


INPUT FILES AND FORMATS

LiDAR swaths **.las, .laz, .txt**

-  **For correction/calibration**, LiDAR data must be **one file per flight line** (swath) and **non self-intersecting**. LiDAR data must contain **timestamps** in either GPS week seconds or adjusted GPS time, in agreement with the LAS specification, and the global encoding bit must be properly set.
- For scan, QC and registration only**, which work without PO files and therefore do not use time data, timestamps are not required, and point clouds do not have to be flight lines. For accurate QC and registration, tiled data is not recommended.

In all cases, LiDAR coordinates must be **projected**.

File formats accepted:

- LAS, LAZ** up to version 1.4, point data only (waveforms ignored)
- ASCII** (automatically converted to LAZ for faster processing)
Space, comma or tab separated values. Header allowed; unreadable lines will be ignored.
Default column format: X Y Z Time (xyzt). Custom column format with option `-iparse` specifying a string using characters from {x,y,z,t} exactly once (resp. X Y Z Time) in the order corresponding to the data. Other optional columns can be used.
Use # to ignore columns if not at the end of row, eg. `t#yx##z` or `xyz#t`

Position, Orientation (PO) data **.out, .trj, .pof, .sol, .bin, .txt ...**

This table summarizes currently accepted PO data formats.

Format info	Applanix SBET	Leica SOL	Riegl POF	TerraScan TRJ	NavLab BIN	ASCII
Extension	.out	.sol	.pof	.trj	.bin	.txt or other
Position: projected				✓		✓ (default)
Position: geodetic	✓	✓	✓		✓	✓ (option -G)
Position: ECEF						✓ (option -G 2)
Time: adjusted GPS		✓	✓ (option -A)	✓ (option -A)	✓	✓ (option -A)
Time: week seconds	✓	✓	✓ (default)	✓ (default)		✓ (default)
Time: other						✓ (option -A 2-9)
Format	binary	binary	binary	binary	binary	space, comma or tab separated
Notes			<i>UTC time format is supported</i>	<i>Subsampling is not an issue</i>	<i>Sonar</i>	<i>Flexible space and time coordinates</i>

➔ **ASCII PO DATA**

Space, comma or tab separated values. Header allowed; unreadable lines will be ignored.

Default column format: Time X Y Z Roll Pitch Yaw (txyzwpk).

Custom column format with option -po_parse specifying a string using characters from {t,[u],x,y,z,w,p,k} meaning {Time [microseconds] X Y Z Roll Pitch Yaw}, in the order corresponding to the data columns. The microseconds field is optional, useful for separate integer seconds and microseconds columns only. Add * at the end for NED attitude angles.

Use # or . to ignore columns if not at the end of row, eg. .t.yxz...wpk or ..txyz...kpw*



➔ **Coordinate system**

Option -G controls the coordinate system: default or 0 is projected (same as LiDAR), use 1 for geodetic and 2 for ECEF



➔ **Attitude angles convention**

The default convention for attitude angles is ENU. To use NED instead, add * at the end of the parse string.

Rotations are always defined in this order: x, y and z for roll, pitch and yaw, respectively.



➔ **Custom time format**

Option -A controls the time format (decimal or h:m:s, origin and leap seconds):

0 (default) week sec; 1 adjusted GPS; 2 standard GPS; 3 UNIX; 4 standard UTC; 5 adjusted UTC; 6 day sec UTC;

7 day sec h:m:s UTC; 8 day sec GPS; 9 day sec h:m:s GPS

Note: all formats 2 and above are converted to adjusted during import; some (5 to 9) require -gps_date for conversion

Ground Control/Check Points (GCP) .txt ...

ASCII only. Space, comma or tab separated values. Header allowed; unreadable lines will be ignored.

Default column format: Index X Y Z (ixyz), where Index can be an ASCII label containing no space character, eg. 1234_B.

The index is mandatory.

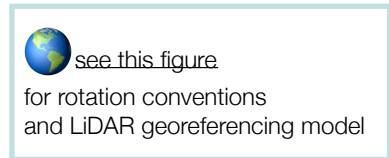
Custom column format with option -gcp_parse specifying a string using characters from {i,x,y,z} exactly once (resp. Index X Y Z) in the order corresponding to the data. Use # to ignore columns if not at the end of row, eg. i.yx..z or xyz.i

Sensor mounting .txt ...

ASCII only. Space separated values only. No header.

Column format: Ax Ay Az Roll Pitch Yaw

- ▶ {Ax Ay Az} are the IMU mounting rotation angles (BODY to IMU)
- ▶ {Roll Pitch Yaw} are the *large* (> 1 deg) sensor or channel boresight angles (ICS to BODY)



Manual corrections: shifts, calibration .txt ...

ASCII only. Space separated values only. No header.

Column format: Lx Ly Lz Roll Pitch Yaw [I1 I2 I3 I4 I5 I6 I7]

- ▶ {Lx Ly Lz} are the Lever Arm components (LiDAR to BODY)
- ▶ {Roll Pitch Yaw} are the (small) boresight angle errors (LiDAR to BODY)
- ▶ {I1 I2 I3 I4 I5 I6 I7} are the internal distortion model coefficients, optional

Well-Known Text (WKT) for PO projection .txt ...

ASCII only. Refer to the [Open Geospatial Consortium](#) website for the standard.

Only a subset of strings are required: PROJECTION (UTM, TM, LCC, AEAC) and the required projection parameters.

UNIT optional but useful! SPHEROID optional.



Can be easily obtained using [lasinfo](#) on LAS/LAZ 1.4 files or 1.2 if WKT included.

File and option lists

- **File lists: ASCII only.** One file name per line, no path means current directory, \$ can be used with `option -$`. Example:

```
C:\directory\lidar_file.las
other_file.laz
$\subdirectory\another_file.las
```

- **Option lists:** see [options and arguments syntax](#) for persistent and additional option files
Multiple option files can be used if necessary.