LAS Version Notes and Differences

Acronyms

GUID = Globally Unique IDentifier
HW = Hardware
ID = IDentifier
LAS = LAS is not an acronym for anything
PHB = Public Header Block
PRMB = Point Record Metadata Block (LAS v2.0)
RID = Record ID
SW = Software
VLR = Variable Length Record

	Item	LAS v1.0	LAS v1.1	LAS v1.2	LAS v1.3
General					
	File Extension	.las	.las	.las	.las
	Data Byte Order	Little-endian (Intel ordering)	Little-endian (Intel ordering)	Little-endian (Intel ordering)	Little-endian (Intel ordering)
	Overall Structure	PHB, VLRs, Points	PHB, VLRs, Points	PHB, VLRs, Points	PHB, VLRs, Points, EVLR
Offset into File & PHB (hex)					
Public Header					
0x00	Identifying Bytes	"LASF"	"LASF"	"LASF"	"LASF"
0x04	File Source ID / Reserved	unused (4 bytes)	2 bytes File Source ID (0 to 65535)		
	Reserved / Global Encoding		2 bytes Reserved	2 bytes Global Encoding, 0 = GPS Week, 1 = GPS Time minus 1×10^9	
0x08	GUID / Project ID	not project specific, GUID is for file	Project GUID (unique # assigned to project)		
0x18	Version Major	1	1	1	1
0x19	Version Minor	0	1	2	3
0x1A	System ID	Specifies Hardware System	Expanded from v1.0, has possible keyword values of "EXTRACTION", "MERGE", etc.		

Offset	Item	LAS v1.0	Clarifications
0x3A	Generating Software	v1.0 spec slanted towards original generating software	Expanded to _any_ generating software, not just original generating software
0x5A	Day	Collection day, julian year	Clarified to be using GMT, integer day of year, for example is Jan 1 = 1
0x5C	Year	Year data was collected	Clarified that year is a 4-digit year, still stored as an integer
0x5E	Header Size	PHB size, value = 227 (hex 0x00E3)	Clarified for the rare case of added data to end of PHB, but unextended size still 227 (hex 0x00E3) unextended size is 235 (0x00EB) or 243 (0x00F3)
0x60	Offset to point data	Byte count from file start to 1st byte of 1st point record	Clarified. Note well: dropped Point Data Start Signature (0xCCDD), this field (Offset to point data) is all you need to find the start of point records.
0x64	Number of VLRs		_- same -_

Offset into File & PHB (hex)	Item	LAS v1.0	LAS v1.1	LAS v1.2	LAS v1.3
0x68	Point Data Fmt ID	0 = 20 bytes point record no timestamp, 1 = 28 byte point record w/ timestamp		0 and 1 AND 2 = 26 bytes, has RGB, 3 = 34 bytes, has timestamp and RGB	0,1,2,3 AND 4 = 57 bytes, has timestamp, waveform 5 = 63 bytes, has tstamp,RGB,waveform
0x69	Point Data Record Length	20 or 28		20, 28, 26, or 34	20, 28, 26, 34, 57, 63
0x6B	Number of point records	_- same -_			
0x6F,0x73,... ,0x7F	Number of points by return	_- same -_			
0x83,0x8B, ...,0x93	X,Y,Z Scale Factor	_- same -_ typically < 1.0 (i.e. 0.001, etc.)			
0x9B,0xA3, ...,0xAB	X,Y,Z Offset	_- same -_ $X_{actual} = (X_{record} * X_{scale}) + X_{offset}$, etc.			
0xB3,0xBB	Max X, Min X	_- same -_			
0xC3,0xCB	Max Y, Min Y	_- same -_			
0xD3,0xDB	Max Z, Min Z	_- same -_			
0xE3		Start of Waveform Data Packet Record			_Waveform only in v1.3_
0xE3 or 0xEB	...next byte after PHB...				

