SINGLE CHANNEL SEISMIC SENSOR SYSTEM

SYSTEM OVERVIEW
The Quantum Technology Sciences Single Channel System meets the demand for persistent movement monitoring, intrusion detection and situational awareness. This easy-to-install, low visibility system gives real-time alerts when human footsteps, vehicle movement or digging are present in the vicinity of one or more seismic-acoustic sensors.

Based on a nodal approach, each system includes a single processing node, a single concealable sensor, cabling, and power supply. This single channel system delivers the only situational awareness solution with a three dimensional 360° detection sensitivity in air, water and the earth.

Vibrations in the earth are gathered by the sensor and are analyzed immediately and automatically by the node. The sensor has an extended sensitivity range and does not require line of sight to its detected potential threat. If the system determines that the vibrations are from a selected potential threat source, for instance human footsteps, the node immediately notifies, by wireless or wired means, a remote base station or monitoring device. The notification includes the node identity and the type of potential threat detected.

Multiple nodes can be serviced by a single monitoring device, where the user interface is installed. Customer needs dictate the monitoring device such as a command center computer, remote laptop, digital assistant, or an existing security architecture.

The Single Channel System is a source of situational awareness when deployed at a boundary around a private property site, a valued industrial asset, a military or government property, a component of a critical public infrastructure, such as pipelines or pumping or power stations, or as a country’s border. It may function as a stand-alone product, or may be integrated with other products built by Quantum Technology Sciences or by other manufacturers.

System installation is handled by a Quantum certified installer, but may be done by the owner/user. The installer digs a small hole, approximately 6" in diameter and 12” deep, places the sensor at the bottom of the hole, and refills the hole, packing dirt tightly around the sensor. Unlike many traditional types of ground sensors, the sensor does not need to be accurately vertical, simplifying deployment. The node may be buried in a similar fashion, deployed on the ground surface, or mounted to a short post above the ground, depending on the nature of the installation.

The installation may be temporary or permanent. The deployments may be of a single sensor-node-user-interface configuration or multiple sensor-node combinations supporting a single user interface. The installation may be at a single point or along or around an entire perimeter with a length of tens or hundreds of miles.

The Single Channel System is configured for detecting and classifying human footsteps, motor vehicles, and digging. Additional potential threats, such as motorboats and powered aircraft, are available as custom options. The standard software supplied with the product is installed on the customer monitoring device and displays coded icons at the sensor positions in map view. The icons show the state of health of each sensor and the type of each potential threat source detected.
A SINGLE CHANNEL SYSTEM may be deployed with one sensor, one node, and one base station, as shown above, to provide 360° situational awareness. The base station and monitoring device are able to support multiple sensors and nodes, monitoring multiple sensor locations on a single user interface.

Adding sensor-node combinations to the system generates the configuration as diagrammed to the right. The sensors and nodes may be deployed with their antennas within range of the base station antenna.
**SPECIFICATIONS**

**COMPONENTS**

- **NODE BOX** - Contains hardware & software for potential threat processing, data recording, communications (Digi International Xtend® 1 Watt/900 MHz Long Range RF Module)

- **SENSOR** - Seismic-acoustic sensing element and signal conditioning hardware

- **BASE STATION (OPTIONAL)** - Mobile monitoring device transceiver with power cable, antenna and RS232/USB cable for connecting to the GUI device

- **RF ANTENNA (OPTIONAL)** - Connects to the node box for communicating with the monitoring device; cable length 4 ft used when system is buried

- **GPS ANTENNA** - Connects to the node box for GPS time sync & node Lat/Long position; cable length 3m

- **ETHERNET** - Standard communication media from node box to the monitoring device.

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**USER INTERFACE**

**THE USER INTERFACE ALLOWS** remote access to the node(s) via radio or ethernet from a computer application or mobile device. It can graphically monitor the system as a whole or examine activities of individual nodes, and can also play back historical alerts. The user interface software provides an interactive map, a node status summary, and a message viewer.

**THE USER INTERFACE INTERACTIVE MAP DISPLAYS**

- Node(s) location
- The current state-of-health status of the individual nodes and sensors
- Detection & classification alerts from individual nodes and sensors
- Node and sensor status

**THE NODES AUTOMATICALLY AND IMMEDIATELY** report all alerts and, at programmed intervals, state of health (SOH) messages to the monitoring device, and record them internally as well. The monitoring device uses these reports to continuously update the user interface with the most current information.
## Performance

### Detection Range (Typical)
- Digging: 30m / 100ft
- Walking: 125m / 410ft
- Vehicle: 250m / 820ft

### Input Power
- 12 VDC typical, 15VDC max

### Typical Power Consumption
- Ethernet Comms:
  - Power Mode: 540mW*
- RF Modem Comms (Optional):
  - Power Mode: 240mW*

### Node to Host Interface Options
- 100Mbps Ethernet (Standard)
- 900MHz Wireless RF Modem (Optional)
  - Embedded Digi XTran:
    - XT09-MI module ([www.digi.com](http://www.digi.com))
    - 9600 Baud raw data rate
  - Passive Omni Antenna Options:
    - 3 dBi Rubber Duck
    - 5 dBi Mag Mount

### Monitoring Device Recommendations
- Windows operating system, an equivalent of an i5 processor, with 4-8 G8 RAM, a minimum of 512 MB of video memory

### Interoperability
- Common Alerting Protocol (CAP)
- IP Camera
- IP Devices
- WiFi/ethernet Radio

### GPS / GNSS Receiver
- Embedded TC6000GN Receiver Module
  - using Texas Instruments CC4000 GPS Chip
- Tracking Sensitivity
  - -162 dBm
- Adhesive Mount high gain (30 db)
  - external active antenna with 3 meter cable. Taoglas AA.108.30111

## Physical

### Sensor
- Deployment Location:
  - Buried with soil fill at an 8 inch minimum depth below the surface
- Size: 6.43cm x 5.84cm / 2.53in x 2.3in (Height x Diameter)
- Sensor to Node Cable:
  - Length: 3m / 10ft
  - Connectors: 14 Pin Mil-DTL-26482
- Weight: 118g / 0.26 lbs

### Node
- Size: 12.95cm x 5.08cm x 18.03cm / 5.1in x 2.0in x 7.1in (L x W x D)
- DC Power Cable:
  - Length: 1.2m / 4ft
  - Connector: 2 Pin Mil-DTL-26482
- Weight: 816.5g / 1.7lbs

### RF Modem Base Station (Optional)
- Refer to [www.digi.com](http://www.digi.com) for more X1end-PKG RF Modem details
- Size: 6.98cm x 13.97cm x 2.87cm / 2.75in x 5.5in x 1.13in (L x W x D)
- Serial Cable Length: 0.91m / 3ft
- Weight: 201g / 7oz

## Environmental

### Operating Temperature
- -40°C to +70°C (-40°F to 158°F)

### Storage Temperature
- -40°C to +70°C (-40°F to 158°F)

### Ruggedized System Tested to MIL-STD 810G-1

<table>
<thead>
<tr>
<th>Tested Description</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration Truck/Trailer Loose</td>
<td>514.7</td>
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<tr>
<td>High Temperature</td>
<td>501.6</td>
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<tr>
<td>Low Temperature</td>
<td>502.6</td>
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<tr>
<td>Blowing Sand</td>
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<tr>
<td>Blowing Rain</td>
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<tr>
<td>Salt Fog</td>
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<td>Icing Freezing Rain</td>
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<tr>
<td>Freeze Thaw</td>
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</table>

IEC Standard 60529 IP67 Compliant

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*At steady state. Higher power consumption at start up for up to five minutes.