LGO – POINTS, TRIPLETS, INTERVALS AND OBSERVATIONS

We quite often receive support questions here in the Leica Headquarters in Heerbrugg, Switzerland, relating to points, triplets, observations and intervals within LEICA Geo Office (LGO) and how all these elements relate to each other.

The aim of this newsletter is to clarify and explain the principles and basic ideas of points, triplets, intervals and observations within LGO.

The next newsletter will then focus on the new features within LGO v1.1 release which includes the ability to re-assign Reference or Measured triplets and to automatically merge Reference triplets during data import.

POINTS, TRIPLETS – THE BASICS

POINTS

Points are the fundamental database objects in LGO projects. A lot of information can be stored with a point and some of this information is unique for a point. For example each point can only have one thematical code, and of course also the Point Id is unique for every point.

To see the properties of a point, right click on any point in the View/Edit or Points tab view of a project and choose **Properties** from the context menu – the **Point Properties** dialog will appear.
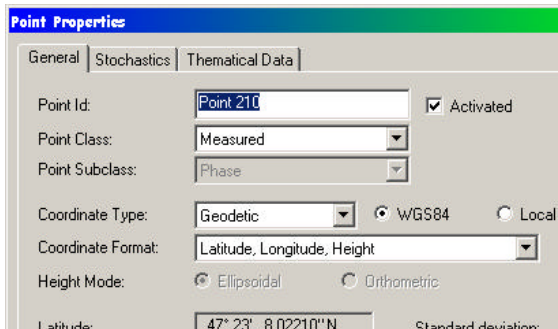
But what about the coordinates? A point can be stored with more than one set of **coordinates**.

TRIPLETS

Imagine you measured the same point twice (with the same point ID) but with slightly different coordinates. Both will be stored with the point. Or imagine the point was used in an adjustment computation and you then stored the adjusted coordinates. Or you manually entered Control coordinates for a point.

In LGO (and in the System 1200 onboard database as well) a set of coordinates is called a **triplet**, because it typically consists of three coordinate components (Easting, Northing and Height **or** Latitude, Longitude and Height **or** Cartesian X, Y, Z).

POINT CLASSES

Each triplet represents a **coordinate class**. The following coordinate classes are available:

> **Estimated**
> **Navigated**
> **SPP**
> **Measured**
> **Average**
> **Reference**
> **Adjusted**
> **Control**

In the example above (where a point was measured twice), then the point will have **two Measured** triplets and one **Average** triplet stored. Note, in addition, an Adjusted (after an adjustment) and a Control (user entered) triplet could also be stored.
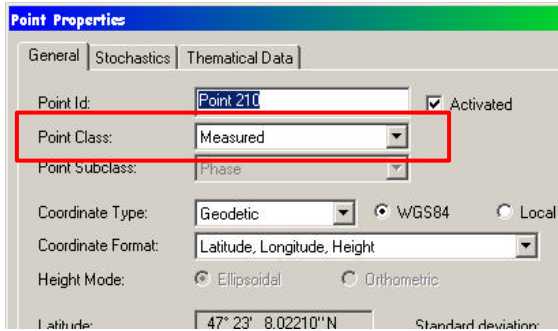
To see the different point classes (and therefore the triplets) of a point, toggle between the point class options in the **Point Class** list box in the **Point Properties** dialog.
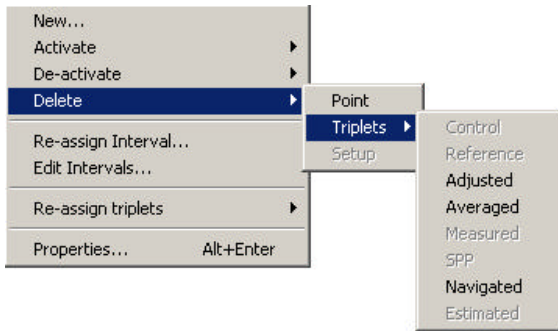
Note, if you **delete a point**, all triplets stored with the point will also be removed from the database. If however, you **delete only a point triplet** then only that triplet is deleted and all other triplets will remain. Note, only if a point has only one triplet and that triplet is then deleted is the point itself then also removed.

The point class **Measured** is the only class for which more than one triplet can be stored. If more than one Measured triplet is stored (with the same ID) then an **Average** triplet is automatically available. Deleting an Average triplet will automatically remove all Measured triplets of the same point – hence an Average triplet cannot exist by itself without the Measured triplets.

Like the Average triplet also the **Reference** triplet cannot exist on its own. The Reference triplet is always the "start" point of an observation: for GPS it represents the reference coordinates of a GPS baseline vector or for TPS, the setup coordinates of a TPS observation. To ensure that the point does not get deleted when just the observation gets removed, there must always exist a second triplet next to the Reference triplet. If required an Estimated triplet is added for that reason.

Estimated and **Control** are the only point classes for which a triplet can be manually entered. In an adjustment, the Estimated triplet can be used as approximate initial coordinates, and the Control triplet will be used to hold a point fixed in the adjustment computation.

