

Survey Mobile Field Software

User Guide

v2.6



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Release Notice

This is the March 2020 release (Revision A) of the Survey Mobile User Guide. It applies to version 2.6 of the Survey Mobile software.

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(TNL - TEBV)

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

Release Notes, March 2020 - v2.6

- Added diagnostics feature.
- Updated TPSDK to 2019.0.409.18801.
- Updated coordinate system database to v87.
- Added support for the Trimble R2 GNSS receiver
- Added photo attribute for GNSS points.
- Updated the Greek language file.
- Two or more lines or polygons can now be logged simultaneously.

Release Notes, September 2019 - v2.5

- Updated TPSDK to 2019.0.350.18557.
- Fixed an issue where the transition between RTX satellites and RTX Internet did not succeed at the first attempt.
- Bluetooth RTK is now only available if the device supports long-range Bluetooth (SP60, S-Max, R4s, and R4s LE) to prevent connection problems.
- SNR values for IRNSS satellites show in the satellites diagram.
- Static surveys were considered as Stop & Go surveys.
- TERIASat solution type is shown now when base data with ID116 is received.
- Added SBAS and IRNSS satellite tracking support.

Release Notes, July 2019 - Changes relevant to MobileMapper Field V4.0

- New coordinate systems available (Philippines, Azores).
- Two or more lines or polygons may be logged at the same time.
- Selecting a target directly on the map for revisiting a feature is now possible. Zoom in setting around target is now better than 0.50 m.
- Lines and polygons can now be created directly from existing points and/or from any locations on the map.
- While logging a line or polygon in manual mode, the last vertex logged may be deleted so you can resume the logging of this vertex.
- "Features" function now allows you to list, edit, delete features present in a job.
- "About" function in main menu now reports the software version of the application.
- Contour color and fill color of polygons can now be different.
- Tip boxes associated with point features on the map view now show Z coordinates of points.
- Large SHP files display more quickly.
- Features from a given layer may be automatically hidden on the map view if the scale value used is less than a given threshold.

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Introduction to Survey Mobile

Introduction The Spectra® Geospatial Survey Mobile software 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 SP60 or SP80 GNSS receiver or with a Nikon or Spectra mechanical total station.

- Installation**
- Download the installation file (an apk file) from the Spectra Geospatial 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):

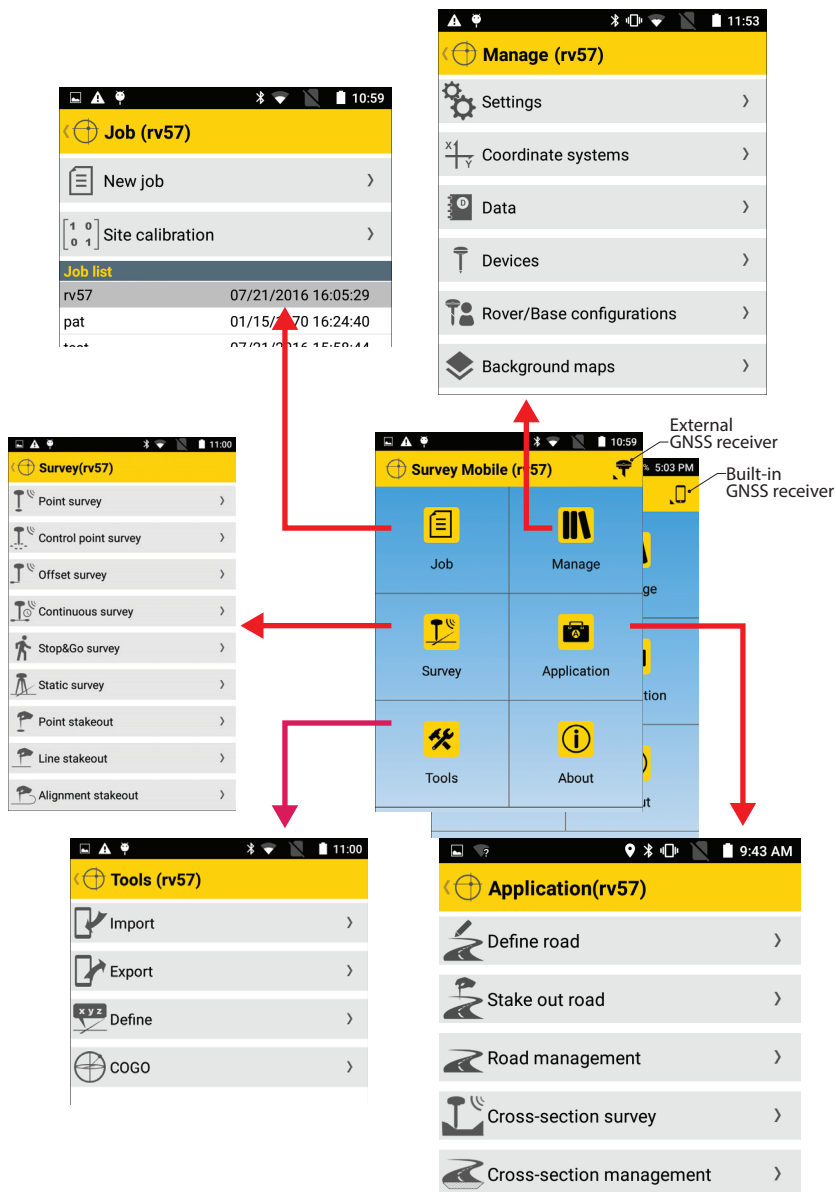
- Only one job can be created
- The number of points in the job is limited to 20
- There can only be one of each of these items in a job: lines, arcs, transitions, alignments, cross-sections, roads, dxf files and traverses.
- Only the first 20 stations of a line, arc, transition, alignment or road can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

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

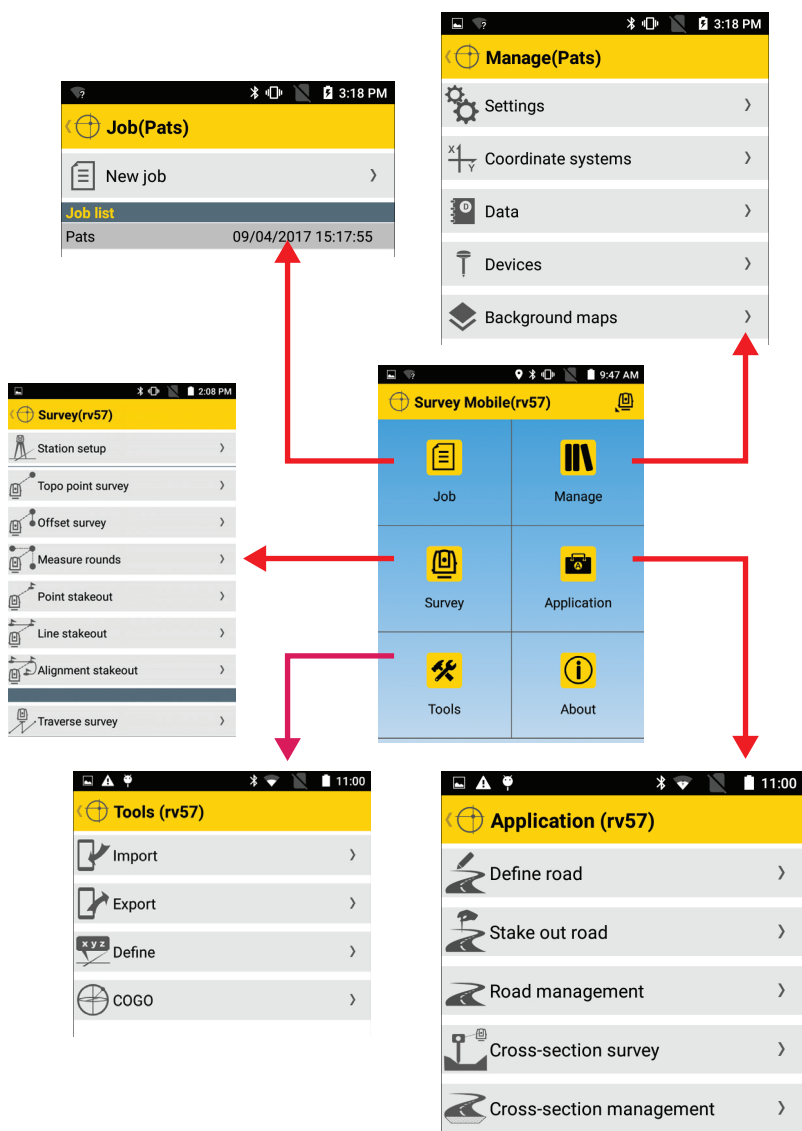
Survey Mobile Main Menu & Submenus

See diagrams below.

Survey Mobile Connected to built-in or external GNSS Receiver:



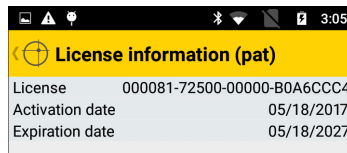
Survey Mobile Connected to a Mechanical Total Station:



Switching from the Trial to the Official Version

Survey Mobile is currently running in trial version. But you recently bought a license from Spectra Geospatial, 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).



License information (pat)	
License	000081-72500-00000-B0A6CCC4
Activation date	05/18/2017
Expiration date	05/18/2027

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 **Need Help?**). Do this **ONLY** if for some reason, the license activation at some point fails. A message is then displayed explaining what can be done from there. 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:

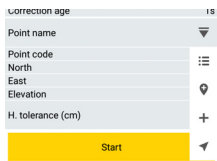
- When manually creating several points, straight lines, arcs or transitions in a row using the **Tools>Define** function.
- Within the **Survey** function when logging several points in a row.






Different Ways of Specifying a Point in Survey Mobile

In many occasions, Survey Mobile will ask you to specify the name of a point. Depending on whether the point already exists or needs to be created, you will follow a different procedure to populate the point name field. In all cases, this field will show this icon:



Touching this icon will open a vertical, context-sensitive icons menu (see example on the left), which you will use as explained below:



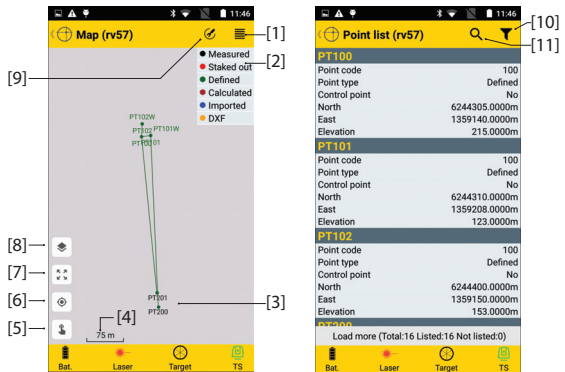
-  : Use this icon to open the list of existing points and to choose one from the list.
-  : Use this icon to view the map showing the location of each of the existing points and to pick one directly from the map. Survey Mobile will ask you to confirm the point you have selected.
-  : Use this icon to create a new point in the job and select it.
-  : Use this icon to select the existing point the closest to your current location.
-  : Use this icon to pick the current location.

