Volumet

FORMAT REFERENCE

Point cloud file formats cheat sheet

.las, .laz, .e57, .rcp and 3DGS: what each is for, which to request, and how to check what you receive.

6	13	10 min
Formats covered	Use cases mapped to a deliverable	QA to run the day a cloud arrives

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01 REFERENCE

The formats

FORMAT	WHAT IT ACTUALLY IS	OPENS IN	ASK FOR IT WHEN
`.las`	The industry-standard LiDAR point format: XYZ + colour + intensity + classification per point	CloudCompare, ReCap, ArcGIS, QGIS, Civil 3D	You need the raw, lossless cloud for survey, GIS or archival
`.laz`	Losslessly compressed .las (~10–20% of the size)	Same as .las (near-universal)	Sharing or archiving large clouds: same data, far smaller
`.e57`	Vendor-neutral exchange container: points + scanner positions + imagery	Almost everything (AEC standard)	Moving data between different software ecosystems, or when the recipient hasn't told you their tool
`.rcp / .rcs`	Autodesk ReCap project/scan, an indexed cloud Revit and AutoCAD link natively	Revit, AutoCAD, Navisworks	The deliverable feeds BIM modelling; modellers want .rcp, not raw .las
`.ply / .obj`	Surfaced geometry (triangles), not points	Blender, Unity, Unreal, CAD	Downstream tools need surfaces: visualisation, 3D printing, game engines
3DGS	Gaussian-splat photoreal scene: radiance, not measurement (.ply splats / LCC scene)	LCC CyberColor viewer, web viewers, Unreal/Unity plugins	The output must *look* real: venue previews, media, XR, simulation backdrops

02 REFERENCE

Quick pairings by workflow

YOUR DOWNSTREAM WORKFLOW	REQUEST
Scan-to-BIM in Revit	`.rcp` (plus .e57 as neutral backup)
Survey / GIS with coordinates	`.las` (georeferenced, SVY21 or WGS84 stated)
Sharing with an unknown toolchain	`.e57`
Long-term archive	`.laz` + .e57
Game engine / XR	`mesh` (+ 3DGS for photoreal)
Marketing / stakeholder walkthrough	`3DGS` scene or Matterport tour

03 BY INDUSTRY

Deliverables by use case

The workflow table above answers "what do I request"; this one answers it per industry job, with the downstream tools each sector typically runs. Deliver the master format first and derive the rest.

USE CASE	TYPICAL DOWNSTREAM TOOLS	REQUEST	NOTES
Scan-to-BIM (as-built modelling)	Revit, Archicad, Navisworks	`.rcp + .e57 master`	Modellers link .rcp natively; the .e57 is your tool-independent insurance
Construction progress & QA	Navisworks, Verity-class comparison tools, ReCap	`.rcp or .e57, dated`	Consistent coordinates between captures is what makes comparison possible: same origin every scan
Renovation / fit-out design	Revit, AutoCAD, SketchUp	`.rcp + decimated .e57`	Colourised; the decimated copy is what the design office actually opens daily
Facilities management / digital twin	FM platforms, Matterport cloud, web viewers	`Hosted tour and/or .e57`	Name files by floor/room codes; FM value lives in searchability, not density
Survey / topographic / GIS	Civil 3D, QGIS, ArcGIS, TerraScan	`.las (CRS stated)`	Keep classification and intensity; .laz for transfer. SVY21 in Singapore
Stockpile / earthworks volumetrics	Civil 3D, Global Mapper, CloudCompare	`.las + volume report`	State the base-surface convention with the numbers; the cloud is evidence for the report
Heritage / HBIM archive	Revit (HBIM), CloudCompare, archives	`.e57 w/ imagery + .laz`	Highest density retained; archive both; the record may be the last capture of the fabric
Plant / marine retrofit engineering	Plant-design suites (E3D, Smart 3D), CAD	`.e57`	Engineers use panoramas to identify what points are; confirm the plant's own CRS
Real estate marketing	Matterport cloud, listing portals	`Hosted tour link`	The deliverable is the link, not a file; e57 export exists if measurement comes later
Film / VFX & virtual production	Maya, Houdini, Nuke, Unreal	`.e57 or .las + mesh`	VFX pipelines convert everything; registered stations with imagery are the valuable part
XR / game environments	Unity, Unreal, Blender	`mesh + 3DGS`	Mesh for collision and interaction, splats for photoreal visuals; engines want both layers
Robotics / simulation training data	Isaac Sim-class simulators, ROS tooling, engines	`.las/.e57 + mesh + 3DGS`	Reported practice: geometry grounds physics and navigation, the splat layer supplies photoreal rendering
Forensics / insurance documentation	Court-presentation tools, claim files, CloudCompare	`.e57 w/ imagery`	Provenance is the product: capture date, device and processing steps documented, master never edited

