

# ARC WELDABLE STRAIN GAUGE

MODEL 4000, 4050



Model 4000 Vibrating Wire Strain Gauge with pluck and read coil, mounting blocks and hose clamp.

## APPLICATIONS

The Model 4000 Vibrating Wire Strain Gauge is designed primarily for long-term strain measurements of steel structures including

- Tunnel linings
- Excavation bracing
- Arches
- Struts
- Sheet piling
- Piles
- Bridges

## OPERATING PRINCIPLE

The Model 4000 Series Vibrating Wire Arc Weldable Strain Gauges are designed to be arc welded to the surface of a structural steel member. Strains are measured using the vibrating wire principle. A length of steel wire tensioned between two mounting blocks that are arc welded to the surface of a structural steel member. Deformation of the structure under load produces relative

movement between the two mounting blocks causing a change in the wire tension and a corresponding change in its frequency of vibration.

The resonant frequency is measured by plucking the wire using an electromagnetic coil connected through a signal cable to a readout, which also measures the frequency and displays the strain in the wire directly in microstrain.

The Model 4000 can also be used on other materials such as wood, rock or concrete. Standard mounting blocks can be epoxy bonded to the surface or special concrete mounting blocks can be used in which short rebar studs are grouted into boreholes.

The Model 4050 is a modified version of the Model 4000 designed for measuring strains over a longer base length.

## ADVANTAGES AND LIMITATIONS

The Model 4000 is the most popular vibrating wire strain gauge in the world on account of its elegant, robust design combined with all the usual advantages of vibrating wire technology, i.e. long-term stability, high resistance to water intrusion and lightning damage and the ability to be used with long signal cables.

The electronic coil can be detached from the rest of the gauge at any time without disturbing the gauge reading. This provides a degree of flexibility in the event of cable damage. Gauges and coils are re-usable.

Temperature effects are automatically compensated for when the gauges are welded to steel. The thermistor permits real thermal induced strain to be distinguished from load induced strains.



The Model 4050 with a 305 mm active gauge length.

## SYSTEM COMPONENTS

The vibrating wire is protected inside a stainless steel tube with 'O' ring seals at both ends for complete water-proofing. The electronic coil clips over the center of the tube and a thermistor is encapsulated with the coil to permit the measurement of temperature.

The Model 4000-8 spacer bar and welding jig is used to correctly space the mounting blocks during welding. Cover plates (Model 4000-6) can be used to protect the gauge from accidental damage.

Readout is accomplished using the Model GK-404 or GK-406 Readouts.

For remote unattended applications, the Model 8600 dataloggers or Model 8900 GeoNet Wireless Data Hosting System can be used to provide automatic data collection at predetermined intervals and data transmission via wireless methods.



GEOKON Model GK-406 Readout for use with the Model 4000 and 4050 Strain Gauges.



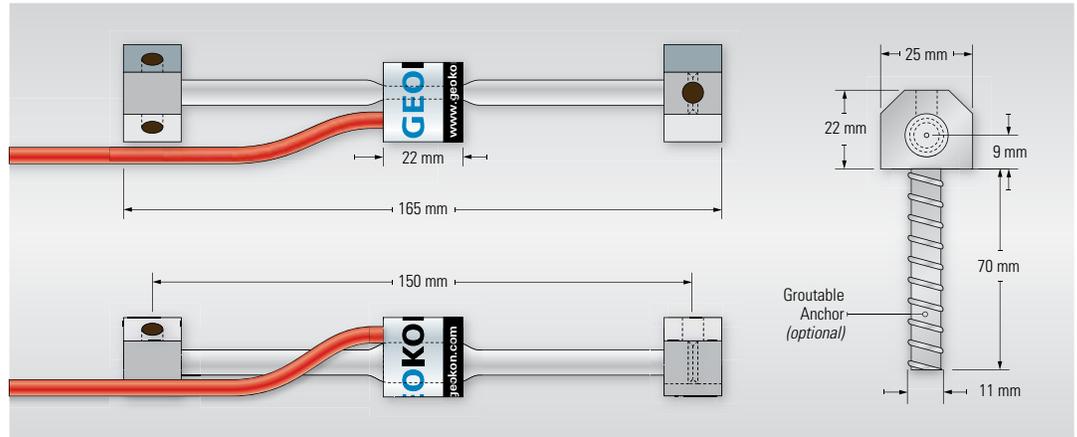
A spacer bar and welding jig (Model 4000-8) can be used during strain gauge installation.



Concrete mounting blocks (optional).



Cover plate (optional).



Dimensions of the Model 4000 and concrete mounting blocks.

