

# Leica SurvCE Training

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## Table of Contents

|     |                                             |   |
|-----|---------------------------------------------|---|
| 1.0 | Introduction.....                           | 2 |
| 2.0 | One-Point Localization at the Rover .....   | 3 |
| 3.0 | Multi-Point Localization at the Rover ..... | 7 |
| 4.0 | 7-Parameter Helmert Transformation .....    | 9 |

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## 1.0 Introduction

### Objectives

In this exercise you will learn how to perform transformations by differing methods using Leica SurvCE.

GPS measured points are always stored based on the global geocentric datum known as WGS 1984. Most surveys require coordinates in a local grid system, for example, based on a country's official mapping datum or an arbitrary grid system used in a particular area such as a construction site. To convert the WGS 1984 coordinates into local coordinates, a coordinate system is required. Part of the coordinate system is the transformation used to convert coordinates from the WGS 1984 datum to the local datum.

This is done with the **Localization** function.

Localization files may be created during the GPS Base (GPS Reference) Setup or after GPS Rover Setup. The proper plane coordinate projection must be selected prior to creating a localization file. **Tutorial 10-Creating a job in Leica SurvCE** details how to define the coordinate system. Please refer to **Tutorial 14-GPS Base Setup with Leica SurvCE**, which details the proper procedure for creating a one point localization at the reference station.

An important item to note is if the user intends to use a geoid model (typical for localizations that contain less than 3 control points), **the geoid model must be applied prior to the creation of the localization file.**

**Tutorial 07-Creating a Geoid Separation File** details how to create the geoid model. Local geoid files with grid sizes exceeding 100 miles cause poor performance. Please keep this in mind when creating the local files.

Transferring the known (local) points to the data collector prior to going to the field eliminates the need to enter the known coordinates for these points into the CRD file one at a time from the keyboard. **Tutorial 06-Leica SurvCE Data Transfer** explains how to transfer the coordinate file to the RX1250.

At the end of the exercise you should be able to perform the following on Leica SurvCE:

- Create a Localization file in Leica SurvCE.
- Create a One-Point Localization at the Rover.
- Create and evaluate a Multi-Point Localization
- Import/Export 7-parameter Helmert Transformation values

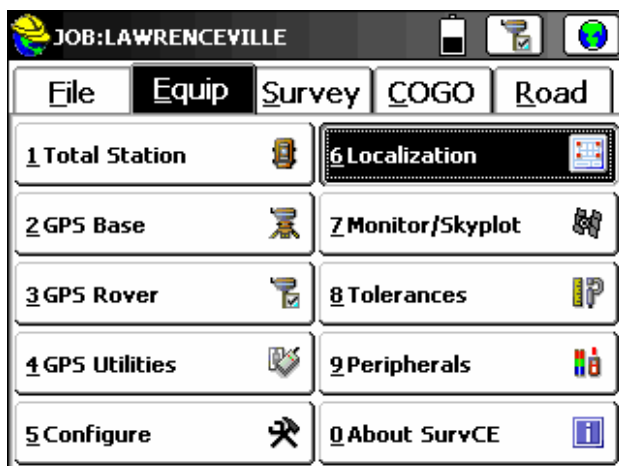
## 2.0 One-Point Localization at the Rover

**Getting Started** One point localizations provide better results with the following four parameters:

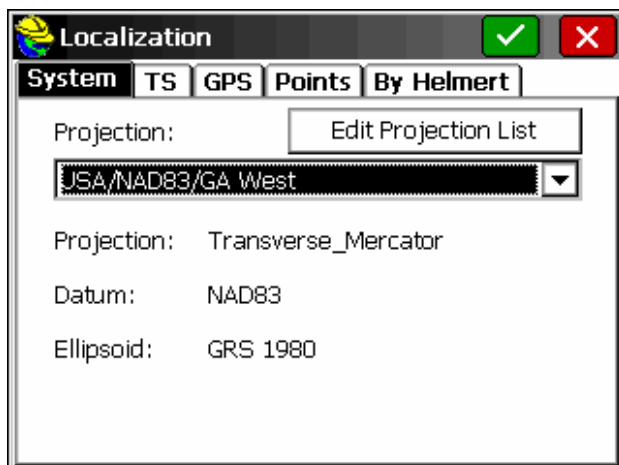
- The localization point is in the center of the job.
- A Geoid model is applied.
- The baseline does not exceed 10km.
- The scale factor has a value of 1.

Following the instructions provided in the tutorials previously mentioned, create a job with the appropriate state plane projection system selected and obtain a corrected position at the Rover.

**Creating a Localization file**



From The **Equip** tab select **6 Localization**.