04 DEEP DIVES

Format deep dives

.las: the lingua franca, with version traps

LAS came out of the airborne LiDAR world (maintained by ASPRS) and became the default interchange for point data everywhere. Each point carries XYZ plus attributes (intensity, RGB, classification, return number), defined by the file's *point record format*, and the file's *version* matters more than people expect. LAS 1.2 is the safe, universally-readable baseline; LAS 1.4 added new point record formats (6–10), 64-bit point counts for very large files, richer classification codes and better coordinate-system metadata, but older software, and some current software's older importers, choke on 1.4 files or silently drop the new attributes. The classic failure: a 1.4 export lands with a recipient whose tool reads it as garbage or refuses it outright. When you don't control the recipient's software, ask for (or export) LAS 1.2 with a common point format, or confirm 1.4 compatibility first. Coordinates are stored as scaled integers, so sane scale/offset headers matter, and a cloud exported with global coordinates but a poor offset can lose precision to rounding.

.laz: the same data, a fraction of the size

LAZ is losslessly compressed LAS via LASzip: every point, every attribute, bit-for-bit recoverable, at typically 10–20% of the original size. That makes it the correct format for transfer and archive: the only trade-offs are a modest decompression cost on read and the fact that a minority of tools still want LAS handed to them uncompressed (a free one-step conversion). The version gotcha carries over: compressing LAS 1.4's newer point formats requires the extended LAZ 1.4 support, which very old tooling lacks. Same rule, confirm the recipient can read it. One habit worth keeping: because LAZ is lossless, there is no reason to archive uncompressed LAS "just in case"; archive LAZ and regenerate LAS on demand.

.e57: the neutral container that carries more than points

E57 (ASTM E2807) was designed as the vendor-neutral exchange format for the AEC scanning world, and its underrated feature is what it embeds alongside the points: scanner station positions, and the panoramic/HDR imagery captured at each station, all in one file. For tripod scanners like the BLK360 G2 that imagery is a first-class part of the deliverable: modellers use the photographic panoramas to identify what the points are. Two practical notes: not every importer reads the embedded imagery even when it is present (points import, images silently ignored, so check before assuming they're lost), and E57 can store either gridded per-station scans or unstructured clouds, and some tools care about the difference. When the recipient's toolchain is unknown, E57 is the safest single file to send.

.rcp / .rcs: Autodesk's indexed doorway into Revit

ReCap converts source clouds (E57, LAS, etc.) into .rcs scan files plus a .rcp *project* file that references them. The point of the format is indexing: ReCap spatially indexes the points so Revit and AutoCAD can stream the visible portion at interactive speed rather than loading everything, which is why modellers ask for .rcp instead of a raw .las they would have to convert themselves anyway. The behaviours worth knowing: a .rcp is not one file but a folder-set (send the .rcp *with* its support files/.rcs, or use ReCap's export; a .rcp emailed alone is broken on arrival), the index bakes in the coordinate placement so agree the origin before conversion, and the format is effectively one-way: treat .rcp as a derived product for Autodesk consumption, never as your master archive.

One capture, two deliverables: point cloud (left) and 3DGS splat scene (right) of the same trench

3DGS: photoreal radiance, not measurement

Gaussian splatting represents a scene as millions of oriented, coloured, semi-transparent blobs optimised so that renders from any viewpoint match the captured imagery: the result *looks* startlingly real, complete with reflections and view-dependent lighting that point clouds cannot show. It is a rendering representation, not a survey product: there is no meaningful accuracy statement, no classification, no per-point provenance, and edits are awkward. From a Lixel K2 rental week, 3DGS scenes come via LCC CyberColor alongside (not instead of) the measurable cloud. Deliver splats as the experience layer (web viewer, Unreal/Unity) and keep .las/.e57 as the evidence layer; a project that confuses the two ends up measuring marketing material.

05 COORDINATES

Coordinates & units, for Singapore

- **SVY21 (EPSG:3414)** is Singapore's national projected coordinate system, the one land surveys, government submissions and most civil/site data use. Coordinates are metric eastings and northings. If your cloud must align with survey drawings, cadastral data or another consultant's site model, deliver in SVY21 and say so, via RTK/PPK georeferencing or surveyor-provided control points.
- **WGS84 (EPSG:4326)** is what raw GNSS speaks: latitude/longitude in degrees. It is fine as a tag ("where on Earth is this site") and wrong as a working CRS for building-scale work: degrees are not metres, and software that naively loads lat/long as XY produces a paper-thin smear. Clouds delivered "in WGS84" for AEC use should really be in a projected system; in Singapore, that means SVY21.
- **Project-local** means the cloud agrees with itself but floats free of the world: the right, cheaper choice for most interior renovation work. State the origin and the level datum ("0,0,0 at grid A1, 0 m at L1 FFL") so the next dataset can be placed relative to it.
- **The metres assumption.** LiDAR formats generally carry metres, but nothing enforces it, and downstream CAD environments configured in millimetres (common in Singapore AEC) are where unit mismatches surface: a building imported at 1/1000th scale, or one thousand times too large. Write the units into the delivery note, and check them in the first minute of QA.
- **One system per project.** Mixed deliveries (cloud in SVY21, model in project-local, no transformation documented) cost more coordination hours than any other format issue. Pick one, document the transformation to any other, and put both in the sidecar note.

