CONCRETE EMBEDMENT STRAIN GAUGES

GEOKON®

MODEL 4200 SERIES



Model 4202 (front), Model 4200 (shown with pluck and read coil) (center) and Model 4210 (rear) Concrete Embedment Strain Gauges.

APPLICATIONS

The Model 4200, 4202 and 4210 are designed to measure strains in or on:

- Foundations
- Piles
- Bridges
- Dams
- Containment vessels
- Tunnel liners
- Mass concrete with coarse aggregates
- Laboratories and/or where space limitations exist



GeoNet Vibrating Wire Data Logger.

OPERATING PRINCIPLE

The Model 4200 Series Vibrating Wire Embedment Strain Gauges are designed for direct embedment in concrete. The Model 4200 (standard model) has a 153 mm gage length and is commonly used for strain measurements in foundations, piles, bridges, dams, containment vessels, tunnel liners, etc. The Model 4210 has a 250 mm gage length and is designed for use in mass concrete with coarse aggregates. It is extra rugged to resist bending and has large flanges to provide greater engagement area. The 4202 and 4204 (51 mm and 102 mm gage lengths, respectively) are designed for laboratory use and/or where there are space limitations.

Strains are measured using the vibrating wire principle: a length of steel wire is tensioned between two end blocks that are embedded directly in concrete. Deformations (i.e. strain changes) of the concrete mass, will cause the two end blocks to move relative to one another, thus altering the tension in the steel wire. The tension is measured by plucking the wire and measuring its resonant frequency of vibration using an electromagnetic coil.

ADVANTAGES AND LIMITATIONS

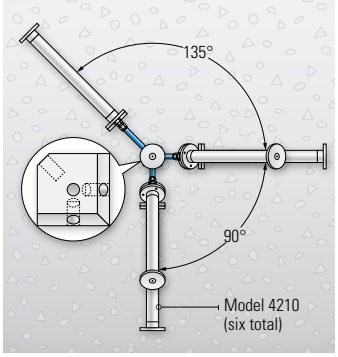
The Model 4200 Series Strain Gauges enjoy all the advantages of vibrating wire sensors, which includes excellent long term stability, maximum resistance to the effects of water, and a frequency output suitable for transmission over very long cables.

All components are made from stainless steel for corrosion protection and the gauges are fully waterproof. The Model 4210 is very rugged and designed to withstand the rigors of concrete placement.

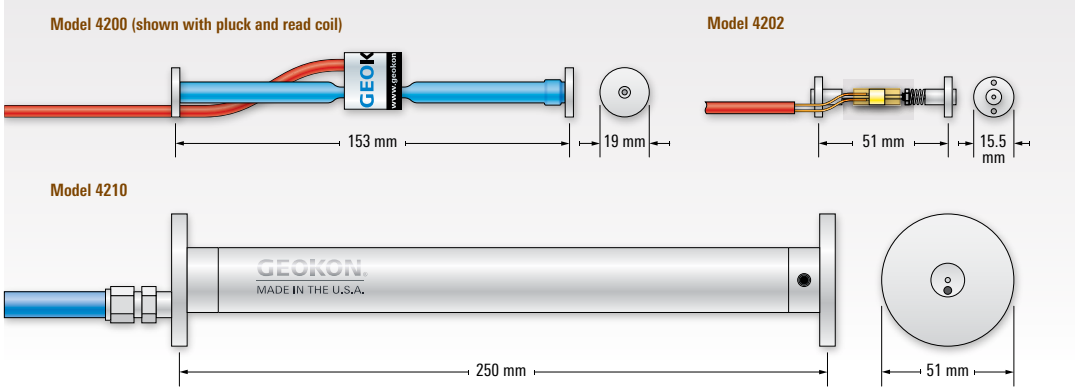
Each gauge incorporates a thermistor so that the temperature can be read and displayed by the readout.

Extended range, low modulus, and high temperature versions are also available. The Model 4200HT is designed for short-term use at temperatures up to 200 °C.

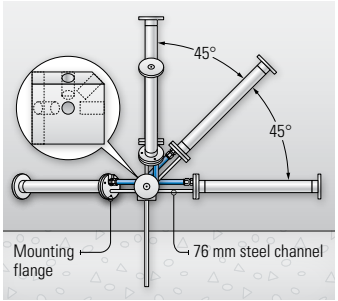
Strain Gauges can be customized to meet your needs. Our staff will work with you throughout the process. Common customizations include gage length, materials, mounting options, temperature range, etc.



