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# GeoCue Group

## LP360 Product Family

LP360 is a family of point cloud exploitation tools for both native Windows (“standalone”) and the ArcGIS® desktop platform. LP360 for ArcGIS is the world’s most popular point cloud (such as LIDAR and dense image matching) visualization, editing and information extraction tool set for ArcGIS®. It is available directly from GeoCue Group Inc.<sup>1</sup> ([www.geocue.com](http://www.geocue.com)) and (outside North America) from a global reseller network ([www.LP360.com/purchase/resellers.html](http://www.LP360.com/purchase/resellers.html)).

LP360, sUAS is a licensing level of LP360 designed specifically for the small Unmanned Aerial Systems (sUAS) market. LP360, licensed at the sUAS level, is available from GeoCue Group, our UAS subsidiary AirGon and a number of sUAS focused resellers.

LP360 applications are available in two platform configurations (all Microsoft Windows®-based):

- LP360 – This is the native 64-bit Windows version of LP360. It has no software prerequisites other than Windows. It executes on Windows x64, Version 7 and later.
- LP360 for ArcGIS® - A fully qualified extension for ArcMap® desktop. LP360 for ArcGIS® requires the Basic level of ArcMap® (“the “ArcView®” level of ArcMap under the ESRI versions prior to the 10.1 naming scheme). This remains a 32-bit product. LP360 will not be available for ArcGIS Pro until ESRI® releases a deep application programmers’ interface. The 2018.2 LP360 release is certified on versions of ArcGIS desktop from 10.0 to 10.6. LP360 for ArcGIS® contains a subset of the full functionality of LP360. We strongly recommend using the native Windows version of LP360 unless you are absolutely required to use ArcGIS.

LP360 is available in five capability (licensing) levels:

- Viewer – This is a free viewer level of the software. It is available to anyone for standalone Windows and to ArcGIS users who have at least one LP360 application on current maintenance.
- Basic (Windows, ArcGIS®) – This is the basic level, suitable for visualization, Quality Check and some derived product generation.
- Standard (Windows, ArcGIS®) – This level adds interactive classification, 3D editing and analysis capabilities.
- Advanced (Windows, ArcGIS®) – This level adds advanced point cloud “tasks” and automatic classification routines.
- LP360 for sUAS (Windows, ArcGIS) – This version is feature identical to LP360 Advanced but is limited to a maximum aggregate point cloud size of 4 km<sup>2</sup> (approximately 1,000 acres), a size sufficient for most practical sUAS projects.

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<sup>1</sup> Note that special versions of LP360 are available from GeoCue for applications such as large project QC and Railway Feature Extraction. Please contact GeoCue ([info@geocue.com](mailto:info@geocue.com)) for details.

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LP360 and LP360 for ArcGIS® are available in two licensing models:

- Node Locked – The software is assigned to a specific machine and can be executed only on that machine
- Floating – The software can be loaded on any machine and up to the number of owned floating licenses can be simultaneously run

Note that as of version 2018.1, the following changes have been made to the LP360 lineup:

- We have migrated to a commercial, hosted license manager (Reprise License Manager or RLM). This new licensing system adds a few capabilities:
  - You can now “roam” a floating license – that is, you can check out a floating license for situations where you cannot remain connected to the license server
  - You can “move” node-locked licenses without assistance from GeoCue. You must be connected to the Internet to move a node-locked license and can only do so after the license has been installed on a machine for 7 or more days and can move a specific license a maximum of 3 times.

The follow matrices reflect features and functions that appear in the 2018.2. Note that features new to 2018.2 are highlighted in yellow. With each release of the software, we make numerous bug fixes and performance enhancements. These are generally listed in the Release Notes but not in these feature matrices.

The matrices show the licensing level of each feature for LP360.

Note that while the licensing level LP360 for sUAS includes both the Windows version and ArcGIS versions of LP360, we list the features for the Windows version of sUAS (this column is for convenience since the sUAS version is functionally equivalent to LP360 Advanced).