After selecting a point through one of these icons, the name of this point will appear in the **Point name** field.

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]: Opens/closes an icons menu used to create points directly from objects shown on the map.

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

[7]: 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.

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

[9]: 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.

Also gives access to the Online map function. When enabled, this function lets you choose one among three different types of map sources: DigitalGlobe Imagery, NAIP or Trimble Mapview. An Internet connection is required to allow Survey Mobile to display the selected map type.

[10]: Gives access to a point filtering window. The filtering is based on various criteria: point type, point library and point solution.

[11]: Gives access to a point search dialog. The search requires that you know the name of the point you are searching. Enter that name and then touch OK. Survey Mobile will display the point list in such a way that the definition of the searched point can be read. Touch the point definition to read all the details relevant to that point.

NOTE 1: For the first four GNSS surveying functions, the Map screen shows additional buttons. See *page 76*.

NOTE 2: To add background maps, see *page 122*.

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:

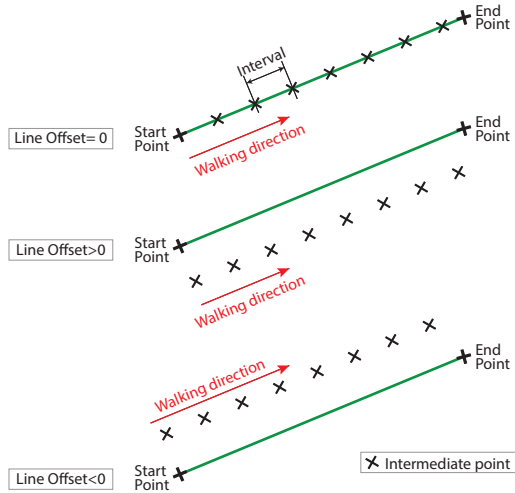
1. A line that you stake out may be a straight line, an arc or a transition. At the beginning of this process, you choose which type of line you want to stake.
2. When you stake out a line, Survey Mobile will guide you successively to intermediate points along the line, from the start point to the end 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:

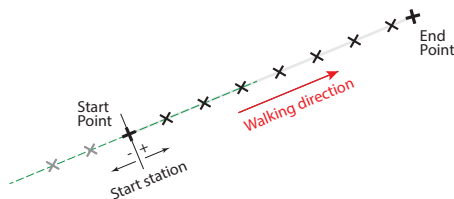
- **Line offset**= 0: Guidance provided along the “real” line.
- **Line offset**> 0: Guidance provided along a virtual line located to the left of, and parallel to the “real” line.
- **Line offset**< 0: Guidance provided along a virtual line located to the right of, and parallel to the “real” line.

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).

(Example of straight line stakeout)



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:

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

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).


Introduction to Jobs

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.
- If a GNSS receiver is used, you may want to express the coordinates you will be collecting in the field in the same datum as the one used by the base providing your receiver with corrections. In that case, enable the **Broadcast RTCM** option. Otherwise, keep this option disabled.
- Define the coordinate system used in the job.

If you have just enabled the **Broadcast RTCM** option, that means the GNSS receiver is expected to use the projection parameters you are about to define in the coordinates system but remember the datum used will be the one received from the base through RTCM messages. (see also *RTK Network on page 41*).

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).

(For **Geoid** or **Shift Grid**, touch  to open the list of folders in the root directory of your Android platform and then touch the one where the desired geoid or shift grid file is located¹. The name of the file then appears in a dialog box and you just need to touch **OK** to load the file to Survey Mobile. The name of the selected geoid or shift grid then appears in the corresponding 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.

1.The geoid or shift grid file should have been uploaded to the Android platform beforehand.

- 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 15.
- 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.

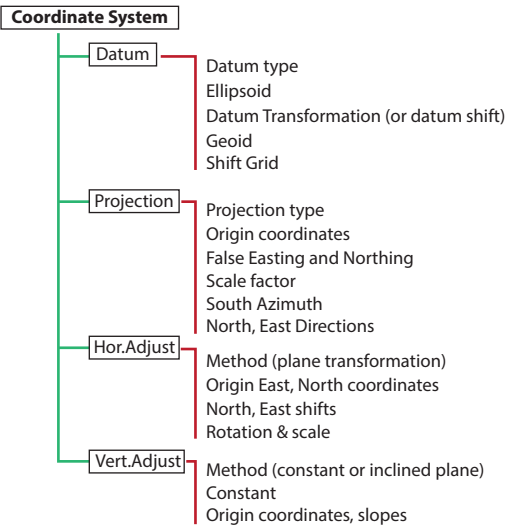
NOTE: To delete a coordinate system you have created in Survey Mobile:

- 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:

- 1. 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).

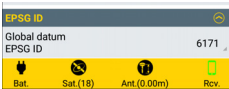


NOTE 1: **Datum type** and **Ellipsoid type** can both be set to “blank” (first option in the corresponding scroll-down list) so you can enter a custom ellipsoid and a custom datum transformation.





To deselect the chosen option in **Geoid** or **Shift grid**, select the first option (“blank”) in the corresponding scroll-down list.

NOTE 2: For your information, the last field shows the name of the EPSG ID (if any). If you select a datum type, then the **EPSG ID** field is made non-editable but the value this field displays is either blank (if there is no EPSG datum matching the datum you selected) or a value identifying the EPSG global datum that matches the datum you selected.



If you keep the **Datum Type** field blank, then you are allowed to directly select the ID of an EPSG global datum from the list of existing ones. If you also leave that field




blank, you should at least define ellipsoid parameters and **Datum transformation** parameters (e.g. 3 out of 7 parameters) to have a valid definition of your datum. Defining an EPSG ID allows you to make the appropriate transformation of your computed coordinates when a Trimble RTX service is used.

- Once done, name the system and touch  in the title bar to save the system definition.
2. 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.
3. 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 85).


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 118*

- Open the job in which 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 (by default, Survey Mobile lists the files stored in ..\SurveyMobile.Droid\Import\). To import a file from a different folder, see *page 121*).

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:

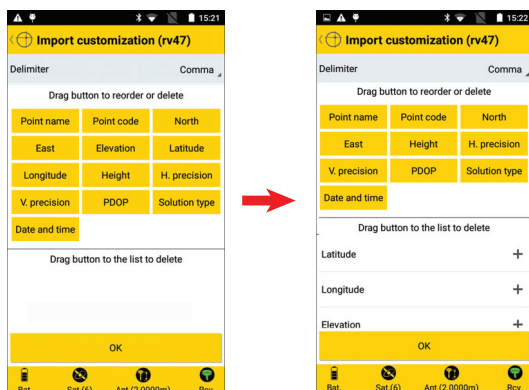
Name Code North East Elevation

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

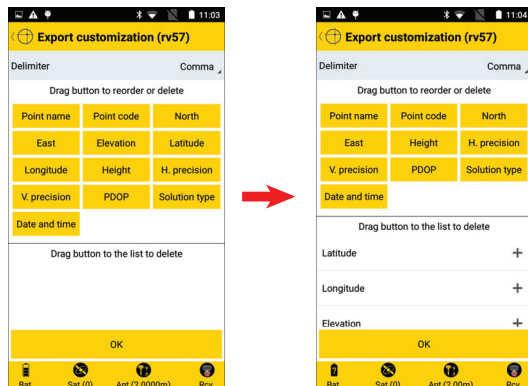
For export operations other than with "Survey Mobile point" format, please refer to *Other Import/Export Functions* on page 118.

- Open the job from which to export points (see *Opening an Existing Job* on page 17).
- 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)

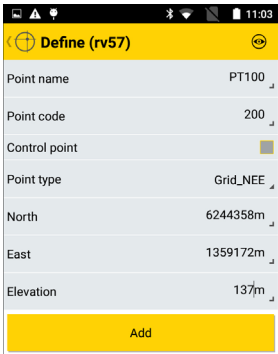
- Name the export file.
- Touch the big yellow **Export** button to run and complete the export operation. The resulting file is saved to the default folder (...\\SurveyMobile.Droid\\Export\\). To export to another folder, see *page 121*.

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**.




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 **Point 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 the local grid).
 - **Point type** (type of coordinates): Choose the system in which the point’s known coordinates are expressed: Grid_NEE (North, East, Elevation), WGS84_LLH (latitude, longitude and height), or WGS84_XYZ (WGS84 Cartesian XYZ coordinates),
 - Point coordinates, as known in the selected coordinate system.
- 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 touching **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 32*.

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 is the line's end point.

Touch  to open the vertical icons menu through which you can define these points (see how to use these icons on *page 7*).

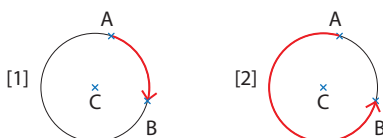
 - **Interval:** Enter a distance value specifying how accurate staking out the line should be. For example, if you choose an interval of 2 meters, then Survey Mobile will take you successively to points 2 meters apart along the line.
 - **Start station:** Enter the distance on the line, measured from the line's start point, defining the location on the line from which to start staking out the line (see also *About Line Stakeout on page 9*).

- 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).

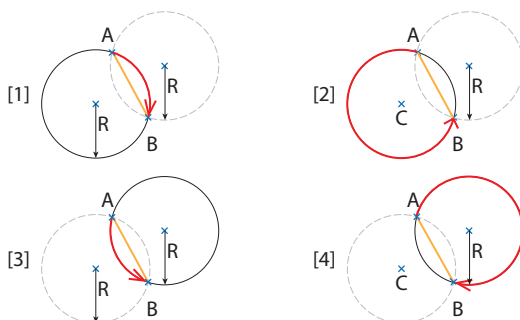


The start point of the arc is A, and the end point is B. Using the locations of A, B and C, Survey Mobile can deduce the radius of the circle.

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.

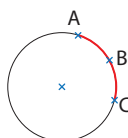
Two circles and four arcs are possible.




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	A
End point	B
Radius	25m
Interval	3m
Start station	0+000.0000m
Add	

- Enter additional parameters, as required by the method you chose (directions, points, radius).
- **Interval:** Enter a distance value specifying how accurate staking out the arc should be. For example, if you choose an interval of 2 meters, then Survey Mobile will take you successively to points 2 meters apart along the arc.
- **Start station:** Enter the distance along the arc, measured from the arc's start point, defining the location on the arc from which to start staking out 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

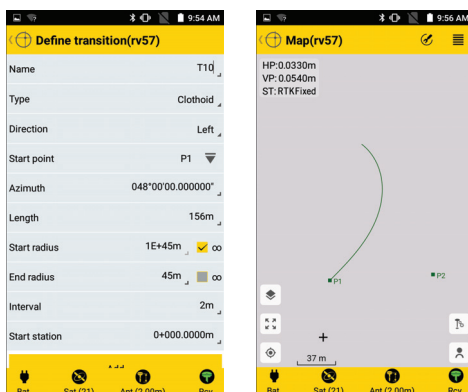
Transitions are used to connect a straight line to an arc or vice-versa. To smoothly connect a transition to a straight line, the transition's radius should be infinite at the junction point, and to connect a transition to an arc, the transition's radius should be equal to that of the arc at the junction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


- **Clothoid:** This curve type 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 (settings on the left screen, resulting transition on the right screen, as seen on the map view).



