# Product Bulletin

GEOSPATIAL
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## WORKING WITH POINT CLOUDS IN TRIMBLE BUSINESS CENTER

This bulletin explains the differences between working with point clouds in Trimble® Business Center and Trimble RealWorks® software, and how to work with point cloud data from multiple sources like terrestrial and aerial hardware in the Trimble Business Center software.

## Scale factors with survey or scan data

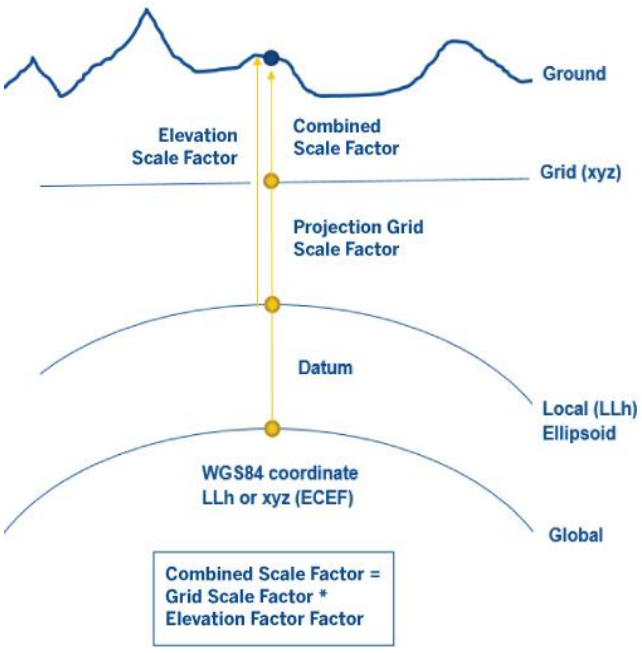
When working with any survey or scan data, it is critical to understand what coordinates the data is using, and specifically, whether the coordinates are ground or grid units. Ground units are computed when you measure distances with a tape measure (where the scale factor equals one). Grid units are based on a known grid-projection from ground through a scale factor (not equal to one).

The scale factor is applied differently in Trimble Business Center (TBC) and Trimble RealWorks (TRW) software when working with point clouds. Importing and exporting point clouds in these software packages scales the data differently depending on the type of point cloud source. It is important to recognize the distinction between grid- and ground-based coordinate systems to understand how TBC handles different sources of point cloud data.

### Grid-based or ground-based coordinates support in TBC

Trimble Business Center works natively in a grid coordinate system, but supports ground-based coordinates for local site and site calibration applications.

Depending on the project and requirements, surveyors need ground-based coordinates as well as local coordinates. TBC uses a combined scale factor to transform coordinates between grid and ground, as shown to the right.




### Ground-based only coordinate support in TRW

In contrast to TBC, Trimble RealWorks always works in ground coordinates. This is because this software is for scanning professionals who typically work in projects and sites that do not require a defined coordinate system with a datum and geoid. Examples of these are building interiors, piping systems, and other structures. Therefore, TRW does not support grid-ground data scaling like TBC. This simplifies the workflow for users but can have effects on data that covers large areas such as for large road projects.

## Scale factor implications for Scan Data

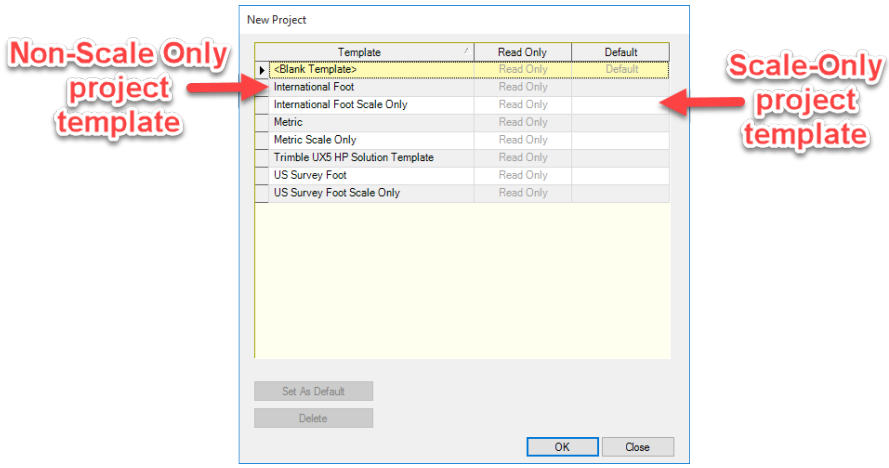
Terrestrial point cloud systems such as the Trimble TX6, TX8, VX, S-series with VISION™ technology, and SX10 collect scan data in ground coordinates. These distances are the true point-to-point measurements that do not take into account coordinate systems, projection, and curvature of the earth. This can be different from point cloud data generated from UAS aerial photogrammetry such as the Trimble UX5 and UX5 HP. The point clouds generated from aerial imagery can cover small to very large tracts of land, therefore TBC calculates these point clouds in grid coordinates. Other UAS imagery processing packages may not create point clouds scaled to grid coordinates.