<b>Project Management Functions</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS <sup>2</sup>	LP360 for sUAS
Set project Path variable for use in Point Cloud Task I/O Manager	V	B	✓
Modify paths in project file (“Repath”) for correcting moved projects	V	B	✓
Re-enable dialog warnings	V	B	✓
Set Project Spatial Reference System	B	*	✓
Set Layer Spatial Reference System	B	*	✓
Set default values for the source point classification flags for filters	S	S	✓
Open projects containing LAZ compressed files	V	B	✓
Cloud-hosted License Manager	V	B	✓
Ability to “roam” a floating license	V	B	✓
Self-management of node-locked licenses	V	B	✓
Ability for corporate IT to view license usage (floating licenses)	V	B	✓

<b>Data Import, Load, Export</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Load Points from LAS format file (Version 1.0 to 1.4)	V	B	✓
Import points from ASCII files, converting to LAS or Shape	V	B	✓
Load points from LizardTech MG4 format and convert to LAS (Viewer supports single file import only)	V	B	✓
Open/Display multiple LIDAR files simultaneously	V	B	✓
Support multiple, separate layers of LAS data for comparative analysis	V	B	✓
Generate reduced resolution data sets (pyramids) for both LAS data and imagery, enabling rapid access during zooming	V	B	✓
Selectively load/unload point data (file based) from Table of Contents	V	B	✓
Files can be opened for viewing (Read Only)	V	B	✓
Files can be opened for modification (Read/Write)	S	S	✓
Inspect LAS header data in the file Open dialog and optionally export to the clipboard for direct copy into Excel <sup>®</sup>	V	B	✓
Automatically segregate data into layers based on compatible LAS formats	V	B	✓
Open most image sources supported by GDAL <sup>3</sup> including N band, 16 bit per pixel and Float	V	*	✓

<sup>2</sup> \* indicates features supplied by ArcGIS Desktop

<sup>3</sup> Geospatial Data Abstraction Library, a commonly used data import/export library

<b>Data Import, Load, Export</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Inspect Image header data in the file Open dialog and optionally export to the clipboard for direct copy into Excel®	V		✓
Automatically group imagery into layers based on compatible properties	V		✓
Load Shape Files, 2D	B	*	✓
Load Shape Files, 3D	B	*	✓
Load DWG files, convert to Shape	B	*	✓
Load KML/KMZ and convert to Shape	B	*	✓
Transform feature spatial reference system on import	B	*	✓
Automatically set Layer, Project Spatial Reference System (SRS) based on input data SRS (if present)	B	*	✓
Import raster DEM, converting to LAS	B		✓
Transform raster DEM SRS on import	B		✓
Set LAS class of imported raster DEM when converting to LAS	B		✓
Import files in LAZ format and convert to LAS	B	B	✓
Export files from LAS format into compressed LAZ format	B	B	✓

<b>Live View (Visualization Filter)</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Live View – Dynamically update views as view parameters are modified	V	B	✓
Set point size base on legends or by override value	V	B	✓
Synchronize selected views (lock views to use the same filter)	V	B	✓
Create custom named filters	V	B	✓
Filter by Classification	V	B	✓
Change classification color	V	B	✓
Filter by Classification flag	V	B	✓
Choose flag logic (AND, OR)	V	B	✓
Set point display size on an individual class basis	V	B	✓
Display number of points in each classification (file scan)	V	B	✓
Toggle points on/off based on return combinations	V	B	✓
Filter points based on point source ID (e.g. Scan Line)	V	B	✓
Set Point Source ID display color	V	B	✓
Display number of points in each Point Source ID (file scan by scan line)	V	B	✓
Set Point Sound ID point size on a per ID basis	V	B	✓
Filter points by Intensity ranges (user selectable, multiple ranges)	V	B	✓

<b>Live View (Visualization Filter)</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Color intensity range by solid color	V	B	V
Sample display to set intensity range (optionally clip by standard deviation)	V	B	V
Create multiple intensity ranges based on user specified criteria	V	B	V
Set user defined name for each intensity band (optional)	V	B	V
Set user defined elevation bands	V	*	V
Color elevation band by solid color (e.g. flood zone visualization)	V	B	V
Sample display to set elevation range (optionally clip by standard deviation)	V	B	V
Create multiple elevation ranges based on user specified criteria	V	B	V
Filter points by scan angle	V	B	V
Sample display to set scan angle range (optionally clip by standard deviation)	V	B	V
Create multiple scan angle ranges based on user specified criteria	V	B	V

<b>Visualization – All Views<sup>4</sup></b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Change View backdrop color	V	*	V
Filter display by: Class, return combination, elevation bracket, Intensity, Classification Flags, Point Source ID, scan angle	V	B	V
Display points by elevation	V	B	V
Display points by classification	V	B	V
Display points by intensity	V	B	V
Display points by return combinations	V	B	V
Display points by point source (e.g. Flight Line)	V	B	V
Display points by RGB values	V	B	V
Display points colorized by file source	V	B	V
Personalize color-coding schemes for display	V	B	V
Modulate any display mode by point Intensity (blend intensity into display)	V	B	V
Step-wise zoom in, zoom out, pan, fit	V	B	V
Continuous zoom of display	V	*	V
Toggle Breakline enforcement on/off from toolbar button	V	B	V
Synchronize active LAS Layer mode with Table of Contents	V	B	V

