

C-ALS Gyro[®]

Cavity Auto-Scanning Laser system with integrated gyro

The Carlson C-ALS Gyro is a fully 360° deployable laser scanner, ruggedized to work in the uncompromising underground work environment. With a diameter of just 50 mm, the C-ALS probe can be deployed along all standard boreholes. The C-ALS provides safe, quick, and reliable mapping capabilities for inaccessible underground cavities. The newly integrated gyro means that the C-ALS can now be deployed using just a load-bearing cable, without the need for stabilising rods to orientate the survey. The gyro gives greater navigational capability, ensuring that the probe's position along the borehole can be determined without relying on the mechanical alignment of deployment rods or a magnetic compass. The versatility of the C-ALS means that the probe can still be pushed with rods for horizontal and uphole boreholes and it can be deployed into stopes on a boom or down orepasses on a zip-wire.

The C-ALS Gyro will carry out laser scanning of air-filled voids and, with the advanced onboard gyro, can accurately geo-reference the resulting 3D model with respect to your site coordinate system.

The advantages of C-ALS Gyro laser scanning

- Ability to survey potentially dangerous underground voids safely
- Get precise and accurate cavity/void measurement in minutes, not days
- Gyro integration enables hassle-free, rodless deployments, reducing deployment times and weights
- 360° spherical coverage from a single scan, with no blind spots
- Operation is remotely controlled from a safe location
- Flexible deployment methods
- Easily transported
- Rugged design for durability in extreme conditions
- Probe rated to IP67
- Withstands submersion to a depth of 1 m (in case accidentally deployed in a flooded cavity)
- Intuitive Carlson Scan software, optimised for tablet use, provides seamless integration with CAD and mine planning packages.



CLASS 1
LASER PRODUCT
IEC / EN 60825-1: 2014

How it works

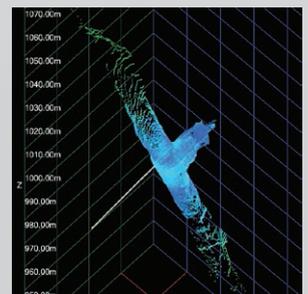
- With a diameter of just 50 mm, the Carlson C-ALS Gyro system is easily deployed through boreholes, downhole or uphole, in order to survey inaccessible spaces.
- Survey the collar location on your mine coordinate system to give a starting point for the survey.
- Use the supplied calibration jig to initialise the gyro to a known heading.
- Connect to the C-ALS using Carlson Scan software.
- Control the C-ALS system from a safe location, via a ruggedised tablet linked to the C-ALS system by Ethernet cable or a Wi-Fi.
- As the C-ALS Gyro is deployed, take regular readings of the MEMs IMU.
- The IMU establishes the heading and inclination of the probe as it is deployed and as it scans in the void.
- A nosecone camera, embedded within the end of the C-ALS probe, provides onscreen video and a real-time view of the borehole as the probe is deployed. This allows operators to see any obstructions and to judge the point at which the C-ALS scanning head and rotating horizontal shaft breaks through into the void.
- Once in the void, Carlson Scan runs a scan to measure the 3D shape of the void with full 360° coverage, up to a range up to 150 m.
- Using Carlson Scan, the operator can view live data, with the option to import existing data as a backdrop to the ongoing survey.



The C-ALS system deployed downhole to survey an inaccessible underground void.



The nosecone camera provides a helpful view into the borehole during deployment.



The probe rotates on two axes to create full 360-degree scans of voids and cavities.

C-ALS Applications

Support underground or surface mining projects

By using C-ALS Gyro to determine the size, extent, and status of inaccessible voids, mining customers get a complete picture of the situation underground before committing to projects or deploying workers. In addition, a full understanding of the layout of underground workings and their relation to surface operations is essential for safe open-pit operations using heavy machinery, explosives, and personnel. The C-ALS system provides a detailed visual record of the following:

- Excavation and infill of stopes
- Location of voids
- Geometry and condition of mine workings
- Inaccessible historic workings
- Collapsed areas, sinkholes, and troughs
- Erosion of ore passes
- Volumes of voids
- Position of cavities in relation to other underground workings and structures
- Size and location of remaining pillars
- Location of the voids/workings relative to surface features

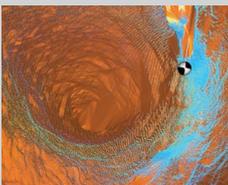
Utilize the Carlson C-ALS Gyro system when a complete picture of the situation underground is needed. The C-ALS system can be used in a huge range of applications where an inaccessible void exists and accurate data is required.

Standard C-ALS option

Standard C-ALS units without an integrated probe are also available. The standard C-ALS provides a cost-effective solution for simple projects or for users less concerned with the geo-referencing of their data. The standard C-ALS is deployed on rods and uses accelerometers to orientate and level the data. The standard C-ALS can also be used on a boom or zip-wire to survey stopes and orepasses.