When dealing with multiple point cloud sources from different hardware, it is important to understand the source and the scaling of point clouds whether from TBC, TRW, or third-party software. Sometimes coordinate system definitions that include projection, datum, and geoid information are required to ensure the correct positioning and scaling of data into that system. To assist with this, TBC now supports the scaling of imported scan data.

## Working with Point Cloud Data in TBC

### Starting a new TBC Project

*Scale Only Projects for ground-based projects* **-** When creating a project in TBC, you can choose a **Scale Only** or a **Non-Scale Only** template. Scale Only projects operate in a scale factor 1.0 system equivalent to ground, while Non-Scale Only projects use the combined scale factor in scaling the project data from ground to grid.



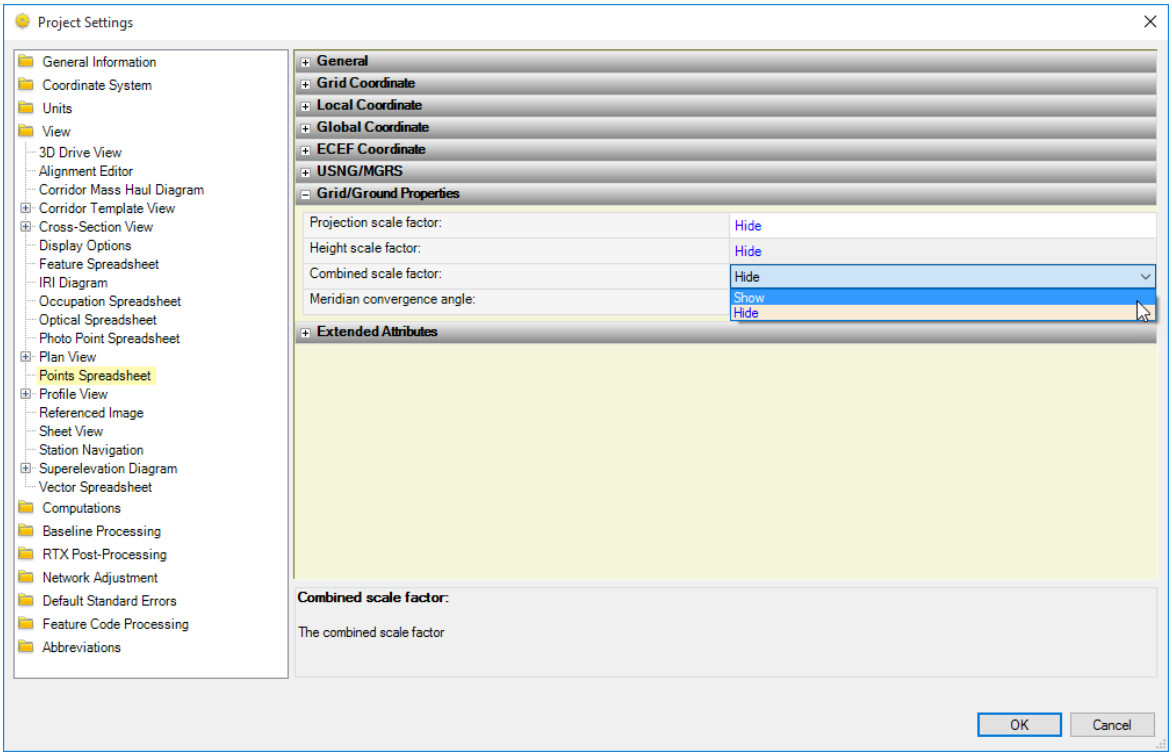

*Non-Scale Only Projects for grid and local site projects* – TBC works in a grid-defined coordinate system. When importing scan data into TBC, the software uses the combined scale factor to scale scan data measured in ground values to a grid coordinate system. Additional site calibration routines must be completed to translate coordinates into local site projects.