<sup>4</sup> LP360 incorporates three major views – Map (planimetric), Profile and 3D

<b>Map View Visualization</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	<b>LP360</b>	<b>ArcGIS LP360 for</b>	<b>LP360 for SUAS</b>
Support multiple collections (folders) of LAS data in potentially multiple formats	V	B	✓
In multi-layer LAS sessions, toggle the Active LAS layer	V	B	✓
Display LAS file boundaries	V	B	✓
Display points by elevation color bands	V	B	✓
Display by elevation with “flood fill” (show flood zones based on Z)	V	B	✓
Display points colorized by file source	V	B	✓
2D length measurement	V	*	✓
Create and display shaded Triangulated Irregular Network (TIN)	V	B	✓
Create and display TIN Wireframe	V	B	✓
Display points superimposed on shaded/wireframe TIN	V	B	✓
Set separate display filters for TIN and Points (allows, for example, point vegetation superimposed on a Ground TIN)	V	B	✓
Dynamically generate and display contours	V	B	✓
Dynamically generate and display smooth contours	S		✓
Step-wise zoom in, zoom out, pan, fit	V	B	✓
Quick move to previous/next zoom level	V	B	✓
Zoom to rectangle	V	B	✓
King’s Move via toolbar arrow buttons	V		✓
Point Information readout (select point and display properties)	V	B	✓
Set vertical display clipping plane (used for mobile mapping)	V		✓
Display backdrop imagery	V	*	✓
Display rotated images	V	*	✓
Set “NODATA” transparency or color in images	V	*	✓
Replace an image pixel value or range of values with transparency or a color	V	*	✓
Enhance imagery by automate stretch	V	*	✓
Support Web Mapping Services (WMS) backdrop imagery	B	*	✓
Support standard catalog of WMS/WMTS Servers	B	*	✓
Set layer transparency via Table of Contents (TOC) right click menu	B	*	✓
Toggle polygon fill, set fill color	B	*	✓
Set point cloud to Monotonic colorization	V	B	✓
Set monotonic color	V	B	✓
Toggle Hillshade of TIN from the View Toolbar	V	B	✓

<b>Profile View Visualization</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Create arbitrary profile view graphically by drawing in Map View	V	B	√
Support all visualization modes supported in the Map View except TIN	V	B	√
Support all point filter modes supported in the Map View	V	B	√
Display vertical and/or horizontal graticules	V	B	√
Modify graticule line styles, colors, label fonts	V	B	√
Display 3D vector graphics	V	B	√
Measure	V	B	√
Drape points with line	B	B	√
Set separate sources for Points and Drape Line	B	B	√
Drape profile by point source ID (used for laser swath QC)	B	B	√
Set visualization clipping plane (for mobile mapping data)	B		√
Dynamically move, rotate profile via mouse wheel, arrow keys	V	B	√
Dynamically synchronize Map View and 3D View to Profile View (move in lock-step for QC)	V	B	√
Dock/Undock Profile View window, move to separate monitor	V	B	√
Set point cloud to Monotonic colorization	V	B	√
Set monotonic color	V	B	√
Area measurement tool	B	B	√
Extended cursor cross-hair option	B	B	√

<b>3D View Visualization</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Define 3D view by dragging rectangle in top view	V	B	√
Undock 3D View, move to separate monitor	V	B	√
Zoom, pan, rotate 3D View	V	B	√
Support all visualization modes supported in the Map View	V	B	√
Support all point filter modes supported in the Map View	V	B	√
Set elevation flood fill	B	B	√
Display 3D Vector graphics	B	B	√
Clip 3D features to the selected view area	V	B	√
Drape imagery from Map View (Image fusion)	B	B	√
Drape vectors from Map View (vector fusion)	B	B	√
Dynamically generate and display 3D contours	V	B	√
TIN hill shading	V	B	√
Set sun azimuth and elevation for shaded relief visualization	V	B	√
Line of sight visualization		B	

<b>3D View Visualization</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Toggle polygon fill, set fill color	V	B	√
Set point cloud to Monotonic colorization	V	B	√
Set monotonic color	V	B	√

