NOTE: Other possible actions from within this field:

- You may touch  located in the title bar to select the type of guidance you want to walk to the target

(Northward/Eastward or Forward/Leftward; see *Stakeout Guidance Options on page 42*).

- You may touch  to list all the points stored in the job and select one to be staked out.
- You may touch  to create a new point that you would like to stake out.
- You may touch  to select the point in the job that is the nearest to your current position.



The screenshot shows the 'Stakeout (rv57)' application interface. At the top, there's a yellow header with the title and icons. Below the header, a table displays various data points:

North	6243045.9017m
East	1359190.0698m
Elevation	37.9608m
Horizontal precision	0.0212m
Vertical precision	0.0430m
PDOP	1.3
Solution type	RTKFixed
Correction age	2.0s

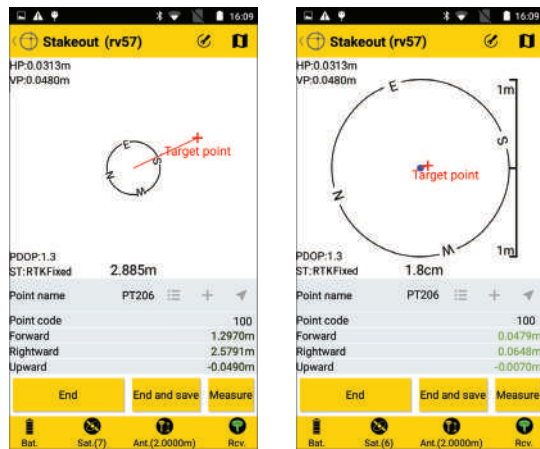
Below the table, there's a section for 'Point name' (PT206) with icons for list, plus, and arrow. Underneath, another table shows point-specific data:

Point code	100
North	6243045.6188m
East	1359190.4999m
Elevation	36.3858m

At the bottom, there's a field for 'H. tolerance(cm)' with a value of 3 and a 'Start' button.

- Set the horizontal tolerance (expressed in the selected distance unit). The point will be staked out only if the horizontal precision on the position solution is better than this tolerance.
- Touch **Start** to begin (or press **Volume-**). The screen then shows a compass giving the direction to the point. The lower part of the screen also shows in real time the North, East and vertical components of the distance to go to reach the point (see below left).
- Walk in that direction, watching on the screen the values of these components as you move forward to the point. When you are exactly on the point, the screen looks like the one below right (note that when the computed

coordinates turn green, you are within the expected tolerance and allowed to stake out the point).




- Dig a stake into the ground to mark the point.
- Touch **End and Save** (or press **Volume+**) if you want to quit and save the position solution currently provided by Survey Mobile for the staked out point. By default, the point will be named "<target\_point\_name>\_stakeout", but you may enter a different name if you wish. You may also type in a code for this point (**Point Code** field). After choosing a name and possibly a code for the point, tap **OK** to save it.


Touch **End** if you just want to quit without saving that position.

NOTE: At any time while walking to the target point, you may additionally measure any position you are on by touching the **Measure** button. Following this action you have the possibility to save that position as a new point by touching the big yellow **Measure** button again.

## Line Stakeout



- In Survey Mobile's main menu, touch .
- Touch **Line Stakeout**. First select the type of line you want to survey (a straight line, an arc or a transition). Then confirm or correct the antenna parameters and tap **Continue**. Survey Mobile opens a new screen from which you can create and stake out a line.



The upper part of the screen shows the coordinates of your current position – as computed by the GNSS receiver – as well as accuracy-related figures (horizontal/vertical accuracies, PDOP) and the position computation status (solution type, correction age).



Stakeout (rv57)	
North	6243045.4755m
East	1359190.1162m
Elevation	37.8738m
Horizontal precision	0.0212m
Vertical precision	0.0430m
PDOP	1.3
Solution type	RTKFixed
Correction age	2.0s
Line name	: : +

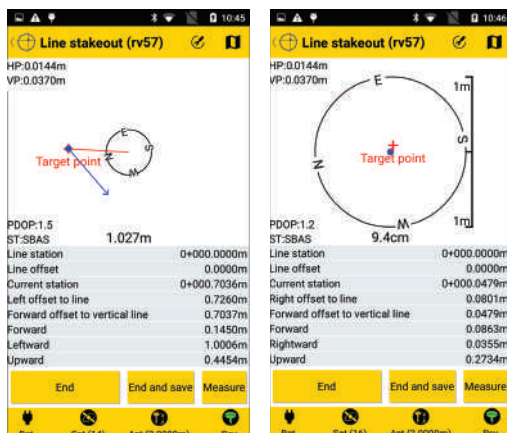
- Select an existing straight line, arc or transition, or create a new one (see [page 21](#), [page 22](#) and [page 24](#)).

When you touch  or , Survey Mobile respectively lists the existing straight lines/arcs/transitions or displays the screen allowing you to define a new straight line/arc/transition, according to your initial selection.

- **Station** and  or  : May be used to shift the locations of intermediate points on the straight line/arc/transition by a certain distance. See *About Line Stakeout on page 8*.
- **Offset (L-/R+)**: "0" if stakeout should take place exactly on the straight line/arc/transition, a positive or negative distance otherwise (see *About Line Stakeout on page 8*).
- **North/East**: (Read-only fields) Coordinates of first point to go to (coordinates appear after changing the **Station** value).
- **Design elevation**: Enter the planned elevation for the straight line/arc/transition.
- **H. tolerance**: Choose a value in such a way that each point of the straight line/arc/transition will be considered as valid only if the horizontal precision on the position is below (better than) this tolerance.
- Touch the big yellow **Start** button. Survey Mobile guides you to reach the first point (i.e. the start point, or any other point according to the **Start station** and **Station** settings). The screen then shows a compass giving the direction to the point. The straight line/arc/transition you are staking

out is shown in blue. The lower part of the screen also shows in real time the North, East and vertical components of the distance to go to reach the point (see below left).

- Walk in that direction, watching on the screen the values of these components as you move forward to the point. When you are very close to the point, the screen looks like the one below right.



- Dig a stake into the ground to mark the point.
- Touch **End and Save** if you want to proceed with the next point and save the position solution currently provided by Survey Mobile for the staked out point. By default, the point will be named as detailed below, but you may enter a different name if you wish. You may also type in a code for this point (**Point Code** field). After choosing a name and possibly a code for the point, tap **OK** to save it.


<line name>\_<station number>\_<time>\_stakeout  
Where time is HHMMSS (for "hours, minutes, seconds").

Example:

"L1\_0\_103200\_stakeout" is the default name of the first point staked out and saved while staking out line L1 on its start point at 10:32.

Touch **End** if you just want to proceed with the next point without saving that position.

NOTE: At any time while walking along the straight line/ arc/transition, you may additionally measure any position you are on by touching the **Measure** button. Following this action you have the possibility to save that position as a new point by touching the big yellow **Measure** button again.

- Touch  to select the next point on the straight line/arc/transition and then repeat the present procedure until the straight line/arc/transition has been entirely staked out.

## Alignment Stakeout



The procedure is very similar to line stakeout, except that you first select an existing alignment or you create a new one. Alignment stakeout is a procedure also used in roads for staking out horizontal alignments.




## Running GNSS Surveys Directly from the Map Screen

Some of the GNSS survey functions may conveniently be run from the Map screen. These are:

- Point survey
- Control point survey
- Offset survey
- Continuous survey


This is the way to proceed:

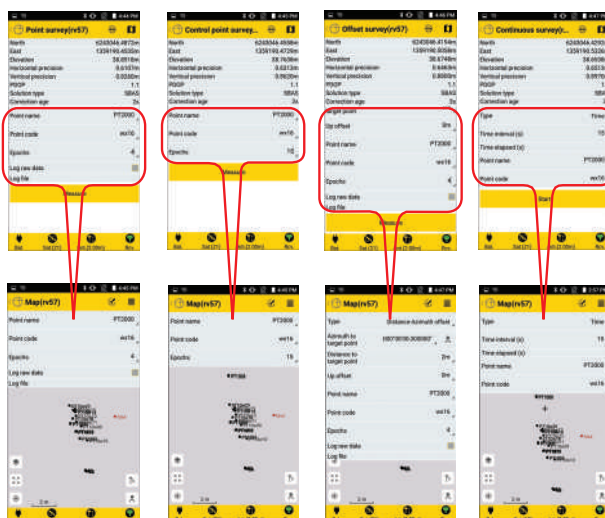
- In Survey Mobile's main menu, touch .
- Select one of the above four survey functions. Confirm or correct the antenna parameters then tap **Continue**.
- Touch  in the title bar to access the map view. This screen contains two additional buttons in the lower-right corner and accuracy figures shown in the top-left corner (more information in the table below).


Feature	Purpose
	Touch this button to show or hide the settings relevant to the survey function you have selected (see also screen examples below).
	Touch this button every time you want to make a point measurement.
	The previous button will blink red while Survey Mobile collects points through the Continuous survey function.
HP: 0.0330m VP: 0.0540m ST: FIXED	Displays the current accuracy figures and solution type for the computed position. Turns blue when a point is being collected and the accuracy figures are within the tolerances.




In the conventional way of using these four survey functions (see previous sections in this chapter), the top of the screen always shows the following data: currently computed coordinates, accuracy figures, PDOP, solution type and age of corrections.

When touching  to set your survey from the Map screen, none of these fields is displayed. Only those specific to the selected survey function are. This is summarized in the diagram below for the four survey functions concerned (conventional at the top, map-driven at the bottom).




After you touch  again to close the settings window, the screen is entirely dedicated to the map.

Touch  to perform measurements. You can see right away the geographical location of each of your measured points on the map (see example below).

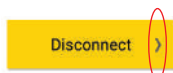


## Ending a Survey    Ending Bluetooth Connection

- On Survey Mobile, touch , then touch the yellow **Disconnect** button. This instantly ends the Bluetooth connection between Survey Mobile and the GNSS receiver.

## Ending Bluetooth Connection and Shutting Down the Receiver

- On Survey Mobile, touch , then touch precisely the right arrow in the yellow **Disconnect** button:



This opens a menu showing the **Ask for receiver shutdown and disconnect** option or, if the GNSS receiver supports this function, the **Ask for receiver reboot and disconnect** option. If you select the first option, Survey Mobile will be disconnected from the receiver after asking the receiver to shut down. If you select the second option, Survey Mobile will be disconnected from the receiver after asking the receiver to reset.