- Enter additional parameters, as required by the method you chose (direction, azimuth, length, radiuses, etc.).
- **Interval:** Enter a distance value specifying how accurate staking out the transition should be. For example, if you choose an interval of 2 meters, then Survey Mobile will take you successively to points 2 meters apart along the transition.
- **Start station:** Enter the distance along the transition, measured from the transition's start point, defining the location on the transition from which to start staking out 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 131 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 a distance value specifying how accurate staking out the alignment should be. For example, if you choose an interval of 2 meters, then Survey Mobile will take you successively to points 2 meters apart along the alignment.
- 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 97 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 112).

- 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 tell whether Earth curvature should be taken into account or not.

New traverse(rv57)


Traverse type	Open traverse
Traverse name	Tra2
Start point	P2
Backsight of start point	P1
Temperature	24°C
Pressure	800mmHg
PPM	-10
Refraction	0.142
Curvature	<input type="checkbox"/>

OK

Bat. Laser Target TS

- 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)	
PT100		L1	
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		
PT101		L2	
Point code	100	Line start point	PT100
Point type	Defined	Line end point	PT102
Control point	No	Interval	3.0000m
North	6244310.0000m	Length	95.5249m
East	1359208.0000m	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_LLLH or WGS84_XYZ). So these coordinates may not always be expressed using the same type of coordinates that the one used by the coordinate system selected for the job.

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 backsight points.


Editing Points

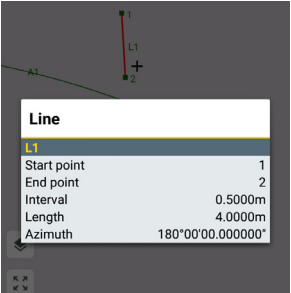
Definitions of points may be corrected if necessary using the procedure below:

- 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.


**Viewing/Selecting
Objects from the
Map View**


From within the map view you can touch any of the objects shown (points, straight lines, arcs, transitions). The touched object will turn red on the screen and you will see a dialog box providing all the details of the object.

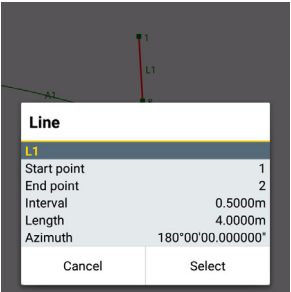
From any survey function, you may touch  in the title bar to access the map view. Then if you touch any of the displayed objects, Survey Mobile will show the details of the selected object. Below is an example of the dialog box you get when selecting a line on the map view:



You then have to touch the screen elsewhere on the map to remove the dialog box.

But if you access the map view by touching  from within any of the stakeout functions available, Survey Mobile will in addition show two buttons allowing you to confirm (or cancel) the use of that object as the one you want to stake.

Below is the same dialog box as above, but obtained after touching  in the **Line stakeout** function:





If you choose **Select**, the touched object will be the one you choose to stake out.

Creating Geometrically Defined Points

Survey Mobile lets you create additional points that you will create by applying some specific geometrical rules on existing objects shown on the map (lines, arcs, transitions, **whether from the job itself, or from a displayed background map**). This is explained below.








From any of the Survey functions:



- Touch .
- Touch  located in the lower-left part of the screen. This opens an icons menu (see on the left) while the icon you've just touched turns dark. (To hide the icons menu, touch this icon again, which turns back to white.)

Here is how you should use the icons menu when shown:

1. Taking a look at the table below, choose and then touch the icon that will create the point you would like to add:

Icon	Function	Name of Created Point
	Will create a point at the middle of a straight line	<line_name>_mid<ID*> (e.g. L1_mid5145)
	Will create a point at the closest end of a straight line	<line_name>_end<ID*> (e.g. L2_end2392)
	Will create a point at the intersection of two straight lines**	<Line1>_<Line2>_cross<ID*> (e.g. L1_L2_cross1897)
	Will create a point where the two tangents to an arc intersect	<arc_name>_inters<ID*> (e.g. A1_inters3910)
	Will create a point at the center of an arc	<arc_name>_center<ID*> (e.g. A1_center6018)
	Will create a point on the object the closest to your current location	<geometry_type>_nearest<ID*> (e.g. Li_nearest4089)
	Will delete all the points you have just created using the above icons since you opened this menu on the map view.	



*: "ID" is a 4-digit random number.

**.: If the touched line (named "Line1") intersects with several other straight lines, the chosen intersection point will be the one the closest to where you touched that line. The name of the intersecting line is "Line2".

(When you touch one of these icons, it turns dark.)

2. Touch the object on the map view from which to create the point. When done, the created point appears in red on the map view and is named automatically. The icon you touched in the menu turns back to white.
3. Touch the point again. Survey Mobile names the new point and suggests you save it. If you agree just touch **Save**.

NOTE: Like any other points, the points you create through that procedure can be staked out using the **Point Stakeout** function. In addition, you can stake out a geometrically defined point directly from within the **Point Stakeout** function:

- In the **Point Name** field touch , then .
- Create your geometrically defined point as explained above.

Then you can directly proceed with the staking out of this point:

- Select the newly created point on the map. Confirm this is the point you want to select.

Survey Mobile comes back to the Stakeout screen where you can now see this point as the point to be staked.

- Stake the point as you would normally do (see *page 71* or *page 107*).



After the point has been staked, the resulting point can be saved to the job. By default, the staked point is named: "*<created_point_name>_stakeout*" but you can always change this name before it is actually saved.

NOTE: Be aware the point created this way through a geometrical rule will be saved only after you have actually selected it on the map (achieved by touching the **Select** button in the dialog box), independently of whether you stake it or not afterwards.

Interfacing Survey Mobile to a GNSS Receiver

Connecting Survey Mobile to an External Receiver via Bluetooth

- Make sure Survey Mobile is set to be connected to an external 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 Receiver**.
- 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**).

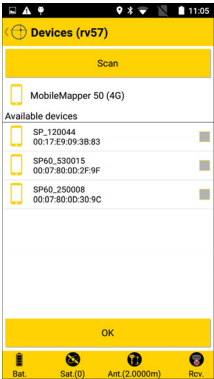
Should the scanning fail, you can still touch the big yellow **Scan** button to resume a new search phase.

- 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



Connecting Survey Mobile to the Built-in GNSS Receiver

(SP20)

- Make sure Survey Mobile is set to be connected to the built-in GNSS receiver: On the main menu, you should see a handheld icon in the title bar. If not, touch the displayed icon (a total station or external GNSS icon) and select **Switch to Handheld**.

As a result, the connection to the built-in GNSS receiver is automatically started. Survey Mobile switches to the screen you would normally get by touching this icon in the lower part of the screen:



And the message “**Connecting...**” is displayed.

After a few seconds, the connection is made active, the **Connect** button is turned gray and the icon in the lower-right corner looks like this:



- Touch  to define the antenna height:

A screenshot of the 'Antenna(DemoJob)' configuration screen. It has a yellow header with a back arrow and a globe icon. Below the header is a table with four rows: 'Antenna type' (Internal), 'Antenna model' (SP20), 'Measure to' (Bottom of half-pole adapter), and 'Antenna height' (1.2m). Each row has a small downward arrow on the right. At the bottom is a yellow 'OK' button.

Antenna(DemoJob)	
Antenna type	Internal
Antenna model	SP20
Measure to	Bottom of half-pole adapter
Antenna height	1.2m
OK	

- **Antenna type:** “**Internal**” is the choice you should make when using the built-in GNSS receiver. Choose “**External**” if you wish to use an external antenna connected directly to your device via a coaxial connection.
- **Antenna model:** Choose the model of antenna used if you selected an external antenna (see previous parameter).
If you use the internal antenna, this field shows the name of the device you are using.
- **Measure to:** Indicate the reference point on the antenna from which the antenna height to the ground is measured.

- **Antenna height:** Enter the measured value of antenna height. The measurement is supposed to have been made using the reference point on the antenna that you selected in the previous field.

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.


- **TERIASat:** Corrections come from the TERIA network of geostationary satellites, which broadcast RTK and PPP corrections either via the Internet or via receivers with an integrated TERIASat-compatible L-band modem.

NOTE: **RTK Radio** and **RTK Bluetooth** are not supported by the SP20.

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	Receiver that supports long-range Bluetooth (version 5.0 and later). These include the SP60, S-Max, R4s, and R4s LE.
RTX	<p>Hardware requirements:</p> <ul style="list-style-type: none"> • Via satellites: None • 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. <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 90*). 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 an External Receiver via Bluetooth on page 36*), 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 an External Receiver via Bluetooth on page 36*), 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.

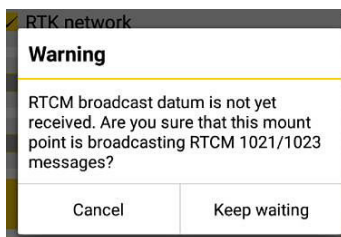
- Touch the big yellow **OK** button to save all the entered parameters. This takes you back to the previous screen.
- Use the **Name** field to enter a name for the configuration you have just defined, then touch **Save** to save it.
- Touch **Start** and wait until a message tells you that the whole system is ready for use.

If you selected **Broadcast RTCM** when creating the job (see *Creating a Job on page 12*), the message “**Waiting for RTCM datum...**” will be displayed until a datum is received. Then Survey Mobile will automatically take you back to the main menu.

NOTE: After you have selected “**Broadcast RTCM**” and a coordinate system has been defined for the job, Survey Mobile will only use the defined projection’s horizontal and

vertical parameters. No datum parameters will be used until a broadcast datum is received from the selected base through the RTCM 1021/1023 messages. Survey Mobile will then be able to determine the ellipsoid and datum transformation parameters required to define a full coordinate system for the job.

If no datum is received the following message will pop up prompting you to keep waiting or to give up starting a survey in that rover configuration.




NOTE: If the base happens to broadcast a new datum, then Survey Mobile will warn you through this message: **"The application was re-initialized because of the updating of broadcast RTCM datum. Are you sure to use the new datum?"**. You can decide whether you wish to use the new datum or discard it. In the latter case, you will continue to use the one you received previously.

RTK Bluetooth

This operating mode is made available only if the connected GNSS receiver is a Spectra SP60 or SP85.


After activating the Bluetooth connection to the receiver (see *Connecting Survey Mobile to an External Receiver via Bluetooth on page 36*), 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 an External Receiver via Bluetooth on page 36*), do the following:

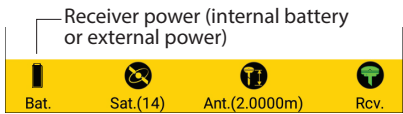
- Touch  and then open the **Rover** tab.
- Enable the **RTX** check box within the **RTX** field and then touch this field. This opens the **RTX** screen.
- Complete these fields:
 - **Link type**: For SP60, choose “**Controller Internet**” (corrections via Internet) or “**RTX satellite**” (corrections 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 (rv57)	
Connect	Rover
Status	
Position	
Latitude	047°17'56.284704"
Longitude	-001°30'32.586978"
Height	88.6520m
Horizontal precision	0.0170m
Vertical precision	0.0350m
PDOP	1.4
Solution type	RTKFixed
Correction age	1s
Base information	
Latitude	000°00'00.000000"
Longitude	000°00'00.000000"
Height	m
Antenna height	m
Baseline	m
Base index	
Satellites tracked:22	
GPS	10
GLONASS	7
Beidou	3
Galileo	2
QZSS	0
Bat.	Sat.(16)
Ant.(2.00m)	Rev.