Top view of a Model 4210 Strain Gauge rosette configuration. Inset shows rosette fixture (enlarged for detail).



Dimensions of the 4200 Series Strain Gauges.



Front view of a Model 4210 Strain Gauge rosette configuration. Inset shows rosette fixture (enlarged for detail).

SYSTEM COMPONENTS

The strain gauges are shipped ready for installation with the correct amount of cable attached. Installation is accomplished by attaching the strain gauge onto, or suspending it between, reinforcing bar. In mass concrete, rosette fixtures are used to hold multiple strain gauges in different orientations, allowing the measurement of strain in multiple directions.

Also available are no stress-strain enclosures (double-wall plastic containers lined with Styrofoam) designed for use in concrete dams. These enclosures isolate one strain gauge from the stress field in the concrete, thereby allowing the effects of moisture, temperature, autogenous-growth, etc., to be estimated and corrected.

All standard strain gauge models are equipped with integral thermistors for the simultaneous measurement of temperature.

Data acquisition can be performed manually via direct readout or autonomously using data loggers that provide automatic data collection at predetermined intervals and wireless data transmission.



Model 4200 Strain Gauge (shown with pluck and read coil and hose clamp) mounted to reinforcing bar using Model 4200-SPACER brackets.

TECHNICAL SPECIFICATIONS

	4200	4200-ER-5 4200-ER-10	4200L	4200HT	4202	4204	4210
Range[1]	3000 με	4200-6: 5000 με 4200-7: 10000 με	3000 με	3000 με	3000 με	3000 με	3000 με
Resolution	1.0 με	2.0 to 5.0 με	1.0 με	1.0 με	0.4 με	1.0 με	0.4 με
Accuracy[2]	±0.5% F.S.[3]	±0.5% F.S.	±0.5% F.S.[3]	±0.5% F.S.[3]	±0.5% F.S.[3]	±0.5% F.S.[3]	±0.5% F.S.[3]
Nonlinearity	< 0.5% F.S.	±2.5-4.0% F.S.	< 0.5% F.S.	< 0.5% F.S.	< 0.5% F.S.	< 0.5% F.S.	< 0.5% F.S.
Coil Resistance	180 Ω	180 Ω	180 Ω	120 Ω	50 Ω	180 Ω	180 Ω
Frequency Datum[4]	800 Hz	800 Hz	800 Hz	800 Hz	2600 Hz	1250 Hz	2600 Hz
Thermal Coefficient of Expansion	12.2 ppm/°C	variable	12.2 ppm/°C	12.2 ppm/°C	12.2 ppm/°C	12.2 ppm/°C	12.2 ppm/°C
Temperature Range	–20 °C to +80 °C[1]	–20 °C to +80 °C[1]	–20 °C to +80 °C[1]	–20 °C to +200 °C	–20 °C to +80 °C[1]	–20 °C to +80 °C[1]	–20 °C to +80 °C[1]
Cable Type	4-conductor, 2 twisted pairs, 22 AWG (for all models)						
Cable Jacket	Red PVC, 4.75 mm Ø	Red PVC, 4.75 mm Ø	Red PVC, 4.75 mm Ø	White Teflon® 5.20 mm Ø	Red PVC, 4.75 mm Ø	Red PVC, 4.75 mm Ø	Blue PVC, 6.35 mm Ø
Active Gage Length	153 mm (6.025")	153 mm (6.025")	153 mm (6.025")	153 mm (6.025")	51 mm (2")	102 mm (4.016")	254 mm (10")

[1]Other ranges available on request. | [2]Transducer accuracy established under laboratory conditions.
[3]±0.5% F.S. with standard batch calibration. ±0.1% F.S. with individual calibration. | [4]Typical. | [5]Other lengths available on request.



Model 4200-ER-5 Extended Range (5,000 με) Strain Gauge (shown with pluck and read coil).



Model 4200-ER-10 Extended Range (10,000 με) Strain Gauge (shown with pluck and read coil).



Model 4200L Low Modulus Strain Gauge.



Model 4200HT High Temp (200° C) Strain Gauge.



Model 4200X-TI Custom Cryogenic Titanium Strain Gauge.



Model 4202X Custom 3D Strain Gauge.