- Select the desired option.

**Purpose** The Site Calibration function allows you to “adjust” the coordinate system you chose for your job. This is required when you go back to a previously surveyed site for additional measurements, and you need that the new measurements and those made during a previous session are consistent with each other.

See also *Customizing the Coordinate System Used in a Job* on page 13.

## Calibration Methods

Survey Mobile offers four different methods to make this adjustment. Choose the one that is best suited to your case of use:

- **Horizontal adjustment:** The initially selected coordinate system will possibly be scaled, translated and rotated horizontally. This transformation requires at least two “pairs of points” (see definition below).
- **Vertical adjustment:** Elevation will be corrected, applying either a constant value for every computed position (**Constant** sub-type), or a specific correction value, depending on the computed North/East coordinates of each surveyed point (**Inclined plane** sub-type). This transformation requires at least two “pairs of points” (see definition below).
- **Horizontal+Vertical adjustment:** The initially selected coordinate system will possibly be scaled, translated and rotated horizontally. Elevation will be corrected, applying either a constant value for every computed position (**Plane transform + Constant** sub-type), or a specific correction value, depending on the computed North/East coordinates of each surveyed point (**Plane transform + Inclined plane** sub-type). This transformation requires at least two “pairs of points” (see definition below).
- **Single point:** This method does not make any changes to the initially selected coordinate system but saves a position deviation, which Survey Mobile will apply to all the points you will measure subsequently.  
This method is particularly well suited if you choose to install the base at an unknown location (free base installation) and there is a control point available on site. With this method, the calibration consists in defining a single pair of points through which the known local

coordinates of the control point (target point) will be compared to those measured with the rover occupying this point (original point). The result of the calibration will be a position deviation, with its three components: North, East, and Elevation offsets.

By accepting the calibration result, you will agree to let Survey Mobile apply the position deviation to all the points you will measure subsequently, and save the corrected positions to the job.

### **What a “Pair of Points” is**

This expression designates two sets of independent coordinates describing the location of the same point:

- The first set of coordinates consists of local NEE coordinates, expressed in the still unknown local coordinate system (which the calibration procedure is about to determine). In Survey Mobile, this set of coordinates is designated as the “target point”.
- The second set of coordinates consists of GNSS (WGS84) coordinates, as determined by a GNSS receiver placed on this point. In Survey Mobile, this set of coordinates is designated as the “original point”.

Typically, “target points” are points measured in a previous survey session and stored in the job, whereas “original points” will most probably be points you will survey during the calibration procedure to build your pairs of points.


It is therefore assumed that some points in the working area have already been surveyed (their positions are expressed in NEE coordinates and are stored in the job) and you can occupy these points for a second time (i.e. these are points marked in the field).

## Running a Calibration


Calibration is therefore a three- or four-step procedure during which you will:

- Choose the suitable calibration method.
- Build the required pair, or pairs, of points.
- Allow Survey Mobile to determine the calibration values.
- For the first two methods only, name the resulting local coordinate system and make it the new system used in the job.

After running Survey Mobile and making sure your GNSS receiver is running, follow the instructions below to perform a calibration:

- In Survey Mobile's main menu, touch , and then **Site Calibration**.
- Touch **Calc. type** and select the method that best suits your case of use. Then if appropriate, use the **Calc. sub-type** field to complete the choice of the method you wish to use (see *Calibration Methods on page 65*).

NOTE: If you choose the single point method, you may need to touch the **Cancel** button to zero the North, East and Elevation offsets (shown at the bottom of the screen). If these fields are not "0.000", that means a single-point calibration was run previously and the result of this previous calibration should be cleared before you start a new one.

- Build the required pair or pairs of points as follows:
  1. Select a target point: In the **Target point** column, touch **Input** in the **Pt.** field and select the point name from the scroll-down list (This point should have been stored in the job beforehand).
  2. Surveying the original point: Head for the corresponding point in the field.
  3. When you are exactly on the point, touch  to save the current position, as computed by the GNSS receiver. The point's coordinates appear in the fields underneath (these may be either WGS84 LLH or WGS84\_XYZ (ECEF) coordinates).
  4. Use the **Input** field nearby to name the point. It's a good idea to name the point in relation to the target point name (e.g. "PT100\_GNSS if the target point name is "PT100").

NOTE: The point may have been surveyed earlier during the current working session, in which case you


just have to select the corresponding point name from the scroll-down list.

Pt.	pt11	Pt.	pt11W
North	6234188.3982m	Lat.	047°17'52.000000"
East	1586566.5005m	Lon.	001°30'00.000000"
Elev.	12.1143m	H.	S8.0000m

5. Touch the big yellow **Add** button to save the pair of points.


At this stage, and only if you chose the single-point method, you just need to touch the yellow **Apply** button to complete the calibration procedure.


6. For the other two methods, resume the previous five steps to add more pairs of points.

- When enough pairs have been added, touch  in the title bar so you can check the list of point pairs now part of the calibration process. If needed, you may edit a point to correct its definition: hold the finger pressed on the point definition and select **Edit**.

A large number of pairs will provide redundancy in the measurements allowing you to qualify the contribution of each pair in the calculation result. It may be useful to remove from the calculation all those pairs showing high residuals.

NOTE: To delete a point pair from the list, hold your finger pressed within the area of the point pair you want to delete until a menu pops up, then select **Delete**.

Then touch  to go back to the previous screen if you wish to add other pairs of points.

- Touch  to read the final list of point pairs.
- Touch the big yellow **Calculate** button to let Survey Mobile determine the transformation parameters.

Survey Mobile then displays the result of the calculation. See example below.

**Site calibration result (rv57)**

**Plane transformation**

Origin North	6243568.6040m
Origin East	1359185.6146m
Shift North	0.0052m
Shift East	0.0532m
Rotation	-000°00'13.892636"
Scale	0.99999401

[View residual and RMS](#)

**Inclined plane**

Origin North	6244399.9978m
Origin East	1359149.9974m
Slope North (PPM)	82.8764520600366
Slope East (PPM)	85.6372533553223
Constant	0.0010m

[View residual and RMS](#)

**Apply**

- Touch the big yellow **Apply** button to accept the new coordinate system. A warning message asks you to confirm your choice. Touch **OK** if you agree.
- Name the new coordinate system and touch **OK** to complete the calibration procedure.


## Setting a GNSS Base

### Introduction

Setting a base is a two-step procedure:

1. First you choose the format in which the base will generate its corrections (7 different formats possible) and the means through which the base used to will deliver its corrections. Survey Mobile offers three different options to generate (7 different formats possible) and deliver RTK corrections:
  - **RTK Radio:** Corrections are broadcast using a radio transmitter. The radio transmitter is connected to the GNSS receiver used (see *RTK Radio on page 71*).
  - **RTK network:** Corrections are delivered via an IP connection using the Direct IP protocol (see *RTK Network on page 72*).
  - **RTK Bluetooth:** Corrections are delivered via a wireless long-range Bluetooth connection.
2. Second, you enter the different parameters specific to the base:
  - **Antenna type:** A read-only field where you can read the name of the connected GNSS receiver.
  - **Measure to:** Indicate the point on the antenna used as reference for specifying the antenna height.
  - **Antenna height:** Distance measured from antenna reference point (defined above) to ground.
  - **Base index:** Base identification number
  - **Base site:** Define the coordinates of the base. These can be held as a point saved in the job, measured coordinates, or typed in as a new point.
  - **Point type:** Choose the system in which the known base location is expressed. Available systems are **WGS84\_LLH**, **Grid\_NEE** and **WGS84\_XYZ**.
  - **Coordinates:** Enter the known coordinates of the base location. Coordinates may be “**Latitude, Longitude, Height**”, “**North, East, Elevation**” or “**XYZ**”, depending on the chosen coordinate system.

Survey Mobile allows you to create and save different base configurations, based on either of the available options. That way, you can easily switch from one to another.


NOTE: Go to  then select **Rover/Base Configurations**, then **Base** to list the existing base configurations. Any unused base



configuration may be deleted from your data collector by making a long touch on the configuration's name, and then by selecting **Delete**.


## RTK Radio

After activating the Bluetooth connection to the receiver (see *Connecting Survey Mobile to a Receiver via Bluetooth on page 28*), do the following:

- Touch  and then open the **Base** tab.
- Enable the **RTK Radio** check box within the **RTK Radio** field and then touch this field. This opens the **RTK Radio** screen.
- Complete these fields:
  - **Link type:** Type of radio used on GNSS receiver side. If the radio is embedded in the GNSS receiver, select “**Internal radio**”. If it's separate from the GNSS receiver, select “**External radio**”.
  - **Radio frequency:** Only if “**Internal radio**” is selected. Select the frequency you are allowed to use. This frequency should be chosen from the list of available frequencies.
  - **Broadcast format:** Choose a format to broadcast corrections. This can be: RTCM3.0, RTCM3.2, CMR, CMR+, ATOM standard, ATOM compact or ATOM super compact.
  - **Port, Baud rate, Data bits, Parity, Stop bits:** Needed only if an external radio is used. Tell Survey Mobile which port on the GNSS receiver is used to communicate with this radio. Enter the different parameters used in the serial connection between the GNSS receiver and the radio.
- Touch the big yellow **OK** button to save all the entered parameters. This takes you back to the previous screen.
- Enter all the parameters specific to the receiver (see list in point 2. on *page 70*).
- Use the **Name** field to enter a name for the configuration you have just defined, then touch **Save** to save it.
- Touch **Start** and wait until a message tells that the base is operating.
- Stop the Bluetooth connection between Survey Mobile and the GNSS receiver (see *Ending Bluetooth Connection on page 64*), and let the base operate on its own.

## RTK Network

After activating the Bluetooth connection to the receiver (see *Connecting Survey Mobile to a Receiver via Bluetooth on page 28*), do the following:


- Touch  and then open the **Base** tab.
- Enable the **RTK Network** check box within the **RTK Network** field and then touch this field. This opens the **RTK Network** screen.
- Complete these fields:
  - **Link type:** Choose “**Internal Internet**” for SP80.
  - **Protocol type:** Choose “**DirectIP**” (“**NTRIP**” is not supported in this case).
  - **IP, Port:** Enter the base IP address.
  - **User, Password:** Enter your credentials allowing you to receive corrections from the base.
- Touch the big yellow **OK** button to save all the entered parameters. This takes you back to the previous screen.
- Enter all the parameters specific to the receiver (see list in point 2. on *page 70*).
- Use the **Name** field to enter a name for the configuration you have just defined, then touch **Save** to save it.
- Touch **Start** and wait until a message tells that the base is operating.
- Stop the Bluetooth connection between Survey Mobile and the GNSS receiver (see *Ending Bluetooth Connection on page 64*), and let the base operate on its own.

