

# Spot-Weldable Strain Gages

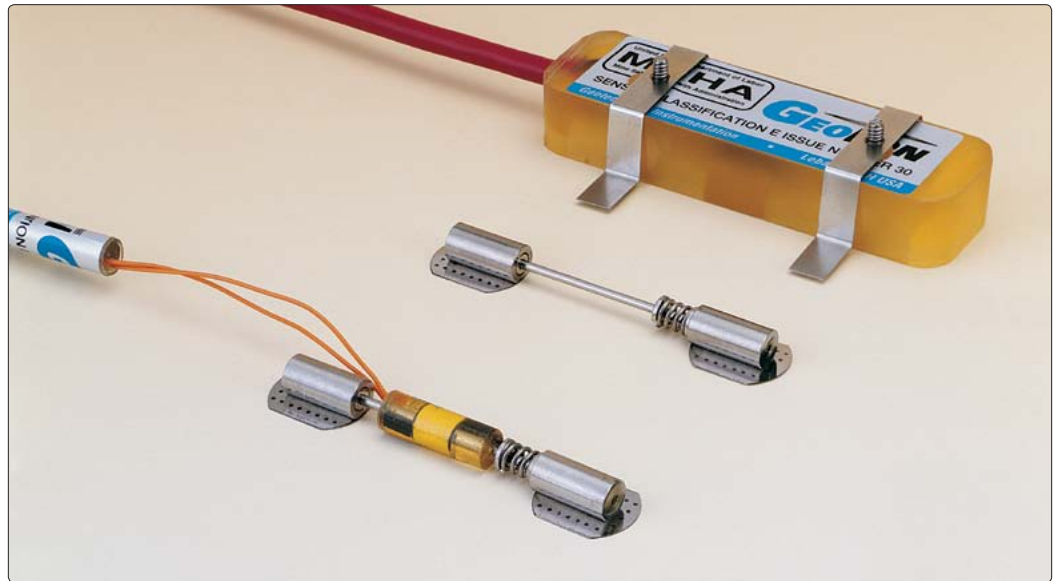
## Applications

The 4100 Series Vibrating Wire Strain gages are designed to measure strains in or on...

- Pipelines
- Bridges
- Buildings
- Tunnel linings
- Piles
- Reinforcement bars



● Model 4151 Strain Gage mounted to a fiberglass rebar.



● Model 4150 (front) and Model 4100 Spot-Weldable Strain Gages.

## Operating Principle

The Model 4100 and 4150 Vibrating Wire Strain Gages are designed primarily to measure strains on the surface of steel structures, although they may also be used to measure strains in other materials. Essentially, the gages consist of a steel wire tensioned between two mounting blocks. These blocks are attached to stainless steel shim-stock tabs, which can be either spot-welded or epoxy bonded to the surface in question. Also available is the Model 4151 Strain Gage with groutable pins welded to the end-blocks.

Deformation of the structure under load causes the end blocks to move relative to one another resulting in a change in the wire tension and a corresponding change in the fundamental, resonant frequency of vibration of the wire.

The wire is plucked by means of an electronic coil and permanent magnet connected by a signal cable to a readout box, which sends voltage pulses to the coil. The vibration of the wire so produced induces an alternating current in the coil—the frequency of which is the same as the vibrational frequency of the wire and is measured using the same electronic coil and a readout box. The frequency value is squared and multiplied by a constant so that the values displayed by the readout box are directly in micro-strain.

## Advantages and Limitations

The Model 4100 and 4150 strain gages are small so that they can be used in confined spaces. They are particularly useful for spot-welding to steel reinforcement bars and rock bolts and for spot welding to pipelines and other sensitive structures where arc welding is prohibited, or where the services of an arc welder are unavailable.

All components are made from stainless steel for corrosion protection and the gages are waterproof.

The Model 4100 and 4150 enjoy all the advantages of vibrating wire sensors: i.e., excellent long term stability, maximum resistance to the effects of water and a frequency output suitable for transmission over very long cables.

Each gage also incorporates a thermistor so that the temperature can be read and displayed by the readout box.