06 PLANNING

Typical file sizes

Rules of thumb, not promises. Uncompressed LAS costs roughly 30–40 bytes per point depending on point format (RGB costs extra). From there:

DATASET	TYPICAL POINTS	.LAS	.LAZ
One residential unit / small office (SLAM)	tens of millions	a few GB	hundreds of MB
One office floor, full density	~100–300 million	~5–15 GB	~1–3 GB
Multi-storey building, full week	~0.5–2 billion	tens to ~100 GB	~a tenth of that
Decimated viewing copy (10 mm spacing)	~5–10× fewer	proportionally smaller	proportionally smaller

E57 lands in the same order of magnitude as LAS (larger when imagery is embedded); ReCap projects add index overhead on top of the source size; 3DGS scenes are typically hundreds of MB to a few GB per scene. Plan **~50–200 GB per capture day** across raw + processed + exports, and remember raw SLAM data (trajectories, imagery) is separate from, and often larger than, the exported cloud.

Point cloud render: one office floor at full density

07 ACCEPTANCE

Receiving a point cloud: the 10-minute QA

Run this the day a cloud arrives, not the day you need it.

1 1 MIN **Open it** in a neutral viewer (CloudCompare is free), not just confirm the file transferred. Corrupt or truncated files fail here, while there is still time to re-request.

2 1 MIN **Check the point count and extent** against expectation. A 4-storey building arriving as 8 million points, or an extent of 40,000 km, tells you immediately something is wrong.

3 2 MIN **Check units and coordinates.** Measure a door width: it should be ~0.9, not 900 or 0.0009. Then look at the coordinate values themselves: SVY21 eastings/northings look like tens of thousands of metres; values near zero mean project-local; degrees mean someone delivered raw WGS84.

4 2 MIN **Walk the coverage.** Fly through floor by floor against the scope list: are all agreed spaces present, are the voids the agreed ones (locked rooms) or surprises?

5 2 MIN **Cut a section** through a junction where capture passes overlapped (a stair core, a scene boundary). One crisp wall line = good registration; onion-skinned double walls = raise it now.

6 1 MIN **Check colour and attributes** you specified: colourisation present, intensity/classification populated if promised.

7 1 MIN **Check the sidecar note** exists and answers: format + version, CRS and units, datum, capture date, device, and any exclusions. If there is no sidecar note, that is itself a QA finding. Request one.

Ten minutes, and every dispute-prone question ("wrong place, wrong units, missing floor") is caught while the capture team can still fix it cheaply, during a rental, possibly while the scanner is still on hire.

08 CUSTODY

Storage & archive strategy

- **Keep one master, derive everything.** The master is the highest-fidelity, least-processed export (.las/.laz, plus .e57 where imagery matters). Meshes, .rcp, decimated copies and 3DGS are derivatives, regenerable from the master, so their loss is inconvenient, not fatal. Never re-export through a lossy chain: each conversion sheds metadata (classification, intensity, imagery).
- **Archive .laz + .e57.** Lossless compression for the points, the neutral container for points-plus-imagery. Skip archiving uncompressed .las (regenerable from .laz) and treat .rcp as disposable working data.
- **Three copies, two media, one off-site.** During the rental: working SSD + backup drive in separate bags, every evening. After delivery: project store + office NAS + one cloud/off-site copy. Device storage does not count. It is wiped after the rental returns.
- **Name for the decade, not the week.** `SITE_LEVEL_scope_CRS_date` beats `final_v2_FIXED`. Keep the sidecar note (CRS, units, datum, device, date, exclusions, QA table) next to the master forever: a cloud without its metadata degrades from evidence to guesswork.
- **Budget the archive.** A building capture week can be tens of GB compressed. That is trivially cheap against re-scanning. The point of keeping the master is that in three years, when the next renovation starts, the existing-conditions survey is already done. You keep every dataset from a Volumet rental; the strategy above is what makes that ownership worth something.

FAQ

Questions we hear most

1. Which single format should I ask for if I can only pick one?

.e57: it is the format most likely to open in whatever the next tool turns out to be, and it can carry imagery alongside points. If the destination is definitely Revit, ask for .rcp *plus* .e57; the .rcp saves the modeller a conversion, the .e57 protects you.