NOTE: SP60 cannot be used as a base in an RTK network.

## RTK Bluetooth



This operating mode is made available only if the connected GNSS receiver is a Spectra Precision SP60.

After activating the Bluetooth connection to the receiver (see *Connecting Survey Mobile to a Receiver via Bluetooth on page 28*), do the following:


- Touch  and then open the **Base** tab.
- Enable the **RTK Bluetooth** check box within the **RTK Bluetooth** field and then touch this field. This opens the **RTK Bluetooth** screen.
- Choose a data format for the corrections that will be broadcast by the base via long-range Bluetooth. This may be RTCM, CMR or ATOM in different format versions.
- Touch **OK**.

- Enter all the parameters specific to the receiver (see list in point 2. on *page 70*).
- Use the **Name** field to enter a name for the configuration you have just defined, then touch **Save** to save it.
- Touch **Start** and wait until a message tells that the base is operating.
- Stop the Bluetooth connection between Survey Mobile and the GNSS receiver (see *Ending Bluetooth Connection on page 64*), and let the base operate on its own.

### Loading a Previously Saved Configuration

- Touch  and then open the **Base** tab.
- Touch  within the **Name** field. This opens a new window listing all the saved configurations.
- Select the configuration you wish to use. As a result, this configuration is loaded to Survey Mobile for immediate use.

### Stopping a Base

- At the end of your survey, go back to the base with you Android device.
- Establish a Bluetooth connection with the base (see *Connecting Survey Mobile to a Receiver via Bluetooth on page 28*)
- Touch  and then open the **Base** tab.
- Touch the **Stop** button.

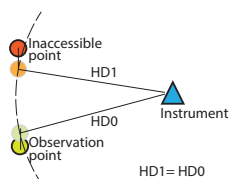
## Important Things To Know in Optical Surveying

### Offsets

Offset techniques are used when a point you want to survey cannot be accessed with a prism.

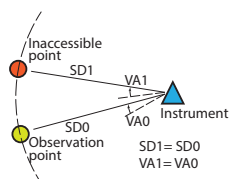
In this case, you will measure an accessible point, named *observation point*, located in the vicinity of the inaccessible point and, for three of the available offset techniques, you will then aim at the inaccessible point using a reflectorless (Direct Reflex) as the target.

Below is the list of possible offset types in Survey Mobile. Each offset type requires extra measurements, with very specific constraints, also explained below. Survey Mobile will warn you about these constraints.



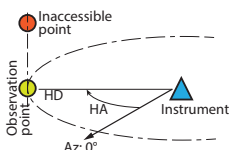
- **Angle** offset: The observation point is at a certain angle – i.e. with non-zero horizontal (HA) and vertical (VA) components – from the inaccessible point.

Special requirement: Before you measure HA and VA, as requested, you should make sure the *horizontal distance* (HD) from the instrument to the inaccessible point is the same as the one from the instrument to the observation point.



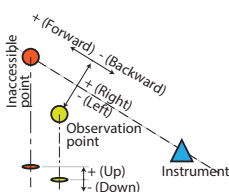
- **H. angle** offset: The observation point is exactly on the same horizontal plane as the inaccessible point, at some angle from this point seen from the instrument.

Special requirement: Before you measure HA, as requested, you should make sure the *slope distance* (SD) and *vertical angle* (VA) from the instrument to the inaccessible point are the same as the ones from the instrument to the observation point.



- **V. angle** offset: The observation point is exactly on the same vertical plane as the inaccessible point, at some angle from this point seen from the instrument.

Special requirement: Before you measure VA, as requested, you should make sure the *horizontal distance* (HD) and *horizontal angle* (HA) from the instrument to the inaccessible point are the same as the ones from the instrument to the observation point.



- **Distance** offset: The location of the observation point can accurately be described with respect to the inaccessible point in terms of horizontal (right/left) and vertical (up/down) deviations, as well as in terms of forward/backward distance compared to the location of the instrument.

These deviations should be measured and then entered before pointing at and measuring the observation point.

The extra measurements needed for each offset type are summarized in the table below.

Offset Type	Required Extra Measurements	When	By
Angle	Horizontal angle (HA) and vertical angle (VA)	After measuring observation point	Your instrument
H. angle	Horizontal angle (HA)		
V. angle	Vertical angle (VA)		
Distance	Left/Right - Backward/Forward, Down/Up deviations	Before measuring observation point	External means (tape measure, ruler, etc.)

## Measure Rounds

This survey function refers to the capacity of Survey Mobile to control and run sequentially a series of measurements to one or more points using one face or the two faces of your instrument.

Before starting a series of measurements with this function, you should set the following parameters:

- **Face order:** Tell Survey Mobile how you wish to use the two faces of your instrument:
  - **F1 only:** Only face 1 of your instrument is used.
  - **F1...F2....:** Face 1 is used first to measure all the points, then you change manually the face of your instrument to Face 2 and repeat all the measurements to the same points.
  - **F1/F2....:** Each point is measured successively with Face 1 then Face 2. Each time you have to change face manually. You repeat this sequence for each of the points you have to measure.
- **Observation order:** This parameter is visible only if you choose **Face order= F1...F2....**. In this case, you have two possible options for this parameter:
  - **123...123:** All points are measured successively with Face 1, then you change face to Face 2 and repeat all measurements to the same points in the same order.
  - **123...321:** All points are measured successively with Face 1, then you change face to Face 2 and repeat all measurements to the same points, but this time in the reverse order.
- **Number of rounds:** Tell Survey Mobile how many times you want to repeat the sequence of measurements you've defined (i.e. resulting from your choices for **Face order**, **Observation order** and the number of points to be measured).

- **Backsight included:** You may include the prior measurement of a backsight point before starting your rounds of measurements. Enable this option if that is what you want to do. Otherwise keep it disabled (default setting).
- **2C value:** Tolerated deviation between horizontal angles to the same point measured successively with one face then the other face of the instrument.
- **2C discrepancy value:** Tolerated deviation between all the 2C values measured at the end of every round.
- **Angle offset between rounds:** Tolerated deviation between horizontal angle measurements made in the same conditions (i.e. same face used, same point measured), but performed in different rounds.
- **Distance offset in round:** Tolerated deviation between slope distance measurements performed in the same conditions (i.e. same point measured) but using a different face of the instrument.
- **Distance offset between rounds:** Tolerated deviation between slope distance measurements performed in the same conditions (i.e. same point measured) in different rounds.

Whenever the chosen tolerances are exceeded, Survey Mobile will warn you so you can make the right decision (i.e. continue anyway or resume the measurements).

## Point & Line Stakeout

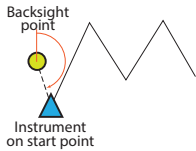
Survey Mobile supports only 2D (horizontal), not 3D staking out. That's why the measured values of vertical offsets have no impact on the stakeout process.

## Traverse Survey

Five important things to know about traverses:

1. Survey Mobile supports three types of traverses:

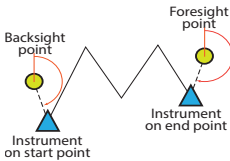
- **Open traverse:** A traverse in which the first station is a control point. This point is called the *start point* in Survey Mobile. You need to define another control point, called *backsight of start point* in Survey Mobile, used to start the traverse. A first measurement is made to that point to determine the start azimuth of the traverse, the instrument being placed over the start point.



- **Connecting traverse:** A traverse in which the first and last stations are both control points. The first station occupies the *start point* and the last station the *end point*. You need to define two more control points:

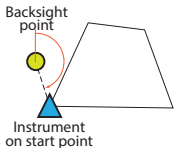
One, known as *backsight of start point* is used to determine the start azimuth of the traverse, the instrument being placed over the start point.

The other, known as *foresight of end point* is used to determine the end azimuth of the traverse, the instrument being placed over the end point.



- **Closed traverse:** A traverse in which the first and last stations are the same control point. This point is called the *start point* in Survey Mobile. You need to define another control point, called *backsight of start point* in Survey Mobile, used to start and end the traverse.

A first measurement is made to that point to determine the start azimuth of the traverse, the instrument being placed over the start point. At the end of the traverse, the same measurement is made, the instrument being again placed over the start point.



- Traverse survey does not require prior station setup as this procedure is included within the function. When starting a traverse survey, you will be asked to enter the usual environmental parameters (ambient temperature, atmospheric pressure, refraction and possible use of Earth curvature), as you would in a standard, known point station setup procedure.
- When measuring a point, traverse survey operates exactly as in the measure rounds function. The same scenario and operating options are made available: **Face order**, **Observation order** and **Number of rounds**; see page 75. The same parameters are checked for measurement accuracy:

**2C, 2C discrepancy, Angle offset between rounds, Distance offset in round and Distance offset between rounds.**

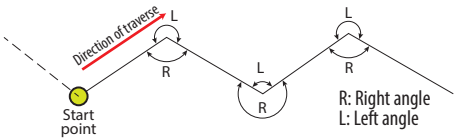
Traverse survey asks you to define an additional parameter named **Turn angle type** (see point 4. below).

All these parameters are grouped into one single screen that you can access by touching this icon in the title bar:

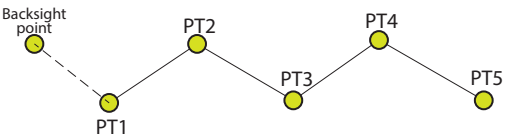


Once you've set all these parameters, touched **OK** and started the traverse, you will no longer be allowed to change them. You can however go back to this screen by touching the same icon so you can be remembered which values you chose for these parameters.

4. **Turn angle type:** Starting from the traverse start point, going toward the end point, the turn angle type defines which value of angle, on the right or on the left of the traverse, you would like to save as being part of the results of the traverse (see diagram below).




5. The order in which points are measured in traverse surveys is recalled in the diagram and table below (open traverse example), each time complying with the measure rounds you will have defined for the traverse before starting.



