

Geophone Installation Methods



Burial

According to ISEE recommendations, the hole for burying a geophone should be at least three times the height of the sensor. The bottom of the hole must be level and well-compacted to ensure solid ground coupling. Geophone spikes can be used, but are not necessary, to anchor the sensor firmly into the soil, and the surrounding area should be tightly compacted to eliminate air gaps and minimize the chance that the geophone will bounce around leading to inaccurate data. The International Society of Explosives Engineers (ISEE) recommends backfill with native soil or similar

soil, compacted in 13-25 mm (0.5 - 1 in) lifts, back to the near original grade. Room for the cable must also be allowed. Before covering with soil, verify the sensor's orientation with a level and perform a sensor check to ensure proper operation. Additionally, the cable should be laid out as flat and straight as possible to avoid crimping or damage.

Ideal Ground Conditions

- Soft to moderately firm soils (clay, loam, sand with cohesion)
- Easy to dig and provides tight coupling
- Not recommended for hard-to-excavate ground (rocky, frozen, or very dense)



Benefits of Burial

Reliable Sensor Coupling

Direct contact with the soil ensures high-quality signal transmission.

Protection from Surface Noise

Subsurface placement reduces wind and air overpressure interference.

Stable and Accurate Results

Proper burial helps maintain consistent sensor coupling throughout the monitoring period.



Attachment

Attachment of a triaxial geophone is accomplished by bolting, clamping, or adhering the sensor directly to a rigid surface, such as concrete, rock, or structural steel. This can be done using a wall-mount bracket or a ground-leveling plate, depending on the application and the orientation required. The goal of the attachment is to achieve rigid, continuous contact between the sensor base and the surface, ensuring accurate transmission of ground vibrations without introducing resonance or mechanical decoupling.

While attachment to a hard surface such as rock or concrete can provide reliable sensor coupling, the International Society of Explosives Engineers (ISEE) recognizes several acceptable sensor installation methods, including attachment to rock or concrete, in-ground burial, and, where site conditions have been evaluated and the risk of sensor decoupling has been determined to be minimal, spiking and sandbagging. Proper surface preparation is essential for effective attachment. The mounting area should be clean, flat, and free of debris or loose particles, and care must be taken to minimize air gaps or unstable contact points.

Ideal Ground Conditions

- Hard, rigid surfaces (rock outcrops, tunnel walls, structural foundations)
- Steel frames or engineered platforms
- Driveways, walkways, and slabs should be avoided where possible

Note: Mounting near a structure may include the structure's response, not just ground motion. Foundation mounting should be within ± 0.305 m (1 ft) of ground level.

Benefits of Attachment

High Precision Alignment

Ideal for tunnel monitoring where directionality matters.

Stable Ground Contact

Easily secure geophones on surfaces that are not level, like bedrock.

Minimized Measurement Errors

Keeps the geophone properly aligned, especially on uneven ground.



Triaxial Geophone
Leveling Plate
(P/N:714A1801)



Triaxial Geophone
Wall Mount Kit
(P/N:718A1101)



Sandbagging with Spikes

Sandbagging is a surface installation method that may be used when burial, direct attachment to rock or concrete, or other site-specific installation methods are not practical. It is particularly suited to locations with shallow soils, sensitive surfaces, environmental restrictions, or where minimal ground disturbance is desired. Where appropriate, surface vegetation or loose material should be removed to expose compacted soil while minimizing disturbance to the underlying ground conditions. The potential for sensor decoupling should be evaluated before installation.

Consistent with ISEE recommendations, surface installations should use both spikes and a minimum 9.1 kg (20 lb) sandbag that is as low and wide as possible with a maximum firm contact with the ground. (Spikes or sandbags alone are not recommended.) The geophone should be placed on prepared ground with its base in firm contact with the soil, and the sandbag positioned to distribute its weight evenly over the sensor and surrounding surface. The sandbag should be filled with loose, free-flowing granular material. Proper installation helps minimize sensor movement and the risk of decoupling during monitoring.



Because surface installations are generally more susceptible to coupling variability than buried or rigidly attached sensors, the installation method should be selected based on site conditions and monitoring objectives. The sensor should also be periodically inspected throughout the monitoring period to verify that adequate coupling is maintained.

Ideal Ground Conditions

- Shallow soil over rock, or sites where excavation isn't permitted
- Minimal ground disturbance is required (heritage site, sensitive area)

Benefits of Sandbagging with Spikes

Quick Deployment

No digging or mounting saves installation time.

Improves Sensor Stability

The added mass of the sandbag helps reduce sensor movement caused by wind, weather, personnel activity, or other external influences while maintaining contact with the ground surface.