

- **Low Noise: 10 $\mu\text{g}/\text{Hz}$ Typical for $\pm 2\text{g}$ Full Scale Versions**
- **-55 to +125°C Operating Temperature Range**
- Flexible +8 to +32 VDC Power
- Excellent Long Term Stability
- $\pm 4\text{V}$ Differential Output or 0.5V to 4.5V Single Ended Output
- Responds to both DC and AC Acceleration (0 to 2000+ Hz)
- Low Impedance Outputs Support up to 2000 Feet of Cable
- Integrated Cable or Connector, Traditional & Small Footprint Sizes
- Simple Four (4) Wire Connection
- Rugged Anodized Aluminum Case
- Fully Calibrated and Serialized for Traceability

AVAILABLE G-RANGES

| FULL SCALE ACCELERATION | MODEL SUFFIX |
|-------------------------|--------------|
| $\pm 2 \text{ g}$ | -002 |
| $\pm 5 \text{ g}$ | -005 |
| $\pm 10 \text{ g}$ | -010 |
| $\pm 25 \text{ g}$ | -025 |
| $\pm 50 \text{ g}$ | -050 |
| $\pm 100 \text{ g}$ | -100 |
| $\pm 200 \text{ g}$ | -200 |
| $\pm 400 \text{ g}$ | -400 |

The SDI Models 2210, 2220, 2260, 2266, and 2276 Single Axis MEMS Variable Capacitive Accelerometers from Silicon Designs are rugged plug-and-play measurement devices for suitable for a wide array of demanding applications. All five models excel in zero-to-medium frequency commercial and industrial applications, particularly where reliable performance, extremely low noise, and long-term stability are absolute requirements.

The 2210 and 2220 come in a traditional 1-inch square package with an integrated cable. They are operationally identical to the 2260, 2266, and 2276, the small footprint devices for tight spaces. **The 2220 and 2276 include initial calibration certificates, and their upgraded accelerometers greatly reduce bias and scale factor temperature shift.**

LOW COST SDI 2210, 2260 & 2266

HIGH PERFORMANCE SDI 2220 & 2276



Each SDI single axis accelerometer module features a hermetically sealed low noise SDI accelerometer chip within a robust, anodized aluminum case. Onboard voltage regulation and an internal voltage reference eliminate the need for precision power supplies. They are relatively insensitive to temperature changes and gradients. The case is potted then epoxy sealed and is easily mounted via two screws, an adhesive, or by attaching a magnet.

PERFORMANCE BY G RANGE

| INPUT RANGE | FREQUENCY RESPONSE (MINIMUM, 3 DB) | SENSITIVITY, DIFFERENTIAL | OUTPUT NOISE, DIFFERENTIAL (RMS, TYPICAL) | MAX. MECHANICAL SHOCK (0.1 MS) |
|-------------|------------------------------------|---------------------------|---|--------------------------------|
| g | Hz | mV/g | $\mu\text{g}/(\text{root Hz})$ | g (peak) |
| ± 2 | 0 – 300 | 2000 | 10 | 2000 |
| ± 5 | 0 – 400 | 800 | 15 | |
| ± 10 | 0 – 600 | 400 | 23 | |
| ± 25 | 0 – 900 | 160 | 38 | |
| ± 50 | 0 – 1200 | 80 | 60 | |
| ± 100 | 0 – 1400 | 40 | 121 | 5000 |
| ± 200 | 0 – 1750 | 20 | 243 | |
| ± 400 | 0 – 2000 | 10 | 475 | |

$V_{DD}=V_R=5.0 \text{ VDC}$, $T_C=25 \text{ }^\circ\text{C}$

Single ended sensitivity is half of values shown.

ZERO (DC) TO MEDIUM FREQUENCY APPLICATIONS



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MODELS 2210, 2220, 2260, 2266 & 2276 1-AXIS ACCELEROMETERS

PERFORMANCE - ALL VERSIONS

All Models: Unless otherwise specified, Vs=+8 to +32 VDC, TC=25°C, Differential Mode. Span = ±g range = 8000 mV.

| PARAMETER | MIN | TYP | MAX | UNITS |
|---|-----|------------|------|-------------|
| Bias Calibration Error | | 0.25 | 0.9 | ± % of span |
| Scale Factor Calibration Error ¹ | | 0.5 | 1.25 | ± % |
| Non-Linearity (-90 to +90% of span) ¹ | | 0.15 | 0.5 | ± % of span |
| Cross Axis Sensitivity | | 2 | 3 | ± % |
| Power Supply Rejection Ratio | 50 | >65 | | dB |
| Output Impedance | | 1 | | Ω |
| Output Common Mode Voltage | | 2.5 | | VDC |
| Operating Voltage | 8 | | 32 | VDC |
| Operating Current (AOP & AON open) | | 7 | 10.5 | mA DC |
| Operating Temperature | -55 | | +125 | °C |
| Mass 2210-2220 / 2260 / 2266-2276 (not including cable) | | 10 / 6 / 9 | | grams |
| Cable Mass (3' integrated cable, 2210, 2220, 2260) | | 14 | | grams/meter |

Note 1: For 2g thru 50g only; 100g and greater versions are tested and specified from -65 to +65g.

NOTICE: Stresses greater than those listed may cause permanent damage to the device. These are maximum stress ratings only. Functional operation of the device at or above these conditions is not implied.

| MODELS | PARAMETER (T _c = -55 to +125°C) | MIN | TYP | MAX | UNITS |
|--|--|------|-----|------|------------------|
| Low Cost 2210 / 2260 / 2266 | Bias Temperature Shift (Coefficient) | -200 | 0 | +200 | (PPM of span)/°C |
| | Scale Factor Temperature Shift (Coefficient) | -200 | 0 | +200 | PPM/°C |
| High Performance 2220 / 2276 | Bias Temperature Shift (Coefficient) | -100 | 0 | +100 | (PPM of span)/°C |
| | Scale Factor Temperature Shift (Coefficient) | -150 | 0 | +50 | PPM/°C |

BIAS & SCALE FACTOR TEMPERATURE SHIFT EXPLAINED

| | |
|---|--|
| Bias | The accelerometer output with no acceleration present. For SDI's differential output analog accelerometers it is a signed quantity that is expressed in terms of either g or output volts and is ideally equal to zero g or zero volts. |
| Bias Temperature Shift (Coefficient) | The amount of bias to expect with change in temperature expressed as PPM of span per °C. For example, the percent of span bias shift that would occur for a 25g full scale device with a +/-200 PPM of span per °C rating and a 55 °C rise from room temperature would be: +/-200 / 1,000,000 x (80C - 25C) x 100% of span = +/-1.1% of span. The g shift would be +/-1.1% of 50g = 0.55 g. This error in terms of output voltage for a 25 g analog accelerometer would be +/-1.1% of span = +/-1.1% of 8 V = 88 mV. |
| Scale Factor | The ratio of the change in output to a unit change in the input acceleration expressed in millivolts per g (mV/g). Since the output of most accelerometers is slightly non-linear, the scale factor value is defined as the slope of the least-squares-fit line to the acceleration input vs output curve. SDI measures -90% to +90% of full scale or from -65g to +65g, whichever range is smaller. |
| Scale Factor Temperature Shift (Coefficient) | The amount of scale factor to expect with change in temperature expressed as PPM per °C. For example, the percent shift in scale factor that would occur for a device with a +200 PPM per °C rating and a 60 °C rise from room temperature would be: +200 / 1,000,000 x (85C - 25C) x 100% = +1.2%. For an analog 10g device, the scale factor would rise from its nominal (8 V)/(20 g) = 400 mV/g at +25C to 400 mV/g +1.2% = 404.8 mV/g. |

Every accelerometer has a bias and scale factor temperature coefficient, meaning the output shifts slightly due to temperature changes. Many applications operate within a relatively small temperature band or at room temperature, and therefore rarely encounter interference from the bias or scale factor temperature shifts. These customers are ideal candidates for SDI's Low Cost accelerometer modules.

For applications experiencing larger temperature variations (i.e. exposure to engine temperatures or arctic testing) SDI suggests the upgraded High Performance accelerometer modules. These have enhanced, temperature compensated, proprietary SDI accelerometer chips, which are individually tested, calibrated and verified in a climate chamber to provide the most accuracy and come with an initial calibration certificate.

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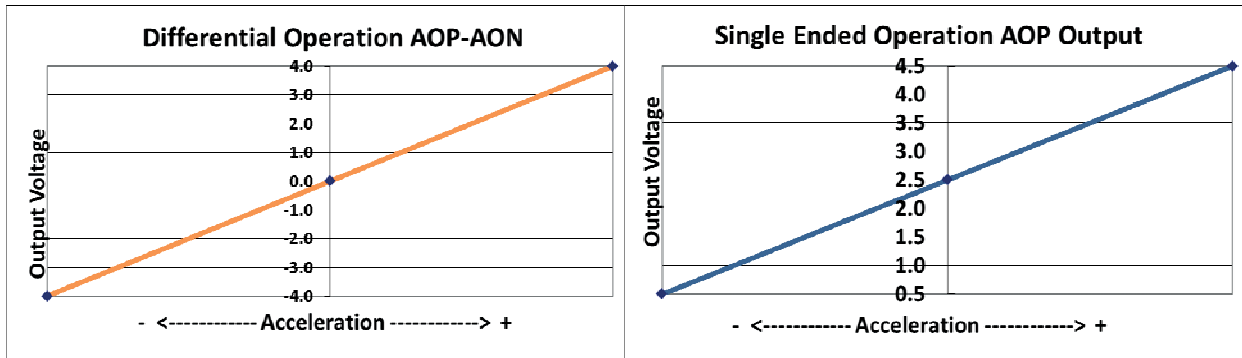


OPERATION

SDI Models 2210, 2220, 2260, 2266, and 2276 MEMS Variable Capacitive Accelerometers provide optimal performance when they are connected to instrumentation in a differential configuration using both the AOP and AON output signals, but they also support single ended operation for complete flexibility.

These Accelerometers produce differential analog output voltage pairs (AON & AOP) which vary with acceleration. The signal outputs are fully differential about a common mode voltage of approximately 2.5 volts. At zero acceleration, the output differential voltage is nominally 0 volts DC; at ±full scale acceleration, the output is ±4 volts DC, respectively, as shown in the figure (below). The output scale factor is independent from the supply voltage of +8 to +32 volts.

When a differential connection is not possible, SDI recommends connecting the accelerometer to instrumentation in single ended mode by **connecting AOP and GND** to the instrumentation and **leaving AON disconnected**. Keep in mind that the signal to noise ratio is reduced by half for a single-ended vs. a differential connection.



SIGNALS & CABLE SPECIFICATIONS

2210 / 2220 / 2260: The standard 3' integrated cable consists of four 28 AWG (7x36) tin-plated copper wires with Teflon FEP insulation surrounded by a 40 AWG tin plated copper braided shield. The shield jacket is Teflon FEP with a nominal outer diameter of 0.096". The cable's braided shield is electrically connected to the case. The black ground (GND) wire is isolated from the case.

2266 / 2276: The case's integrated connector shells, pins and sockets are gold plated brass. The 4PIN-CAB cable consists of four 30 AWG (7x38) silver-plated copper wires with PTFE insulation surrounded by a braided shield. The black FEP shield jacket has a nominal outer diameter of 0.100".

Both cable styles end in a 4-wire pigtail (shown below).



| WIRE | SIGNAL |
|--------------------------|-----------------|
| VS: red wire | Power |
| GND: black wire | Ground |
| AOP: (Output) green wire | Positive output |
| AON: (Output) white wire | Negative output |



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2266 / 2276 STANDARD CABLE LENGTHS



The 4PIN-CAB is available in four standard lengths, and custom lengths may be available for special order.

| NAME | LENGTH - FEET | LENGTH - METERS (APPROXIMATE) |
|-------------|---------------|-------------------------------|
| 4PIN-CAB-04 | 4 Feet | 1.2 Meters |
| 4PIN-CAB-14 | 14 Feet | 4.4 Meters |
| 4PIN-CAB-33 | 33 Feet | 10 Meters |
| 4PIN-CAB-50 | 50 Feet | 15.4 Meters |

CABLE LENGTH CONSIDERATIONS

Cable lengths of up to 15 meters (50 feet) can be used without the need to test for output instability. For cable lengths exceeding 15 meters, Silicon Designs recommends checking each individual installation for oscillation by tapping the accelerometer and watching the differential output for oscillation in the 20 kHz to 50 kHz region. If no oscillation is present, extended cable length should behave as expected. From the standpoint of output current drive and slew rate limitations, all SDI Universal Accelerometers are capable of driving over 600 meters (2000 feet) of cable. However, at some length ranging between 15 and 600 meters, each device will likely begin to exhibit oscillation.

OPTIONAL ACCESSORIES



Model 2235 Stud Mount Adaptor Block

- Stud mount Adaptor for any SDI module
- Anodized 6061-T6 aluminum block, 6.2 grams, 0.7" x 1" footprint

Model 2230 Triaxial Mounting Block

- Anodized 6061-T6 aluminum 1.25" cube
- Mix and Match up to 3 single axis modules in similar or different g-levels for a custom orthogonal two or three axis accelerometer



ALTERNATIVE MODELS

Both performance levels of SDI's single axis accelerometers are also built in three-axis configurations for multi-dimensional sensing.

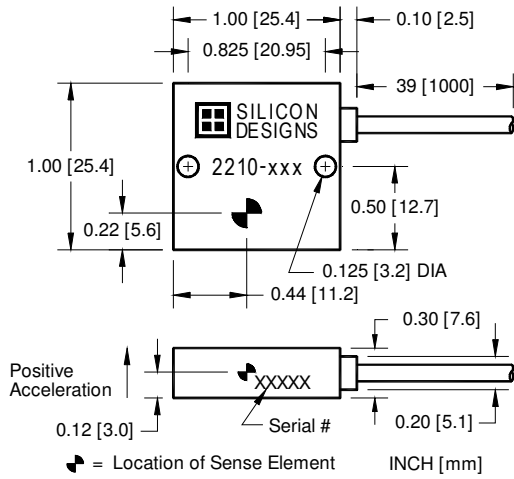


The SDI Models 2460 and 2466 are the triaxial versions of the 2210 and 2260/2266, respectively, rounding out the SDI Universal Module low-cost family. The high performance SDI Models 2470 and 2476 are the three axis versions of the 2220 and 2276 with similarly upgraded SDI accelerometer chips, improved bias and scale factor temperature shift performance, and include an initial calibration certificate.



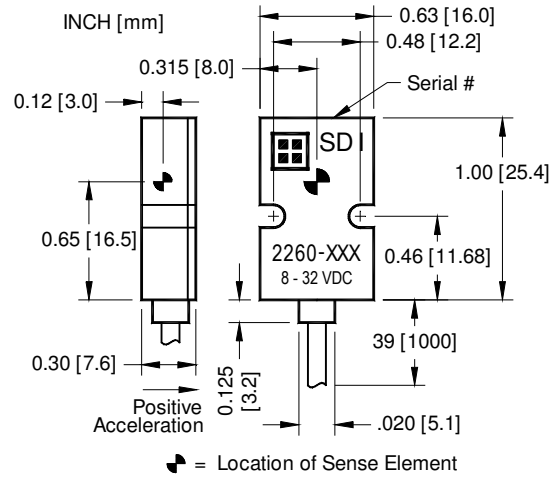
The 2460 and 2470 include a 3-foot integrated cable and are operationally identical to the 2466 and 2476, which feature connectors for easily customized cable lengths and positions.

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PACKAGE DIMENSIONS


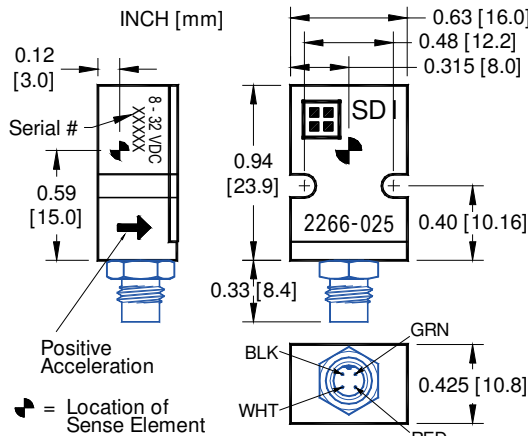
☐ = Location of Sense Element INCH [mm]

2210 / 2220
Module Mass: 10 Grams



☐ = Location of Sense Element

2260
Module Mass: 8 Grams



☐ = Location of Sense Element

Note: Connector index may not be positioned as drawn

2266 / 2276
Module Mass: 9 Grams

Data sheets dated 1-November-2015 and newer apply to 2210/2220's with serial numbers above 23532, 2260's with serial numbers above 3870, and 2266/2276's with serial numbers above 1000. Contact SDI for data sheets pertaining to parts made prior to these.

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