Purpose: GPS Cadastral Survey Procedure, Leica GPS System 1200

(Procedure can an be adapted to be used with System 500 and System 500 - 1200 combinations.)

For the purpose of this guide the GPS operation procedure (key strokes) has not been included please see Quick Reference Guide 1 on Instructions for Use.

This guide has been broken into 2 parts. Part 1 is the field procedure and part 2 is the office procedure.

A GPS survey needs to first be observed and calculated in terms of it self. Once this is complete the survey is then massaged into terms of the local control.

Part 1: Field Procedure (please read carefully)

1) New boundary pegs and witness marks are placed as required. A sketch plan of the point locations should be prepared and points to be captured given a unique number to be used in their capture. The searching and tying to old marks for definition, control, or even the origin can be done in conjunction with the survey capture.

2) An existing or new survey witness mark needs to be chosen as an initial base point and all other marks then need to be surveyed from this origin. The coordinates entered at the initial base can either be as from existing data, traverse sheets, plan, or as calculated by the GPS using the *HERE* function (see 7, for notes on Datums) . Do NOT enter an assumed false coordinate. The orthometric height (height above mean sea level) needs to be entered for the control mark at the height prompt. If the point does not have a known height it should be scaled from a 1:50000 map.

Please Note:

Heighting is import in a GPS Cadastral survey. The reason for this are two fold.

1) The GPS survey procedure using the Leica system equipment uses the height as part of the checking (double tying) procedure
2) The surveyed baseline distances need to be reduced to sea level distances. In the post processing procedure the GPS recorded heights will be used in conjunction with the position to determine accurate baseline lengths.
3) Cadastral Survey Guidelines – Hardcopy Plans SURVEY PROCEDURES Chapter 3 - Page 3

3.3.1 Cadastral Survey Dataset Distances

The distances shown in cadastral survey datasets are to be ellipsoidal distances (Rule 22). In a CSD, this distance (also known as the spheroidal distance) can be approximated by the horizontal distance at mean sea level. These distances therefore reflect the actual ground distance after any sea level correction has been applied, are not projection distances, and therefore do not include the projection scale factor correction used to derive coordinates. Conversely, where a calculated distance is derived from projection coordinates and included in a CSD, the projection scale factor must be applied to correct the projection distance to an ellipsoidal or sea level distance.

3) The marks that need to be surveyed include all the underlying survey control, those marks that provide your definition, new boundary and witness marks, and the survey mark that is going to be used to check (double tie) all the other surveyed marks. Wherever possible the underlying control captured should extend beyond, and fully surround, the limits of the new survey.

4) Once all data has been captured the base position needs to be moved to a new location and all the survey data double tied. This double tying includes the surveying of the initial base position. It is important that the coordinates entered into the GPS for the second base position are the coordinates as surveyed from the first base, NOT coordinates from existing, or underlying, data.

Please Note:

If existing, underlying, coordinates were used for the second base any positional error in the underlying survey would be introduced to the GPS survey. It would then not be obvious if coordinate differences in the two ties come from errors in the underlying surveys or from bad GPS observations. To reiterate, it is important that the observed coordinate from the first base is used as the position for the second base. This will ensure that the survey can be in terms of itself and positions can be checked in the process of double tying.

5) When double tying the points the points do not need to be surveyed in the same order. The points MUST be given the same name as surveyed from the first base. This will allow the on board software to check the two ties against each other and store the surveyed and mean coordinate of the position if the coordinate (N, E and H) are within the tolerances set by the user (typically 0.03 for position and 0.05 for height). If the comparison fall outside this range a warning is displayed and the user can either still accept the data or make a decision on whether the point needs to be resurveyed. Functions such as *"NEAR*" on the Leica GPS System, when initialised search for the closed point to the current position helping guide the user to the next location to be surveyed.

6) The COGO, and Reference Line functions are licensed and those users who have them on board the receiver can use them to calculate any intersections onto existing boundaries, and the Set Out routines will allow for quick placement of the intersection marks.

7) Datums. GPS records all its raw data in WGS84 the data it then transformed onto a local projection. Hence it does not matter if the survey is in terms of the 1949 or 2000 datum. If the survey is to be done in terms of OLD CADASTRAL datum issues in coordinating the points will arise. Please read QRG 3 Purpose: Perform the steps necessary to operate a System 1200 GPS in terms of NZ Local Circuit coordinates.

Part 2 Office Procedure – (Ski Pro/Leica Geo Office)

1) Import raw observational data into New Project

2) Move the data if necessary by altering the coords of the base, all rover points will be moved in terms of the base.

3) Confirm points are with inside specified tolerances

4) Create another New Project and enter all the underlying coordinates, from traverse sheets, or plans, of the old marks found. The coordinates are entered by right clicking in the view and selecting "*New point*".

