

## Multi-use seismic stations for earthquake early warning

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### 1. Nanometrics Seismic Monitoring Solutions

Earthquake Early Warning (EEW) network performance improves with the number and density of sensing stations, quality of the sites and of strong-motion instrumentation, degree of coverage near at-risk populated areas and potential fault zones, and minimizing latency of signal processing and transmission. Seismic research tends to emphasize competing requirements: low-noise sites, high-performance broadband seismic instrumentation, and high-quality signal processing without regard for latency. Recent advances in instrumentation and processing techniques have made feasible the concept of a multi-use seismic station in which strong- and weak-motion seismometry are both cost-effectively served without compromising the performance demands of either.

Our concept for a multi-use seismic station meets the needs of both EEW and high-quality seismic research. One significant enabler is a 6-channel dual-sensor instrument that combines a 120s broadband seismometer and a class A accelerometer in a single ultra-compact sonde suitable for direct burial. Combining two sensors effectively adds broadband capability to a station without increasing the already optimized site footprint, preparation and management costs associated with shallow direct-burial installations. The combined sensors also simplify and speed up installation (for example, the accelerometer provides real-time tilt readings useful to leveling the seismometer). Integration simplifies alignment to north, as there is only one instrument to orient. A dual-use 6-channel digitizer simultaneously provides two sets of independently processed streams from both sensors, one set optimized for low-latency earthquake warning, and the other set for high-quality seismic research purposes.

Such a dual-use seismic station can serve both seismic research and civil warning infrastructure objectives without adding significantly to the cost of a single-use station, while increasing the utility for all users of the station's data.

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