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Vibrating Wire Strain Gauges

Introduction

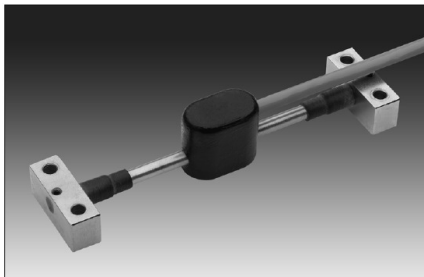
Strain is defined as the ratio between the length of an element before and after a force has been applied to it. In concrete strain can be seen in the change of concrete or reinforcing steel due to temperature, curing and forces applied during its use.

The strain gauge operates on the principle that a tensioned wire, when plucked, vibrates at a frequency that is proportional to the strain in the wire. The gauge is constructed so that a wire is held in tension between two mounting blocks that are welded to the structural member. Loading of the structural member changes the distance between the two mounting blocks and results in a change in the tension of the wire. An electromagnet is used to pluck the wire and measure the frequency of vibration. Strain is then calculated by applying calibration factors to the frequency measurement.

Strain gauges can be surface mounted or embedded into concrete. Other gauges also using a similar measurement technique are Crack and Joint meters. All of these gauges require logging devices which range from mini-dataloggers capable of monitoring 1 gauge, to data loggers capable of monitoring multiple gauges.

Surface Mounted Strain Gauges

This strain gauge is designed for monitoring strain in steel structures or strain in concrete or masonry surfaces. These include built-in thermistor or RTD.



Installation

The strain gauge is screwed onto mounting plates, which are welded, screwed, or bonded to the structure. Because there are a wide variety of surfaces to which the gauge can be attached, two types of mounting plates are available, one for steel and one for concrete.

Specifications

Requires signal cable and mounting plates.

Range: 3,000 microstrain. User can set tension to maximize range for the application.

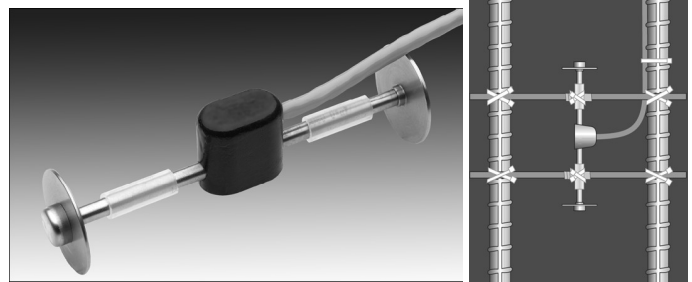
Resolution: 1 microstrain with VW Data Recorder.

Accuracy: $\pm 0.1\%$ FS.

Thermal Coefficient: 11ppm / °C.

Gauge Length: 140 mm (5.5").

Embeddable Strain Gauges



The embeddable strain gauges are ideal for measuring the internal strains in concrete, whether this is caused by shrinkage of the concrete itself, or the relative motion of the reinforcing.

Installation

In reinforced or pre-stressed concrete, the strain gauge is usually tied to the reinforcing cage, as shown above. Some specifications require that the gauge be cast in a concrete briquette prior to installation. In mass concrete applications, the gauge may be installed either before or immediately after placement of the concrete.

Specifications

Requires signal cable.

Gauge Length: Standard gauge has gauge length of 140mm. Long-base gauge has gauge length of 250 mm. Gauges can be special ordered with gauge lengths from 50 to 250 mm.

Range: 3,000 microstrain, set mid-range.

Resolution: 1 microstrain with VW Data Recorder.

Accuracy: $\pm 0.1\%$ FS.

Thermal Coefficient: 11 ppm / °C.

Operating Temp: -20 °C to 80 °C.

Other Gauges

Embeddable Joint Meters

The VW embedment Jointmeter is embedded in adjacent pours of mass concrete to monitor movement at joints. It is typically installed in mass concrete structures such as abutments, foundations, and dams.

The VW Jointmeter detects changes as small as 0.15 mm with a repeatability of ± 0.3 mm. The transducer is mounted on universal joints so that it can accommodate shear movements as well as opening and closing of the joint. The VW Jointmeter is equipped with a temperature sensor.