Receiver (rv57)	
Connect	Rover
Status	
Position	
Latitude	000°00'00.000000"
Longitude	000°00'00.000000"
Height	0.0000m
Horizontal precision	0.6448m
Vertical precision	0.6780m
PDOP	0.9
Solution type	RTX
Correction age	25s
RTX	
Latitude RTX	034°11'49.646760"
Longitude RTX	108°52'58.247874"
Height RTX	476.5573m
Reference frame	ITRF2008
Epoch	2005
Tectonic plate	Eurasia
RTX position type	CenterPoint-FastInit
Base information	
Latitude	000°00'00.000000"
Longitude	000°00'00.000000"
Height	m
Antenna height	m
Bat.	Sat.(14)
Ant.(2.0000m)	Rev.

- 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...**

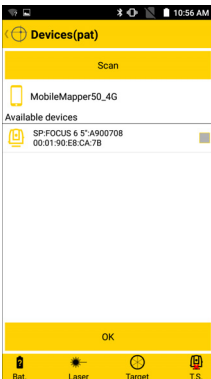
Every time a new Bluetooth device is detected, its Bluetooth ID is added to the list of available devices (under **Available devices**).

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, simply accept the pairing request. (by default, 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.

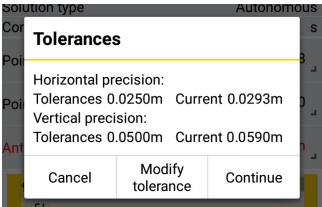
Important Things To Know in GNSS Surveying

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

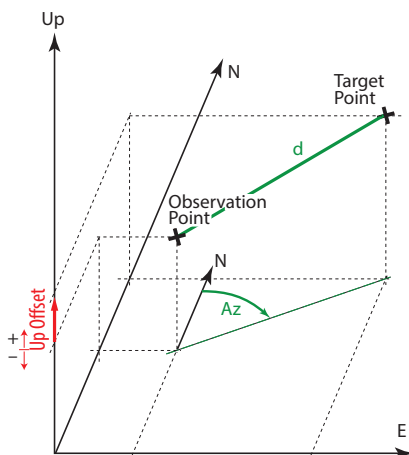
- **Control Points:** When measuring a control point, the message “**Failed to measure point**” will show up if at least 40% of the measurements made are not RTK fixed solutions.

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.

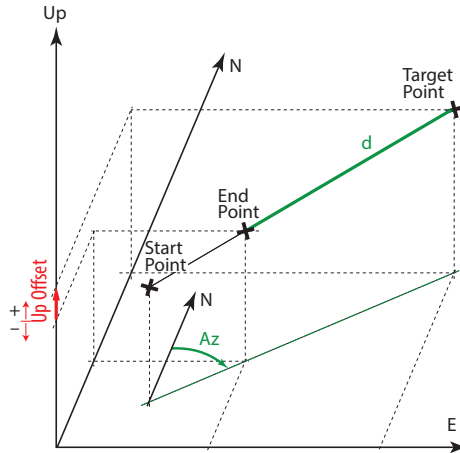


If unknown, the azimuth may be determined by Survey Mobile, directly in the field, **by specifying two points aligned with the target point** (see diagram below).

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 your current position from the last point collected, 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 you are located 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)

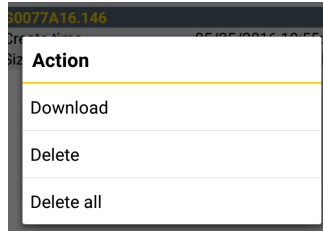
Examples: "G0015A16.132" (static survey); "GF015A16.133" (Stop & Go survey).

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

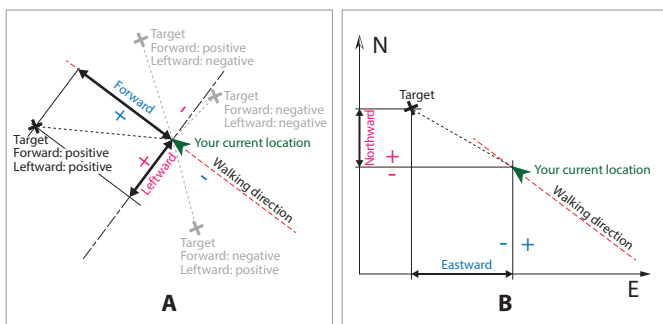
If you run out of receiver memory while being in the field, there is an emergency procedure that allows you to delete all the files from the receiver memory. Obviously you will not delete important files that have not been previously backed up at the office. So please think about the files still in memory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

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

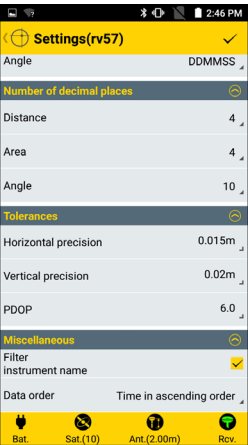
The new screen that opens (see below) allows you to choose:

- The units you want to use for distances (meters, feet, US survey feet), areas (square meters, square feet, square yards and 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 GNSS receivers).


- **Camera** (SP20 only): By enabling this option, you allow Survey Mobile to display a picture of what the rear camera of your mobile device sees while you are surveying or staking out points, lines, etc. (see *page 78*). If this option is disabled, you don't get such a view on the survey screens.
- **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**).
- **Grid coordinate display order**: Setting this option allows you to choose whether you want the coordinates to be displayed in the "NEE" or "ENE" order:
NEE: Coordinates will be displayed in this order:
Northing, Easting, Elevation.
ENE: Coordinates will be displayed in this order:
Easting, Northing, Elevation.

- 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 an External Receiver via Bluetooth on page 36*).

- 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. With SP20, you can choose between internal and external antenna (see *page 37*).
 - **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.

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:


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

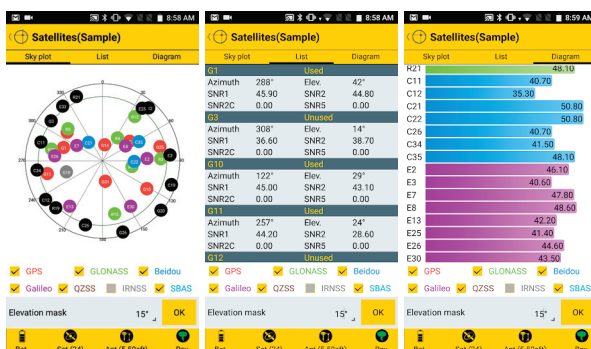
- When selecting **Point Survey**, **Control Point Survey** or **Offset Survey**.
- When selecting **Point Stakeout**, **Line Stakeout** or **Stake out road**.
- Before logging the start or end point of a line.
- Before logging a point within the site calibration function.
- Before logging a point within 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 an External Receiver via Bluetooth on page 36*.
- 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 environment. 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.

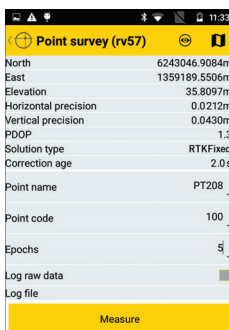
NOTE 2: The number of satellites being used for computing the position is indicated by the satellite icon. If however the mobile device's internal GNSS receiver is used, this number will always be "0" regardless of the number of satellites actually used.

Point Survey

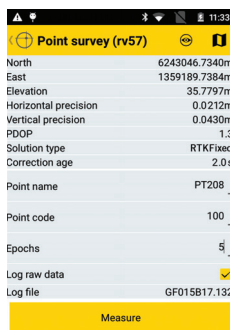
Assuming your system is now ready for use:

- 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).



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	2.0s
Point name	PT208
Point code	100
Epochs	5
Log raw data	<input type="checkbox"/>
Log file	



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	2.0s
Point name	PT208
Point code	100
Epochs	5
Log raw data	<input checked="" type="checkbox"/>
Log file	GF015B17.132

- 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.
NOTE: Alternatively, if you earlier imported a point code file into Survey Mobile (see *page 118*), a list of imported point codes will be prompted (for you to select one) when tapping within the **Point code** field.
 - **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.

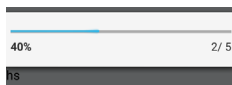
- Make sure you are standing exactly over the point, keep the pole vertical and stay at standstill.
- Touch the big yellow **Measure** button (or press **Volume-**). The point is being measured.

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).

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	2.0s
Point name	PT208
Point code	100
Epochs	12

Measure

- 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.

NOTE: Alternatively, if you earlier imported a point code file into Survey Mobile (see *page 118*), a list of imported point codes will be prompted (for you to select one) when tapping within the **Point code** field.

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.

Measure


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.

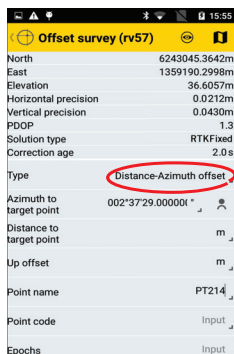
Offset Survey

Please read *Offset Points on page 50* 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.

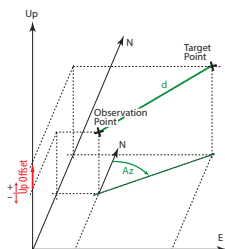
The upper part of the screen shows the coordinates of your current position – as computed by the GNSS receiver – as well as accuracy-related figures (horizontal/vertical accuracies, PDOP) and the position computation status (solution type, correction age).

- 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 50*.



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	2.0 s
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.

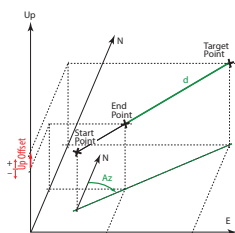


1st case: The azimuth from the observation point is known or was previously determined using an external measuring tool (compass, etc.):


- Choose the observation point from where to make the offset measurement.
- Touch $000^{\circ}00'00.000000$ 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.

NOTE: Alternatively, if you earlier imported a point code file into Survey Mobile (see *page 118*), a list of imported point codes will be prompted (for you to select one) when tapping within the **Point code** field.

- 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.

Calculate azimuth (rv57)	
Start point	
Start point	P1
North	6243300.0000m
East	1359300.0000m
Elevation	80.0000m
End point	
End point	P2
North	6242500.0000m
East	1358900.0000m
Elevation	80.0000m
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, picking their names from the list of existing points or directly from the map, or 3) by occupying these points one after the other.

For cases 2) and 3), first touch  then choose the right icon (see also *page 7*) so you can select or measure your points. For case 3), 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.

NOTE: Alternatively, if you earlier imported a point code file into Survey Mobile (see *page 118*), a list of imported point codes will be prompted (for you to select one) when tapping within the **Point code** field.

