

4200 Series Vibrating Wire Strain Gages

(Concrete Embedment)

MONITORING APPLICATIONS

- Foundations, piles, and tunnel liners
- Bridges, dams and containment vessels
- Mass concrete with coarse aggregates
- Laboratory and spatially limited projects (Model 4202)

FEATURES & ADVANTAGES

- Rugged design and long term stability
- Corrosion resistant design
- Waterproof



OPERATING PRINCIPLE

4200 Series Vibrating Wire Strain Gages are designed for direct embedment in concrete. The Model 4200 (standard) has a 153 mm gage length and is commonly used for strain measurements in foundations, piles, bridges, dams, containment vessels, tunnel liners, and more. 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 Model 4202, with a 51 mm gage length, is designed for laboratory use and other applications 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 of the concrete mass cause the two end blocks to move relative to one another, thus altering the tension in the steel wire. This tension is then measured by plucking the wire and recording its resonant frequency with an electromagnetic coil.

ADVANTAGES & LIMITATIONS

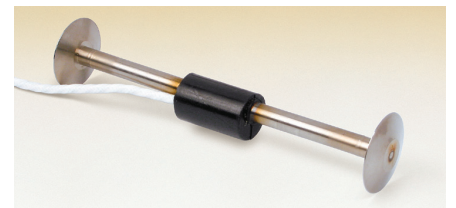
4200 Series strain gages enjoy all the advantages of vibrating wire sensors: excellent long term stability, maximum resistance to the effects of water, and stable data transmission over long cable lengths. All components are made from corrosion resistant stainless steel. Gages are fully



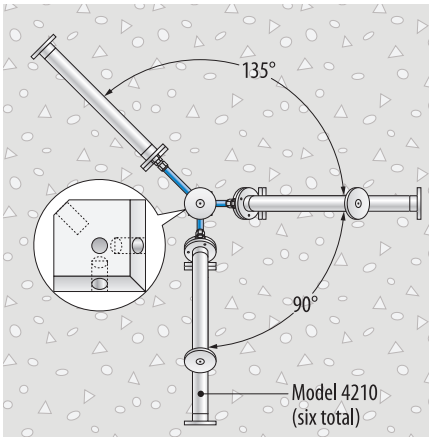
Model 4202 (front), Model 4200 (center) and Model 4210 (rear) Concrete Embedment Strain Gages.

waterproof. The Model 4200(HT) and 4210 are especially rugged, and are designed to withstand the rigors of concrete placement. Each gage also incorporates a thermistor for taking temperature readings.

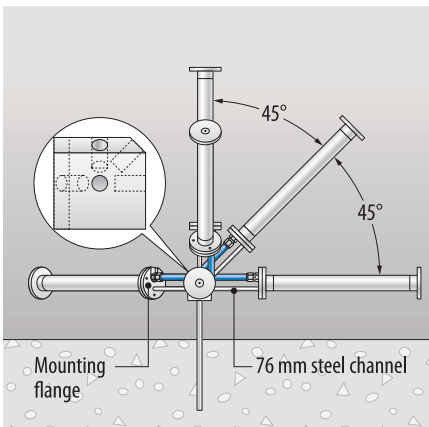
High temperature versions (Model 4200HT) are available for use in steam-cured concrete piles.



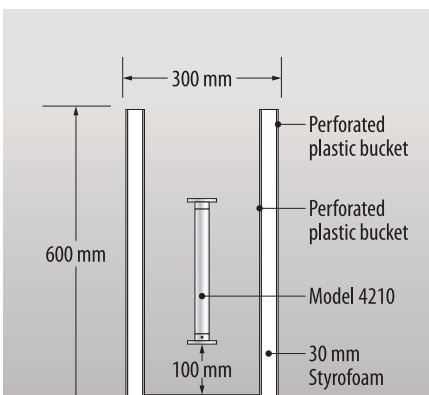
Model 4200HT High Temperature Strain Gage.



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



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

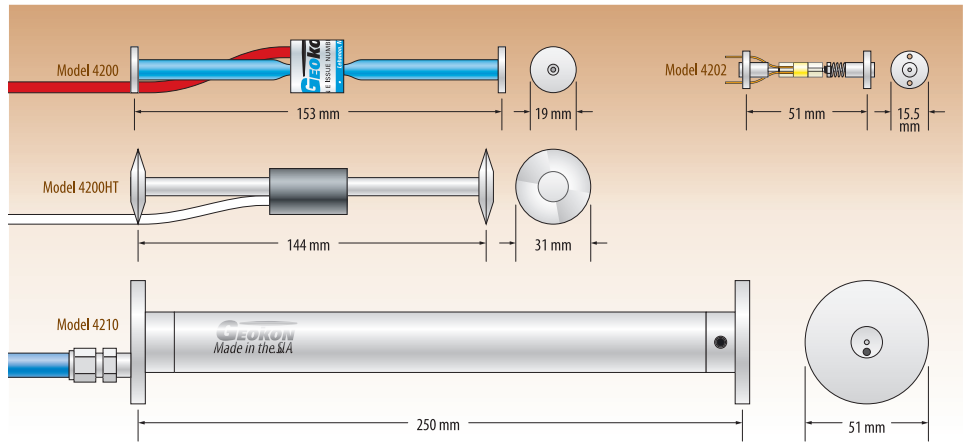


"No stress-strain" enclosure using the Model 4210.

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A CARBO Company



Dimensions of the 4200 Series Strain Gages.

SYSTEM COMPONENTS

Strain gages are shipped ready for installation with a customer specified cable length. Installation is accomplished by attaching the strain gage to any steel reinforcement bar later to be cast. Gages may also be attached to special rosette fixtures for taking strain measurements in three dimensions. This is highly popular for installations in mass concrete. Also available are no stress-strain enclosures for use in concrete dams. These enclosures are double-walled, sheet-steel containers lined with Styrofoam, designed to isolate one or more

strain gage from the stress field in the concrete. This packaging allows the effects of moisture, temperature, autogenous growth, etc., to be estimated and compensated for.

Use the 4200 Series strain gages with our Advisor Vibrating Wire Readout unit for measuring microstrains in the field.

TECHNICAL SPECIFICATIONS	4200	4200HT	4202	4210
STANDARD RANGE	3000 $\mu\epsilon$	3000 $\mu\epsilon$	3000 $\mu\epsilon$	3000 $\mu\epsilon$
RESOLUTION	1.0 $\mu\epsilon$	1.0 $\mu\epsilon$	0.4 $\mu\epsilon$	0.4 $\mu\epsilon$
ACCURACY ¹	$\pm 0.5\%$ 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.
TEMPERATURE RANGE	-20°C to +80°C	-20°C to +200°C	-20°C to +80°C	-20°C to +80°C
ACTIVE GAGE LENGTH	153 mm	144 mm	51 mm	250 mm ²
THERMAL COEFFICIENT OF EXPANSION	12.0 ppm/°C	12.0 ppm/°C	12.0 ppm/°C	12.0 ppm/°C
COIL RESISTANCE	180 Ω	120 Ω	50 Ω	180 Ω
CABLE TYPE	4 conductor shielded 22 awg (for all models)			
FREQUENCY DATUM ³	800 Hz	800 Hz	2600 Hz	2600 Hz

¹ $\pm 0.5\%$ F.S. with standard batch calibration. $\pm 0.1\%$ F.S. with individual calibration. Accuracy established under laboratory conditions.

²Other lengths available on request.

³Typical.