<b>Breakline Enforced Visualization</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Select feature layers as elevation model breaklines	B	B	√
Support multiple breakline layers	B	B	√
Support points (“mass points”), polylines, polygons as breaklines	B	B	√
Use designated layers of closed polygons to denote date voids (for example, water bodies)	B	B	√
Use selected attribute to override Z for elevation	B	B	√
Perform on-the-fly Topology correction when using multiple breakline layers	B	B	√
Exclude “buffer class” points from breaklines	B	B	√
Enforce islands and holes in breakline models	B	B	√
Display breakline enforced stockpile toes in 3D view	B	B	√
Toggle breakline enforcement on/off from toolbar button	B	B	√

<b>LIDAR QC and Annotation Tools</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Inspect Point via information readout	V	B	√
Inspect TIN via information readout	V	B	√
Inspect image via information readout	V	*	√
Inspect vector via information readout	V	*	√
Visualize contours superimposed on wire frame model of TIN	V	B	√
Quick access QA/QC toolbar	B	B	√
“Jump” views by user specified amount on key click	B	B	√
Synchronize Map, 3D and Profile views during review	B	B	√



<b>LIDAR QC and Annotation Tools</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Center views on mouse click	B	B	√
Create “Issues” shape file	B	B	√
Add user defined issue types	B	B	√
Annotate issues using rectangle, circle, polygon	B	B	√
Modify an issue’s attributes	B	B	√
Point statistics computation and report generation	B	B	√
Display colored by point density (point density testing)	B	B	√
Export raster file(s) colored by point density (point density testing)	B	B	√
Export float raster files containing point density maps	B	B	√

<b>LAS File Analyst<sup>5</sup></b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Load LAS metadata into Analysis Table from right click TOC menu	S		√
Support LAS 1.0 – 1.4 for analysis	S		√
Examine all metadata fields of LAS header	S		√
View project totals for project relevant attributes (number of points, points by return, min and max dimensions, etc.)	B		√
Scan file contents and display all scan-derived attributes (point by return, etc.)	S		√
Scan all point data record fields and display in sortable columns (e.g. Z, classification, return, Intensity, ...)	S		√
Display top ten used point source IDs by file	S		√
Set LAS tests via options dialog and test for LAS compliance	S		√
Test for inconsistencies between file header content and actual file content	S		√
Repair files based on user-selectable repair criteria	S		√
Manually set ESPG and/or WKT Spatial Reference System data	S		√
Update user fields in file headers (GUID, Generating System, etc.)	S		√
Export LAS File Analyst tables to CSV files	S		√
Edit Point Source ID	S		√

<sup>5</sup> LAS File Analyst is a new tool set for LP360 2017.2 that is used for testing LAS files for compliance for programs that demand correct LAS metadata (e.g. the USGS 3DEP program) and for general QC.

<b>Vertical/Horizontal Accuracy Testing</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Import Control Points from an ASCII file, creating a Shape File	B	B	√
Assign Control Point data from 2D or 3D Shape Layer	B	B	√
Navigate through control point list, centering views	B	B	√
Support Horizontal, Vertical and Full (HV) control/check points (“Types”)	B	B	√
Generate Control Report, optionally export report	B	B	√
Navigate control points via control point report rows, including Type mode (navigate by Horz, Vert or Full)	B	B	√
Withhold points	B	B	√
Filter control surface by class, returns, elevation bracket	B	B	√
Compute vertical difference between control point and LAS surface using both TIN and Inverse Distance Weighted (IDW) methods	B	B	√
Interactive measurement of horizontal Control/Check Points in the Map View	B	B	√
Compute residuals between control points and measured points (both Horizontal and Vertical)	B	B	√
Compute NMAS/VMAS and ASPRS/NSSDA accuracies	B	B	√
Display by delta Z in overlap regions (relative accuracy testing)	B	B	√
Export raster of delta Z between flight lines for synoptic visualization of relative accuracy	B	B	√
Export float raster image of elevation differences between flight lines	B	B	√
Drape profile colorized by point source ID (used for laser swath QC)	B	B	√
Seamline analysis tool for quantitative analysis of vertical deviations between seamlines		S	

<b>Product Generation</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Export Points in LAS 1.0 – 1.4 format	B	B	√
Export Points in Shape, DGN, DXF, ASCII format	B	B	√
Promote compatible previous LAS versions to LAS 1.4, Point Data Record Formats 6, 7 and 8	B	B	√
Export LAS files in one-to-one correspondence with source LAS files	B	B	√
Create surfaces using Triangulated Irregular Network (TIN) method	B	B	√
Create surfaces using Inverse Distance Weighting (IDW) method	B	B	√
Apply breakline enforcement using shape layers during surface creation	B	B	√