On the **System** tab verify you have selected the proper projection.

The screenshot shows the 'Localization' dialog box with the 'GPS' tab selected. The 'RTK Method' dropdown is set to 'Plane Similarity'. Below it, the 'State Plane Grid' dropdown is also visible. To the right of this dropdown are 'Define' and 'Report' buttons. Further down, the 'Geoid File' is set to 'Support2003.gsf'. At the bottom, the 'Scale' is set to '1.000000000000' and there is a 'Read GPS' button.

On the **GPS** tab verify the RTK Method. For most applications **Plane Similarity** and **State Plane Grid** are the appropriate selections.

The Geoid file must be applied **before** points are added to the localization file.

For most applications a one point localization should have a scale factor of 1.

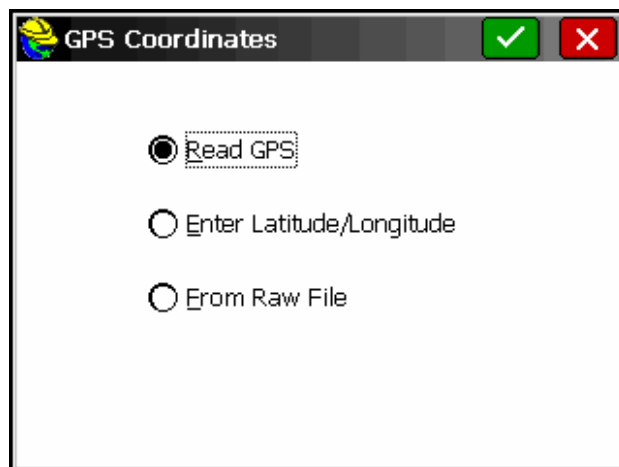
The screenshot shows the 'Localization' dialog box with the 'Points' tab selected. It displays a table with columns: 'Pt ID', 'Northing', 'Easting', 'Elevation', and 'H F'. Below the table is a scrollable area. At the bottom right, there is a checkbox labeled '2pt Rotate Only'. A row of buttons at the bottom includes 'Add', 'Delete', 'Edit', 'On/Off', 'Load', 'View', 'Monitor', and 'Save'.

On the **Points** tab tap the **Add** button to add a point to the file.

The screenshot shows the 'Local Point' dialog box. It contains the instruction: 'Please enter local coordinate values. You may use a point ID from the current or control job.' Below this, there are four input fields: 'Point From File:', 'Local Northing:', 'Local Easting:', and 'Local Elevation:'. Each field has a unit indicator 'ft' to its right. To the right of the 'Point From File:' field are two small icons: a list icon and a point icon.

You can select a point from your coordinate file or you have the option to enter the coordinates of a point not stored in your file.

Define the point and tap the  on the screen to accept the point.



GPS Coordinates

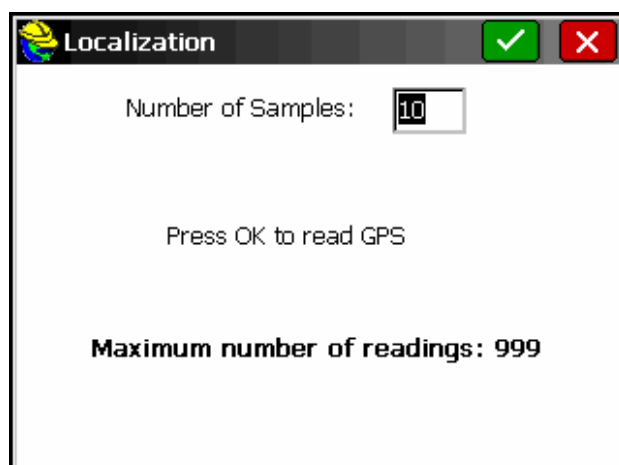
☒ Read GPS

☐ Enter Latitude/Longitude

☐ From Raw File

Although there are three options, the easiest and most common method is **Read GPS**.

Tap the  on the screen to continue.