Step	Instrument located on:	Measurements
1	PT1 (Start point)	To backsight then PT2 (foresight)
2	PT2	To PT1 (backsight) then PT3 (foresight)
3	PT3	To PT2 (backsight) then PT4 (foresight)
4	PT4	To PT3 (backsight) then PT5 (foresight)
5	PT5	To PT4 (backsight) then etc.



## Choosing Units, Number of Decimals and Search Mode

- In Survey Mobile's main menu, touch  and then **Settings**.

The new screen that opens (see below) allows you to choose:

- The units you want to use for distances (meters, feet, US survey feet), areas (square meters, hectares), angles (Degrees, DDMSS, radians, gons), temperature (Celsius or Fahrenheit) and pressure (Pascal, Millibar, inch mercury or millimeter mercury).
- The number of decimal places you want Survey Mobile to provide for all distance, area, angle, temperature and pressure measurements.


NOTE: In some languages, the decimal point is displayed as a comma.


- **Filter instrument name:** When requested to scan for Bluetooth devices, Survey Mobile will either list the names of all the detected Bluetooth devices (case where the **Filter instrument name** option is disabled), or on the contrary, with the option enabled, will only list the names corresponding to supported devices (i.e. those of Spectra Precision or Nikon mechanical total stations).

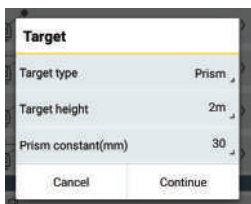


- **Data order:** Setting this option allows you to arrange your lists of points, lines, etc. from the oldest to the latest (**Time in ascending order**) or the other way around (**Time in descending order**).

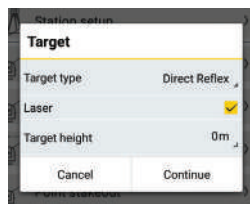
## Defining the Target Used

- Touch  located in the title bar to validate all your changes.

Whatever the option you select in  (except for **Traverse survey**), Survey Mobile will ask you to define the target used. Two types of targets are possible (see screens below):



The screenshot shows a dialog box titled "Target". It has two input fields: "Target type" set to "Prism" and "Target height" set to "2m". Below these is a label "Prism constant(mm)" with a value of "30". At the bottom are "Cancel" and "Continue" buttons.



The screenshot shows a dialog box titled "Target". It has two input fields: "Target type" set to "Direct Reflex" and "Target height" set to "0m". Between these fields is a "Laser" checkbox which is checked. At the bottom are "Cancel" and "Continue" buttons.

- **Prism:** Specify its height and prism constant.
- **Direct Reflex** (reflectorless): Specify the use or not of the visible laser, as well as the target height (usually "0").

## Station Setup

Station setup is required prior to starting your optical survey. There is however an exception in traverse surveying for which station setup is entirely part of the process.

When asking for station setup, you will be prompted either to go for a new one (**New station setup**), or re-use the last station setup (**Open last station setup**). In the latter case you should make sure nothing has changed in the field and with your instrument since you performed this setup.

Choose among three types of possible station setup types:

- **Known Point:** The total station is installed on a known point (control point) and is set up by measuring the angles (and possibly the distance) to a backsight point (also a known control point).
- **Known Azimuth:** The backsight point is located in a direction of known azimuth, as seen from the point where the total station is installed. The total station is set up by measuring the angle to that backsight point.


- **Resection:** The total station is installed at an unknown point from which two or three known resection points (control points) are measured. The resection algorithm is then used to compute the station coordinates. Then use any the resection points as a backsight point to confirm the station setup.

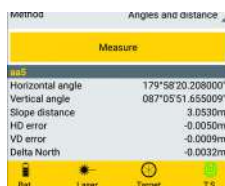


Whatever the setup type you choose, you will have to enter the following correction parameters before proceeding with the station setup as such (see example):

- Value of ambient temperature
- Value of atmospheric pressure (the value of PPM will automatically be deduced from the entered atmospheric pressure)
- Possibly refraction (enter its value if enabled)
- Earth curvature (enabled or disabled).

### Station Setup on Known Point


- Select or define the point occupied by the total station.
- Enter the instrument height.
- Select or define the backsight point.
- Choose the measurement method (**Angles** or **Angles and distance**).
- Point the total station at the backsight point.
- Touch **Measure** to measure the backsight point. A beep can be heard when the measurements are complete and successful. Angle/distance measurements as well as observed errors (should be as close as possible to 0) are displayed in the lower part of the screen (see example).
- If you agree, touch  in the title bar to accept and complete the station setup.




### Station Setup Based on Known Azimuth

- Select or define the point occupied by the total station.
- Enter the instrument height.
- Select or define the point that provides the direction of known azimuth when seen from the station.
- Enter the known value of azimuth in that direction.
- Point the total station at that point.
- Touch **Measure**. A beep can be heard when the measurements are complete and successful. Angle measurements are displayed in the lower part of the screen (see example).



- If you agree, touch  in the title bar to accept and complete the station setup.


### Station Setup by Resection

- Enter a name for the point occupied by the station.
- Enter the instrument height.
- Select or define a control point (resection point).
- Point the total station at that point.
- Touch **Measure**. A beep can be heard when the measurements are complete and successful. Measurements are displayed in the lower part of the screen.
- Repeat the above three steps, selecting other control points in the same Backsight pane of the screen.
- When enough control points have been measured, touch **Calculate**. A beep can be heard when the calculation is complete and successful. The calculated coordinates of the station are automatically associated with the name you gave to the point where the station is installed.
- Touch  in the title bar to accept and complete the station setup.

Calculate	
Measure	
aa5	
Horizontal angle	161°39'02.232000"
Vertical angle	067°11'48.054975"
Slope distance	3.0380m
aa7	
Horizontal angle	187°02'05.136000"
Vertical angle	088°06'35.362793"
Slope distance	4.7010m


### Topo Point Survey

Assuming your station has been set up properly (see page 80):

- Touch  then **Topo point survey**.
- Touch **Continue** to confirm the currently used target (or change it if required before touching **Continue**).
- Name the point you want to measure (**Point name**). Optionally enter a point code (**Point code**).
- Choose the measurement method: **Angles** (only HA and VA measured and displayed) or **Angles and distance** (North, East, Elevation, HA, VA and SD measured and displayed).
- Point the instrument at the surveyed point.
- Touch **Measure**. A beep can be heard when the measurements are complete and successful. The angles measurements are displayed in the upper part of the screen. If the distance to the point was also measured, then the coordinates are also displayed at the top of the screen. These measurements are automatically associated with the point name and the new point is saved.

Topo point sur...	
North	6243049.8872m
East	1359188.8918m
Elevation	24.9427m
Horizontal angle	199°25'10.128000"
Vertical angle	091°27'38.525021"
Slope distance	2.1870m
Point name	aa12
Point code	Input
Method	Angles and distance
Measure	


Note that the point name is automatically incremented at the end of the measurements so you don't need to type a new name for the next point.

NOTE: Touch  in the title bar before measuring the point to set the use of a single or the two faces of the instrument:

- **F1 only:** All measurements are made using Face 1.
- **F1F2:** Each measurement is first made with Face 1, then a message is displayed asking you to turn your instrument to Face 2. The same type of measurement should then be repeated, this time using Face 2.

## Offset Survey

Assuming your station has been set up properly (see *page 80*):

- Touch  then **Offset survey**.
- Touch **Continue** to confirm the currently used target (or change it if required before touching **Continue**).
- Define the type of offset measurement you want to perform. (See principles on *page 74*).

For a distance offset, enter the various components of the distance separating the observation point from the inaccessible point.



- Name the observation point (**Point name**). Optionally enter a point code (**Point code**).
- Point the instrument at the observation point.
- Touch **Measure**. A beep can be heard when the measurements are complete and successful.
- If you are using one of the first three offset types, aim the instrument at the inaccessible point making sure a reflectorless target is used, then touch **Measure HA VA**, **Measure HA** or **Measure VA** (depending on the selected offset type) to complete the measurements.


Note that the point name is automatically incremented at the end of the measurements so you don't need to type a new name for the next point.

NOTE: All measurements in offset surveys are made using the instrument's Face 1 by default.

## Measure Rounds

Assuming your station has been set up properly (see [page 80](#)):

- Touch  then **Measure Rounds**.
- Touch **Continue** to confirm the currently used target (or change it if required before touching **Continue**).
- Touch  then make the different settings related to measure rounds (see details on [page 75](#)).
- Touch **OK** when it's done. Note that these settings can no longer be changed until you end the rounds in progress. Survey Mobile now displays the following.



Measure round...	
Horizontal angle	000°00'00.000000"
Vertical angle	000°00'00.000000"
Slope distance	m
Point name	Input
Point code	Input
Target height	2m
Method	Angles and distance
Point type	Fore sight
Face	FF
Round	1
Measure	

Callouts: [9] points to Horizontal angle; [1] points to Point name; [2] points to Point code; [3] points to Target height; [4] points to Method; [5] points to Point type; [6] points to Face; [7] points to Round; [8] points to the Measure button; [9] also points to the Horizontal angle field.

- Enter the name ([1]) and code ([2]) of the first point to be measured.

If you've asked for a measurement of the backsight point in the settings, these two fields show the name and code of this point. Otherwise these fields are empty and should be completed with the name and code of the first point to be measured.

- Check/correct the target height ([3]).
- Choose which measurements to perform for each surveyed point (**Angles** or **Angles and distance**).
- Point the instrument at the first surveyed point.
- Touch **Measure**. The results of the measurement are provided at the top of the screen ([9]).

The next steps will depend on your settings.

You may be asked to change face. After doing so, touch **End face** to continue with the measurements according to the sequence you defined.

When you see that the point name ([1]) is automatically incremented, that means Survey Mobile is asking you to point the instrument at the next point to be measured. Survey Mobile can also come back to the first point measured in which case you will see this field display the first name you entered.

While you are running your rounds of measurements, keep an eye on the following parameters to see at what stage in the sequence you actually are.

[5]	Will always indicate "Foresight" except at the beginning of the measurement round if you asked for a backsight measurement. In that case, this field will read "Backsight" throughout the measurement of this point.
[6]	Indicates which face of the instrument should be used at this time. Change face if it's currently not the one asked for.
[7]	Indicates the number of the round you are currently running. Is incremented by one to tell you that you are expected to start a new round of measurements.
[8]	<b>Measure, End round, End face</b> buttons are visible in this area depending on the stage in the sequence. <b>End face</b> is touched instead of <b>Measure</b> when using <b>F1...F2...</b> and you have finished measuring all your points with Face 1.
[9]	Displays the values of the last measurement made.