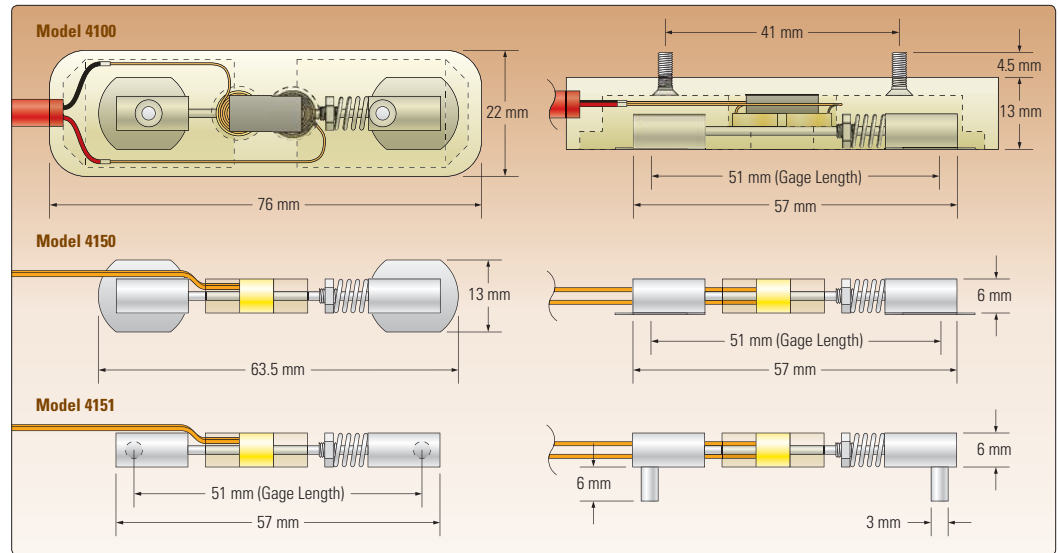
An external spring holds the wire in initial tension thus greatly simplifying the installation procedure.

Gages are certified by MSHA for use in explosive atmospheres when used with certified readouts.

The gages are not suitable for measuring dynamic (rapidly changing) strains.



● Model 4150 under the Model 4150-1 protective cover plate, with dimensions.



● Dimensions of the Models 4100, 4150 and 4151 strain gages.

### System Components

The Model 4100 consists of two main components: the gage itself and a separate plucking coil housing. The stainless steel tube around the wire is O-ring sealed so that the gages are waterproof. This tube floats free and thus does not impede the free movement of the end blocks. The coil housing contains a thermistor and fits loosely over the gage. It is secured in place by means of stainless steel straps. It also serves as a measure of protection from mechanical damage.

The model 4150 consists of only one component since the coil housing is encapsulated around the stainless steel tube that protects the wire. The Instrument cable is connected to the coil housing through small diameter lead wires. A thermistor, contained in a small encapsulation, is provided at the end of the cable. A separate

cover plate protects the gage from mechanical damage. Stainless steel straps hold the cable and cover plate firmly to the structure.

The model 4151 is a modification of the 4150 strain gage in which the spot-weldable tabs have been replaced by pins welded to the end blocks and designed to be grouted into two short holes drilled into the material under test. Special versions of the 4151 are available with extended ranges: 5,000  $\mu\epsilon$  (4151-1) and 10,000  $\mu\epsilon$  (4151-2). These gages are particularly useful for measurements in high strain regimes such as on plastic pipes or piles and on fiberglass structural members and rebars.

Accessories include setting tools, capacitive discharge welder (for spot welding) and epoxy kits (for bonded applications).

### Technical Specifications

	4100	4150	4151	4151-1	4151-2
Standard Range	3000 $\mu\epsilon$	3000 $\mu\epsilon$	3000 $\mu\epsilon$	5,000 $\mu\epsilon$ <sup>1</sup>	10,000 $\mu\epsilon$ <sup>1</sup>
Resolution	0.4 $\mu\epsilon$	0.4 $\mu\epsilon$	0.4 $\mu\epsilon$	1.0 $\mu\epsilon$	2.0 $\mu\epsilon$
Accuracy <sup>2</sup>	$\pm 0.5\%$ F.S.	$\pm 0.5\%$ F.S.	$\pm 0.5\%$ F.S.	$\pm 0.5\%$ F.S.	$\pm 0.5\%$ F.S.
Nonlinearity	< 0.5% F.S.	< 0.5% F.S.	< 0.5% F.S.	< 0.5% F.S.	< 0.5% F.S.
Temperature Range	-20°C to +80°C	-20°C to +80°C	-20°C to +80°C	-20°C to +80°C	-20°C to +80°C
Active Gage Length	51 mm	51 mm	51 mm	51 mm	51 mm

<sup>1</sup>Depends on the readout; figures above pertain to the GK-401 Readout.

<sup>2</sup> $\pm 0.5\%$  F.S. with standard batch calibration.  $\pm 0.1\%$  F.S. with individual calibration. Accuracy established under laboratory conditions.



Geokon, Incorporated  
 48 Spencer Street  
 Lebanon, NH 03766  
 USA

1 • 603 • 448 • 1562  
 1 • 603 • 448 • 3216  
 geokon@geokon.com  
 www.geokon.com

