ASPRS LiDAR Data Exchange Format Standard LAS

Definition: Files conforming to the ASPRS LIDAR data exchange format standard are named with a LAS extension. The LAS file is intended to contain LIDAR point data records.

The format contains binary data in little-endian format.

Mainly data consists:

PUBLIC HEADER BLOCK

VARIABLE LENGTH RECORDS

POINT DATA

Why LAS Format ?

• To provide an open standard format for different LiDAR user group.

•To incorporate all useful informations of LiDAR data collection process in one single compressed file.

•To provide standard file format for LiDAR data processing softwares.

Data types used in LAS format:

char (1 byte)

unsigned char (1 byte)

short (2 bytes)

unsigned short (2 bytes)

long (4 bytes)

unsigned long (4 bytes)

double (8 byte IEEE floating point format)

Details of LAS file format (Version 1.0):

1. Public Header Block

File signature ("LASF")	char[4]
Reserved	unsigned long
GUID data1	unsigned long
GUID data2	unsigned short
GUID data3	unsigned short
GUID data4	unsigned char[8]
Version major	unsigned char
Version major	unsigned char
System identifier	char[32]
Generating software	char[32]
Flight date julian	unsigned short
Year	unsigned short
Header size	unsigned short

Public Header Block Continued…

Offset to data	unsigned long
Number of variable length records	unsigned long
Point data format ID (0-99 for spec)	unsigned char
Point data record length	unsigned short
Number of point records	unsigned long
Number of points by return	unsigned long[5]
X scale factor	double
Y scale factor	double
Z scale factor	double
X offset	double
Y offset	double
Z offset	double
Max X	double
Min X	double
Max Y	double
Min Y	double
Max Z	double
Min Z	double

2. Variable Length Records: The projection information for the point data is required for all data. The projection information will be placed in the variable length records.

Record Signature (0xAABB)   unsigned short

User ID   char[16]

Record ID   unsigned short

Record Length After Header   unsigned short

Description   char[32]

Variable Length Records Continued…

Record Signature: The record signature is a two byte data field that must contain 0xAABB.

User ID: The user ID field is ASCII character data that identifies the user which created the variable length record.

Record ID: The record ID is dependent upon the User ID. There can be 0 to 65535 record Ids for every User ID.

Record Length after Header: The record length is the number of bytes for the record after the end of the standard part of the header.

Description: Optional null terminated text description of the data. Any remaining characters not used must be null.

Point Data Start Signature:

Two bytes after the last variable length record, and before the point data 0xCCDD.

3.1. Point Data Record Format 0:

X	long
Y	long
Z	long
Intensity	unsigned short
Return Number	3 bits
Number of Returns (given pulse)	3 bits
Scan Direction Flag	1 bit
Edge of Flight Line	1 bit
Classification	unsigned char
Scan Angle Rank (-90 to +90)	char
File Marker	unsigned char
User Bit Field	unsigned short

3.2. Point Data Record Format 1:

X	long
Y	long
Z	long
Intensity	unsigned short
Return Number	3 bits
Number of Returns (given pulse)	3 bits
Scan Direction Flag	1 bit
Edge of Flight Line	1 bit
Classification	unsigned char
Scan Angle Rank (-90 to +90)	char
File Marker	unsigned char
User Bit Field	unsigned short
GPS Time	double

Description:

X, Y, and Z: The X, Y, and Z values are stored as long integers.

Intensity: The intensity value is the integer representation of the pulse return magnitude.

Return Number: The return number is the pulse return number for a given output pulse.

Number of Returns (given pulse): The number of returns is the total number of returns for a given pulse. So a laser data point may be return two (return number) with a total number of five returns.

Scan Direction Flag: The scan direction flag denotes the direction at which the scanner mirror. A bit value of 1 is a positive scan direction, and a bit value of 0 is a negative scan direction.

Edge of Flight Line: The edge of flight line data bit has a value of 1 only when the point is at the end of a scan.

Classification: The classification field is a number to signify a given classification during filter processing.

Scan Angle Rank: The scan angle is within 1 degree of accuracy from +90 to –90 degrees.

File Marker: The file marker is an optional field that should be used in conjunction with the variable length records. The file marker allows for the LAS flight-line based files to be combined into single files with more than one flight-line.

User Bit Field: A bit field that is to be used at the users discretion.

GPS Time: The GPS time is the double floating point time tag value at which the point was acquired.