<b>Product Generation</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	<b>LP360</b>	<b>ArcGIS LP360 for</b>	<b>SUAS LP360 for</b>
Perform “on-the-fly” topology correction when creating surfaces from multiple breakline layers	B	B	✓
Apply LAS point buffers to breaklines during surface creation	B	B	✓
Create and export elevation data in binary raster, XYZ raster, ASCII XYZ	B	B	✓
Create and export elevation data in <b>GeoTIFF, IMG</b>	B		✓
Create and export elevation data in ESRI® format		B	
Create and export elevation difference (delta between two elevation surfaces) data	B	B	✓
Create and export slope surface in binary raster, XYZ raster and ASCII XYZ	B	B	✓
Create and export slope surface in <b>GeoTIFF, IMG</b>	B		✓
Create and export Aspect surface in binary raster, XYZ raster and ASCII XYZ	B	B	✓
Create and export Aspect surface in <b>GeoTIFF, IMG</b>	B		✓
Create and export Hill Shade surface in binary raster, XYZ raster and ASCII XYZ	B	B	✓
Create and export Hill Shade surface in <b>GeoTIFF, IMG</b>	B		✓
Create and export Contours in shape format	B	B	✓
Create and export smoothed Contours in shape format	B	B	✓
Create and export intensity images (LIDAR “orthos”) in binary raster, XYZ raster and ASCII XYZ	B	B	✓
Create and export intensity images (LIDAR “orthos”) in <b>GeoTIFF, IMG</b>	B		✓
Create, export profile draping line in Shape, DXF, DGN and ASCII format	B	B	✓
Export raster of delta Z for synoptic visualization of relative accuracy	B	B	✓
Export raster of point source ID Counts for dZ analysis	B	B	✓
Export dZ value for analyzing LIDAR swath overlap	B	B	✓
Export colorized raster of density for synoptic LAS point density testing	B	B	✓
Export raster of numerical point count for density testing	B	B	✓
Export raster of numerical point density for density testing	B	B	✓
Set Coordinate Reference System (CRS) of exported LAS files	B	B	✓
Export feature layers from the TOC <sup>6</sup> in DXF format	B		✓
<b>Nyquist compliant product export for dense point clouds (multi-threaded)</b>	B		✓

<sup>6</sup> Map View Table of Contents

<b>Map View Interactive Point Classification</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Filter source points by any combination of Class, Return Combinations, Elevation Range, Intensity, Classification Flags, Scan Angle, Point Source ID	S	S	√
Move from Filtered source to specified destination class	S	S	√
Set classification flags (withheld, synthetic, overlap, model key point) of destination points <sup>7</sup>	S	S	√
Adjustable paint brush sizes	S	S	√
Classify by rectangular paint brush	S	S	√
Classify by circular paint brush	S	S	√
Classify points within a user drawn polygon	S	S	√
Classify points regardless of Map View zoom level	S	S	√
Set reclassification input filter to pre-filter by the Map View display filter	S	S	√
Dynamically highlight points to be reclassified in the Profile and 3D views	S	S	√
Allow reclassification when not at 100% resolution	S	S	√
Toggle between allowing and disallowing classification of non-visible points	S	S	√

<b>Profile View Interactive Point Classification</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Filter source points by any combination of class, Return Combinations, Elevation Range, Intensity, Classification Flags, Scan Angle, Point Source ID	S	S	√
Set classification flags (withheld, synthetic, overlap <sup>8</sup> , model key point) of destination points	S	S	√
Classify points above user drawn line	S	S	√
Classify points below user drawn line	S	S	√
Classify points within user drawn polygon	S	S	√
Classify points via “paint brush” (small, medium, large)	S	S	√
“Remember” individual destination settings for classification tools	S	S	√
Set option to classify on forward, back movement of profile view	S	S	√
Set option to preserve classification line and automatically classify while stepping through the data	S	S	√
Set reclassification input filter to prefilter by the Map View display filter	S	S	√

<sup>7</sup> Overlap flag available in LAS 1.4 only

<sup>8</sup> Overlap flag available in LAS 1.4 only

<b>Profile View Interactive Point Classification</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Classify points regardless of Map View zoom level	S	S	√
Dynamically highlight points to be reclassified in the Map and 3D views	S	S	√

<b>Feature-Based Classification<sup>9</sup></b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Filter source points by any combination of Class, Return Combinations, Elevation Range, Intensity, Classification Flags, Scan Angle, Point Source ID	S	S	√
Set classification flags (withheld, synthetic, overlap, model key point) of destination points	S	S	√
Classify by file-based feature set	S	S	√
Classify by user selected features	S	S	√
Classify by point feature	S	S	√
Classify by line feature	S	S	√
Classify by polygon feature	S	S	√
Dynamically adjust classification rules based on user specified type field	S	S	√
Classify “within distance of” (2D and 3D features)	S	S	√
Classify “completely within” for closed features	S	S	√
User defined buffer distance for spatial relationships (2D and 3D)	S	S	√

