



## GINA® Geophones in Avalanches

GINA® enables the monitoring of avalanche activities in specific avalanche paths. Fully integrated into Wyssen Avalanche Control Center WAC.3®, GINA® is a cost-efficient solution to control individual areas.



### Advantages

- Very reliable
- Direct detection avalanches
- Real time detection
- Independent of weather conditions, detection possible even in whiteout conditions

The geophone system consists of a central unit and one or more geophone sensing units. The central unit is responsible for the communication with warning-systems while the sensing units continuously record and evaluate the ground vibrations.

#### Geophone central unit

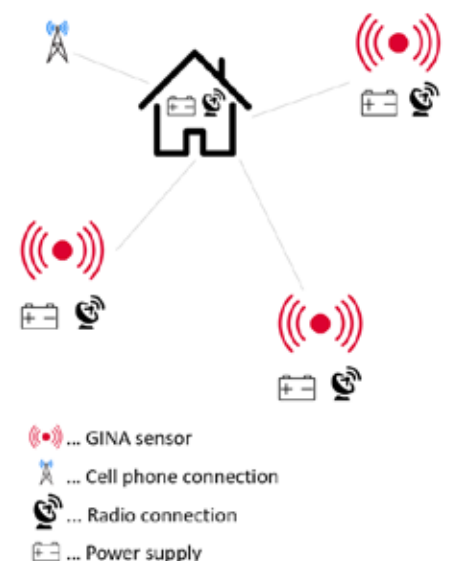
The central unit communicates with attached warning-systems or traffic lights and connects to the servers through the mobile network. Normally powered by grid power, the central can also be equipped with battery and solar or fuel cell if no grid power is available.

#### Geophone sensing unit

The geophone sensing unit is designed to be a contained stand-alone unit which records and evaluates the ground vibrations continuously. Each geophone sensing unit contains the following components:

- Sensing element
- Optimized power electronics for continuous measurement
- Radio modem for communication to the base station
- Battery

The sensing element needs to be coupled with the ground. To achieve this, the unit is put into the ground and connected to a small box which contains the rest of the geophone sensing unit. The sensing unit samples the sensing element 80 times per second. The measurement is performed with a resolution of 24 bits and can detect very small vibrations. A simple but effective STA/LTA trigger is used to detect any event. The sensing unit doesn't distinguish between avalanches or rockfall this filtering is done later in the base station.



## Facts / Technical data

Display	fully integrated in our Wyssen Avalanche Control Center WAC.3®
Range	up to 50 m (165 ft)
Opening angle	360°
Communication	Mobile phone network or radio connection
Power supply	Grid power, solar or fuel cell

## Local Algorithm

The basic STA/LTA trigger is defined as a threshold of the ratio between short term average (STA) and long term average (LTA). This results in a trigger which will catch all events of a certain magnitude while being unsusceptible to slow changes in ground vibration amplitude.

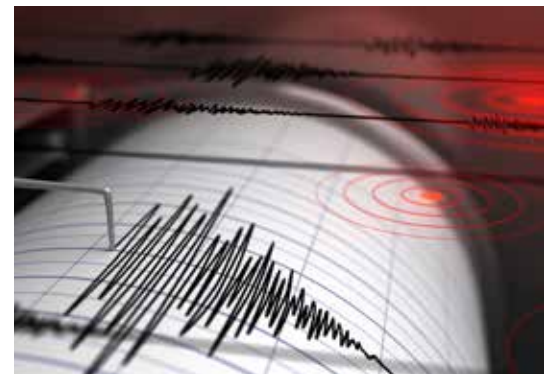
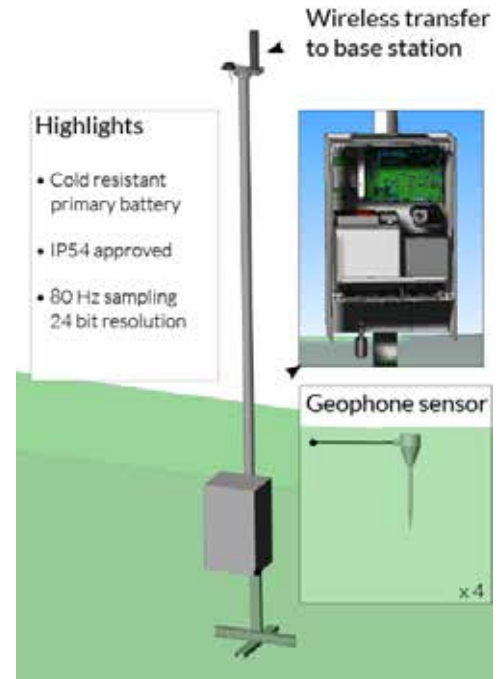
As soon as the trigger is activated the system wakes from its very low power state to a fully operational state and records all the data and sends as much as possible to the central unit. The central unit then has to decide whether there was an avalanche or whether it was some other sort of signal which activated the trigger.

## Power

Even without any signal triggering, each geophone sensing unit will send a signal to the central unit every few hours to give a sign of live while not wasting too much power. Measurements show that the whole geophone sensing unit including communication and continuous measurement does consume a small power supply, less than 2 milliamperes. Therefore the most feasible power source is primary batteries which need to be replaced once per year. Primary batteries as a power supply are superior to most other form of power supply in terms of withstanding low temperature and having low self-discharge.

## Communication

The communication from the geophone sensing units to the central unit is done by a narrow band radio system. A narrow band radio can have a very high range (up to 20km / 12.5 miles in our case) in ideal conditions. The radios operate in a license free frequency band at 868MHz. This band is called an ISM band because it is open for industrial, scientific and medical communications.



## 2. Version

A further version of GINA® is stand-alone sensing units without a central unit. Each sensing unit is independent and sends the recorded data direct via mobile phone network. This version is only possible, when the solar cells receive enough solar radiation. Therefore, this version cannot be connected to warning-systems and traffic lights.