- 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.

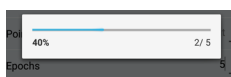
- Touch the big yellow **Measure** button. The point is being measured.

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.

Survey Mobile 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

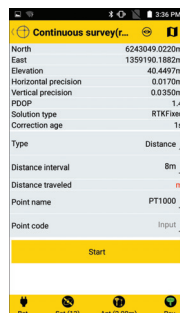
- Get your equipment ready for Continuous operation and then turn it on. Typically the GNSS antenna or receiver is mounted on top of a range pole.
- In Survey Mobile's main menu, touch .
- Touch **Continuous survey**.
- Confirm or correct the antenna parameters then tap **Continue**. Survey Mobile opens 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**).



Continuous survey(r...)

North	6243048.9508m
East	1359190.2043m
Elevation	40.3357m
Horizontal precision	0.0170m
Vertical precision	0.0350m
PDOP	1.4
Solution type	RTKFixed
Correction age	1s
Type	Time
Time interval (s)	10
Time elapsed (s)	
Point name	PT1000
Point code	Input
Start	

Bottom bar: Stop, Start (10s), Ant (0.00m), Menu




Continuous survey(r...)


North	6243049.0220m
East	1359190.1882m
Elevation	40.4497m
Horizontal precision	0.0170m
Vertical precision	0.0350m
PDOP	1.4
Solution type	RTKFixed
Correction age	1s
Type	Distance
Distance interval	8m
Distance traveled	m
Point name	PT1000
Point code	Input
Start	

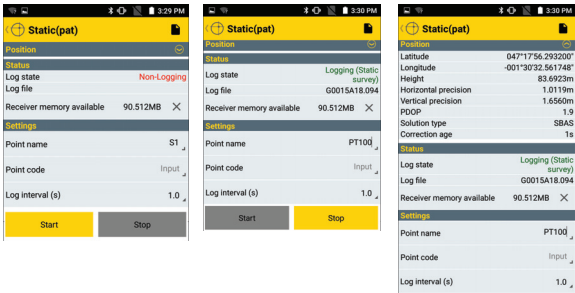
Bottom bar: Stop, Start (10s), Ant (0.00m), Menu

- 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 touch **Start**. Survey Mobile automatically starts counting the time elapsed or distance traveled since you touched **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, touch **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**.
- Confirm or correct the antenna parameters then touch **Continue**. Survey Mobile opens a new screen from which you can configure and start the static survey.
- 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).
NOTE: Alternatively, if you earlier imported a point code file into Survey Mobile (see *page 118*), a list of imported point codes will be prompted (for you to select one) when tapping within the **Point code** field.
 - **Log interval (s)**: Enter the raw data recording rate, in seconds.
 - **Path** (SP20 only): Indicates the path to the file in which raw data will be logged (default: ...\\Download\\).

To change the path, touch  then **...**, then touch the name of the desired folder and touch **OK**.
- Then touch **Start**. Data logging starts after a few seconds (**Starting...** message is displayed in the meantime).




Note that you can display the coordinates of the position computed in real time by the GNSS receiver. By default this tab is not shown.

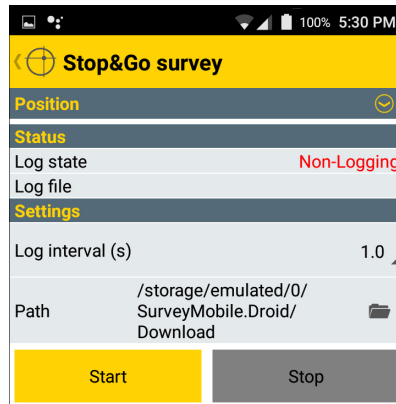
Use  and  to respectively expand or collapse this tab.



- Let Survey Mobile log raw data. During this time, the top of the screen shows the data logging status as well as the name of the file where raw data are being stored (see screen above right) (+ possibly memory status depending on the equipment used). The file is named according to the convention presented in *Conventions Used to Name Raw Data Files* on page 52.
- 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**.
- Confirm or correct the antenna parameters then tap **Continue**. Survey Mobile opens a new screen from which you can configure and start the stop and go survey.
- First enter the following settings:
 - **Log interval (s)**: Enter the raw data recording rate, in seconds.
 - **Path** (SP20 only): Indicates the path to the file in which raw data will be logged (default: ...\\Download\\).

To change the path, touch  then **...**, then touch the name of the desired folder and touch **OK**.



Stop&Go survey	
Position	
Status	
Log state	Non-Logging
Log file	
Settings	
Log interval (s)	1.0
Path	/storage/emulated/0/SurveyMobile.Droid/Download 
Start Stop	

- 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 possibly the memory status depending on the equipment used.

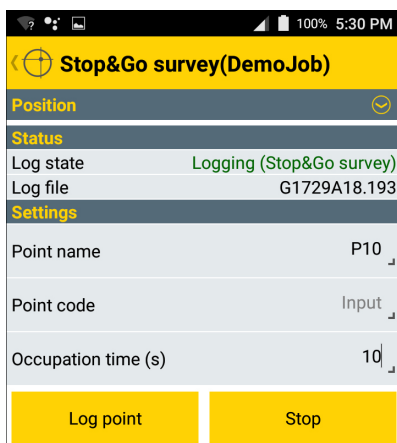
Like in Static Survey, you can display the coordinates of the position computed in real time by the GNSS receiver. By default this tab is not shown.

Use  and  to respectively expand or collapse this tab.

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

- **Point name**
- **Point code**
NOTE: Alternatively, if you earlier imported a point code file into Survey Mobile (see *page 118*), a list of imported point codes will be prompted (for you to select one) when tapping within the **Point code** field.
- **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.

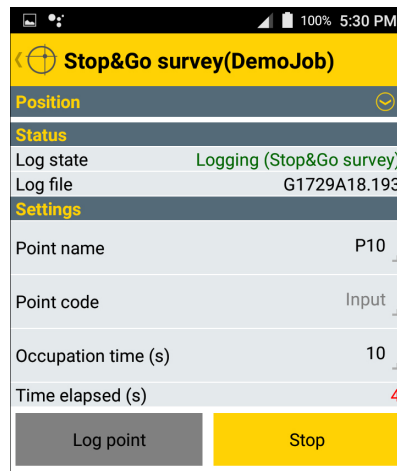


Stop&Go survey(DemoJob)	
Position	
Status	
Log state	Logging (Stop&Go survey)
Log file	G1729A18.193
Settings	
Point name	P10
Point code	Input
Occupation time (s)	10
<div>Log point</div> <div>Stop</div>	

- 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.









Stop&Go survey(DemoJob)	
Position	
Status	
Log state	Logging (Stop&Go survey)
Log file	G1729A18.193
Settings	
Point name	P10
Point code	Input
Occupation time (s)	10
Time elapsed (s)	4
<div>Log point Stop</div>	

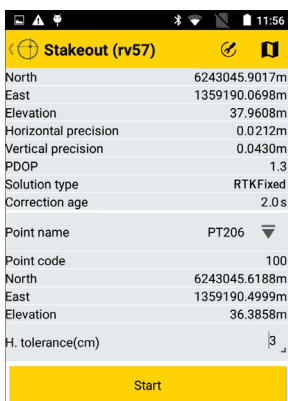
Note that if you wish, you may shorten the occupation time by touching the yellow **Stop** button. This will instantly end the occupation time on the point.



- 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).
- Touch  in the **Point name** field to choose the point from the open job that you want to stake out (see also *page 7*). Use one of the icons as follows:
 -  to list all the points stored in the job and select one to be staked out.
 -  to select the point directly from the map view.
 -  to create a new point that you would like to stake out.
 -  to select the point in the job that is the nearest to your current position.

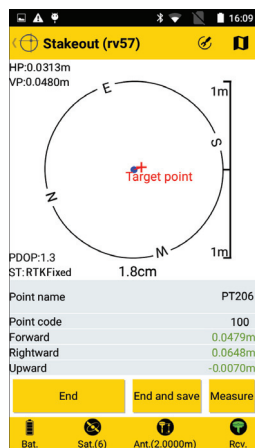
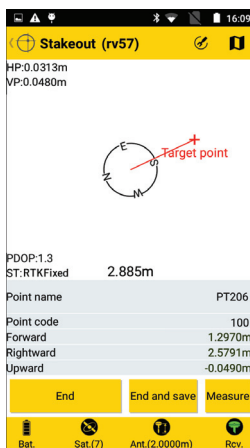
The lower part of the screen then shows information on the selected point (name, code, coordinates).



Stakeout (rv57)	
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	2.0 s
Point name	PT206 
Point code	100
North	6243045.6188m
East	1359190.4999m
Elevation	36.3858m
H. tolerance(cm)	3 
Start	

NOTE: Other possible action 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 54).
- 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).




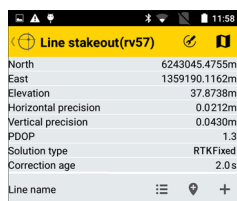
- Dig a stake into the ground to mark the point.

- 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).

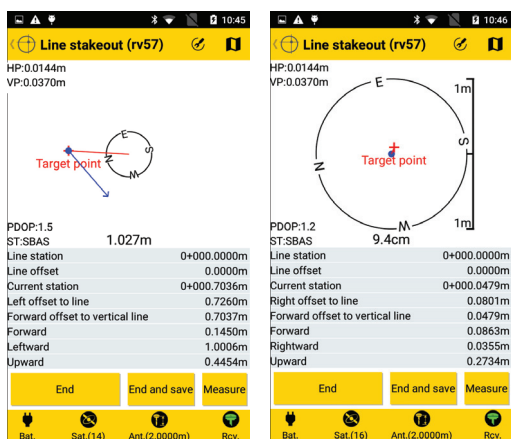


Line stakeout(rv57)	
North	6243045.4755m
East	1359190.1162m
Elevation	37.8738m
Horizontal precision	0.0212m
Vertical precision	0.0430m
PDOP	1.3
Solution type	RTKFixed
Correction age	2.0 s
Line name	⋮ ⓘ +

- Select an existing straight line, arc or transition, or create a new one (see also [page 24](#), [page 25](#) and [page 27](#)).

When you touch ,  or , Survey Mobile respectively lists the existing straight lines/arcs/transitions, shows the map so you can make a selection 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 9*.
- **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 9*).
- **North/East** (read-only fields): Coordinates of first point to go to (these coordinates are linked to 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 collected for the straight line/arc/transition will be considered as valid only if the horizontal precision on the position is below (better than) this tolerance value.
- 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 directly from the Map screen. These are:

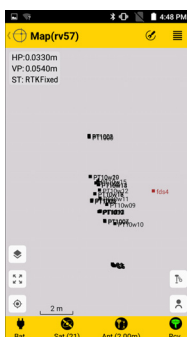
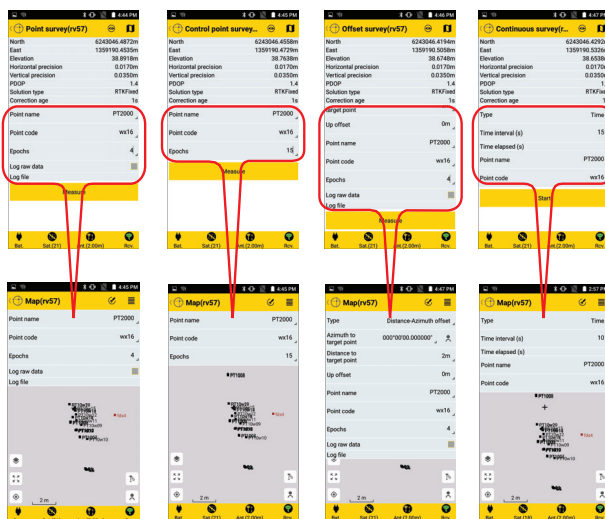
- Point survey
- Control point survey
- Offset survey
- Continuous survey

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 touch **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).