OBSERVATIONS – THE BASICS

The LGO project also stores the GPS and TPS observations. **Observations** can either be GPS baseline vectors (DX, DY, DZ) from RTK or post-processing or TPS observations (horizontal angle, vertical angle, slope distance or azimuth) or levelled height differences.

To view an observation, right click on an observation in the View/Edit tabbed view of a project and choose **Properties** from the context menu – the **Observations** dialog will then appear.
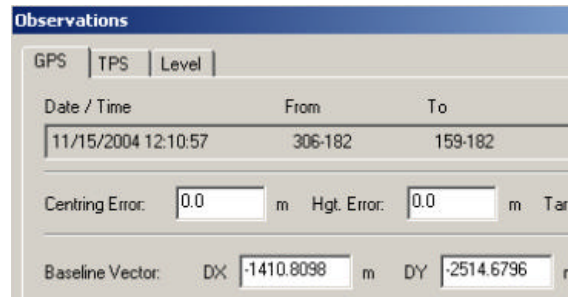
Observations have a strong link to the point triplets: They always start at a **Reference** triplet and end at a **Measured** triplet. When an observation is created in the database, the Reference and the Measured triplets are also created automatically. This happens for example, whenever you store the processing result of a GPS baseline.

If you **delete an observation**, the Measured triplet of the GPS rover or TPS target point will also get removed. The Reference triplet will only be removed, if there is no other observation connected to this point. Note that deleting a GPS observation (the GPS baseline vector) does not remove the GPS **raw data**. The raw code and phase measurements to the satellites remain stored in the database.

INTERVALS – THE BASICS

Intervals are specific for GPS measurements (intervals do not exist for TPS measurements).

To view the properties of an interval, right click on a point in the **GPS-Proc** tabbed view of a project and choose **Properties** from the context menu (alternatively, right click on a GPS measured point in the **View/Edit** tabbed view and choose **Edit Intervals** from the context menu) to access the **Interval Properties** panel.
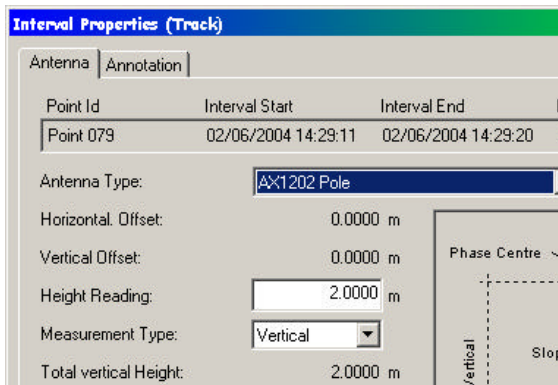

An interval represents the occupation of a point with the GPS instrument and has a start and an end time. When importing GPS data into a project a point triplet of class **Navigated** or **Measured** is connected to each interval, depending on whether the data is for post-processing or from RTK.

When storing a GPS post-processing result, a Measured triplet is created (or updated if it already exists). Note, more than one Measured triplet can result from only one interval, for example if you process (and store) the same interval from more than one reference.

Deleting an interval will automatically remove the Measured triplet of the rover point, the observation and in addition also the GPS raw data from the project.

In the View/Edit and in the GPS-Processing tabbed view of your project you can **re-assign an interval** to a new or to an existing point Id. All observations will then be connected to this new point Id and all Measured triplets derived from the interval will be moved to the new point as well.
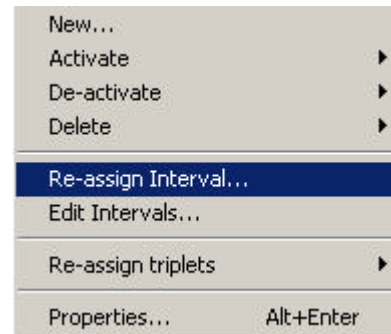
Does an interval always exist for GPS observations? No! If you perform a GPS RTK survey and only import the rover job, then only the reference station coordinates which were received via the RTK data link are available. No interval is available for the reference station.

Also, time-tagged points (recorded as Instantaneous points in the field) and auto-logged points, do not have an interval stored.

REMEMBER …?

Usually at the end of System1200 newsletters, the most important aspects of the newsletter are summarised. This time, try to answer the following five questions to see how much you know (answers on the next page – no looking before answering!):

1. For which point class is it possible to store more than one triplet?

2. Which point triplets cannot exist on its own (there are two)?

3. You drag and drop a GPS baseline vector (or a TPS observation) from one project into a new (empty) project. Which triplets will be created at the start and end point of the observation?

4. What do you have to delete, if you wish to remove the GPS raw data from your project?

5. Which type of GPS measured points are not stored with an interval

ANSWERS:

1. Measured.

2. Average and Reference.

3. Reference and Estimated for the start point, and Measured for the end point.

4. The interval.

5. Time tagged and auto logged.

How did you do? – If you got 5 correct, then you really do understand how points, triplets and observations work!

Please contact your local Selling Unit or local Leica dealer if there are specific topics you would like covered in these newsletters.

We welcome all suggestions for TPS1200, GPS1200, specific applications or LGO. We look forward to receive your idea.