- When the sequence of programmed rounds is over, Survey Mobile displays the final results for all the measurements made.



Set **Round** to either view the individual measurements for each point and each round (select 1 or 2 or 3, etc.), or for




each point, view the averaged results computed over the different rounds performed (select **Average**). **IMPORTANT!** No matter the results you view, the saved results will always be the average of all results (see below).

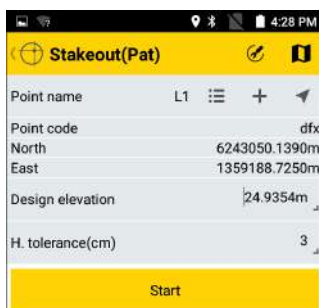
From this screen, you can add a new round, or delete the round you've just completed if you want to resume all your measurements.

If you touch **OK**, Survey Mobile will save the averaged results of all measurements as the coordinates of the points. Confirm this action by touching **OK** again.

## Point Stakeout

Assuming your station has been set up properly (see *page 80*) and the open job contains the list of points (target points) to be staked.

- Touch  then **Point Stakeout**.
- Touch **Continue** to confirm the currently used target (or change it if required before touching **Continue**).
- Touch  then define the following parameters:
  - **Face order**: Define the number of faces used in the measurements performed to stake out points (F1 only or F1F2).
  - **Stakeout Direction**: Defines the way the guidance instructions are provided, i.e. either from the instrument (select **From station**) or from the target used (select **From prism**).
- Touch **OK** when it's done. Note that these settings can be changed at any time while staking out points.
- Choose the point you want to stake out: Choose one from the list of points saved in the job, create a new one or select the one the closest to your current location by touching . As a result the screen shows the coordinates of this point.

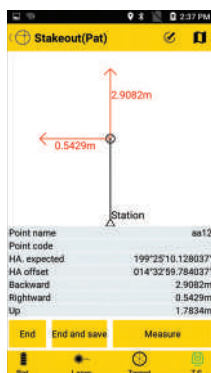


Stakeout(Pat)	
Point name	L1
Point code	dfx
North	6243050.1390m
East	1359188.7250m
Design elevation	24.9354m
H. tolerance(cm)	3
<b>Start</b>	

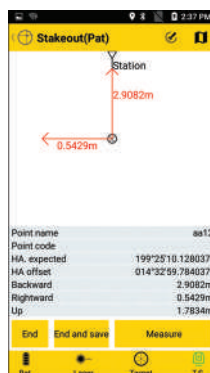


- Set a tolerance on how accurate the exact location of the point should be determined (3 cm by default).
- Point the instrument at the prism placed over a point that you will choose to be as close as possible to the target point.
- Touch **Start**. The instrument automatically measures the distance to the prism. The screen then looks like this.

Stakeout Direction:  
From Station

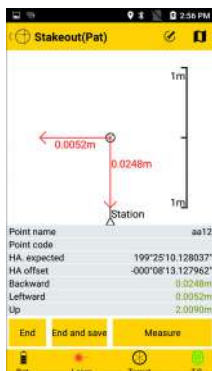


Stakeout Direction:  
From Prism



Remember you can touch  at all times to change the stakeout direction.

- Move the prism according to the instructions and then make a new measurement by touching **Measure**.
- Repeat the previous step until the prism is exactly over the searched point. If the measurements are within tolerances, you will see that all offset values have turned green on the screen.







Note that the vertical offset may be any value.

- Dig a stake into the ground to mark the point.
- Touch **End and Save** (or press **Volume+**) if you want to quit and save the coordinates currently provided by Survey Mobile for the staked point. By default, the point will be named “<target\_point\_name>\_stakeout”, but you may enter a different name if you wish. You may also type in a code for this point (**Point Code** field). After choosing a name and possibly a code for the point, touch **OK** to save it. Touch **End** if you just want to quit without saving that position.

## Line Stakeout

Assuming your station has been set up properly (see *page 80*):

- Touch  then **Line Stakeout**. First select the type of line you want to survey (a straight line, an arc or a transition).
- Touch **Continue** to confirm the currently used target (or change it if required before touching **Continue**).
- Touch  then define the following parameters:
  - **Face order**: Define the number of faces used in the measurements performed to stake out lines (F1 only or F1F2).
  - **Stakeout Direction**: Defines the way the guidance instructions are provided, i.e. either from the instrument (select **From station**) or from the target used (select **From prism**).
- Touch **OK** when it's done. Note that these last two settings can be changed at any time while staking out lines.
- Choose the straight line, arc or transition you want to stake out: Choose one from the list saved in the job or create a new one (see also *page 21*, *page 22* and *page 24*).
- **Station** and  or  : May be used to shift the locations of intermediate points on the straight line/arc/transition by a certain distance. See *About Line Stakeout on page 8*.
- **Offset (L-/R+)**: “0” if stakeout should take place exactly on the straight line/arc/transition, a positive or negative distance otherwise (see *About Line Stakeout on page 8*).
- **North/East**: (Read-only fields) Coordinates of first point to go to (coordinates appear after changing the **Station** value).
- **Design elevation**: Enter the planned elevation for the straight line/arc/transition.

- **H. tolerance:** Choose a value in such a way that each point of the straight line/arc/transition will be considered as valid only if the horizontal precision on the position is below (better than) this tolerance.
- Point the instrument at the prism placed over a point that you will choose to be as close as possible to the start point.
- Touch **Start**. The instrument automatically measures the distance to the prism. The screen then shows how far away from the start point you are situated.
- Move the prism according to the instructions and then make a new measurement by touching **Measure**.
- Repeat the previous step until the prism is exactly over the searched point. If the measurements are within tolerances, you will see that all offset values have turned green on the screen.



Note that the vertical offset may be any value.

- Dig a stake into the ground to mark the point.
- Touch **End** if you just want to proceed with the next point without saving the position currently provided by Survey Mobile for the staked point.


Or touch **End and Save** if you want to proceed with the next point and save that position. By default, the point will be named as detailed below, but you may enter a different name if you wish. You may also type in a code for this point (**Point Code** field). After choosing a name and possibly a code for the point, tap **OK** to save it.

<line name>\_<station number>\_<time>\_stakeout  
Where time is HHMMSS (for "hours, minutes, seconds").

Example:

"L1\_0\_103200\_stakeout" is the default name of the first point staked out and saved while staking out line L1 on its start point at 10:32.


In either case, on the screen that follows you can see that the **Station** field has been incremented by the value of **Interval** (as defined for the straight line, arc or transition being staked out)

- Have the prism moved to the expected next point along the straight line, arc or transition.
- Point the instrument at the prism.
- Resume the previous seven steps until the straight line, arc or transition has been entirely staked.
- Touch  to exit from the **Line stakeout** function.

## Alignment Stakeout


The procedure is very similar to line stakeout, except that you first select an existing alignment or you create a new one. Alignment stakeout is a procedure also used in roads for staking out horizontal alignments

## Traverse Survey

- Touch  then **Traverse survey**.
- Select one of these options in the menu that appears: **New traverse**, **Open traverse**, **Open last traverse**. If no traverse exists yet, select **New traverse**.
- Define the following parameters:
  - **Traverse type**: see *page 77*.
  - **Traverse name**: Name the traverse you are creating.
  - Depending on the selected traverse type, **Start point** and **Backsight of start point**, and possibly **End point** and **Foresight of end point** need to be defined.
  - Environmental parameters (temperature, pressure, refraction and curvature).
- Touch **OK**. This creates the traverse.



Traverse(Pat)	
Traverse name	TRI
Station name	1
Station code	Input
Horizontal angle	000°00'00.000000"
Vertical angle	000°00'00.000000"
Slope distance	m
Azimuth	000°00'00.000000"
Point name	K1
Point code	dgz
Instrument height	m
Target height	2m
Point type	Backsight
Face	F1
Round	1
Last station	

- Touch  then make the different settings related to traverse survey (see *page 77* and *page 75*).
- Touch **OK**. Survey Mobile switches to a new screen (see example on the left).

The instrument being expected to have been set up on the first point of the traverse, **Station Name** and **Station code** are preset to reflect the name and code of the start point you chose for the traverse.

Then the next 4 lines will provide the results of your measurement once you have made one (read-only fields).

**Point name** and **Point code** are preset to the name and code of the chosen backsight point.

- Enter the value of **Instrument height** and confirm the value of **Target height**.

**Point type** indicates the type of measurement you are about to do (the first measurement is necessarily a backsight one) (this is also a read-only field).

**Face** and **Round** indicate the measurement scenario about to be followed (same as in Measure rounds survey).

In a connecting or closed traverse, you will enable the **Last station** box only before you make the last measurement to end the traverse. This will allow Survey Mobile to respectively select the preset foresight point for the end point of the traverse, or select the preset backsight point when back on the start point of the traverse. When you start any of these types of traverses, please, keep this box clear.

- Point the instrument at the backsight point and then touch **Measure**.

Horizontal angle	197°57'57.528000"
Vertical angle	091°42'49.812307"
Slope distance	1.8760m
Azimuth	143°14'41.611315"

The results of the measurement then appear on the screen (**Horizontal angle**, **Vertical angle**, **Slope distance**, **Azimuth**).

**Point type**, **Face** and **Round** are also updated to tell you what should be the next measurement (face change, new round or new point type).

- Act accordingly, adding new measurements (use the **Measure** button) if that's what Survey Mobile is asking you to do.

When you have finished measuring the backsight point, **Point type** switches to **Foresight**, which means you should move the target to the next point in the traverse, point the instrument at it and enter a name and a code for this new point.

When the number of requested rounds for all measurements made from the start point is reached, Survey Mobile shows the results of all these measurements (namely those for the backsight point and the foresight point).

- If you agree, touch **OK** (at this stage you could also add a new round of measurements, or delete the round and start a new one if you don't like the results).
- Touch **OK** again to save the points. Survey Mobile shows an intermediate result for the traverse:

⊕ Traverse points(Pat)	
Name	TR1
Type	Open traverse
Station	1
Backsight	K1
Foresight	K2
Interior angle(Right)	025°20'57.840000"

- Touch **Measure** to switch to the next series of measurements.