2. Is .laz really lossless? Why does everyone still send .las?

Genuinely lossless: every point and attribute is bit-for-bit recoverable. People send .las out of habit and because a shrinking minority of tools want it uncompressed. Send .laz for transfer, convert locally if a tool insists.

FAQ

Questions we hear most, continued

3. My cloud opens miles from the model / at the wrong size. What happened?

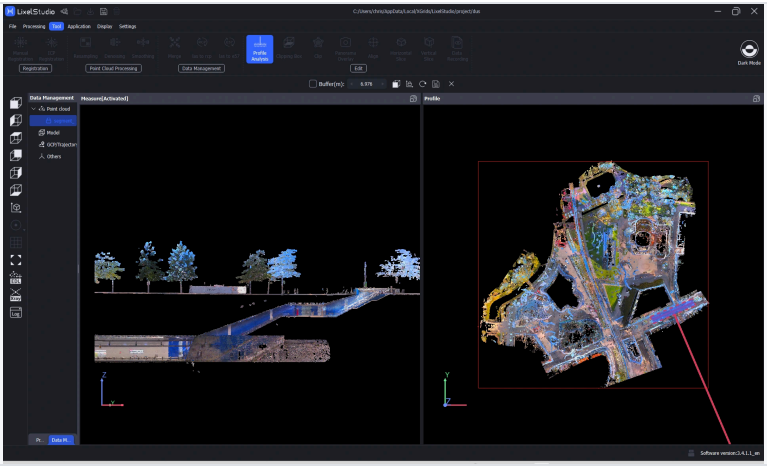
Almost always coordinates or units, not corruption. Check whether the cloud is georeferenced (SVY21-scale coordinates) while the model is project-local, or vice versa; then check metres vs millimetres (the door-width test). The fix is a documented transformation, not nudging the cloud until it "looks right".

4. Can I get a Revit model straight from a point cloud?

No. The cloud is reference geometry that a modeller traces against tolerance rules (that is the Scan-to-BIM process, and why LOD and tolerance need specifying). Automated extraction tools assist, but a deliverable model is authored, not exported.

5. Do I really need the full-density cloud AND a decimated copy?

Yes, and they cost almost nothing extra since both export from one capture. The decimated copy (e.g. 10 mm spacing) is what people actually open in meetings; the full cloud is what measurements and modelling come from. Deliver both, label them clearly, archive the full one.

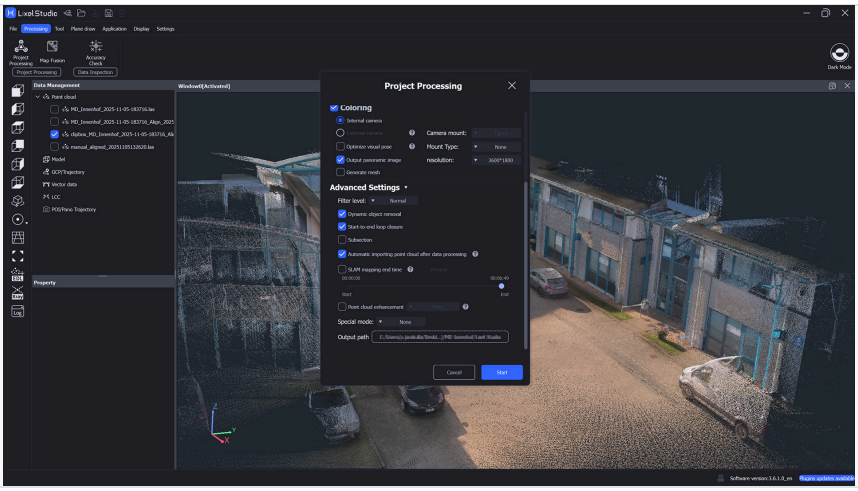


The door-width test: taking a known dimension off a delivered cloud in profile view

WHAT ONE RENTAL WEEK PRODUCES

Every format above, from one walk

From a Lixel K2 rental week you can export every format above, processed in LixelStudio, 3DGS via LCC CyberColor. You keep all data. The specifics, from the LixelStudio manual: direct exports are .las, .laz, .ply and *unstructured* .e57 (SLAM capture has no fixed stations, so per-station grids and panoramas, a tripod-scanner feature, are not part of the container); .rcp comes from the built-in LAS-to-RCP converter, up to 10 LAS files per run, for ReCap and AutoCAD 2020 or newer.



LixelStudio processing: colourisation, panoramas and mesh chosen before anything is exported

Rent the scanner

XGRIDS Lixel K2 from S$2,300/week (GST-excl.). Availability confirmed within 1 business day.

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