Richard P. Feynman Center for Innovation

LA-UR-25-30617

Technology Snapshot

Los Alamos NATIONAL LABORATORY

Digital Seismic Switch (DSS)

Improving Critical Facility Safety with Real-Time, Fault-Tolerant Seismic Detection

Applications

Sectors: seismic detection, critical infrastructure protection, safety systems

Areas: earthquake-triggered system shutdown, industrial diagnostics, digital control integration

Industries: nuclear energy, oil and gas, data centers, pharmaceuticals, industrial construction

Markets: automated earthquake response for critical safety systems such as nuclear waste facilities and power plants, refineries, data vaults

Partnership Opportunities

LANL is seeking partners in electronics manufacturing with demonstrated expertise in safety certification, high-reliability electronics, and hardware QA/QC. Ideal collaborators will support scaling, manufacturing, and deployment of DSS into high-consequence infrastructure systems.

Technology Readiness Level 9

Fully validated in operational environments and ready for commercial deployment.

IP Information

U.S. Patent No. 11,852,764
Certified SIL-2 compliant by Exida (IEC 61508)

Contact Information

For inquiries, contact FCI at licensing@lanl.gov.

Digital Seismic Switch (DSS) hardware module.
This SIL-2 certified unit provides real-time seismic monitoring and automatic system shutdown signaling for critical infrastructure protection.

Overview

The Digital Seismic Switch (DSS) is a compact, fault-tolerant seismic detection system designed for the protection of critical infrastructure. Unlike traditional threshold switches, DSS continuously monitors ground motion and its own operational integrity. When seismic activity exceeds preconfigured limits, DSS sends out a real-time, microsecond-scale signal to trigger protective measures such as system shutdowns or isolations.

Its SIL-2 certification under IEC 61508 and integrated fault diagnostics make DSS a uniquely robust platform for mission-critical safety environments. The system has been validated through operational deployment and is fully ready for commercial scale-up.

Advantages

- **High Reliability**: SIL-2 certified with internal redundancy
- **Fast Response**: Microsecond-scale signal triggering
- **Compact and Integrated**: Combines sensing, logic, and interface in one unit
- **Data-Rich Output**: Continuous streaming of seismic and operational data
- **Standards Compliant**: Meets ANSI/ANS-2.2 and is scalable across safety platforms

Technology Description

At its core, DSS uses a safety-rated microprocessor and redundant MEMS g-force sensors to monitor seismic activity. When motion surpasses the set thresholds, it delivers a switched output signal for immediate response.

Key features include:

- Fault Tolerance: Internal health checks with active failure alerts
- High Availability: Continuous uptime during and after seismic events
- Smart Interface: Real-time data and diagnostics via fiber optic link
- Remote Logging: Seamless seismic data capture in compliance with ANSI/ANS-2.2

DSS is a modular, plug-and-play external component, designed to integrate seamlessly into existing safety architectures.

Market Application

DSS serves critical industries where real-time seismic monitoring is essential for safety and operational continuity.

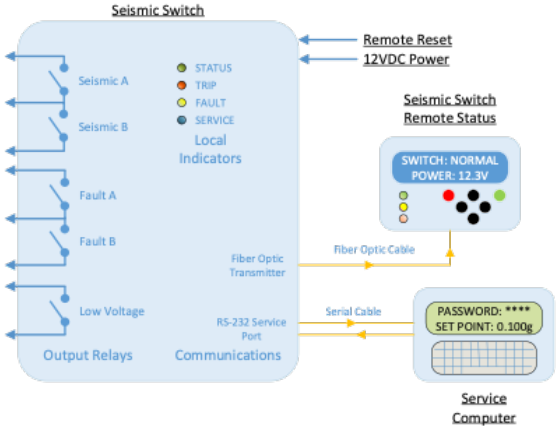
Potential uses include:

- **Nuclear Facilities**: Enables automated system response during seismic events
- **Oil and Gas Production**: Enhances fault detection in pipelines and refineries
- **Data Centers & Infrastructure**: Safeguards sensitive assets from ground motion disruption
- **Medical & Pharmaceutical Equipment**: Maintains equipment stability in seismic scenarios

The global seismic protection device market is projected to reach $4.31B by 2032, positioning DSS as a high-value, future-proof safety solution.

Next Steps

LANL is seeking partners in electronics manufacturing with robust experience in productization and quality assurance to scale DSS for deployment across high-risk infrastructure sectors. Opportunities include co-development of next-gen packaging, certification support, and supply chain readiness for mass production.



System diagram of the Digital Seismic Switch (DSS). Shows integration of seismic sensing, remote monitoring, power interface, and secure configuration through a service computer.