TBC automatically calculates the combined scale factor for your project based on the location of the data in the defined coordinate system.

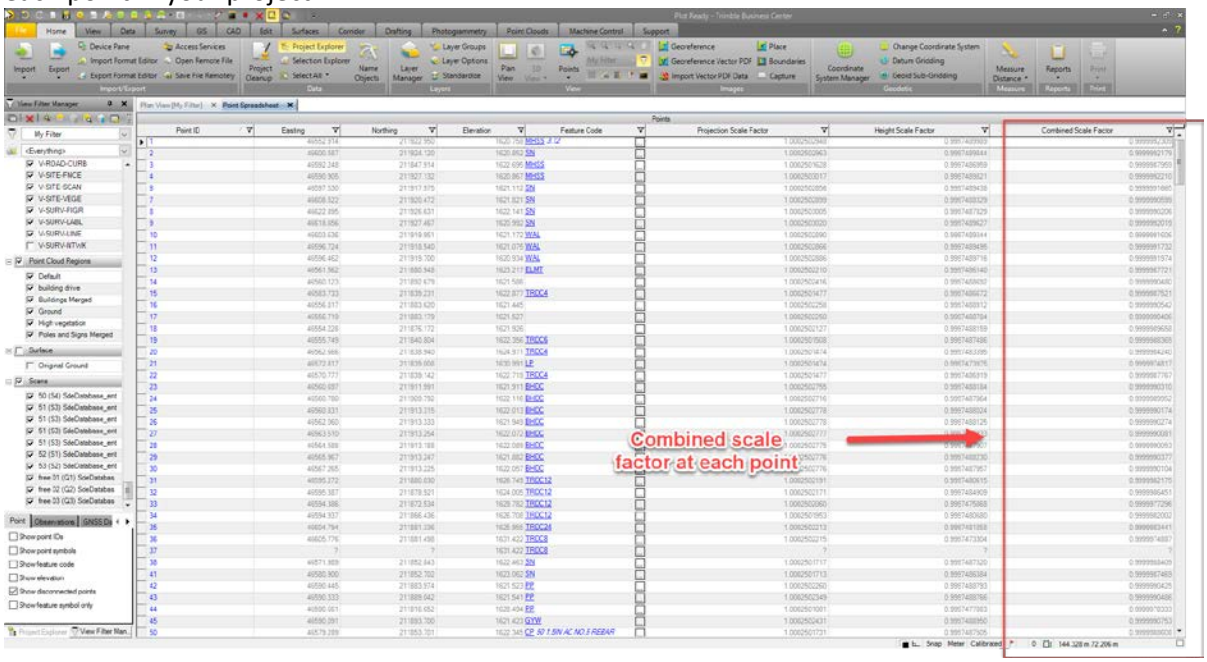
To view the combined scale factor for your current TBC project:

1. Open Project Settings  from the Quick Access Toolbar.

2. Under View > Points Spreadsheet > Grid/Ground Properties set the **Combined scale factor** field to **Show**. This is feature is set to "Hide" by default.




3. Open the Points Spreadsheet under Home > View > Points Spreadsheet. View the combined scale factor for each point in your project.




*Scaling from atmospheric conditions* – In TBC v3.90 and later, for point clouds generated from Trimble optical instruments such as the VX, SX10, and S-series total stations, TBC performs an atmospheric correction on import if the point cloud data was not corrected for atmospheric conditions in the field. In versions prior to TBC v3.90, point clouds imported from Trimble scanning devices such as the VX and S-series total stations were not corrected

automatically on import. To perform the scale correction for any scan in an existing project, make a minor change to the pressure, temperature, or PPM precision value for the scan to trigger an automatic rescaling.