As suggested on the screen, you are requested to set up the instrument on the foresight point you have just measured (**Station name** preset to that point's name), the start point becoming the new backsight point, and the new point in the traverse being the new foresight point.

- Repeat the previous five steps until you reach the end of the traverse.

After making the last measurement, touch **End Traverse** then **OK** twice to save all the results.

NOTE: When Survey Mobile lists all the points measured successively in the traverse, you may resume the measurement of any of these points by making a long touch on this particular point in the list and selecting **Re-Measure** (making sure you are in the right conditions to re-measure this point).

Name	Type	Station	Backsight	Foresight	Interior angle(Right)
TR1	Open traverse	1	K1	K2	025°20'57.840000"
		K2	1	K3	042°25'02.496000"
		K3	K2	K4	000°00'00.000000"

At the bottom of the screen, there are two yellow buttons: 'End traverse' and 'Measure'. Below these buttons is a navigation bar with four icons: Bat, Laser, Target, and T.S.

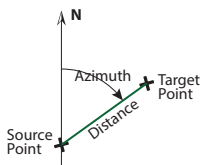
For the last measured point in the traverse (i.e. last point in the list), still through a long touch on that point, you may also delete that point if it's wrong (select **Delete** in the popup menu).

## COGO Functions

Survey Mobile offers three distinct COGO functions:

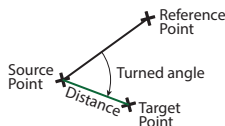
### 1. Calculating the coordinates of a point:

- **By distance and azimuth:** Calculating a **target point** by giving its azimuth and distance from a **source point**. The **source point** may be a known point, picked from the open job, or the current position of the receiver. Touch **Calculate** after specifying all the input parameters. The coordinates of the resulting point are then displayed in the lower part of the screen.



If you want to save the resulting point, check on **Save** before touching **Calculate**. In that case, you will have to name the point before Survey Mobile can determine the target point coordinates.

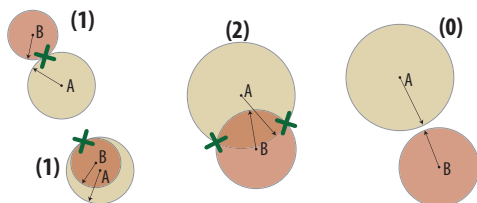
- **By distance and turned angle:** Calculating a **target point** by giving a turned angle and a distance from a **source point**. The turned angle is given with respect to the line passing through the **source point** and a **reference point**. The source point and reference point may be known points, picked from the open job, or the current position of the receiver taken successively at two different locations.



Touch **Calculate** after specifying all the input parameters. The coordinates of the resulting point are then displayed in the lower part of the screen.

If you want to save the resulting point, check on **Save** before touching **Calculate**. In that case, you will have to name the point before Survey Mobile can determine the target point coordinates.

- **By distance and distance:** Calculating target point(s) where two circles intersect. Depending on the location and size of the two circles, there may be one target point (1), two target points (2) or none (0).



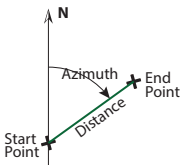
Specify the center of each circle by defining two points (**Point A**, **Point B**), then the radius of each of the two



circles (**Radius A**, **Radius B**). Touch **Calculate** to determine the target point(s).

If no target point is found, the message “Calculation failed” is reported.

If one target is found, you may save the point as a new point in the project. Just touch **Save**, name the point and select **OK**. If two targets are found, first select the point you want to save before touching **Save**.



2. Calculating the distance and azimuth between two points. The **start point** and the **end point** may be any two points from the open job, or the current position of the receiver taken successively at two different locations.

Touch **Calculate** after specifying all the input parameters. The results are then displayed on the screen.

3. Calculating a 2D area or perimeter by specifying all the points making up the closed shape. When selecting this function, the screen shows the complete list of points stored in the job.

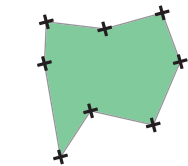
- First select each of the points making up the closed shape. You can select/deselect each point one after the other, or possibly select/deselect them all in one operation.

The shape is drawn in the order the selected points are listed, starting from the top of the list, down to the bottom of the list. A segment is drawn to close the shape from the last selected to the first selected point. As explained below, you may change the position of each point in the list, thus changing the geometry of the closed shape.

- To change the position of a point in the list, tap and hold the point name then select one of these options, depending on what you want to do: **Move up**, **Move down**, **Move up by N rows**, **Move down by N rows**. If you select one of the last two options, you must then indicate the size of the jump (from the current row to the desired row).

- Touch **Calculate** after specifying all the points. (Points are listed in the order they were collected.)

The resulting area and perimeter are then displayed in the lower part of the screen. This is a basic function because you cannot re-arrange the list of points that would allow you to control the way the closed shape is built.



## Other Import / Export Functions

Survey Mobile offers import/export functions other than those described in *Importing Points into the Open Job* on page 15 and *Exporting Points from a Job* on page 17.

The other import functions available in Survey Mobile are:

- **Importing a Survey Mobile coordinate system file** (in scs format).

By default, the coordinate system imported in Survey Mobile will have the same name as that of the imported scs file, but you can enter a different name if you wish.

- **Importing a Trimble JobXML file** (in jxl format).

Importing this type of file will result in a new job created and opened in Survey Mobile. You need to name the job before you are allowed to import the jxl file.

- **Importing a Trimble road design file** (in rxl format).

Importing this type of file will result in a new road created in Survey Mobile, with the same name, or a different name if you specify one.

See also *Importing a Road* on page 103.

- **Importing AutoCAD files (in dxf format)**. See *Adding Background Maps* on page 98 for more details.

NOTE: The files you wish to import should always be moved to the following folder before you can import them:

Internal memory/SurveyMobile.Droid/Import/

or


SD memory card/SurveyMobile.Droid/Import/

After moving a file to one of this folder, its name can be seen under the **Import** button so you can select it for import.

And the other export functions are:

- **Exporting points from the open job to a South CASS point file** (in dat format). Just name the export file and touch the **Export** button.
- **Exporting a custom coordinate system from Survey Mobile.**

Select the custom coordinate system you want to export.

You may touch  to view the main properties of the selected coordinate system.

By default the exported file will have the same name as that of the selected coordinate system, but you can enter a different name if you wish.

When you are ready, touch **Export**.

- **Exporting a job as a Trimble JobXML file** (in jxl format).  
By default the exported job will have the same name as that of the open job, but you can enter a different name if you wish.
- **Exporting a road to a Trimble design file** (in rxl format).  
First select the road you want to export before touching the **Export** button. By default the exported road will have the same name as that of the selected road, but you can enter a different name if you wish.
- **Exporting the parameters of a static survey in txt format**.  
First name the export file and then touch **Export**.  
The file will contain the occupied point name and code, the start time and duration of the static survey, the log interval used and the antenna parameters used.
- **Exporting a cross-section**. First select the file format (txt or csv), then a template. You can use one of the two templates available:

**Name, Point name, Point code, North, East, Elevation**

Where:

"Name" is the cross-section name

The remaining parameters in the line describe the code and coordinates of a point in the cross-section. Exporting a cross-section using this template does not require any further calculation.

**Name, Point name, Point code, Offset, Elevation**

Where:

"Name" is the cross-section name

The remaining parameters in the line describe the code and coordinates of a point in the cross-section. Exporting a cross-section using this template requires the additional calculation of the offset, which replaces the horizontal coordinates of the point. A negative offset means the point is to the left of the centerline, "0" means the point is on the centerline, and a positive offset means the point is to the right of the centerline.

After selecting a template, name the file that will result from the export operation, then touch **Export**. Once the export is complete the name of the export file appears underneath the yellow **Export** button.

**NOTE:** All exported files can be found in one of the following folders:

Internal memory/SurveyMobile.Droid/Export/

or

SD memory card/SurveyMobile.Droid/Export/

# Adding Background Maps

## Introduction



Survey Mobile allows you to display background maps resulting from importing DXF files to a job.

Background maps are shown orange on the job's map view (see legend on *page 7*). Survey Mobile supports the following objects from imported DXF files:

- Points
- Lines and polygons
- Circles and arcs

When importing a DXF file, Survey Mobile will first ask you to specify which distance unit is used in the file and suggest that you preview the file before actually importing it.

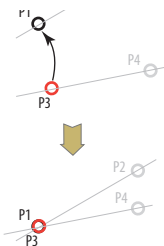
Where the background map will be located on your job's map view will depend on how you defined the XYZ coordinates of the objects in the DXF file:

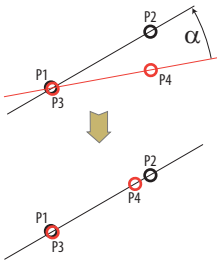
- If these XYZ coordinates are consistent with the coordinate system used in the job, then the objects will appear on the map view at their accurate locations. In that case, using the so-called “original orientation” for the background map will allow Survey Mobile to correctly locate the objects of the background map on the job's map view.
- If the coordinates are not consistent with the coordinate system used in the job, corrections will be needed to adjust the locations of these objects on the job's map view. Corrections will include translating and/or rotating the objects in the horizontal plane. In that case, you will need to select “adjusted orientation” to accurately show the objects on the map view.

But before the “Adjusted orientation” option is a valid choice in Survey Mobile, you will need to take these additional steps using four different points (P1-P4):

- Associate one point from the job (P1) with one point from the DXF file (P3), thus requesting that these two points be the same point on the job's map view.

As a result, Survey Mobile will compute and apply the amount of horizontal translation required from the background map to make this happen.



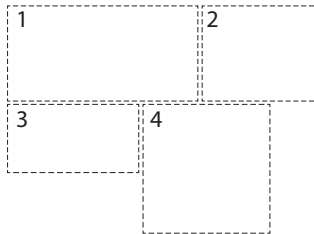


- Associate another point from the job (P2) with another point from the DXF file (P4), thus requesting that the background map be rotated by an angle whose value is given by the direction of segment [P1P2] and the direction of segment [P3P4].





NOTE: Survey Mobile will NOT re-scale the DXF objects to merge points P2 and P4 into one single point.

As a result, Survey Mobile will compute and apply the amount of horizontal rotation required from the background map to make this happen.