Localization

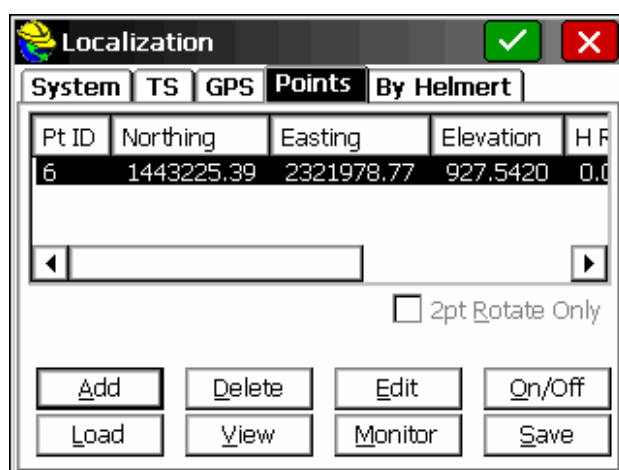
Number of Samples:

Press OK to read GPS

**Maximum number of readings: 999**

It is generally agreed that you should collect several epochs of data at each point. Typically when using a 1 Hz receiver, 10 to 30 readings should be collected to ensure that the RTK solution is consistently reporting the same position for 10 to 30 seconds. On a 5 Hz receiver, the user may want to collect 50 or more readings as 50 readings would take 10 seconds.

Leica receivers utilizing **Smart Check** reduce the number of samples necessary.



Localization

System TS GPS **Points** By Helmert

| Pt ID | Northing   | Easting    | Elevation | H F |
|-------|------------|------------|-----------|-----|
| 6     | 1443225.39 | 2321978.77 | 927.5420  | 0.0 |

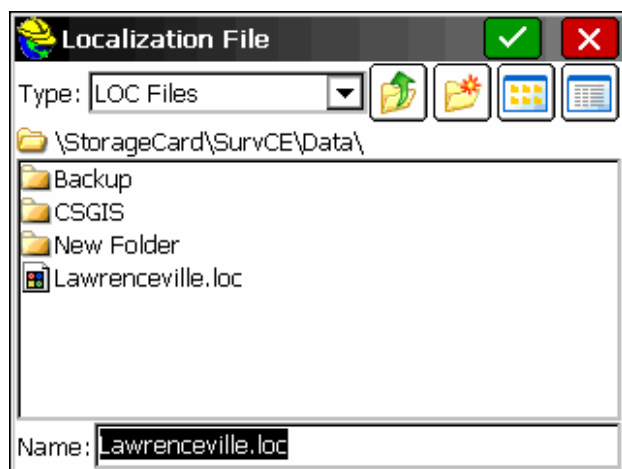
☐ 2pt Rotate Only

Add Delete Edit On/Off

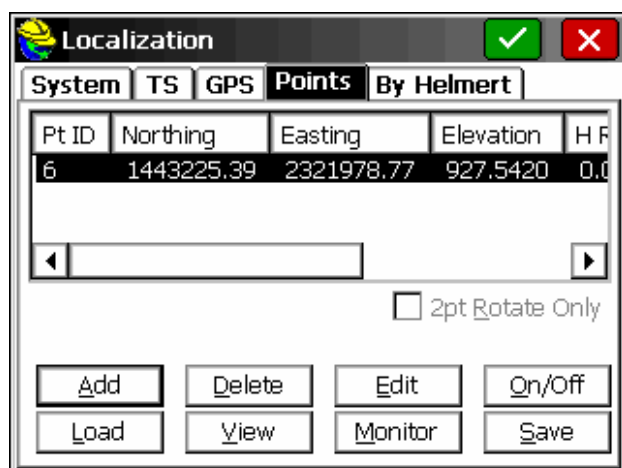
Load View Monitor Save

Once the data collector has points that represent the known (local) coordinates and the measured data for these points, the localization file can be created.

Tap **Save** to name and save the localization file.



Give the file a name and tap the  on the screen to accept the name.



Tap the  on the screen to apply the localization file and continue.

### 3.0 Multi-Point Localization at the Rover

#### Getting Started

Multi-point rover based localizations provide the best match to existing coordinates. The recommendation is to select a minimum of five points for use in your localization file, although you can use fewer. Four points selected around the perimeter of the job with one in the center provide optimal results with redundancy for error checking. In addition to following the instructions provided in the previous section, we will add additional points to the localization file in this section.

| Pt ID | Northing   | Easting    | Elevation |
|-------|------------|------------|-----------|
| 12    | 1443164.43 | 2321523.86 | 928.1435  |
| 3     | 1442887.34 | 2321696.42 | 929.0472  |
| 15    | 1443120.20 | 2321657.19 | 931.5744  |

Scale: 1.000154 ☐ 2pt Rotate Only  
 Avg HRes: 0.0359 Avg VRes: 0.0370

Buttons: Add, Delete, Edit, On/Off, Load, View, Monitor, Save

Additional points may be added to the localization file by tapping **Add** and following the procedure outlined in the previous section.