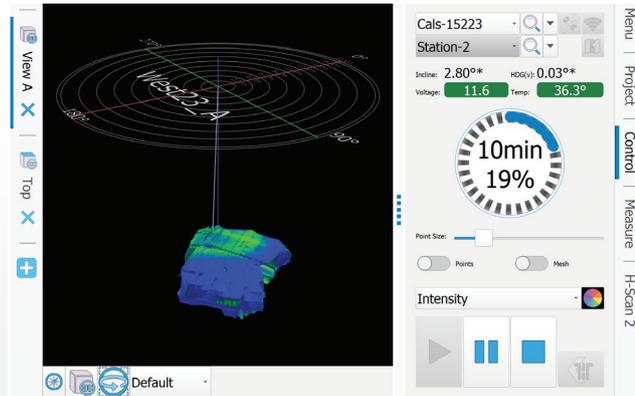


The ruggedised PC enables you to carry out operations on site in extreme environments.



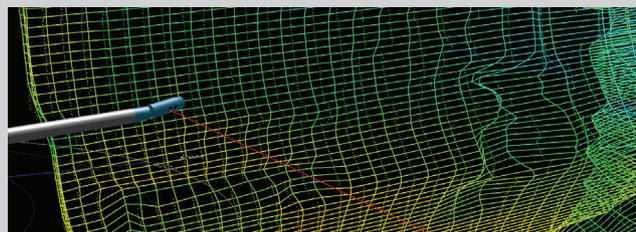
Laser cavity scans are easy to export into a large range of software packages.

Carlson Scan software

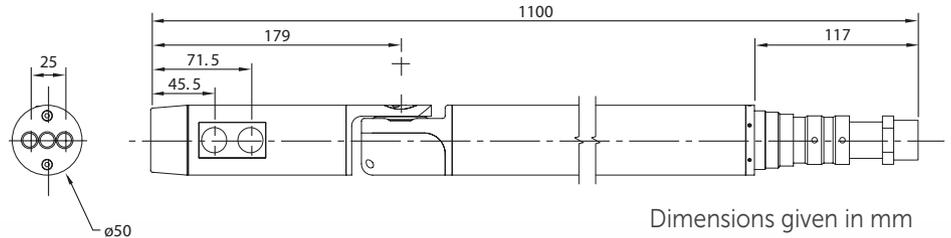


Carlson Scan software for the C-ALS Gyro and standard C-ALS units makes it easier and quicker for operators to use the system, to analyse collected data and to produce industry-standard deliverables.

- Quick navigation and intuitive design for both new and experienced operators.
- Smooth and efficient animation and point cloud rendering
- Optimised for ruggedised, touchscreen tablets for easy in-field use
- Desktop mode for reviewing and editing data in the office.
- See the live heading, inclination and activity of the animated C-ALS probe at all times
- Real-time surfacing and volume calculation from raw scan data for the production of closed 3D models and volumes
- Import existing point clouds and surfaces to see real-time comparisons with design data or previous surveys.
- Quickstart mode with single-click project setup up and instrument auto-detection
- Save live footage from the C-ALS camera
- Easy integration with third-party packages with the ability to import and export formats, such as LAS and DXF
- Carlson Scan is also designed for use with the Void Scanner and VS+, Carlson's other underground laser scanners.



C-ALS Probe dimensions



C-ALS

Laser module

Laser classification (IEC / EN 60825-1: 2014) (Complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8 2019.)		Class 1
Type	InGaAs laser diode	
Wavelength (typical)	905 nm	
Resolution	1 cm	
Maximum range to a passive target ¹	Up to 150 m	
Minimum range	0.5 m	
Range Accuracy ²	± 5 cm	
Divergence	< 2 milliradians	
Maximum average power	< 20.5 mW	

Angle measurement

Type	Opto-electronic encoder	
Angular Accuracy	0.2°	
Angular Resolution	0.1°	
Range	Vertical	-90° to 90°
	Horizontal	0° to 360°
Motion	Servo-driven gear system in both axes with manual clutch override system	

Navigation sensors

Type (C-ALS Gyro)	MEMs IMU	
	3-axis accelerometer ± 0.2°	
	3-axis gyro	
	360° range - inclination roll and heading	
Type (Standard Gyro)	3-axis accelerometer ± 0.2°	
	360° range - roll and inclination	

Physical data

Construction	Machined aluminium and stainless steel	
Water and dust resistant	IP67	
Operating temperature range	Probe	-10° C to +60° C
	Surface Unit	-10° C to +50° C
Dimensions	Probe	1100 mm x Ø50 mm
	Probe with extension piece	2179 mm x Ø50 mm
	Surface Unit	270 mm x 245 mm x 170 mm
Weight	Stainless steel probe	5.9 kg
	Single-section steel extension piece	3 kg
	Main C-ALS cable	0.18 kg/m
	1 m Boretrak rod	0.4 kg
	Surface Unit	4.1 kg
External power input	12-15 V dc and 110-240 V ac	
Power consumption during scan	0.8 to 2.0 A	

¹Max measuring ranges are recorded against Kodak white card (90% reflectivity).

²Under Carlson Test Conditions

For further information and the best possible application and performance support please contact Carlson at lasermeasurement@carlsonsw.com