LAS FORMAT VERSION 1.1

1. Public Header Block

File Signature ("LASF")	char[4]
File Source ID	unsigned short
Reserved	unsigned short
Project ID-GUID data1	unsigned long
Project ID-GUID data2	unsigned short
Project ID-GUID data3	unsigned short
Project ID-GUID data4	unsigned char[8]
Version Major	unsigned char
Version Major	unsigned char
System Identifier	char[32]
Generating Software	char[32]
File Creation Day of Year	unsigned short
File Creation Year	unsigned short
Header Size	unsigned short

2. Variable Length Records: The projection information for the point data is required for all data. The projection information will be placed in the variable length records.

(1.1) Reserved	unsigned short
User ID	char[16]
Record ID	unsigned short
Record Length After Header	unsigned short
Description	char[32]

NOTE: Point Data Start Signature has been removed in LAS Version 1.1.

3. Point Data Record Format 0:

X	long
Y	long
Z	long
Intensity	unsigned short
Return Number	3 bits
Number of Returns (given pulse)	3 bits
Scan Direction Flag	1 bit
Edge of Flight Line	1 bit
Classification	unsigned char
Scan Angle Rank (-90 to +90)	char
User Data	unsigned char
Point Source ID	unsigned short

LAS Converter version 1.1
(LAS To Text and Text to LAS Conversion Software)

Functions of the software

Reader:

Point data record displayed in the table from 80000 to 81000.