5) Once all the data is entered it in necessary to massage the raw data into the underlying control. This is performed through the Datum and Map option of Ski Pro / Leica Geo Office. Select *Tools / Datum and Map,* The screen will split with System A, the upper view representing the points to be transformed. System B, the lower view represents the control or fixed points into which system A is to be transformed.

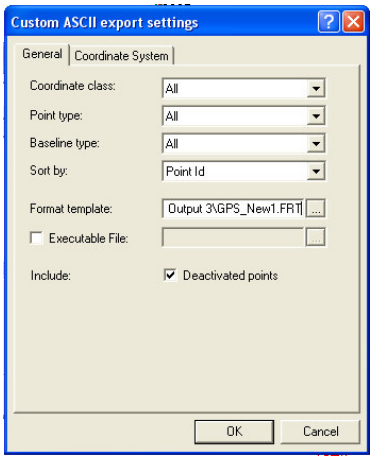
6) The transformation type needs to be selected. This can be done with a right click and selecting Configuration. The recommended transformation is a Two Step with a pre transformation being to either 1949 or 2000 datum depending on the chosen output. For more information on the transformation please use the LGO help or contact Global Survey

7) Select the correct files by clicking on them. Once they have been selected choose the match tab from the bottom of the screen

8) Coordinates can either be selected by a single click on each of the pair to be matched and then right clicking and selecting match, or if the points have the same ID in the control and survey file they can be automatically selected. Automatically matching is all selected by a right click and then selecting Auto Match.

9) With all the points matched the results tab will be displayed. By iteratively working with the points turning some on and off it should be possible to get the GPS survey to fit with local control. Please note that it is preferable to keep points around the perimeter of the job to ensure that any scale errors are not magnified across the site. Once the operator is satisfied with the data reports can be created and closing down Datum and Map will enable the user to update the positions in terms of the new parameters.

10) The data set created at present is only coordinates, to obtain observations to be used for lodging purposes it is necessary and time effective to export the data out and use the freeware program ExportSki.exe

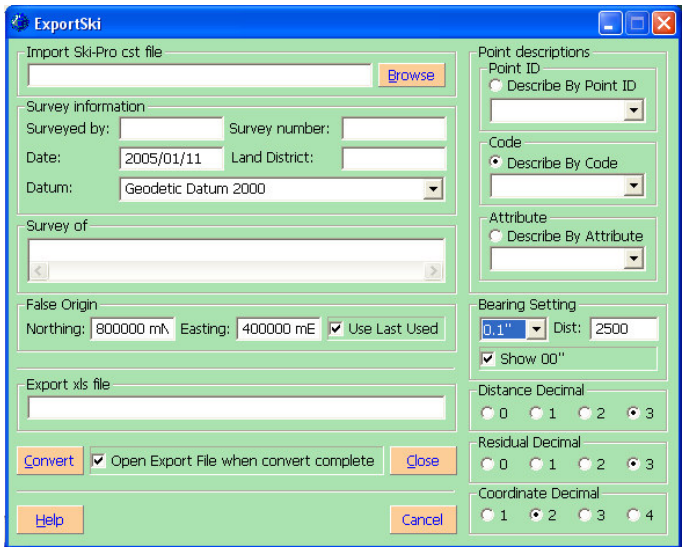


11) Choose a custom ASCII export from LGO / SkiPro and ensure the Format template is set to GPS_New1.frt. This format is available from Global Survey.

12) The CST file created can then be run through ExportSki.exe to create traverse sheets.

13) **<u>Traverse Sheet creation.</u>**

1. ExportSki.exe (freeware). Please note that while we have attempted to keep the software bug free, users are expected to check the accuracy of the results obtained. Global Survey will take no liability for any errors in the data created from ExportSki.exe. Please inform Global Survey of any bugs that you may find.
2. Run ExportSki.exe from folder or desktop shortcut.
3. The following Screen will appear.
4. *Import Ski-Pro file*. Use the *Browse* button to find the .cst file created from LGO or Ski Pro.
5. *Survey Information & False Origin*. Enter the relevant details to be added to the Output file.
6. The *Export xls file* will be populated once and import file has been selected in 3 above. Rename if necessary.
7. The *Point description* for the output file can be chosen from either the Point ID, Code or Attribute as collected in the field. The selection is made by clicking on the circle next to *describe by*… . Once this has been done it will be possible to view the Ids, Codes or Attributes to ensure this is what is required in the output.



8. *Bearing Setting* sets the output precision of the bearing between the base and rover points. The angle displayed will be the precision of the output up to the distance displayed. Once the distance goes beyond it will move to the next level of angular precision up to a max angular precision of 0.01".
9. *Show 00"* will not truncate any observations that are observed to be 00"
10. *Distance Decimal* sets the output precision of the distance between the base and rover points
11. *Residual Decimal* sets the precision of the misclose in the distance. The bearing misclose is showed to the same precision as the set in 7 above
12. *Coordinate Decimal* sets the precision in the displayed coordinates.
13. *Convert* will create and open the xls file in a traverse sheet form.