	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: RTKFixed	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.



Using the Rear Camera in Survey Functions

As of Survey Mobile version 2.5 and later, when surveying with a GNSS receiver, you can now use your device's front or rear camera to take a photo of the point currently being measured. These photos help as a visual reference to where the point is, and are useful if you need to relocate the point for future survey work. The photos are also georeferenced with the location of the device at the time of capture, stored in the file's EXIF data.

NOTE: **You must take the photo of the point before measuring it**, otherwise the photo will be saved to the next point in your measurement. Each point can have up to one photo associated with it.

Taking a Point Photo


To take a photo of a point, touch  on the Photo Point row.

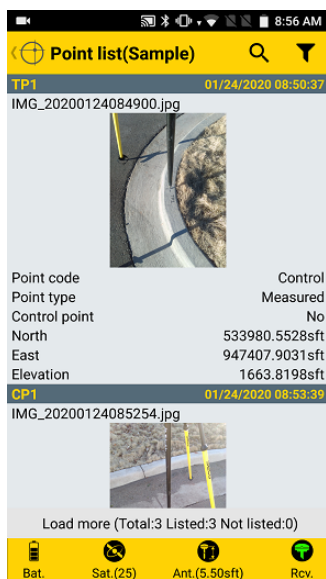
1. Take the photo of the point using your device's camera. The appearance of this screen may vary depending on your device:



2. Once the photo is taken, a thumbnail of the image appears on the photo row screen, as well as the filename.



3. To view previous points, as well as their associated image if there is one, touch .



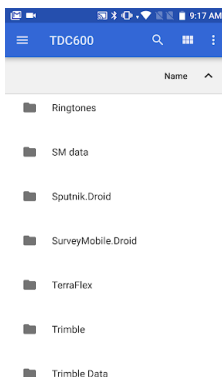
Retrieving Point Photos

Photos, unlike the geospatial data associated with them, are NOT exported using Survey Mobile's export functions. These will need to be retrieved directly from the phone's file system, and exported separately.

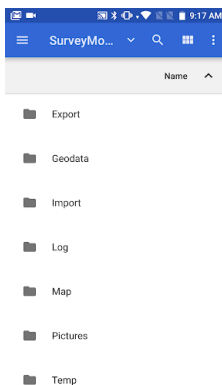
NOTE: In some cases, plugging your phone into your office computer and trying to get the pictures directly from the phone will result in those pictures not appearing on your computer's file manager. If this happens, please use the directions below for exporting the photos directly from the device instead.

Exporting Photos from the Device

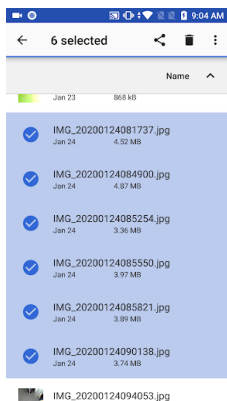
1. Find and open the file manager app on your device. This may be called Files or My Files.




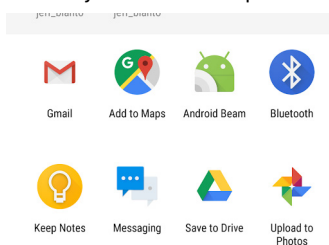
2. The application data for Survey Mobile is stored in the on-board storage for your device. Navigate to this folder, and find the folder called SurveyMobile.Droid. Touch the folder to open it.
3. Inside the SurveyMobile.Droid folder, find the folder called Pictures. Touch the folder to open it.



4. All of the photos taken from the Survey Mobile app appear in this folder. To export these photos, touch and hold every photo you want to export until a check mark appears next to them.

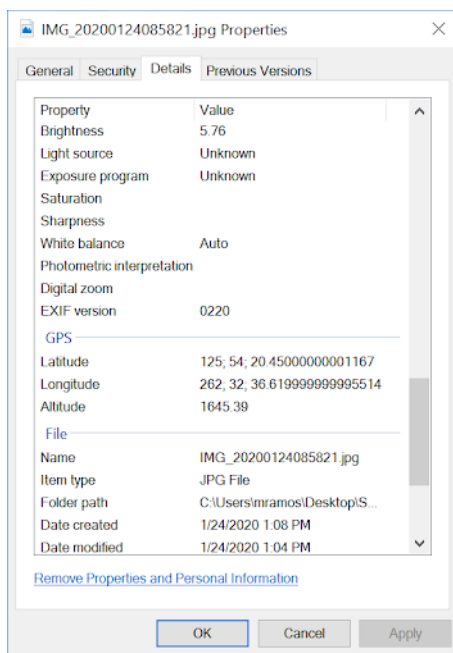


5. Touch  to export the selected photos. A menu of supported apps on your device that can export this data appears. Select your preferred method, and export the data to your office computer.



6. Once the photos are on your office computer, you can view the associated EXIF data on each file to find out which point they belong to. To do this on Microsoft Windows, right-click the photo and select **Properties**. Click on the **Details** tab, then scroll down to the **GPS** section to view the

location data of the photo. These are displayed in a global lat/long system, with the altitude shown in meters.



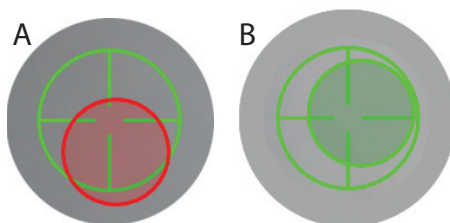
SP20 only

(With the SP20 only, provided the internal antenna is used and the **Camera** option has been activated on the **Settings** screen; see *page 55*. A monopole may be used or not.)

The camera view uses two cross hairs for you to adjust both the orientation of the unit (to be level) and the position of the unit exactly at the vertical above the desired ground point:

- The larger green cross-hair constantly shows the ground point you are aiming at.
- The smaller cross hair indicates the orientation of the unit: it is red if the unit is not level (**A**) and it is green if it is level

(B). When it's green then it's necessarily located within the larger cross hair.



Survey Functions

Except for Static survey and Stop & Go survey where the camera can't be used, the camera view will appear on the screen after you touch the **Measure** button (or the **Start** button in Continuous survey).

The steps required to aim at and measure a point are given below:

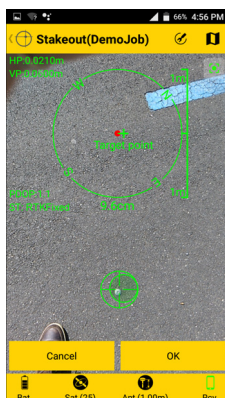
1. Get closer to the desired point so it can be seen somewhere on the camera view.
2. Orientate the unit so the smaller cross hair gets into the larger one and turns green in color.
3. Gently and slowly move the unit horizontally so the desired ground point appears inside the two cross hairs (which should be still concentric and both green).
4. Touch **OK** to make the measurement.



Stakeout Functions

The steps required to locate a target with the camera are given below:


1. Choose a point (or a line, or an alignment) and touch **Start**.
2. Follow the on-screen guidance instructions to head for the target.
3. When you are close enough to the target, touch **End**. (or **End and Save** if you intend to save the location of the target). The screen now shows what the rear camera sees in real time.
4. Orientate the unit so the smaller cross hair gets into the larger one and turns green in color.
5. Gently and slowly move the unit horizontally so the desired ground point appears inside the two cross hairs (which should be still concentric and both green).



6. Mark the point on the ground.
7. Touch **OK** to end the procedure.

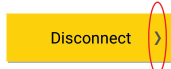
Ending a Survey

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.

Site Calibration in GNSS Surveying

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 15.

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.



IMPORTANT: When you choose this kind of calibration, you are constantly reminded of this choice within the Survey menu, whether you are logging or staking out points, lines, etc. The first line at the top of the screen will display in sequence (at a rate of about 1 second) the normal content of this line and a message in red characters that reads “Single Point calibration has been applied”.

Point survey(DemoJ...)	
North	Single point calibration has been applied 37m
East	1359190.4828m
Elevation	88.0834m
Horizontal precision	0.2020m
Vertical precision	0.3160m
PNOP	1 2

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 85*).

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 or from the map view.

Pt.	North	East	Elev.	Lat.	Lon.
pt11	6234188.3982m	1586566.5005m	12.1143m	047°17'52.000000"	001°30'00.000000"
pt11W			58.0000m		

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 means through which the base will deliver its corrections. Survey Mobile offers three different options to generate and deliver RTK corrections (7 different formats possible):
 - **RTK Radio:** Corrections are broadcast using a radio transmitter. The radio transmitter is connected to the GNSS receiver used (see *RTK Radio on page 91*).
 - **RTK network:** Corrections are delivered via an IP connection using the Direct IP protocol (see *RTK Network on page 92*).
 - **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 an External Receiver via Bluetooth* on page 36), 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 90).
- 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 84*), and let the base operate on its own.

RTK Network

After activating the Bluetooth connection to the receiver (see *Connecting Survey Mobile to an External Receiver via Bluetooth on page 36*), 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 90*).
- 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 84*), 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 SP60.


After activating the Bluetooth connection to the receiver (see *Connecting Survey Mobile to an External Receiver via Bluetooth on page 36*), 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 90*).
- 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 84*), 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 an External Receiver via Bluetooth on page 36*)
- Touch  and then open the **Base** tab.
- Touch the **Stop** button.

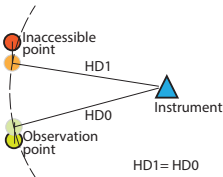
Important Things To Know in Optical Surveying

Offsets

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

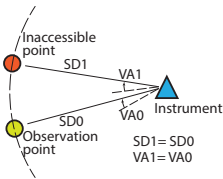
In this case, you will measure an accessible point, named *observation point*, located in the vicinity of the inaccessible point and, for three of the available offset techniques, you will then aim at the inaccessible point using a reflectorless (Direct Reflex) as the target.

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.



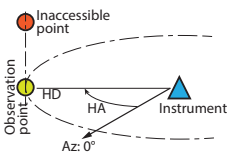
- **Angle** offset: The observation point is at a certain angle – i.e. with non-zero horizontal (HA) and vertical (VA) components – from the inaccessible point.

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.



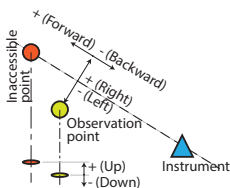
- **H. angle** offset: The observation point is exactly on the same horizontal plane as the inaccessible point, at some angle from this point seen from the instrument.