### Import Point Cloud Data

Point cloud data or *.jxl/*.job files associated with point cloud data can be imported using drag-and-drop into the TBC project or through the Import Pane.

There are no additional settings in the Import Pane when importing point cloud data or *.jxl/*.job files.

When importing common point cloud data formats (like E57, LAS, PTX, PTS, XYZ, POD, RCP) into a TBC project with conventional data (for example from an SX10, S-series, or VX total station), TBC treats the coordinates as ground and will scale the data to grid using the project combined scale factor. If the imported coordinates are already scaled to grid with their own scale-factor, TBC does not read this scale-factor and an additional scale-factor will be applied to the point cloud data upon import. When importing point cloud data from common point cloud data formats into a TBC project without conventional data, TBC imports the data as grid-scaled and TBC does not apply the project's combined scale factor, if applicable.

### Export Point Cloud Data

TBC supports the e57, LAS, LAZ, POD, PTS, PTX, and RCP export formats with the following capabilities in TBC 4.00:

| | E57 | LAS / LAZ | POD | PTS | PTX | RCP |
|---|---|---|---|---|---|---|
| **SCALING** | GROUND<br>GRID | GROUND<br>GRID | GROUND<br>GRID | GROUND<br>GRID | GROUND | GROUND<br>GRID |
| **SAMPLING** | NO | YES | YES | YES | YES | YES |
| **EXPORT UNITS** | METERS | METERS<br>USFT<br>INT'L FEET | METERS | METERS<br>USFT<br>INT'L FEET<br>MILLIMETER<br>CENTIMETER<br>INCH | METERS | N/A |

In addition, the TDX exporter can be used to interface with Trimble RealWorks (TRW) software. Point cloud data imported into TRW from the TDX format will not be scaled. In reverse, the point cloud data imported from TRW into TBC using this format will be scaled based on the project coordinate system settings.

## Point Cloud Data Scenarios in TBC

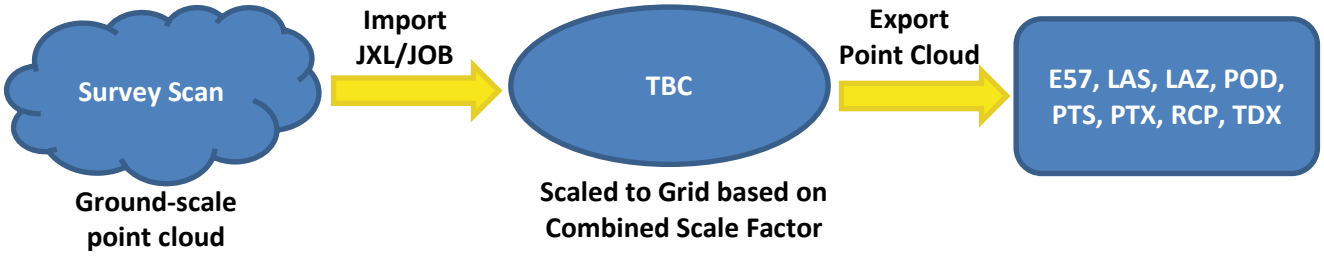
TBC handles the point cloud data import process in two different approaches.

If the point cloud data is associated with a Trimble *.jxl or *.job, TBC scales the point cloud data on import to match the ground or grid settings from the *.jxl or *.job. An example of this would be importing an SX10 point cloud with the corresponding Trimble Access™ *.jxl or *.job.

If the point cloud data is imported **without** a corresponding *.jxl or *.job or from a third-party data source, whether TBC scales the data depends on the type of data being imported. For an explanation of different TBC grid and ground-based scenarios, refer to the following illustrations.