It also shows how much space will be needed for converting files
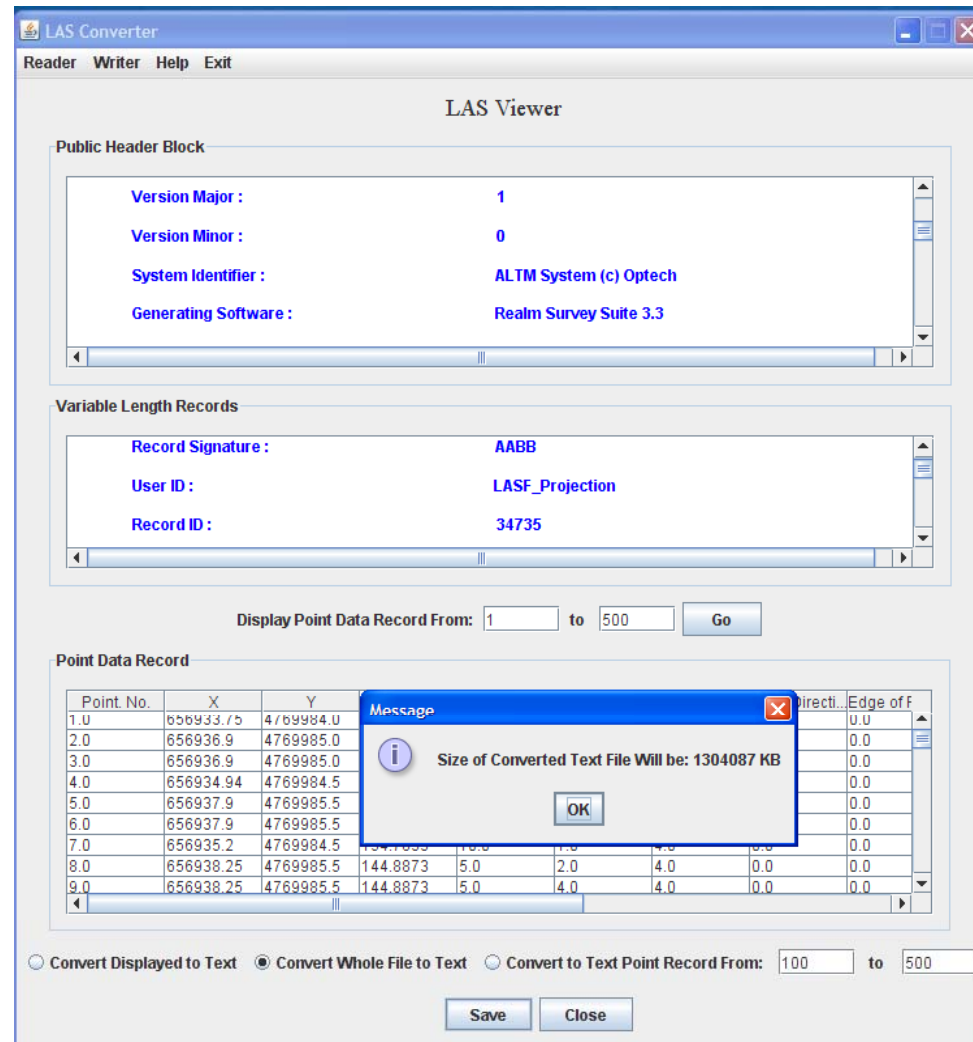
Writer: It converts text file containing X Y Z Intensity Number of Returns into LAS Format.
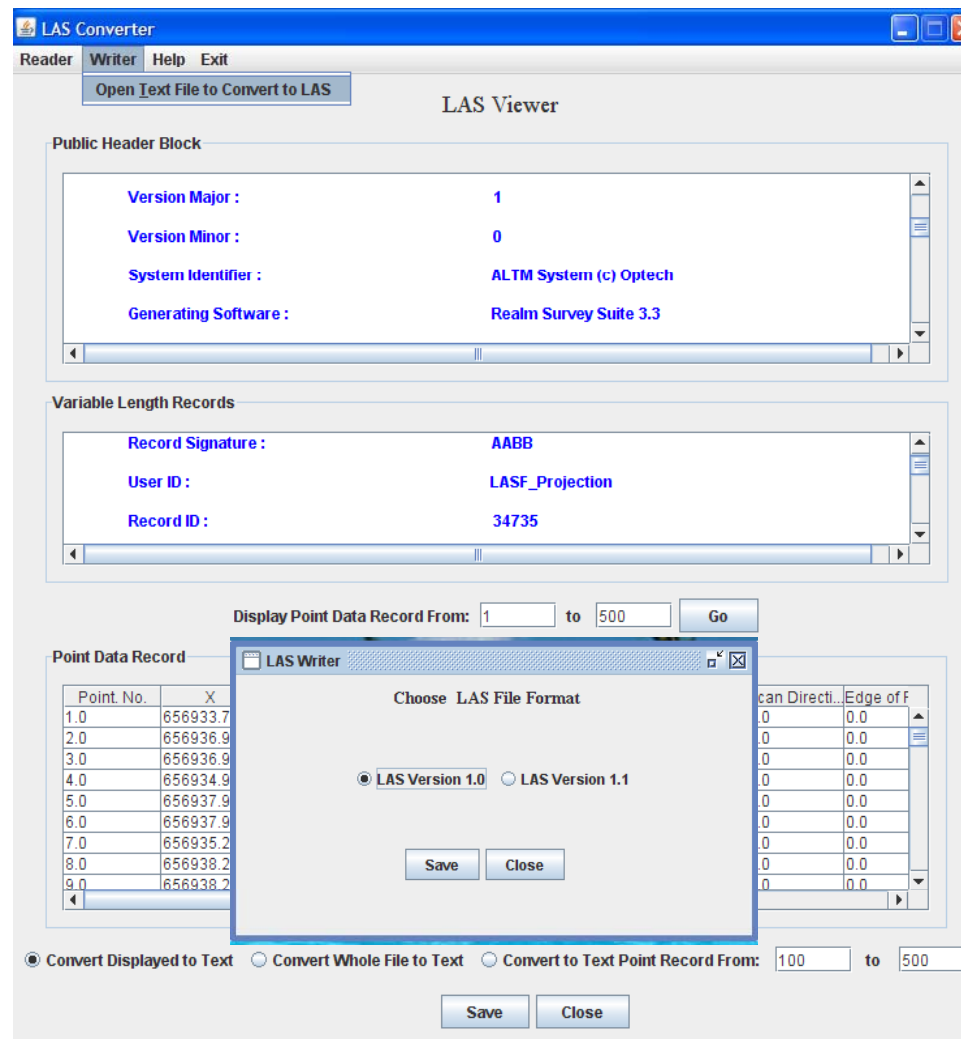
Help: Help file assists you to how to use this software efficiently.

Reader Writer Help Exit

LAS Viewer

Help File

LAS Converter Help

(LAS: ASPRS LIDAR Data Exchange Format Standard)

LAS TO TEXT AND TEXT TO LAS CONVERSION SOFTWARE

This software reads LAS Version 1.0 or Version 1.1 file and displays all details of this file on a panel. It can convert LAS file in the text format. It also reads the text file containing data points and converts it into the LAS Version 1.0 or Version 1.1 file format.