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

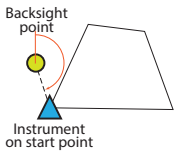
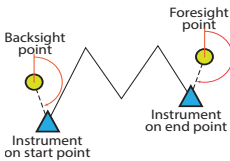
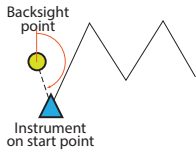
Survey Mobile supports only 2D (horizontal), not 3D staking out. That's why the measured values of vertical offsets have no impact on the stakeout process.

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.



2. 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 95. The same parameters are checked for measurement accuracy: **2C**, **2C discrepancy**, **Angle offset between rounds**, **Distance offset in round** and **Distance offset between rounds**.

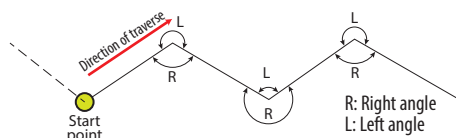
Traverse survey asks you to define an additional parameter named **Turn angle type** (see point 4. below).

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

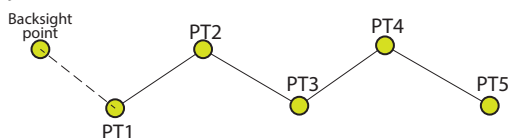


Once you've set all these parameters, touched **OK** and started the traverse, you will no longer be allowed to change them. You can however go back to this screen by touching the same icon so you can be remembered which values you chose for these parameters.

- 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).




- 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.

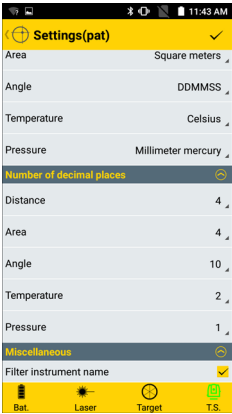


Step	Instrument located on:	Measurements
1	PT1 (Start point)	To backsight then PT2 (foresight)
2	PT2	To PT1 (backsight) then PT3 (foresight)
3	PT3	To PT2 (backsight) then PT4 (foresight)
4	PT4	To PT3 (backsight) then PT5 (foresight)
5	PT5	To PT4 (backsight) then etc.

Surveying With a Total Station

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, square feet, square yards and 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 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**).


- **Grid coordinate display order:** Setting this option allows you to choose whether you want the coordinates to be displayed in the "NEE" or "ENE" order:

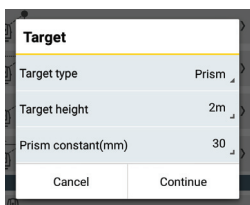
NEE: Coordinates will be displayed in this order:
Northing, Easting, Elevation.

ENE: Coordinates will be displayed in this order:
Easting, Northing, Elevation.

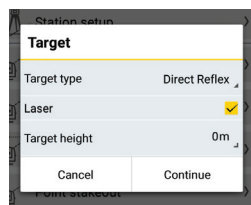
- Touch  located in the title bar to validate all your changes.

Defining the Target Used

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 three input fields: "Target type" set to "Prism", "Target height" set to "2m", and "Prism constant(mm)" set to "30". At the bottom, there are "Cancel" and "Continue" buttons.



The screenshot shows a dialog box titled "Target". It has three input fields: "Target type" set to "Direct Reflex", "Laser" with a checked checkbox, and "Target height" set to "0m". At the bottom, there 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.





Corrections	
Temperature	25°C
Pressure	760mmHg
PPM	4
Refraction	0.142 ✓
Curvature	☐

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.

Angles and distance	
Measure	
Horizontal angle	179°58'20.208000"
Vertical angle	087°05'51.655009"
Slope distance	3.0530m
HD error	-0.0050m
VD error	-0.0009m
Delta North	-0.0032m
   	BS Laser Target T.S.

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.

Measure	
Horizontal angle	179°58'18.912000"
Vertical angle	087°04'46.848000"

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.

Calculate	
Measure	
Horizontal angle	161°39'02.232000"
Vertical angle	087°11'48.054975"
Slope distance	3.0380m
447	
Horizontal angle	187°02'05.136000"
Vertical angle	088°06'35.362793"
Slope distance	4.7010m


- 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. Below the station coordinates are the values of North, East, Elevation and Orientation errors describing the extent of the misclosure, however small it can be.
- Touch  in the title bar to accept and complete the station setup.

Topo Point Survey

Assuming your station has been set up properly (see *page 101*):


- 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**).
NOTE: Alternatively, if you earlier imported a point code file into Survey Mobile (see *page 118*), a list of imported point codes will be prompted (for you to select one) when tapping within the **Point code** field.
- 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.
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.

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: 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 101*):

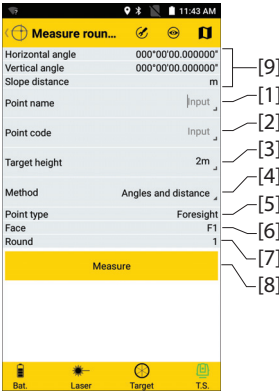
- Touch  then **Offset survey**.
- Touch **Continue** to confirm the currently used target (or change it if required before touching **Continue**).
- Define the type of offset measurement you want to perform. (See principles on *page 94*).
For a distance offset, enter the various components of the distance separating the observation point from the inaccessible point.
- Name the observation point (**Point name**). Optionally enter a point code (**Point code**).
NOTE: Alternatively, if you earlier imported a point code file into Survey Mobile (see *page 118*), a list of imported point codes will be prompted (for you to select one) when tapping within the **Point code** field.
- 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 101*):

- 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 95*).
- 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.



- 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.

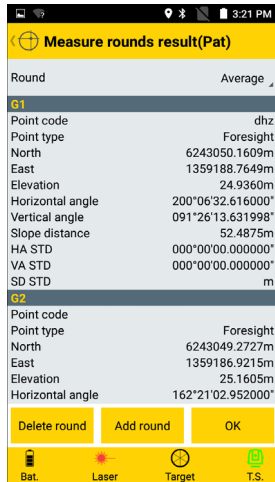
You may be asked to change face. After doing so, touch **End face** to continue with the measurements according to the sequence you defined.

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]	Measure , End round , End face buttons are visible in this area depending on the stage in the sequence. End face is touched instead of Measure when using F1...F2... 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 101*) and the open job contains the list of points (target points) to be staked.

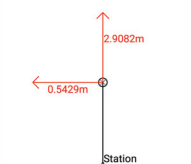
- Touch  then **Point Stakeout**.
- Touch **Continue** to confirm the currently used target (or change it if required before touching **Continue**).
- Touch  then define the following parameters:
 - **Face order:** Define the number of faces used in the measurements performed to stake out points (F1 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.

- Touch  to choose the point you want to stake out: Choose one from the list or from the map, create a new one or select the one the closest to your current location. As a result the screen shows the coordinates of this point.


Stakeout(Pat)	
Point name	aa12 ▾
Point code	dfx
North	6243050.1390m
East	1359188.7250m
Design elevation	24.9354m ▾
H. tolerance(cm)	3 ▾
Start	


- 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(Pat)	
	
Point name	aa12
Point code	
HA, expected	199°25'10.128037"
HA offset	014°32'59.784037"
Backward	2.9082m
Rightward	0.5429m
Up	1.7834m
End	End and save
Measure	
Bat.	Laser
Target	T.S.

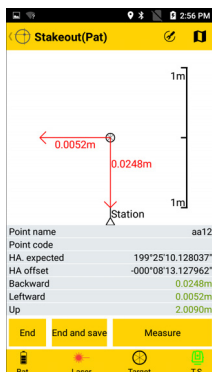
Stakeout Direction:
From Prism

Stakeout(Pat)	
	
Point name	aa12
Point code	
HA, expected	199°25'10.128037"
HA offset	014°32'59.784037"
Backward	2.9082m
Rightward	0.5429m
Up	1.7834m
End	End and save
Measure	
Bat.	Laser
Target	T.S.

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.



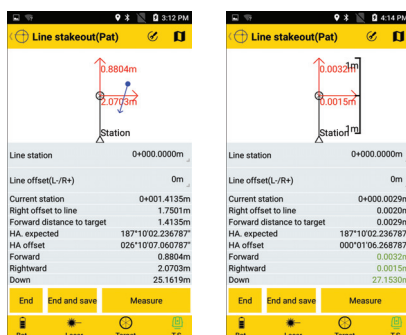
Note that the vertical offset may be any value.

- 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 101*):

- 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 an existing one or create a new one (see also *page 24*, *page 25* and *page 27*).
- **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 9*.
- **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 9*).
- **North/East** (read-only fields): Coordinates of first point to go to (these coordinates are linked to 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 value.
- 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 97*.
 - **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.
- Touch  then make the different settings related to traverse survey (see *page 97* and *page 95*).
- 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**.



Traverse(Pat)	
Traverse name	TR1
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	

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**.

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.

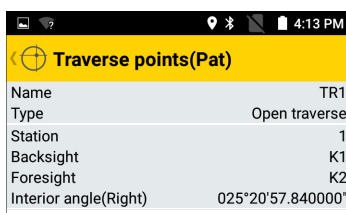
When you have finished measuring the backsight point, **Point type** switches to **Foresight**, which means you should move the target to the next point in the traverse, point the instrument at it and enter a name and a code for this new point.

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).

Horizontal angle	197°57'57.528000"
Vertical angle	091°42'49.612307"
Slope distance	1.8760m
Azimuth	143°14'41.611315"

- Touch **OK** again to save the points. Survey Mobile shows an intermediate result for the traverse:



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

End traverse Measure

Ball Laser Target 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.

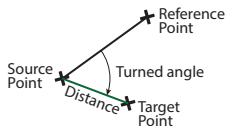
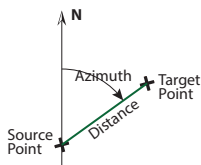
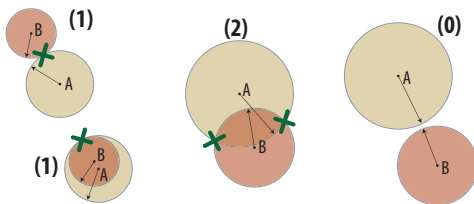
If you want to save the resulting point, check on **Save** before touching **Calculate**. In that case, you will have to name the point before Survey Mobile can determine the target point coordinates.

- **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.

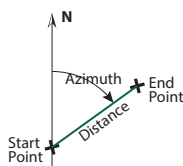
- **By distance and distance:** Calculating target point(s) where two circles intersect. Depending on the location and size of each of the two circles, there may be one target point (1), two target points (2) or none (0).



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**. Then save the other through the same procedure.

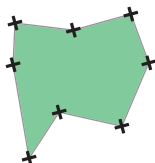


2. Calculating the distance and azimuth between two points. The **start point** and the **end point** may be any two points from the open job, or the current position of the receiver taken successively at two different locations.