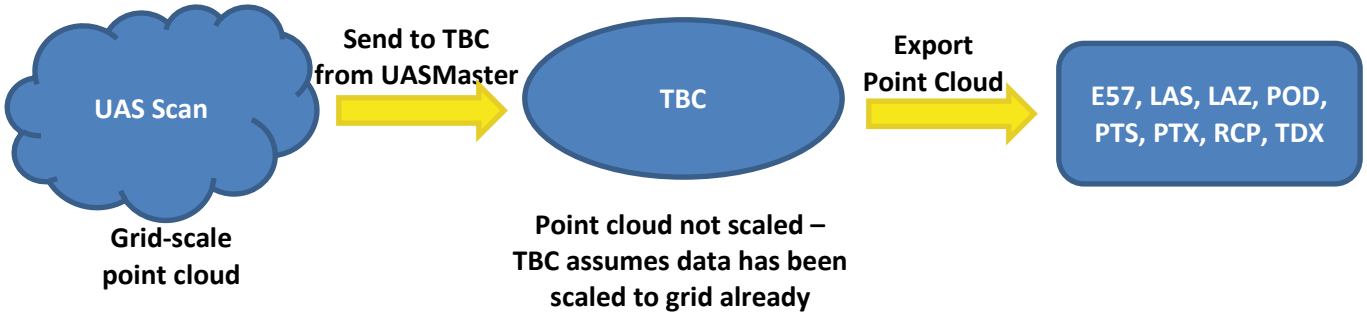
1. ***Terrestrial Survey Point Cloud – for example from a Trimble SX10, S-series, or VX instrument – into grid-based TBC project***

   TBC scales the point cloud to grid based on the project combined scale factor.



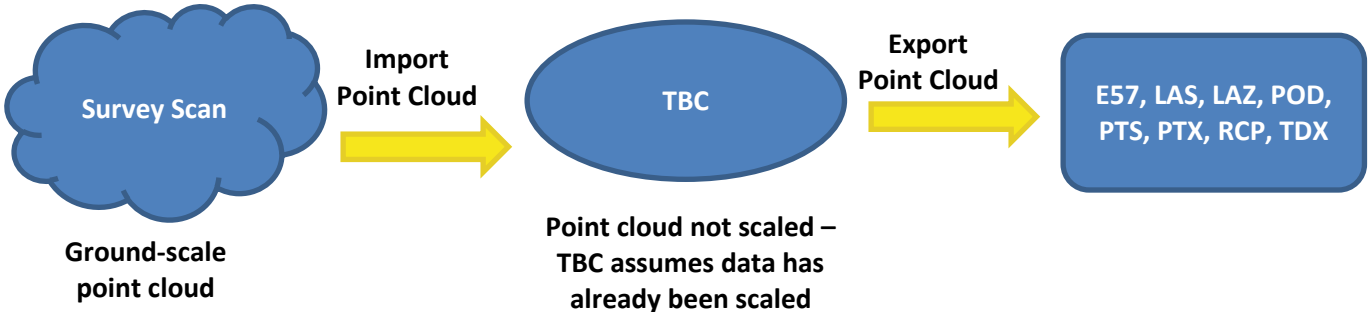

2. ***Aerial Point Cloud – for example from a Trimble UX5 or UX5HP – into grid-based TBC project***

   TBC does not scale the point cloud, TBC assumes the data has already been properly scaled to grid.



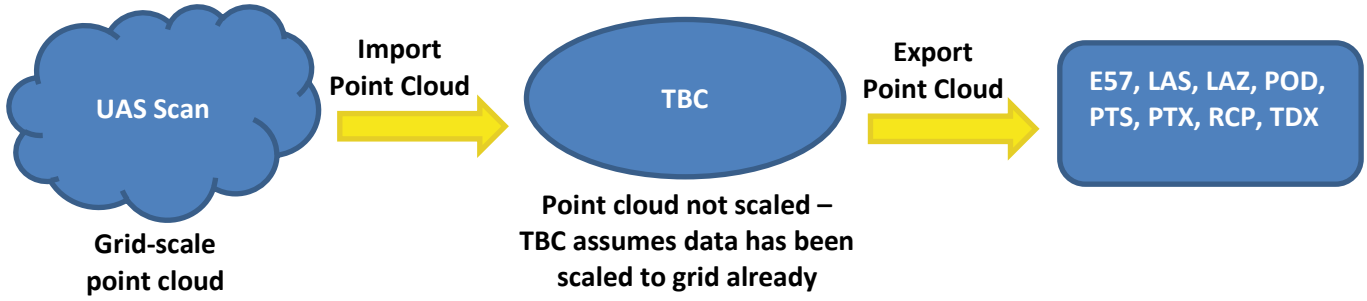

3. ***Terrestrial Survey Point Cloud – for example from a Trimble SX10, S-series, or VX instrument – into ground-based TBC project***

   TBC does not scale the point cloud and remains in its assumed ground coordinates.