You may import as many DXF files as you want. Importing several DXF files to cover your working site makes sense when the resulting background maps only cover different though adjoining parts of the site (see background maps 1-4 below).

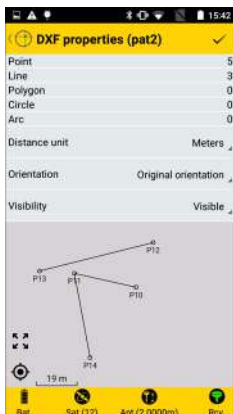


## Importing DXF Files

- Copy your DXF files to “/SurveyMobile.Droid/Import/”.
- Follow one of these two steps to access the “Import DXF” function:
  - In Survey Mobile’s main menu, touch  and then **Background maps**.
  - Or within a survey function<sup>(1)</sup>, touch  then .
- Touch . The lower part of the screen displays the list of DXF files stored in the “Import” sub-folder.
- Select one of these files and then touch the big yellow **Import** button.
- From the now displayed drop-down list, select the distance unit used in the DXF file and then touch **Continue**.

1.Except for “Static survey” and “Stop&Go survey”.

- Before actually importing the DXF file, you may preview its content: Touch **Preview**. Survey Mobile adjusts the zoom automatically so that all the items from the DXF file can be seen on the screen.



The preview includes the following information:

- Type and number of objects per type in the file
  - **Distance unit:** Distance unit used (may be changed)
  - **Orientation:** Only **Original orientation** can be selected at this stage as **Adjusted orientation** requires further steps (see *page 100*) to be usable.
  - **Visibility:** An imported DXF file may be made visible or invisible on the map view. Select the desired option.
  - Graphic view of the various objects found in the file, including the names of the points.
- Touch or to continue.
  - Touch **OK** to complete the import, or touch **Cancel** to abort.

## Adjusting the Orientation of a Background Map

After importing a DXF file to Survey Mobile, do the following:

- Follow one of these two steps to access the properties of the imported DXF file:
    - In Survey Mobile's main menu, touch and then **Background maps**.
    - Or within a survey function<sup>(1)</sup>, touch then .
- The list of imported files is now displayed.

1.Except for "Static survey" and "Stop&Go survey".

- Hold your finger pressed on the name of your DXF file and then select **Adjust orientation**.  
You are then invited to specify the first pair of points.
- Pick one point from the job (left), and the other from the background map (right):

Job point:		Map point:	
pt1	pt2	P14	
N	6243048.7332m	N	6244219.0000m
E	1359190.8402m	E	1359147.0000m
Elev.	86.4144m	Elev.	52.0000m

Add



: Use this button to select the point from a list.



: Use this button to make a graphic selection of a point on the map.



: Use this button to measure a new point whose coordinates will describe your current location.



: Use this button to create a new point in the job by entering its name and coordinates.

Keep in mind that you associate these two points because you want them to occupy the same location on the job's map view (see also *page 98*).


- Touch **Add**. You can now see your pair of points listed underneath this button. If you've made a mistake when creating the pair, you may hold a finger pressed on the pair and select **Edit** or **Delete** respectively to modify or delete the pair.
- The top of the screen still inviting you to enter a pair of points, pick another point from the job (left) and then another from the background map (right).

Keep in mind these two points are associated to determine the rotation angle to be applied to the background map so it correctly appears on the job's map view (see also *page 98*).

- Touch the big yellow **OK** button. A message is returned to indicate that computing the adjusted orientation was successfully completed.


At this point, you can preview the background map according to the adjusted orientation (choose **Preview**),

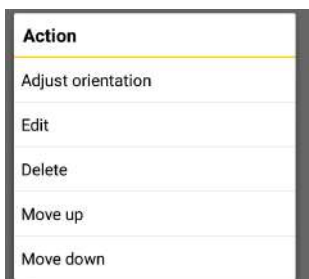
directly accept the adjusted orientation (choose **OK**) or reject the computation (choose **Cancel**).

If you select **Preview**, touch  after you have checked the resulting background map to return to the above menu where you can select **OK** or **Cancel** to respectively accept or reject the adjusted orientation.

Once you have accepted the adjusted orientation, you can go back to the job's map view where you will see the background map shown in orange color.

## Other Functions Connected to Background Maps

In Survey Mobile's main menu, touch  and then **Background maps**. This displays the list of background maps currently used in the job. Hold your finger pressed on any of them to open the following popup menu:



The following functions can be selected from this menu:

- **Adjust orientation:** Allows you to ask Survey Mobile to determine an adjusted orientation for the selected background map (see theory on *page 98* and step-by-step instructions on *page 100*). If you select this function while an adjusted orientation has already been computed, then Survey Mobile will automatically delete the previously computed orientation so you can compute a new one.
- **Edit:** Allows you to review the properties of the selected background map, and possibly change some of its parameters: distance unit, orientation (original or adjusted) and visibility (visible or invisible).
- **Delete:** Deletes the selected background map. This does not delete the imported DXF file from which it originates.
- **Move up / Move down:** Allows you to rearrange the order in which your background maps appear in the list of background maps used by the job.



NOTE: All screen examples shown in this section were generated using GNSS equipment. Be aware mechanical total stations can also be used for staking out roads.

## Introduction to Roads in Survey Mobile

Survey Mobile offers an entry-level road module, with the following three main functions:

- **Importing road projects in rxl format** (Trimble road design files).
- **Staking out roads**, in a much similar way as you stake out lines in Survey Mobile.

Survey Mobile will guide you successively to points along the road (along the centerline, the right or left edge or at some distance from the centerline), with the possibility to save the staked out points to the open job, which incidentally will provide the coordinate system in which all computed positions and saved points will be expressed.

- **Creating roads**. Each road will be defined by a horizontal alignment, a vertical alignment and a cross section.

## Importing a Road

- Move the rxl road file you want to import to the following folder:

Internal memory/SurveyMobile.Droid/Import/

or


SD memory card/SurveyMobile.Droid/Import/

- In Survey Mobile's main menu, touch  and then **Import**.
- Touch **Trimble road design (\*.rxl)**. A new screen appears listing all the rxl files stored in the Import folder.
- Check on the file you want to import.
- If required, complete the **Road name** field if you want the road resulting from the import to have a name different from that of the imported file. If you leave that field blank, the road name will be the same as that of the imported file.
- Touch the big yellow **Import** button to import the file in Survey Mobile.

NOTE: Survey Mobile only supports the clothoid spiral as transition, and only one cross-section for an entire road,

## Staking Out a Road

meaning the cross section can only be made up of a single width and slope on each side of the road's centerline.


- In Survey Mobile's main menu, touch  and then **Stake out road**. Confirm or correct the antenna parameters then tap **Continue**. Survey Mobile opens a new screen from which you can select and stake out a road.

The upper part of the screen shows the coordinates of your current position – as computed by the GNSS receiver – as well as accuracy-related figures (horizontal/vertical accuracies, PDOP) and the position computation status (solution type, correction age).



North	6243045.0225m
East	1359190.3584m
Elevation	38.1768m
Horizontal precision	0.0212m
Vertical precision	0.0430m
PDOP	1.3
Solution type	RTKFixed
Correction age	2.0s

- Touch the **Road name** drop-down list to select the road you want to stake out.

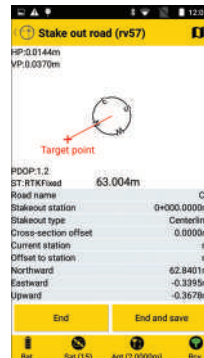
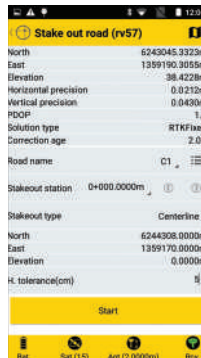
Still in this field, you may touch  to access the entire list of existing roads and then touch any of them if you want to read its full definition.

- After selecting a road, choose where to start staking out, compared to the beginning of the road (**Stakeout station**).

(Touch  to adjust this parameter.)

- Set the **Stakeout type** field allowing you to choose which part of the road you want to stake out: the centerline, the right or left edge of the road, or at some distance (**custom offset**) from the centerline. With the latter option, you should then enter the desired value of offset (**cross-section offset**).
- Set the horizontal tolerance (**H. tolerance**, expressed in centimeters, 3 cm by default; If you change this value, it will be prompted by default for the next road you will stake out). Points along the road project will be staked out only if the horizontal precision on the position solution is below this tolerance.
- Touch **Start** to begin (or press **Volume-**). The screen then shows a compass giving the direction to the first point of the road. The lower part of the screen also shows in real

time the North, East and vertical components of the distance to go to reach the point (see below left).



- Walk in that direction, watching on the screen the values of these components as you move forward to the point. When you are exactly on the point, the screen looks like the one above right (note that when the computed coordinates turn green, you are within the expected tolerance and allowed to stake out the point).
- Dig a stake into the ground to mark the point.
- Touch **End and Save** (or press **Volume+**) if you want to proceed with the next point and save the position solution currently provided by Survey Mobile for the staked out point. The following name will be automatically assigned to the point:

**<road name>\_<stakeout\_station>\_<time>\_stakeout**


Where time is HHMMSS (for "hours, minutes, seconds").

Example:

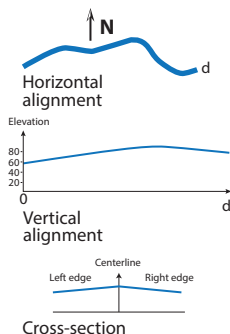
**R1\_100\_103200\_stakeout**

Describes a point staked out at station "100" at 10:32 and is part of the road named "R1".

Touch **End** if you just want to proceed with the next point without saving that position.

- Touch  to select the next point along the road and then repeat the present procedure until the road has been entirely staked out.

## Creating a Road



## Introduction

A road is defined by:

- A *horizontal alignment*, which shows the shape of the road centerline, as you would see it on a geographical map.
- A *vertical alignment* (or longitudinal section), which describes the vertical profile of the road along the road's horizontal axis.
- A *cross-section alignment*, which describes the road, as seen on a plane perpendicular to the longitudinal axis of the road.
- A *distance interval*, which tells Survey Mobile how accurate you want the road to be staked out.