<b>Conflate Z from Point Cloud<sup>10</sup></b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Assign Z to points	S	S	√
Assign Z to polylines	S	S	√
Assign Z to polygons	S	S	√
User defined vertex spacing	S	S	√
Compute Z from nearest point	S	S	√

<sup>9</sup> This moved to a Point Cloud Task (PCT) as of 2014.1

<sup>10</sup> The Feature Edit tools in LP360 (standalone) offer an interactive conflation experience

<b>Conflate Z from Point Cloud<sup>10</sup></b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Compute Z from statistical analysis of nearby points	S	S	√
Compute Z from TIN (surface) of nearby points	S	S	√
Set Z to a user specified constant value	S	S	√
Assign No Data to vertices within void areas	S	S	√
Classify points within a user specified distance of conflated features	S	S	√
Compute individual vertex Z or compute an average Z (summary Z) for entire feature	S	S	√
On-the-fly refresh/redisplay for summary Z features	S	S	√
Override conflation rule by manually digitizing in the profile view	S		√

<b>Breakline/Hydro Feature Editing</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Designate user selected features as breaklines	B	B	√
Create breakline by feature draping	S	S	√
Create stream center line with downhill constraints	S	S	√
Apply statistical validation during downstream digitizing	S	S	√
Water body flattening (lakes, ponds)	S	S	√
Water body flattening with downhill constraints (flatten river polygons)	S	S	√
Indicate deviation from point cloud during downstream modeling by populating vertex M values	S	S	√
Digitize retaining wall	S	S	√
Digitize culvert	S	S	√
Topologically correct Z of crossing lines on same feature layer	S		√
Toggle breakline enforcement on/off from toolbar tool	B	B	√

<b>General Feature Tools</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Select Clockwise or Counter-Clockwise geometry via Table of Contents Right Click Command	S		√
Reverse feature geometry (CW, CCW) via Table of Contents Right Click Command	S		√

<b>General Feature Tools</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for SUAS
Copy (clone) a feature layer via Right Click tool in the TOC	S		√
Merge two or more feature layers via Rick Click tool in the TOC	S		√
Export to DXF via Table of Contents Right Click Command	S		√
Remove TOC feature layer from Table of Contents using Right Click Command	S		√
Delete files associated with TOC Feature Layer using Table of Contents Right Click Command	S		√
Repath files via TOC Right Click command	S		√
Assign Project Spatial Reference System to Layer(s) via Right Click Command	B		√
Assign Layer Spatial Reference System to Project via Right Click Command	B		√

<b>Schema Editor</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for SUAS
Add new attribute	S		√
Rename Attribute	S		√
Delete Attribute	S		√
Change order of attributes	S		√
Modify Attribute properties	S		√

<b>Feature Analyst – Attribute Editor<sup>11</sup></b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for SUAS
Synchronize selection between Map View and Feature Analyst Feature Table (FAFT) at Feature, Part or Vertex level	S		√
Edit Attributes “in-place” using FAFT	S		√
Undo attribute additions/edits in FAFT	S		√
Center Map, Profile and 3D view based on selected row in FAFT by Feature, Part or Vertex	S		√

<sup>11</sup> These are tools that are available in the Standalone versions of LP360. They are generally accomplished by an ArcGIS tool in the ArcGIS versions of LP360. These tools were referred to as Feature Attribute tools in previous versions.

<b>Feature Analyst – Attribute Editor<sup>11</sup></b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for SUAS
Fit Map, Profile and 3D views based on selected row in FAFT – Feature, Part, Vertex	S		√
Set display precision of coordinates and M values via options	S		√

<b>Feature Analyst - Edit Tools<sup>12</sup></b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for SUAS
View feature attributes by Feature, Part or Vertices	S		√
Synchronize selection between Map View and Feature Analyst Feature Table (FAFT) at Feature, Part or Vertex level (e.g. step through Features, Parts or Vertices for detailed QC)	S		√
Undo attribute additions/edits in FAFT	S		√
Center Map, Profile and 3D view based on selected row in FAFT by Feature, Part or Vertex	S		√
Fit Map, Profile and 3D views based on selected row in FAFT – Feature, Part, Vertex	S		√
Set display precision of coordinates and M values via options	S		√
Select profile orientation (parallel, Perpendicular) for vertex navigation	S		√
Dynamically update Feature, Part and Vertex entries while interactively editing a feature	S		√
Copy Feature, Part or Vertex table to the clipboard (for transfer to Excel)	S		√

<sup>12</sup> These are tools that are available in the Standalone versions of LP360. They are generally accomplished by an ArcGIS tool in the ArcGIS versions of LP360. These tools were referred to as Feature Attribute tools in previous versions.