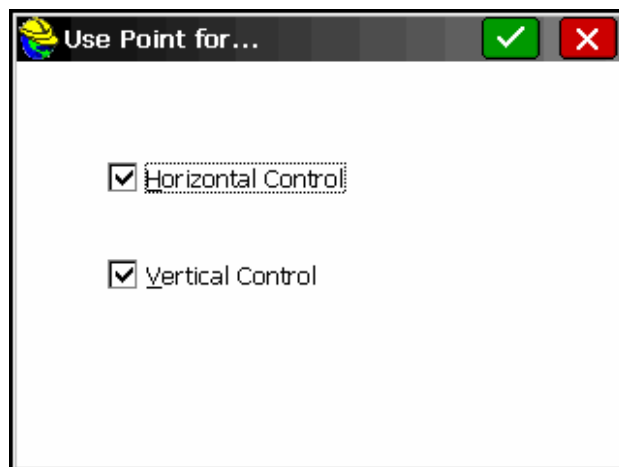
After your points have been added to the file you may scroll to the right of the screen to view the residuals.

| Point    | H Res | V Res | H On | V On |
|----------|-------|-------|------|------|
| 928.1435 | 0.032 | 0.054 | Y    | Y    |
| 929.0472 | 0.036 | 0.026 | Y    | Y    |
| 931.5744 | 0.030 | 0.030 | Y    | Y    |

Scale: 1.000154 ☐ 2pt Rotate Only  
 Avg HRes: 0.0359 Avg VRes: 0.0370

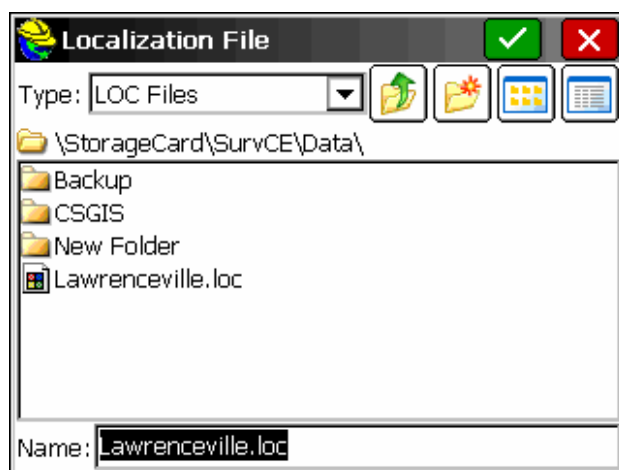
Buttons: Add, Delete, Edit, On/Off, Load, View, Monitor, Save

**H Res** and **V Res** indicate the horizontal and vertical residuals respectively. You may choose to use a point for horizontal control, vertical control, or both by highlighting the point and tapping **On/Off**.



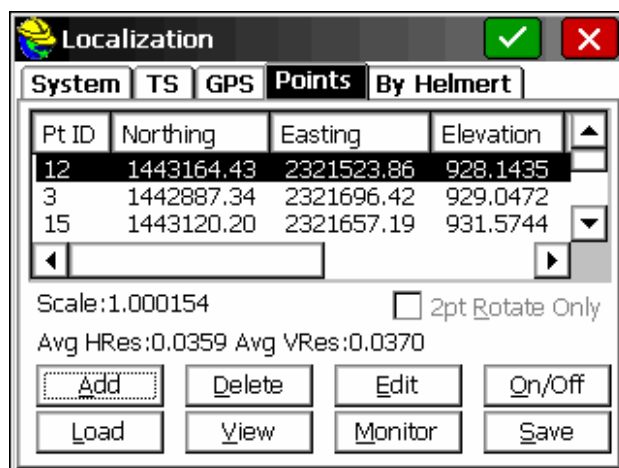
Check the appropriate boxes and tap the  on the screen to accept the setting.

When you are satisfied with the file and wish to save it in the current state you may tap the **Save** button.



You can save the file under the existing name or rename it with a new name, preserving the previous localization file.

Tap the  on the screen to accept the name.



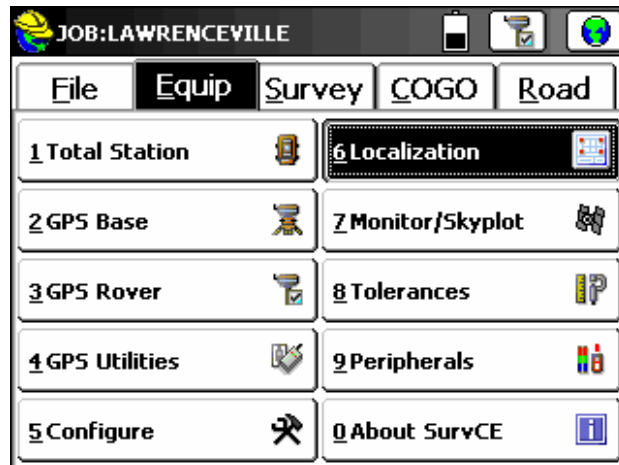
Tap the  on the screen to apply the localization file and continue.