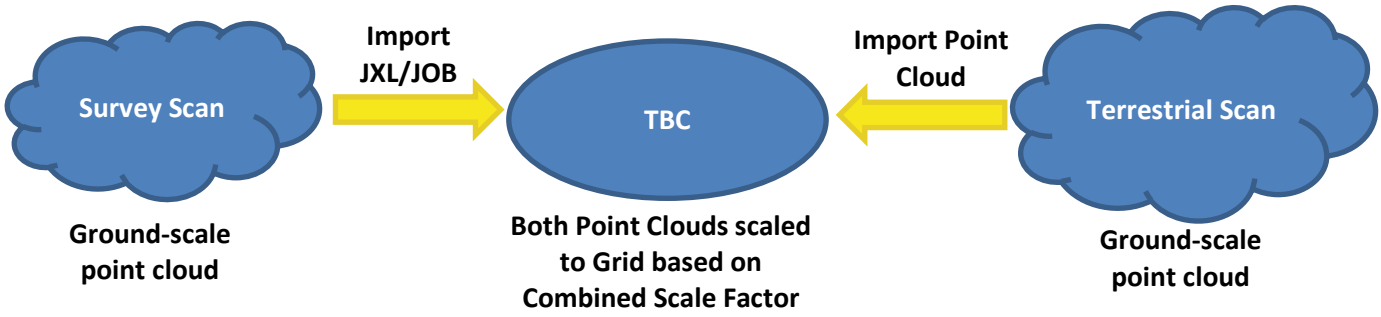
4. ***Aerial Point Cloud – for example from a Trimble UX5 or UX5HP – into ground-based TBC project***

   TBC does not scale the point cloud, TBC assumes the data has already been properly scaled to grid.



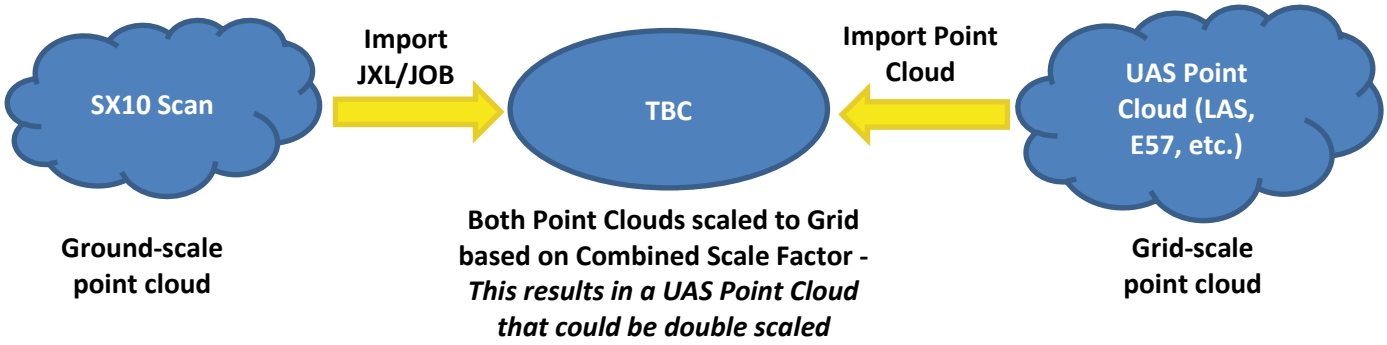

5. ***Terrestrial Survey Point Cloud and Terrestrial Scanning Point Cloud – for example from an SX10 and a Trimble TX8 – into grid-based TBC project***

   TBC scales the point clouds to grid based on the project combined scale factor.