<b>Feature Analyst - Analysis Tools<sup>13</sup></b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	ArcGIS LP360 for	SUAS LP360 for
Display Features, Parts, Vertices in Feature Analyst Feature Table (FAFT)	S		√
Display perimeter, area and direction (for polygons) for features and parts	S		√
Display X, Y, Z,  Z , M,  M , Segment Length, XY Angle,  XY Angle , Slope,  Slope , Z Angle,  Z Angle  in vertex tab of FAFT	S		√
Sort by attributes of X, Y, Z, M,  M , ...	S		√
Test General attributes (Self-Intersecting, CW, CCW)	S		√
Test Planar attributes (XY angles)	S		√
Test Downhill, Uphill	S		√
Test Flat (flat waterbody test)	S		√
Test various Z attributes (Z,  Z , Slope,  Slope , Z angle, etc.)	S		√
Test size attributes (length, area, perimeter)	S		√
Test Measure (M) values – (Min, Max, Equals)	S		√
Sort by failures	S		√
Window Center or Fit on selected failures	S		√
Dynamically update FAFT when performing edits in the Map/Profile view, including test results	S		√

<b>Feature Edit Tools</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	ArcGIS LP360 for	SUAS LP360 for
Create Feature Layer (with and without M value support)	S		√
Multi-level undo for edits and deletes	S		√
Select Feature(s) by intersection and polygon	S		√
Select features by lasso	S		√
Quick resolve selected features and layers	S		√
Delete Selected Features	S		√
Dynamically display feature edges and vertices while editing (“rubber-banding”) in Map and Profile views	S		√
Move feature in Map View	S		√
Move/Add/Delete single, multiple vertices in Map View	S		√
Move/Add/Delete single, multiple vertices in Profile View (both Z and X,Y)	S		√
Set geometry edit properties (color, weight)	S		√
Override Z while digitizing in 3D (force Z below a surface)	S		√

<sup>13</sup> All new to LP360 2017.1

<b>Feature Edit Tools</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Reverse feature geometry (CW, CCW) tool	S		√
Create feature (point, polyline, polygon)	S		√
Create feature (point, polyline, polygon) with Measure (M) values	S		√
Create features from features (create points, polylines, polygons from different geometry types – e.g. points from polylines)	S		√
Suppress creation of duplicate points when creating features from features	S		√
Split feature tool	S		√
Reshape feature tool	S		√
Set Z by key in value	S		√
Shift X, Y, or Z by key in values	S		√
Automatically adjust vertex Z from assigned conflation Point Cloud Task (Auto Z) during vertex edit or while digitizing new feature	S		√
Assign a pre-set constant Z value to vertices during vertex edit or while digitizing new feature	S		√
Thin vertices based on Ramer-Douglas-Peucker algorithm (3D error tolerance vertex culling)	S		√
Respace vertices to user specified value	S		√
Snap to Vertex and/or line while digitizing or editing a feature	S		√
Create topologically correct crossing when digitizing or editing features	S		√
Split Line or Polygon with vertices within a specified tolerance of the spilt deleted (allow splitting of features at a vertex without creating closes spaced vertices)	S		√
Buffer tool – create polygon geometry by buffering point, polyline or polygon geometry	S		√
“Just In Time” (JIT) parameter dialogs added to Feature Edit tools	S		√
Assemble multipart geometry	S		√
Disassemble multipart geometry	S		√
Merge Lines	S		√
Double Line drain (river flattening) as a feature edit tool	S		√
Union geometry	S		√
Intersect geometry	S		√