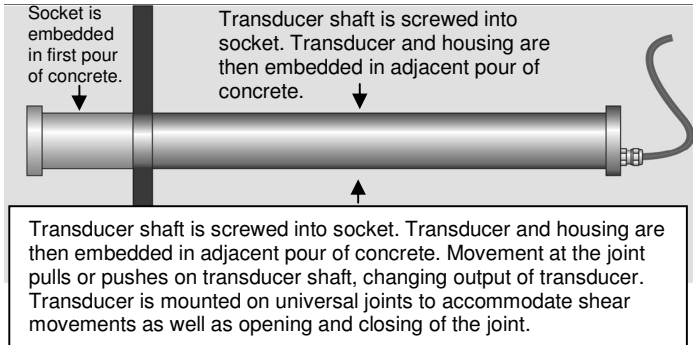


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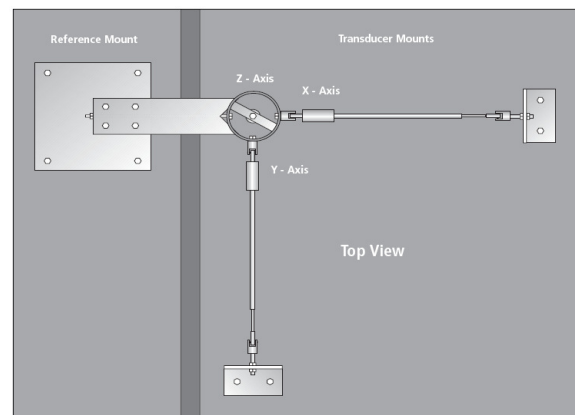
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Sensor Type: Vibrating wire. A built-in thermistor or RTD provides temperature measurements.
Range: 60 mm or 100 mm.
Resolution: 0.025% FS with VW Data Recorder.
Calibration Accuracy: $\pm 0.1\%$ FS.
Repeatability: $\pm 0.5\%$ FS.
Waterproof Rating: Waterproof Crackmeter is rated to 17 bar
Materials: Stainless steel, neoprene O-rings.
Nominal Length: 60 mm Crackmeter is 400 mm long; 100 mm Crackmeter is 530 mm long.

3D Joint Meters



The VW 3-D Jointmeter is used to monitor movement at joints and cracks. Designed to withstand extended submersion, the Jointmeter is suitable for applications such as:

- Monitoring movement at submerged construction joints in concrete- face dams.
- Monitoring joints or cracks in tunnels and tanks.

The VW 3-D Jointmeter consists of several components that are ordered separately. Required components include three VW displacement sensors, signal cable for the sensors, and one 3-D mounting system. Accessories include anchors and a reusable mounting template.

Specifications

Range: 60 mm.
Resolution: 0.025% FS.
Calibration Accuracy: $\pm 0.1\%$ FS.
Repeatability: $\pm 0.5\%$ FS.
Non-Linearity: $< 0.5\%$ FS.
Temperature Rating: -20 to + 80 °C.
Waterproof Rating: 17 bar

Other Equipment

The full Proceq range of equipment is available for insitu non destructive concrete measurement, including Schmidt Hammers, Covermeters, Half Potentials, Resistivity, Ultrasonics and Permeability. We also supply Intelli-Rock maturity, temp and humidity logging systems, corrosion rate monitoring equipment, Ground Penetrating Radar, and Impact Echo.

Specifications

The VW embedment jointmeter includes a VW submersible displacement transducer with built-in thermistor or RTD, transducer housing, and a socket with plug for installation. Signal cable is ordered separately.

Range: 50 mm (2").
Resolution: 0.025% FS.
Calibration Accuracy: $\pm 0.1\%$ FS.
Repeatability: $\pm 0.5\%$ FS.
Waterproof: 17 bar (250 psi).

Materials: 300-series stainless steel.
Socket Size: 51 mm diameter, 90 mm long, Stainless Steel.
Transducer Housing: 51 mm diameter, 420 mm long PVC.

Crack Meters



The VW Crackmeter is suitable for surface monitoring of movement at joints and cracks in concrete structures or rock. Typical applications include:

- Monitoring joints for unexpected movement to provide early warning of performance problems.
- Monitor joints and cracks in structures that may be affected by nearby excavation and construction activities.
- Monitor cracks in structures that experienced seismic activity.

The Crackmeter can detect movements of 0.15 mm with a repeatability of ± 0.3 mm. The VW Crackmeter is available in 60mm and 100 mm ranges. The crackmeter has a unique, twist-proof shaft that prevents accidental damage to the sensor during installation.

Specifications

The VW Crackmeter includes a vibrating wire displacement sensor, two swivel mounts, and two groutable anchors. Signal cable, ordered separately, is connected to the sensor at the factory.