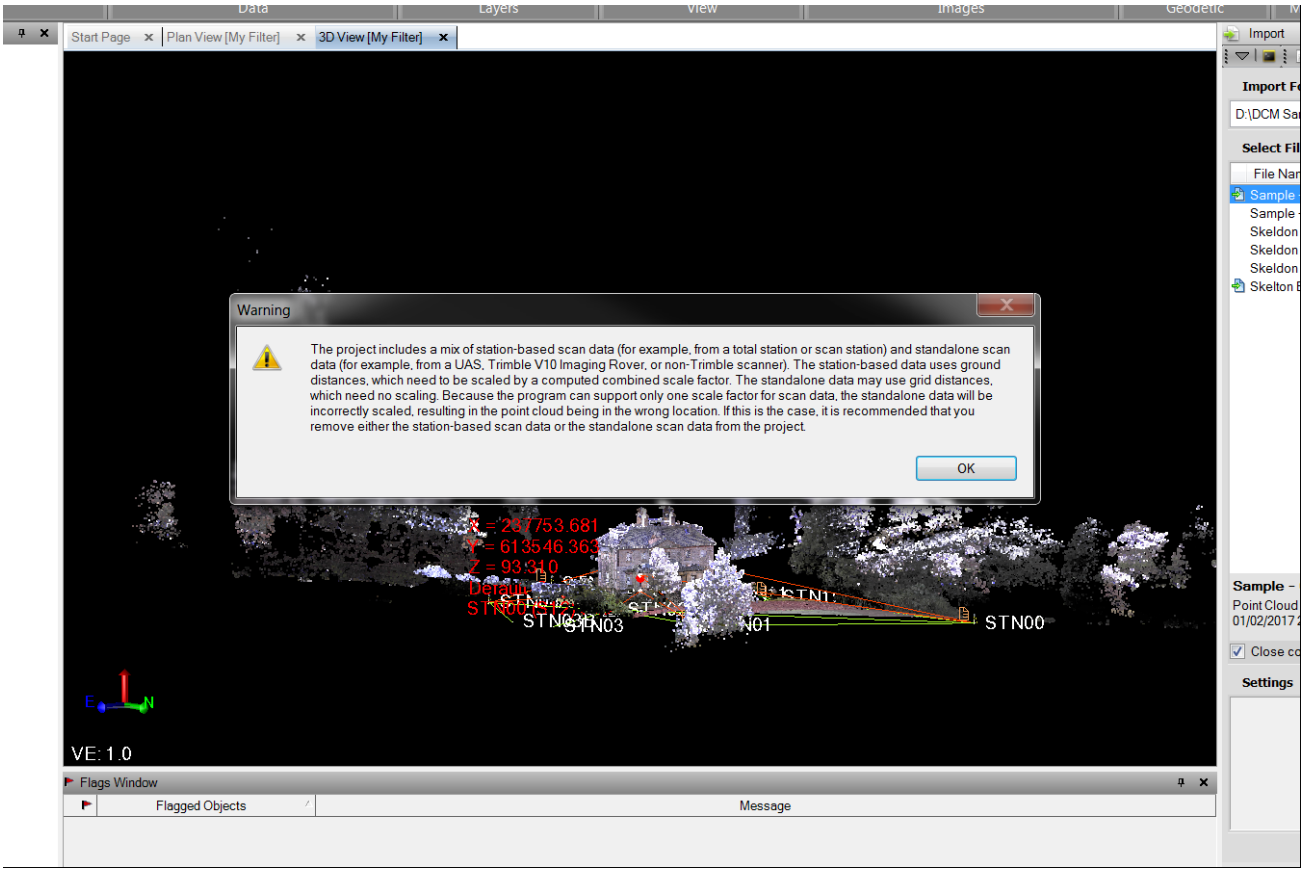



6. ***Terrestrial Survey Point Cloud and Aerial Point Cloud – into grid-based TBC project***

   The terrestrial survey point cloud (for example from an SX10) is scaled to grid based on the combined scale factor in the TBC project. The UAS point cloud (for example from a UX5) is also scaled, but, depending on how this point cloud was generated, it could already be in grid-scaled coordinates. This creates a double-scaled UAS point cloud that can cause errors in the data. Users need to be aware of the origins of any point cloud file they import into TBC to ensure proper alignment and scaling of data.



TBC provides a warning message when point clouds from different sources are imported. If you have a mix of station-based terrestrial scan data and aerial data in your project, Trimble recommends that you remove either the station-based scan data or the standalone scan data from the project.




## For more information

For more information contact your local Trimble Distribution Partner.