If you have collected GPS points prior to the creation of this file you will be prompted to reprocess the raw data so that the localization will be applied to those points.

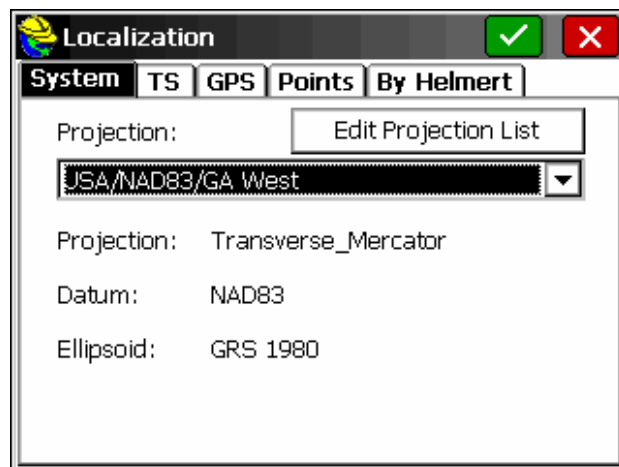
## 4.0 7-Parameter Helmert Transformation

**Getting Started** Following the instructions provided in the tutorials previously mentioned, create a job with the appropriate state plane projection system selected and obtain a corrected position at the Rover.

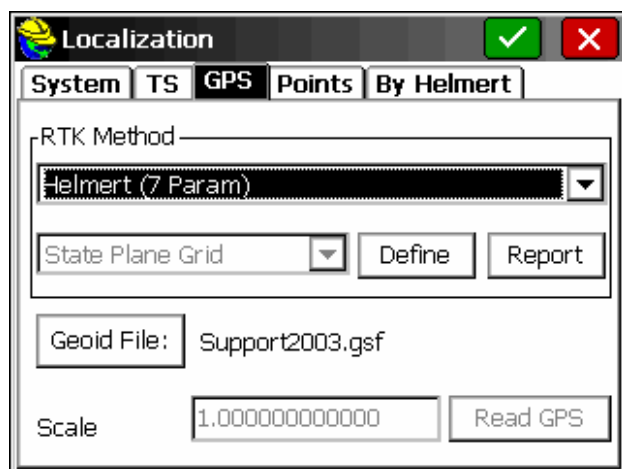
**Creating a Localization file**



From The **Equip** tab select **6 Localization**.



On the **System** tab verify you have selected the proper projection.



Localization

System TS **GPS** Points By Helmert

RTK Method  
Helmert (7 Param)

State Plane Grid Define Report

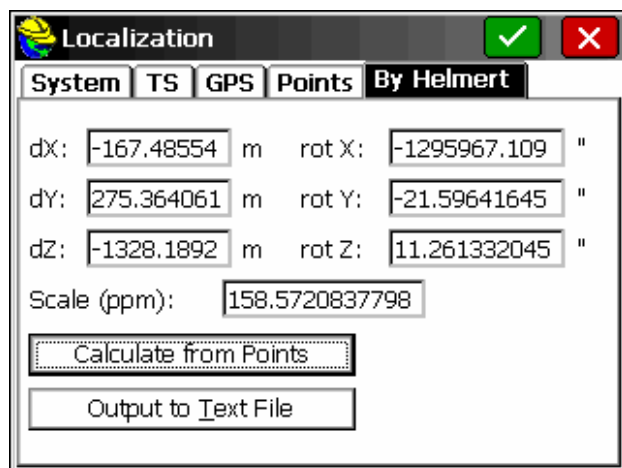
Geoid File: Support2003.gsf

Scale 1.000000000000 Read GPS

On the **GPS** tab verify the RTK Method selection is **Helmert (7 Param)**.

7-Parameter Helmert data may be obtained from coordinate transformations initiated in other software applications and used by Leica SurvCE.

If a geoid file was applied during the creation of the original transformation you must apply the same geoid file when implementing the Helmert transformation.



Localization

System TS GPS Points **By Helmert**

dX: -167.48554 m rot X: -1295967.109 "

dY: 275.364061 m rot Y: -21.59641645 "

dZ: -1328.1892 m rot Z: 11.261332045 "

Scale (ppm): 158.5720837798

Calculate from Points

Output to Text File

Enter the appropriate values for the Helmert transformation on the **By Helmert** tab.

Tap the  on the screen to accept the values.