VECTORSEIS ML21/MT21

FEATURES

- INOVA's industry-leading multicomponent, digital sensor
- Patented MEMS accelerometers to record X, Y, and Z data
- Enables measurement of true ground motion by recording the full seismic wavefield
- Compatible with INOVA’s G3i® HD and Hawk® acquisition systems
- Single-point receivers to facilitate the imaging of anisotropic reservoirs
- Tilt-insensitivity enables faster deployment of sensors in comparison to geophone arrays
- Reinforced with a more robust and rugged mechanical housing, including a 60% stronger case to withstand operational and environmental wear and tear
- 20% power consumption improvement over first generation VectorSeis
- Response down to DC by deselecting low-cut filters
- MT21 design supports marsh applications

TECHNICAL SPECIFICATIONS

**Digital Quantization:** 24 Bits (23 + Sign)

**Sample Rate:** 4 ms, 2 ms or 1 ms
0.5 ms with compatible systems

**Time Standard:** Phase locked to acquisition system clock

**Full Scale (peak)**

(Normal Mode): +/- 3.3 m/s² (at all inclinations)

(Strong Motion Mode): +/- 13.1 m/s² (source radius enabled with compatible systems; at all inclinations including gravity and offset)

**Noise (Normal Mode):**

- 0.4 μm/s²/√Hz
- 3 Hz to 375 Hz

**Equivalent Input Noise (EIN)**

(Normal Mode): 4.18 μm/s² @ 4 ms
5.95 μm/s² @ 2 ms
8.46 μm/s² @ 1 ms
3 Hz to ¾ Nyquist

**Instantaneous Dynamic Range**

(Normal Mode): 118 dB @ 4 ms
115 dB @ 2 ms
112 dB @ 1 ms

Technical specifications are typical values at 25°C
### TECHNICAL SPECIFICATIONS

**Total System**

Dynamic Range:
- 130 dB @ 4 ms
- 127 dB @ 2 ms
- 124 dB @ 1 ms
3 Hz to ¾ Nyquist (at all inclinations)

**Frequency Response:**
- Linear or minimum phase response
- -128 dB attenuation behind Nyquist
- Pass-band Ripple +/- 0.1 dB
- 93.8 Hz @ 4 ms
- 187.5 Hz @ 2 ms
- 375 Hz @ 1 ms

**Digital Low-Cut Filter:**
- None or choice of 32 frequencies from 3 to 90 Hz, 12 dB/octave

**Digital Offset Filter:**
1. **Continuous Filter**
   - 1.450 Hz @ 4 ms
   - 1.463 Hz @ 2 ms
   - 1.470 Hz @ 1 ms
   - 6 dB/octave
2. **Fixed DC Offset Removal**

**Total Harmonic Distortion:**
< 0.002%*

**Sensor to Sensor Matching:**
+/- 0.4% (at all inclinations)

**Cross Axis Isolation:**
- 46 dB

**Sensor Module Interface:**
- Proprietary 2-wire interface

**Inclination Resolution:**
+/- 0.5° arc (relative to vertical)

### PHYSICAL

**Dimensions:**
- **Body:** 16.87 cm x 5.49 cm diameter
- **Top (ML21):** 3.55 cm with an OD of 7.68 cm
- **Top (MT21):** 3.58 cm with an OD of 7.62 cm
- **Weight:** 0.771 kg, including 2 m cable and connector

### ENVIRONMENTAL

**Operating Temperature:**
- -40 °C to +75 °C

**Humidity:**
- 0 to 100%

**Operating Altitude:**
- -100 m to +5500 m

**Water Depth Rating:**
- 15 m

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*Measurement limited by mechanical test apparatus. Technical specifications are typical values at 25°C*
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RELATED PRODUCTS
Alignment Tool: For aligning all VectorSeis receivers along survey specific azimuth during deployment

Extraction Tool: For extracting VectorSeis receivers from the ground

TESTING
Embedded Power-up Self Test: Sensor wake-up and self configuration checks
Control loop validation

Operator Controlled System Tests:
Vertical orientation (evaluates each sensor axis gravity magnitude and vector sum of all 3 sensors)
Spread noise
Sensor loopback (verifies module telemetry and digital filter performance)
Telemetry error count

End of Record Validation Tests (Every Record):
Overscale status
Vertical orientation (used to apply orientation correction)
Sensor orientation deviation (evaluates orientation after each acquisition)
Sensor offset
Digital fault flags
RESPONSE CURVES

2 ms Magnitude Response

Frequency, Hz

Linear Phase Alias
Minimum Phase Alias

2 ms Phase Response

Frequency, Hz

Linear Phase Alias
Minimum Phase Alias

2 ms Impulse Responses

Time, ms

Linear Phase Alias
Minimum Phase