## Horizontal Alignment

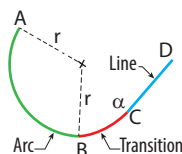
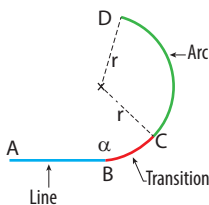
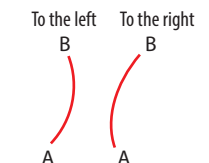
The horizontal alignment (or centerline) may be defined using two different methods (which cannot be combined):

1. By specifying in turn each of the elements making up the road, starting with the definition of a start point for the road as well as an azimuth to orientate the first element. Geometrically speaking, an element may be a straight line, an arc or a transition.

- A *line* is defined by a length.
- An *arc* is defined by a length, a direction (left/right; see illustration) and a radius.
- A *transition* is a curve (clothoid) with changing radius allowing smooth connection between two elements.

A transition is therefore defined by a length, a direction (left/right), a start radius and an end radius.

In the first example, the start radius of the transition (at point B) should be set to infinite ( $\alpha$ ) and the end radius (at point C) should be equal to "r", i.e. the radius of the arc element that follows the transition. Conversely, in the second example, the start radius of the transition (at point B) should be equal to "r", i.e. to the radius of the arc element that precedes the transition, and the end radius (at point C) should be set to infinite ( $\alpha$ ) to make a smooth connection with the line element that follows.



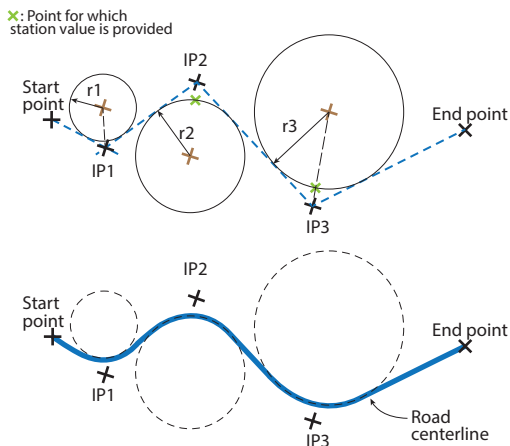
2. By specifying in turn the start point of the road, a number of intersection points and the end point of the road:

- The start point is defined just by its North and East coordinates (no radius required), or it can also be an existing point picked from the list of imported or surveyed points.

- Intersection points are also defined by their North and East coordinates. If only these two fields are filled in for an intersection point, then the road is extended by a straight line from the previous point to this one. If you add a circle radius in the definition, then the road takes a turn that follows the circle tangent to the direction given by the intersection point and the previous intersection point, and the direction given by this intersection point and the next one. Additionally you may specify two distances (LS1 and LS2) to smooth the shape of the road at the connection points (in the same way as you would define transitions in the first method).
- The end point is defined just by its North and East coordinates (no radius required).

NOTE: You will be requested to enter a **Station** value for each intersection point you define. This parameter indicates the curvilinear distance of the road from the start point to the intersection point being defined (more exactly to the point on the road resulting from the intersection of the road with the segment joining the intersection point to the center of the arc; see diagram below). It is admittedly a redundant parameter when a straight line is generated, but not when it's an arc. So this parameter must be defined for every intersection point you define.

The diagram below is a simple example of a road defined using intersection points (noted "IPx" on the diagram).



Start point: North and East coordinates, station

IP1: North and East coordinates, circle radius ( $r_1$ ), station: Straight line + arc generated

IP2: North and East coordinates, circle radius ( $r_2$ ), station: Straight line + arc generated

IP3: North and East coordinates, circle radius ( $r_3$ ), station: Straight line + arc generated

End point: North and East coordinates, station: Straight line generated.

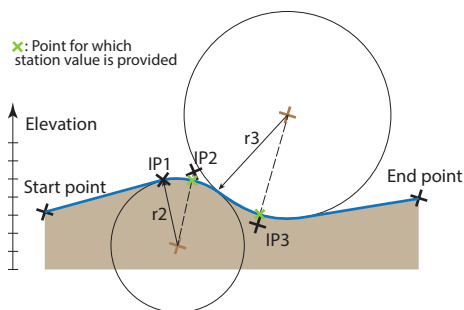
## Vertical Alignment

The vertical alignment (or longitudinal section) is defined a bit the same way as the horizontal alignment, when defined using the second (“intersection point”) method. The vertical alignment consists of:

- The start point is defined by a **slope station** and a **slope elevation** (no radius required).
- Intersection points are also defined each by their own **slope station** and **slope elevation**. If no circle radius is specified, the vertical alignment will be a straight line connecting the elevation from one point to that of the next one (see diagram below).

But if you add a circle radius in the definition, then the elevation will follow an arc, a concave one if the elevation for the point is greater than that of the previous point, or a convex one otherwise.

- The end point is defined just by a **slope station** and a **slope elevation** (no radius required).



NOTE : You cannot define transitions in a vertical alignment.

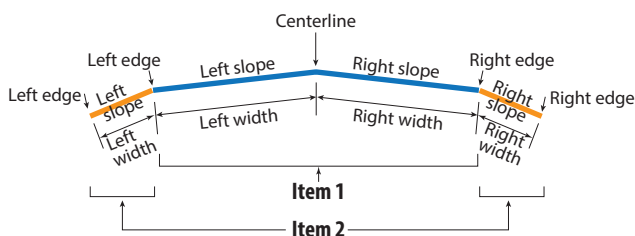
## Cross-Section

An item of road cross-section is defined by:


- A left width, a right width (distance).
- A left slope and a right slope (in %).

The two parts of the item, located on either side of the centerline, may be made symmetrical by setting **Left = Right**.

Defining a second item will result in creating a cross-section that will look like the one shown on the diagram below.



## Step-by-Step Procedure


- In Survey Mobile's main menu, touch  and then **Define road**.
- Enter a road name.
- Define the horizontal alignment by entering successively elements or intersection points. After you have chosen a method, you cannot switch to the other, unless you define another new road. Touch **Add** after defining each element or intersection point.

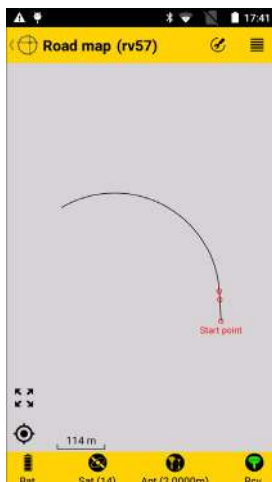
Elements or intersection points show up in the lower part of the screen as you add new ones.


By holding a finger pressed on one of them in that list, you will access a popup menu allowing you to edit, delete or move up or down this item.

If you select **Edit**, Survey Mobile will bring up the definition of the item in the upper part of the screen for modification. Then touch **OK** after you have made your changes to save the modified item.

If you are defining elements, the popup menu will also include an **Insert** option allowing you to insert a new element before the selected one.


You may touch  after adding each element or intersection point to see what the horizontal alignment looks like (see example below).



Touch  when you are done with the horizontal alignment.


- Define the vertical alignment. Intersection points are listed in the lower part of the screen as you add new ones. These can be edited, deleted or moved up or down as explained for the horizontal alignment.

NOTE: Survey Mobile does not provide a view of the vertical alignment.

Touch  when you are done with the vertical alignment.

- Define the cross-section alignment. If the road cross-section is symmetrical, enable the **Left = Right** check box before starting. Any left width or slope you will define will then be replicated symmetrically on the right (or the other way round). If the road cross-section is not symmetrical, disable the **Left = Right** check box and enter separately the description of the left and right sides of the cross-section alignment.

Add as many cross-section items as necessary.

Touch  when you are done with the cross-section alignment.




- Define the distance interval. This parameter will be used when staking out the road to let Survey Mobile determine the next point to be staked out along the road.
- Touch **Create** to save the road definition. Survey Mobile first checks the consistency of the road definition before the road is effectively saved.


If inconsistencies are detected in the entered **Station** values, you are prompted to let Survey Mobile recalculate them using the first or the second point in the road as the point having the right station value (sometimes the station value for the first point is unknown).

### Checking/Editing a Road


This function is used to determine the coordinates and azimuth of any point on the road from a known **Station** value. This can be done while creating a road (just before or after saving the road) using directly the **Check road** button, or later by editing the road:

- In Survey Mobile's main menu, touch  and then **Road Management**. Survey Mobile displays the list of existing roads.
- Hold a finger pressed on the name of the one you want to check and then select **Edit** from the pop-up menu.
- Touch the yellow **Check road** button.
- Enter a **Station** value in the last field and then touch the big yellow **Check** button. As a result, Survey Mobile provides the coordinates and azimuth of the corresponding point on the road.



- Touch  when you are done with this function.
- From there you can edit any of the existing alignments and then touch the **Save** button to save all the changes made to the road.


## Deleting a Road

- In Survey Mobile's main menu, touch  and then **Road Management**. Survey Mobile displays the list of existing roads.
- Hold a finger pressed on the name of the one you want to delete and then select **Delete** from the pop-up menu. The road is then deleted right away.


## Cross-section Survey

Cross-sections may be surveyed separately from the roads for which they were created, for example to determine volumes of cut or fill at a given station.

Cross-sections can be created, named and managed separately from the road for which it was defined. This is how you should proceed:

- In Survey Mobile's main menu, touch  and then **Cross-section Survey**.  
For each cross-section. Survey Mobile provides the station value, the name of the point measured on the centerline at this station, and the number of points measured on either side of the centerline point.
- Set the equipment used (antenna type and height for GNSS, target type and height for total station) and touch **Continue**.
- Select the road name from which to pick the desired cross-section (**Road name** field) and indicate the station value where to find this cross-section (**Station** field).  
As a result, the **Name** field providing the name of that cross-section is automatically completed ("Roadname\_Station" value). When you start surveying points on the cross-section, the cross-section definition will be saved under this name.
- Being physically on that cross-section, measure each of the points you are interested in along that cross-section. You may indicate whether the measured points are on the centerline, or on the left or right edge of the road. The **Point code** field may be used to give more details on each of the collected points.

The cross-sections you create can be managed using the procedure below:

- In Survey Mobile's main menu, touch  and then **Cross-section Management**. Survey Mobile displays the list of existing cross-sections.  
For each cross-section. Survey Mobile provides the station value, the name of the point measured on the centerline at this station, and the number of points measured on either side of the centerline point.
- To delete a cross-section, keep a finger pressed on that cross-section and then select **Delete**.

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