

APPLICATION NOTE

Micron Instruments
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DETERMINING EXCITATION VOLTAGE FOR MICRON INSTRUMENTS SEMICONDUCTOR STRAIN GAGES

CONSIDERATIONS

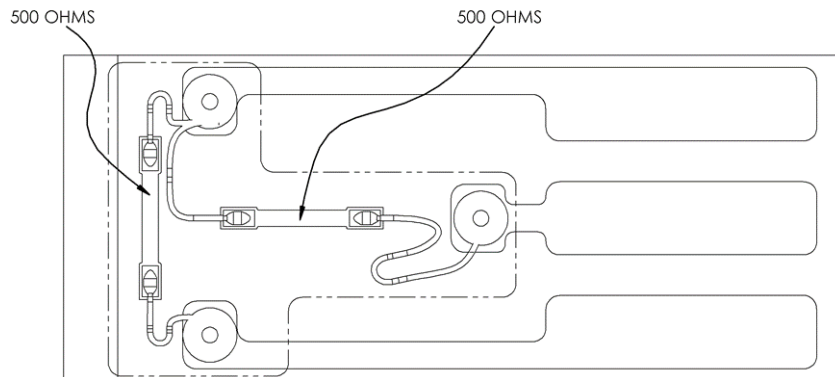
Excitation of Micron Instruments semiconductor strain gages (SSGs) is application dependent. The amount of voltage that a Micron Silicon SSG can sustain without damage depends on a number of variables, including the size of the gage, resistance of the gage, the thickness and type of adhesive used to bond the gage, the material the gage is bonded to, temperature range, accuracy required, etc.

Microns 0.027" gage has an active area of 0.013" in the center of the gage, which is 0.005" wide, 0.0005" thick, and has an ambient resistance of 500Ω. The ends of the gage are shorted and have lead wires attached. Current through the gage heats the gage, which is called *self-heating*. Most of Micron's SSGs have the same width and thickness, so it is the active length that determines the maximum voltage without self-heating. The 0.027" gage is one of our smallest gages. Larger gages can have a higher excitation without self-heating.

Gages are normally bonded down when used. They transmit heat through a layer of adhesive Micron uses to bond gages. Micron has developed a procedure that bonds the gage with Epoxylite 6203 FF to a thickness of 0.00075" +/- 0.00005". The gage is typically bonded to a metal material with good thermal conductivity. Bonded gages will operate with much more voltage than unbounded gages.

RECOMMENDATIONS

For rule of thumb, Micron's SS-060-033-500P gage, which is 060" long with and 0.033" active area, will not have significant self-heating when bonded at 0.5 mW ($EE/R = \text{watts}$) which is 0.5V per gage. For example, a bridge circuit using four 0.060" 500Ω gages, two in series on each side, it would normally have a one-volt drop across the bridge. The SS-060-033-1000P (1,000Ω) would not have any significant self-heating at 0.7 volts per gage, which is 0.5 mW. Micron's SSGs will not be damaged below 10 times the recommended voltage, which in this case is 7 volts per gage.



In some applications, some self-heating is acceptable. This is determined by looking at the output of the bridge with a voltmeter. If the output is stable, there is no significant self-heating. The voltage can be increased until the output becomes too unstable for the application. Reduce the voltage until it is acceptable, and that becomes the optimum excitation for that gage or bridge.

Self heating decreases with increasing temperature due to the TCR (thermal coefficient of resistance) which increases with increasing temperature reducing the potential for self-heating. Therefore, decreasing the temperature will increase the self-heating.

CONTACT US

Micron Instruments works with innovative companies on a wide variety of sensor design considerations, including optimal selection, placement, and processing of semiconductor strain gages. If you require additional assistance with determining the proper excitation voltage for your SSG application, or if you'd like to discuss your sensor application or design, please contact us for a free, confidential consultation either by email (Sensors@MicronInstruments.com) or phone (805-522-4676).