Following are the main menus of this software:

Reader:

1. Open Las File to View / Convert to Text: This opens LAS file and display all details of the LAS file on the panel. There are three parts of the Panel. The first part consists the Public Header. The Second part is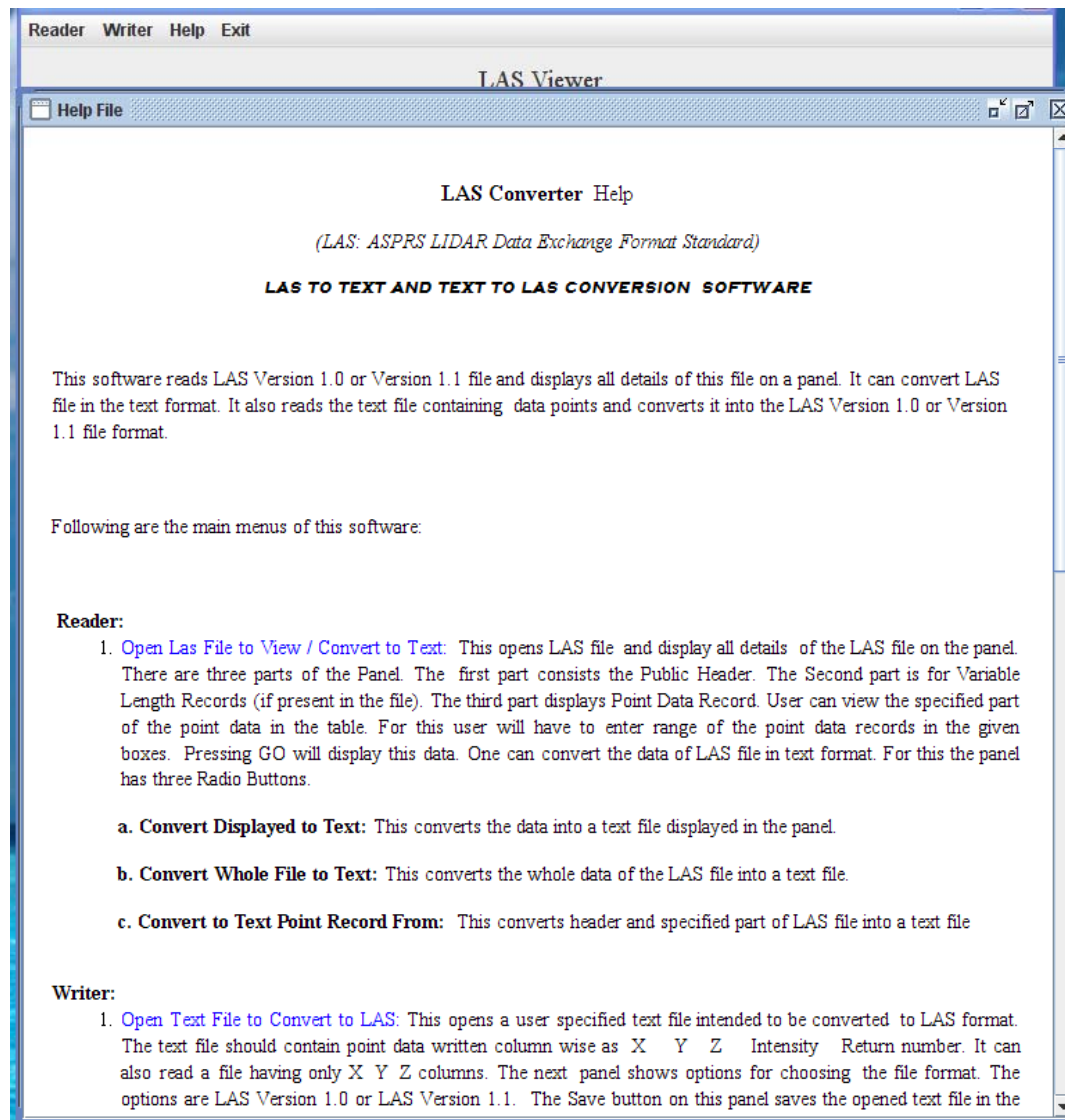 for Variable Length Records (if present in the file). The third part displays Point Data Record. User can view the specified part of the point data in the table. For this user will have to enter range of the point data records in the given boxes. Pressing GO will display this data. One can convert the data of LAS file in text format. For this the panel has three Radio Buttons.

   a. Convert Displayed to Text: This converts the data into a text file displayed in the panel.

   b. Convert Whole File to Text: This converts the whole data of the LAS file into a text file.

   c. Convert to Text Point Record From: This converts header and specified part of LAS file into a text file

Writer:

1. Open Text File to Convert to LAS: This opens a user specified text file intended to be converted to LAS format. The text file should contain point data written column wise as X Y Z Intensity Return number. It can also read a file having only X Y Z columns. The next panel shows options for choosing the file format. The options are LAS Version 1.0 or LAS Version 1.1. The Save button on this panel saves the opened text file in the

Thanks