ORDERING INFORMATION[1]

4200: Vibrating Wire Strain Gauge, concrete embedment type, 153 mm gage length. (Strain gauge only.)
4200A-1: Model 4200 Strain Gauge, with plucking coil, thermistor, hose clamp, and 3 m cable.
4200A-2: Model 4200 Strain Gauge, with plucking coil, thermistor and hose clamp. Cable sold separately.
4200L: Model 4200 Strain Gauge, low modulus version for measuring concrete curing strains, with plucking coil, thermistor, and hose clamp. Cable sold separately
4200-ER-5: Vibrating Wire Strain Gauge, concrete embedment type, 5,000 με range, gauge only. Includes individual calibration.
4200-ER-5-SL: Model 4200-ER-5 Strain Gauge, with plucking coil, 3 m cable, thermistor, hose clamp, arc weldable mounting blocks, and individual calibration.
4200-ER-5-VL: Model 4200-ER-5 Strain Gauge, with plucking coil, thermistor, hose clamp, arc weldable mounting blocks, and individual calibration. Cable sold separately.
4200-ER-10: Vibrating Wire Strain Gauge, concrete embedment type, 10,000 με range, gauge only. Includes individual calibrations.
4200-ER-10-SL: Model 4200-ER-10 Strain Gauge, with plucking coil, 3 m cable, thermistor, hose clamp, arc weldable mounting blocks, and individual calibration.
4200-ER-10-VL: Model 4200-ER-10 Strain Gauge, with plucking coil, thermistor, hose clamp, arc weldable mounting blocks, and individual calibration. Cable sold separately.
4200-1: Plucking coil, thermistor and hose clamp. Cable sold separately.
4200-3: Plucking coil, thermistor and hose clamp. Includes 3 m cable.
4200-SPACER: Pair of mounting brackets for attaching strain gauges to #4 through #11 reinforcing bar. Includes two 254 mm cable ties.
4200ROS: Model 4200 Strain Gauge for rosette mount, with plucking coil, thermistor and hose clamp. Cable sold separately.
4200-3: Rosette Mount for Model 4200ROS. Specify method of attachment to rosette.
4202: Vibrating Wire Strain Gauge, concrete embedment type, 51 mm gage length, with integral plucking coil and thermistor. Cable sold separately.
4202-ER-5: Model 4202 Strain Gauge, with extended 5,000 microstrain range. Includes individual calibration. Cable sold separately.
4202-ER-10: Model 4202 Strain Gauge, with extended 10,000 microstrain range. Includes individual calibration. Cable sold separately.
4204A-1: Vibrating Wire Strain Gauge, concrete embedment type, 102 mm gage length, with plucking coil, thermistor, hose clamp, and 3 m cable.
4204A-2: Vibrating Wire Strain Gauge, concrete embedment type, 102 mm gage length, with plucking coil, thermistor and hose clamp. Cable sold separately.
4204L: Vibrating Wire Strain Gauge, low modulus version for measuring concrete curing strains, 102 mm gage length, with plucking coil, thermistor and hose clamp. Cable sold separately.
02-187V3: Red PVC Cable, 4.75 mm (±0.25 mm) [0.187"] Ø, 2 twisted pairs, for the above.
4210: Vibrating Wire Strain Gauge, concrete embedment type, 250 mm gage length, with integral plucking coil and thermistor. Cable sold separately.
4210-1: Rosette Mount for Model 4210. Specify method of attachment to rosette.
4210-2: No-stress strain enclosure. Double-wall plastic container lined with Styrofoam. Allows a strain gauge to be isolated from the stress field in the concrete.
2-250V6-E: Blue PVC Cable, 6.35 mm (±0.25 mm) [0.250"] Ø, 2 twisted pairs, for the above.
4200HT: Vibrating Wire Strain Gauge, High Temperature (200°C), concrete embedment type, 153 mm gage length, with integral plucking coil, high temperature thermistor. For short-term use.
02-250T: White Teflon Cable, 5.20 mm (±0.25 mm) [0.156"] Ø, 2 twisted pairs, for the above.

[1]*Unless otherwise specified, strain gauges are batch calibrated. Individual calibrations are available upon request for an additional fee.*

COMPATIBLE READOUTS AND DATA LOGGERS

GK-404: Handheld Readout
GK-406: Vibrating Wire Analyzer
8800 and 8900 Series: GeoNet Wireless Mesh Data Acquisition System
8910 Series: GeoNet Wireless LoRa® Data Acquisition System
8920 and 8921 Series: GeoNet Cellular Data Loggers
8930 Series: GeoNet Wi-Fi Data Loggers
8940 Series: GeoNet Local Data Loggers
8951 Series: GeoNet Satellite Data Loggers
8600 Series: Data Loggers

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