#### TECHNICAL SPECIFICATIONS

	4000	4050
Standard Range <sup>1</sup>	3000 $\mu\epsilon$	3000 $\mu\epsilon$
Resolution	1.0 $\mu\epsilon$	1.0 $\mu\epsilon$
Accuracy <sup>2</sup>	$\pm 0.5\%$ F.S.	$\pm 0.5\%$ F.S.
Nonlinearity	$< 0.5\%$ F.S.	$< 0.5\%$ F.S.
Temperature Range <sup>3</sup>	$-20\text{ }^{\circ}\text{C}$ to $+80\text{ }^{\circ}\text{C}$	$-20\text{ }^{\circ}\text{C}$ to $+80\text{ }^{\circ}\text{C}$
Active Gauge Length <sup>4</sup>	150 mm (5.875 in.)	305 mm (12 in.)

<sup>1</sup>Also available with 5,000 or 10,000  $\mu\epsilon$  range (please contact GEOKON for details).

<sup>2</sup> $\pm 0.5\%$  F.S. with standard batch calibration.  $\pm 0.1\%$  F.S. with individual calibration.

<sup>3</sup>Other ranges available on request.

<sup>4</sup>Other lengths available on request.

#### 4000 ORDERING INFORMATION<sup>1</sup>

**4000:** Vibrating Wire Strain gauge only.

**4000A-1:** Vibrating Wire Strain gauge, complete with plucking coil, 3 m cable, thermistor, hose clamp, and arc weldable mounting blocks.

**4000A-2:** Vibrating Wire Strain gauge, complete with plucking coil, thermistor, hose clamp, and arc weldable mounting blocks. Cable sold separately.

**4000B-1:** Vibrating Wire Strain gauge, complete with plucking coil, 3 m cable, thermistor, hose clamp, and rebar mounting blocks.

**4000B-2:** Vibrating Wire Strain gauge, complete with plucking coil, thermistor, hose clamp, and rebar mounting blocks. Cable sold separately.

**4000C-1:** Vibrating Wire Strain gauge, complete with plucking coil, 3 m cable, thermistor, and hose clamp. Mounting blocks not included.

**4000C-2:** Vibrating Wire Strain gauge, complete with plucking coil, thermistor, and hose clamp. Mounting blocks not included. Cable sold separately.

**4000D-1:** Vibrating Wire Strain gauge, complete with plucking coil, 3 m cable, and thermistor. Mounting blocks and hose clamps not included.

**02-187V3:** Red PVC Cable, 4.75 mm ( $\pm 0.25$  mm) [0.187"]  $\varnothing$ , 2 twisted pairs, for the above.

**4000-1:** Plucking coil and hose clamp. Includes thermistor. Cable sold separately.

**4000-3:** Plucking coil and hose clamp. Includes thermistor and 3 m cable.

**4000-4:** Arc weldable mounting blocks.

**4000-5:** Concrete mounting rebar blocks.

**4000-6:** Galvanized steel cover plate, 0.6 m length. Includes mounting hardware.

**4000-8:** Welding jig and spacer bar installation tools.

**4000-9:** Spacer bar installation tool.

**4000-10:** Installation Tool for cover plates.

**4000-11:** Installation Tools for strain gauges with rebar-style mounting blocks (includes spacer bar, modified jig, and drilling template).

**4000-13:** Cover Plate for concrete installation. Requires TLS-209 Rawl Setting Tool.

**4000-15:** Adhesive Kit. Devcon putty, for concrete installations. (Sufficient adhesive for up to 50 gauges).

**4000-18:** Adhesive Kit. H4500 epoxy, for steel installations. (Sufficient adhesive for up to 50 gauges).

**TLS-209:** Rawl, Setting Tool, 3/8"

#### 4050 ORDERING INFORMATION<sup>1</sup>

**4050:** Vibrating Wire Strain gauge, 305 mm extended length version, complete with plucking coil, and thermistor. Mounting blocks sold separately. (Model 4050 Strain Gauges are batch calibrated. Individual calibrations are available upon request for an added fee.)

**4000-4:** Arc weldable mounting blocks.

**4000-5:** Concrete mounting rebar blocks.

**02-187V3:** Red PVC Cable, 4.75 mm ( $\pm 0.25$  mm) [0.187"]  $\varnothing$ , 2 twisted pairs, for the above.

**4050-8:** Welding jig and spacer bar installation tools.

**4050-11:** Installation Tools for strain gauges with rebar-style mounting blocks (includes spacer bar, modified jig and drilling template).

<sup>1</sup>Unless otherwise specified, Strain Gauges are batch calibrated. Individual calibrations are available upon request for an additional fee.