<b>Standard Point Cloud Tasks</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Apply classification macros by envelope, rectangular or circular stamp, user defined circle, Polygon layer(s), project	S	S	✓
Preview point cloud tasks in Preview Window prior to actual application	V	V	✓
“Batch” movement of points from source classes to a destination class	S	S	✓
Elevation bracketed classification above a surface TIN defined by a class (classify by height above surface)	S	S	✓
Draw 2D Point, Polyline or Polygon	S	S	✓
Collect LAS data statistics (Class, Nominal Point Spacing, Source file, .....) <sup>14</sup>	B	B	✓
Conflation of Z based on all Point Cloud Task methods including interactive sketching of Points, Lines, Polygons	S	S	✓
Volumetric analysis with cut/fill graphical image	S	S	✓
Output Volumetric LAS file based on Volumetric analysis	S	S	✓
Line vertex smoothing and respacing	S	S	✓
Cross-section generator with optional clipping to enclosing polygon	S	S	✓
Populate LAS Intensity field based on LAS RGB fields (needed for Pix4D workflows)	S	S	✓
Classify by Feature 2D & 3D (see separate feature table for details)	S	S	✓
Ground cleaner (for cleaning up ground classifications)	S		✓
Attribute Editor – Allows an in-line modification of feature attributes (for example, labeling polygons that are created by a prior PCT)	S		✓
Planar Statistics – test goodness of fit of points to an arbitrary plane	S	B	✓
Classify by cell-based point statistics (min, max, mean, random)	S	S	✓
Transform Spatial Reference System, Shift, Scale LAS files	S	S	✓
Generate grid with various clipping options (to polygon, to LAS data)	B	B	✓
Reproject rasters (within the same Datum), “cookie-cut” raster layer using polygon definition file, cut out raster area by drawing arbitrary polygon, JPEG compress, create overviews	S	S	✓
Duplicate Points Classifier for finding duplicate points (points with coincident geometry) and reclassify or flag the resultant points	S	S	✓

<b>Advanced Point Cloud Tasks</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Planar region detection and classification (used e.g. for building extraction)	A	A	✓

<sup>14</sup> Effective with 2017.1, this PCT can be placed in a Macro – for example Grid PCT followed by Stats PCT yields a QC sample grid of LAS data.

<b>Advanced Point Cloud Tasks</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Vectorize (and optionally square) point groups (Point group tracing & squaring)	A	A	✓
Low point detection and classification (low noise filter)	A	A	✓
Isolated points detection and classification	A	A	✓
Ground detection and classification (automatic ground filtering) via Adaptive TIN algorithm	A	A	✓
Vertical accuracy-based Model Key Point (MKP) extraction ("intelligent" thinning)	A	A	✓
Rail detection, classification, alignment feature creation with new at-grade spanning option	A	A	✓
Automatic Toe Extraction (for stockpile volumetrics) with grow/shrink option	A	A	✓
Automatic classification of overhead points (e.g. conveyors) while automatically extracting stockpile toes	A	A	✓

<b>Experimental Tools/Features<sup>15</sup></b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Copy a selected dynamic contour to the active feature edit layer	S		✓
Draw contours of only a single specified elevation	S		✓

<b>ArcGIS Toolbox Tools</b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	LP360 for ArcGIS	LP360 for sUAS
Define LAS File Projection - Define or assign a projection for one or more LAS files.		B	
Reproject LAS Files - Reproject the points in a LAS files into the desired coordinate system		B	
Scale LAS File- Scale the x, y and/or z components of the points within a LAS file		B	
Shift LAS File- Shift the x, y and/or z components of the points within a LAS file		B	

<sup>15</sup> These tools are for experimental use only. They are subject to defects and removal from the product. Use at your own risk!

<b>Batch Tools<sup>16</sup></b> (V = Viewer, B = Basic, S= Standard, A = Advanced)	LP360	ArcGIS LP360 for	sUAS LP360 for
LASGuid.exe – Assign GUID to LAS file	V	B	V
LDDump.exe – Dump the LAS Header or point records	V	B	V
LDFitLine.exe – Assign point source IDs to all points in a file	V	B	V
LDImport.exe – ASCII conversion	V	B	V
LDMerge.exe – Concatenate LAS files	V	B	V
LDMvCls.exe – Basic classification change	V	B	V
LDPyramid.exe – Construct LP360 overviews for LAS files	V	B	V
LDReorder.exe – Spatially reorder LAS files	V	B	V
LDThin.exe – Unintelligent thinning	V	B	V
LP360ExpLAS.exe - Export	B	B	V
LP360PntDen.exe – Point Density	B	B	V
LP360Stats.exe – Statistics Extractor	B	B	V
LPRunPCT – Allows PCTs to be run from the command line <sup>17</sup>	B	B	V
LDExport – Allows export of all derivative products (LAS, Image, Contours, etc.) from the command line	B	B	V
LPScanInfo – Allows read of a LAS file and creation of the associated '.scan' file containing point count information from the command line	B	B	V

<sup>16</sup> Tools marked “V” under LP360 do not require a license to run

<sup>17</sup> The licensing level to actually run the PCT depends on the individual PCT license requirement (as shown under the PCT tables in this document)