Item	LAS v1.0	LAS v1.1	LAS v1.2	LAS v1.3

VLR Section

VLR Section Size	_Not explicit, must walk through all VLRs, size is sum of each VLR size._			

	VLR Header Size	54			
	LAS Standard User IDs	"LASF_Spec", and "LASF_Projection"			
	Projection Storage	*Optional* GeoTIFF encoding, "LASF_Projection" with Record IDs of 34735, 34736, or 34737	*Required* GeoTIFF encoding, USER ID "LASF_Projection", Record IDs of 34735, 34736, and 34737		
	Classification Lookup	"LASF_Spec" RID 0. Spec has error in length of record	Not known to be used due to standard classification types. Length is corrected from v1.0 to be 255 sub records * 16 (1 class #, 15 chars class desc.)		
	Header Lookup	"LASF_Spec" RID 1. *Not known to be used.*	Dropped in favor of v1.1 scheme of Point Source ID (File Source ID @ offset 0x04 when Point Source ID = 0)		

Offset from VLR start	Item	LAS v1.0	LAS v1.1	LAS v1.2	LAS v1.3
	VLR Record Fields				
0x00	Record Signature /Reserved	Value of 0xAABB	Dropped signature requirement, in v1.1 field is "reserved". VLRs found sequentially starting at HeaderSize (field in PHB) bytes from file start		
0x02	User ID	16 byte string. Register w/ LAS managing body	16 byte string. Register w/ ASPRS		
0x12	Record ID	LAS Spec manages their two sets ("LASF_")	ASPRS manages their two sets of record IDs ("LASF_"), registered users manage their own sets of record IDs and the associated structure.		
0x14	Record Length After Header	Equals total VLR record length minus 54, the VLR header size.			
0x16	Description	*- same -* , optional, null filled			
0x36	*VLR data*	*- same -* , varies per User ID, Record ID combination			

	Item	LAS v1.0	LAS v1.1	LAS v1.2	LAS v1.3
	Point Data				
	Bytes between last VLR and point data	Allowed, but last 2 bytes before point data has value 0xCCDD	Extra space allowed, has advantage of leaving room for future additional VLRs, any values for all bytes.		
	Point Data Record Types	*Types 0 and 1*		*Types 0, 1, 2, and 3*	*Types 0, 1, 2, 3, 4, 5*

Offset from Point Record start	Item	LAS v1.0	LAS v1.1	LAS v1.2	LAS v1.3

Point Record Fields

Offset	Field		
0x00	X	*Integers! To get actual coordinate, multiple by scale and then add the offset*	
0x04	Y		
0x08	Z		
0x0C	Intensity	Unsigned 2 byte integer, represents magnitude of returned pulse	**Added recommendation to always include**
0x0E	Return Number	*- same - , b001 to b101*	
	Number of Returns	*- same - , b001 to b101, number of returns for associated pulse*	
	Scan Direction	*- same - , 1 = positive scan dir, 0 = negative scan dir*	
	End of Flight Line	*- same - , 1 iff point is at end of a scan, i.e. last point of a given scan line.*	
0x0F	Classification	0 to 255 point classifications, no strong standard for values	0 = never classified, 1 = unclassified, lower 5 bits per ASPRS standard classifications, bits 5,6,7 are flags for synthetic, keypoint, and withheld
0x10	Scan Angle Rank	Signed 1 byte integer. -90 (left) to 0 to +90 (right).	Clarified that rounding is to the nearest integer. (Note that referenced to nadir (prependicular to ground).)
0x11	User Data / Point Source ID	File Marker (old flight line scheme	User Data (users discretion)
0x12		User Bit Field (not known to be used)	Point Source ID (new flight line scheme)

for record types 1,3,4:

0x14	Timestamp	Double floating point time that point was acquired, seconds since start of GPS week (GMT)	If global encoding bit 0 in PHB is set, timestamp is a GPS time

for record types 2,3,5:

0x14 or 0x1C	Red	Not part of LAS standard, but possibly found in SILC extensions to the point records (1 byte per R,G,B,I)	2 bytes each for R,G,B. Color is ancillary "colorization".	2 bytes each for R,G,B. Color is ancillary "colorization".
0x16 or 0x1E	Green			
0x18 or 0x20	Blue			

for record types 4,5: