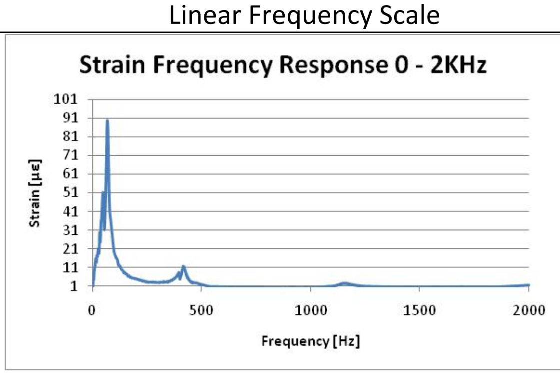
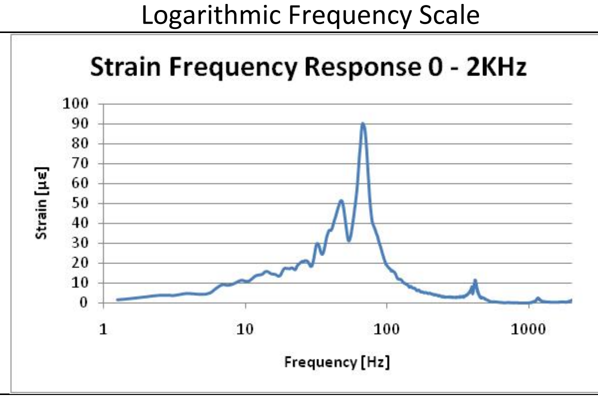
# World's Best Strain Gauge!

NEW

## Enhance Your Strain Measurement Capabilities with the S1

| Strain Measurement Application | Resistive Strain Gauge | IntelliVibe® S1 Strain Gauge |
|---|---|---|
| Static strain measurement | ✔ | |
| Thin walled structures | ✔ | |
| Highly curved structures | ✔ | |
| Resolution of strain components | ✔ | |
| Repeated measurement over time | | ✔ |
| Measurement across wide temperature range without compensation | | ✔ |
| Strain measurement in less than a minute from start to finish | | ✔ |
| Broadband dynamic measurement | | ✔ |
| Accelerometer replacement | | ✔ |
| Near instant and highly accurate estimate of resonant frequencies | | ✔ |
| Real-time crack generation and propagation detection | | ✔ |
| Real-time incipient failure detection | | ✔ |
| 15 mV/με sensitivity | | ✔ |
| Sub με resolution | | ✔ |
| Measurement without external power | | ✔ |
| Measurement without soldering leads | | ✔ |
| Measurement with a single wire | | ✔ |
| High-sensitivity, high-resolution strain measurement without Wheatstone bridges, completion modules, or any other signal conditioning equipment in less than a minute from start to finish | | ✔ |

## Get Accurate Frequency Response Functions in Minutes Not Days

| Linear Frequency Scale | Logarithmic Frequency Scale |
|---|---|
|  |  |

## Directions for Use

In order to measure strain with the IntelliVibe™ S1 non-directional strain gauge, please follow these steps:

1. Identify the area on your structure where you want to measure strain.
2. Make sure that the area surface is flat and clean from any dust or debris.
3. Wipe both the sensor and the structure with isopropyl alcohol (available from www.intellivibestore.com) and dry with a clean dry cloth.
4. Apply a generous amount of quick-set adhesive to the sensor, covering the entire bottom surface. We recommend the Loctite Super Bonder Gel 409 (available from www.intellivibestore.com) because it does not run on vertical surfaces and does not set too quickly allowing accurate positioning of the sensor.
5. Glue the sensor to the structure and wait the appropriate amount of time for the glue to set.
6. Attach the Hirose side of the Hirose to BNC adapter cable (available from www.intellivibestore.com) to the left-side connector marked with the letter "U".
7. Attach the BNC side of the adapter cable to a BNC cable using a BNC connector (available from www.intellivibestore.com).
8. Attach the BNC cable to the input channel of a data acquisition or logging device (available from www.intellivibestore.com).
9. Operate the structure under normal loading conditions. The strain measurement will appear as voltage.
10. To estimate strain in micro-strain, divide the recorded voltage (in milli-volts) by the S1 sensitivity of 2.844 [mV/µε].
11. **For thin-walled structures only:** relocate the cable to the right-side connector marked with the letter "B". Repeat Steps 7 through 10 and compare the output level to the previous, unimorph measurement. Determine whether unimorph or bimorph gives higher output and use the "U" or "B" connector based on this determination.

## Specifications

| Specification | Value |
|---|---|
| **Minimum sensitivity (unamplified) [mV/µε]** | **15.65** |
| **Measurement range [peak µε]** | 3,000 |
| **Frequency range [Hz]** | 1 - 20,000 |
| **Non-linearity [R-square value]** | 0.9998 |
| **Shock limit [peak g]** | Unlimited |
| **Temperature range [C]** | -60 to 120 |
| **Excitation voltage** | Not required |
| **Amplification** | Not required |
| **Capacitance [nF]** | 20.00 |
| **Internal gain [µA/V]** | 0.75 |
| **Sensing element** | PZT |
| **Number of sensing elements per unit** | 2 |
| **Housing material** | Fiberglass (FR4) |
| **Sealing** | Epoxy (printed circuit board) |
| **Overall Size (Width × Length × Height) [mm]** | 25.4×25.4×1.3 |
| **PZT wafer size (Width × Length × Height) [mm]** | 19.05×19.05×0.1 |
| **Weight [gr]** | 4.00 |
| **Mounting** | Adhesive |
| | |

## Sensitivity Determination

The sensitivity of the S1 was determined using a cantilever beam excited at its free end by a shaker. The excitation force was determined using a PCB Piezotronics load cell. The S1 was mounted at the root of the beam and the strain at the center of the S1 was computed using the formula for static stress in cantilever beams under point force excitation:

$$\varepsilon = 6F(L-a-b)/Ech^2$$

Where $F$ is the point force measured by the load cell in Newtons, $L$ is the total free length of the beam in meters [0.24765], $a$ is the distance from the free end to the point force in meters [0.01905], $b$ is the distance from the clamped end to the center of the S1 in meters [0.0127], $E$ is the elastic modulus of the steel in Pascals [$2\times10^{11}$], $c$ [0.1016] is the width of the beam in meters, and $h$ [0.00635] is the thickness of the beam in meters.

The test was performed using sinusoidal force at 2Hz, thus ensuring that the beam response was static and not affected by dynamic amplification. The results of the sensitivity determination test appear in the figure below and show a sensitivity of 15.65 [mV/µε] with nonlinearity of less than 0.1%.