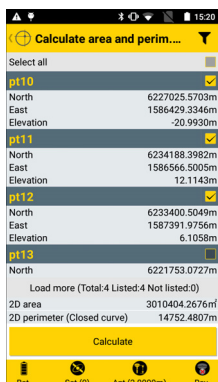
Touch **Calculate** after specifying all the input parameters. The results are then displayed on the screen.

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.

Import / Export Functions

Other Import/ Export Functions

Survey Mobile offers import/export functions other than those described in *Importing Points into the Open Job* on page 18 and *Exporting Points from a Job* on page 20.

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 128.

- **Importing AutoCAD files (in dxf format)**. See *Adding Background Maps* on page 122 for more details.

The **Export points as “Blocks”** option, when enabled, allows you export each point name as well. When disabled, only the point coordinates are exported.

- **Importing Point Codes:** Predefined point codes (feature codes) saved to a txt file can be imported to Survey Mobile so that these can readily be selected before collecting points: When touching the **Point code** field, the list of imported point codes will pop up for you to quickly choose one.


Importing a point codes file will be successful if the comma is used in the txt file as delimiter between point codes (e.g.: *Fence,Hydrant,Streetlight,Manhole*)

Imported point codes cannot be deleted. If you want to start with an empty list of imported point codes, you need to create a new job (imported point codes are attached to jobs, not to the Survey Mobile application).

Importing a second valid txt file in the same job will result in adding up the point codes it contains to the existing list of imported point codes. Potential redundancies in the point codes you import are not solved (i.e. the same point code may appear several times if imported from different txt files).

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.

If **Broadcast RTCM** is enabled in the currently open job and the relevant messages are actually received, then exporting the job to Trimble JobXML will also generate a file (with RTD extension) describing the datum and ellipsoid used by the system (the base) delivering the broadcast RTCM messages.

- **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 other 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 other 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:

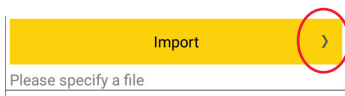
Internal memory/SurveyMobile.Droid/Export/

or

SD memory card/SurveyMobile.Droid/Export/

Importing a File from any Folder

1. Before you touch the **Import** yellow button, touch the arrow within the button:



2. Select **Import file from a specified directory**, select a folder from the list and then possibly one or more subfolders until the name of the file you want to import shows up in the dialog box.
3. Select the file and then touch **OK**. The file name (and possibly other file names) now appears in the file list at the bottom of the screen (provided the **File type** field at the top of the screen has been properly set).
4. Tick the check box corresponding to the file and then touch the **Import** yellow button. Let Survey Mobile guide you to complete the import operation.

Specifying the Folder Where to Export Files

1. Before you touch the **Export** yellow button, touch the arrow within the button:

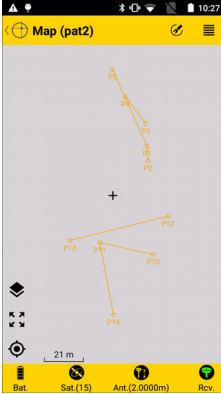


2. Select **Specify an export directory**, select a folder from the list and then possibly one or more subfolders until you read the path to the desired folder.
3. Touch **OK**. The desired path is now displayed underneath the **Export** button.
4. Touch the **Export** yellow button to let Survey Mobile complete the export operation.

NOTE: You can easily reverse to the default directory by selecting **Default export directory** after step 1. above.

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 8*). If the online map function is active (see *page 8*), any background map you add covering the same geographical area will overlay the online map. Survey Mobile supports the following objects from imported DXF files:

- Points
- Lines and polygons
- Circles and arcs

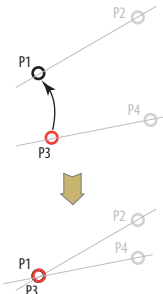
When importing a DXF file, Survey Mobile will first ask you to specify which distance unit is used in the file and suggest that you preview the file before actually importing it.

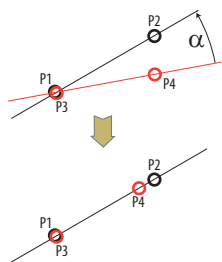
Where the background map will be located on your job's map view will depend on how you defined the XYZ coordinates of the objects in the DXF file:

- 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.





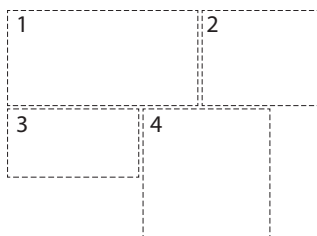
As a result, Survey Mobile will compute and apply the amount of horizontal translation required from the background map to make this happen.

- 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).

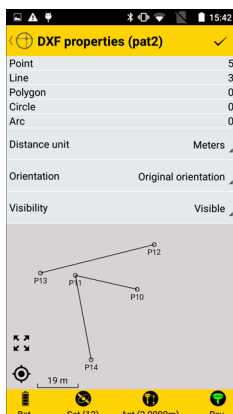


Importing DXF Files



- 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⁽¹⁾, 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.

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

- From the now displayed drop-down list, select the distance unit used in the DXF file and then touch **Continue**.
- 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 125) 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.

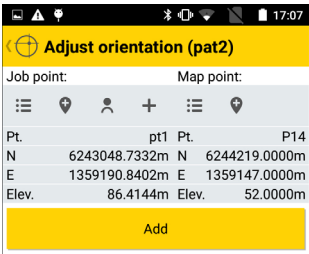
Adjusting the Orientation of a Background Map


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⁽¹⁾, touch  then .


The list of imported files is now displayed.


- 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):



 : 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 122](#)).

- 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.

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


- 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 122*).
- Touch the big yellow **OK** button. A message is returned to indicate that computing the adjusted orientation was successfully completed.

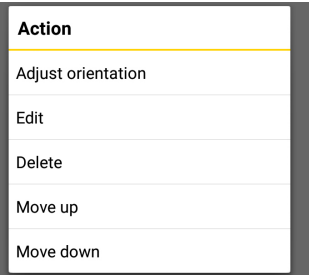
At this point, you can preview the background map according to the adjusted orientation (choose **Preview**), directly accept the adjusted orientation (choose **OK**) or reject the computation (choose **Cancel**).

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:



Action
Adjust orientation
Edit
Delete
Move up
Move down

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 122* and step-by-step instructions on *page 125*). 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.

Roads

NOTE: All screen examples shown in this chapter 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/

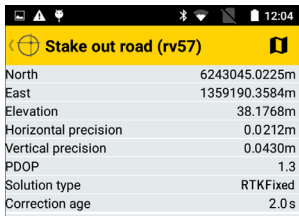
- In Survey Mobile's main menu, touch  and then **Import**.
- Touch **Trimble road design (*.rxl)**. A new screen appears listing all the rxl files stored in the Import folder.
- Check on the file you want to import.
- If required, complete the **Road name** field if you want the road resulting from 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, meaning the cross section can only be made up of a single width and slope on each side of the road's centerline.

Staking Out a Road


- 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	2.0 s

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

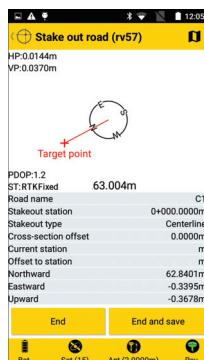
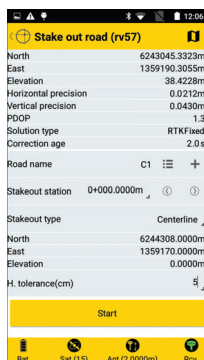
Still in this field, you may touch  to access the entire list of existing roads and then touch any of them if you want to read its full definition.

- 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:

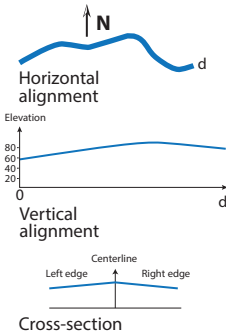
R1_100_103200_stakeout

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):

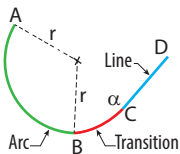
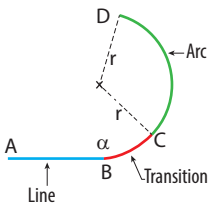
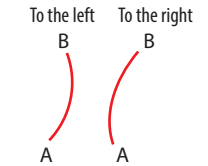
- By specifying in turn each of the elements making up the road, starting with the definition of a start point for the road as well as an azimuth to orientate the first element. Geometrically speaking, an element may be a straight line, an arc or a transition.

- 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 (α) 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 (α) to make a smooth connection with the line element that follows.



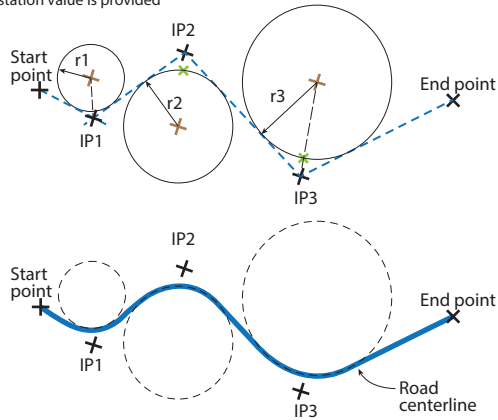
- By specifying in turn the start point of the road, a number of intersection points and the end point of the road:

- 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).

✕: Point for which station value is provided



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.

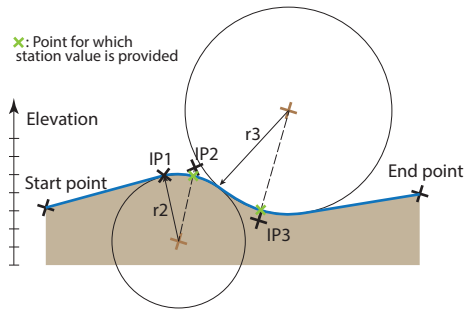
Vertical Alignment

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).



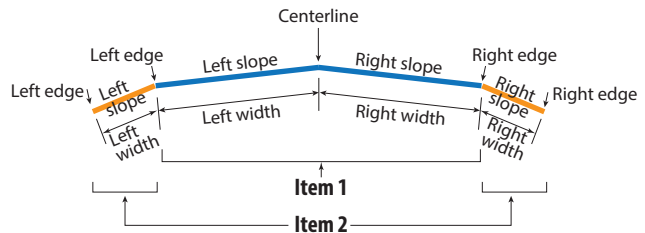
NOTE : You cannot define transitions in a vertical alignment.

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.

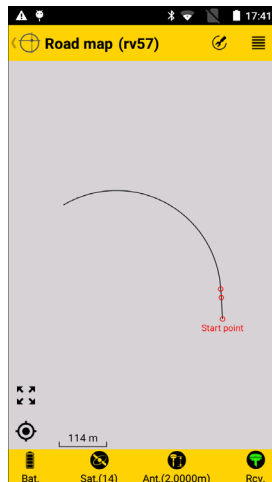
Elements or intersection points show up in the lower part of the screen as you add new ones.


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.

Check road	
North	6244131.9120m
East	1359421.4797m
Elevation	0.0000m
Azimuth	125°00'00.000000"
Station	307m

Check

- 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 they were 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 (in the form "<Road name>_<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 Survey 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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