

Electrical Resistance Type Rebar Strainmeters and “Sister Bars”

Applications

Electrical Resistance Type Rebar Strainmeters are used for measuring static and dynamic strains in all concrete structures. Typical uses include...

- Situations where existing data acquisition systems are not compatible with vibrating wire type rebar strainmeters
- Bridge decks
- Piles



• Close-up of Model 3911 shown as installed in concrete pile reinforcing cage.



• Model 3911A Rebar Strainmeter (front) and the Model 3911 “Sister Bar” (rear).

Operating Principle

The Model 3911 Electrical Resistance Type Rebar Strainmeters are designed primarily for monitoring the stresses in reinforcing steel in concrete structures, such as bridges, concrete piles and diaphragm walls.

The Model 3911, or “Sister Bar,” consists of a short length of high-strength steel, 0.5" (12.5 mm) diameter, welded between two 23.375" (594 mm) long sections of reinforcing bar. The rebar extensions on either side of the central gauged section are long enough to ensure adequate contact with the surrounding concrete so that the measured strains inside the steel are equal to the strains in the surrounding concrete. The Model 3911 is designed to be wire tied in parallel with the structural rebar. The small diameter of the bar minimizes its affect on the sectional modulus of the concrete. The cable exits from the strain meter through a small gland of protective epoxy.

The Model 3911A is similar to the 3911, consisting of a short length of high-strength steel welded between two 18" (457 mm) long sections of reinforcing bar.

The diameter of the 3911A varies between 0.5" (12.5 mm) to 1.375" (35 mm) corresponding to the structural rebar size, between sections of which it is to be welded. The cable exits through a Swagelok (or similar) elbow fitting.

In use, the Model 3911 and 3911A are usually installed in pairs on either side of the neutral axis of the structural member being investigated. This is done so that bending moments may be analyzed, in addition to axial loads.

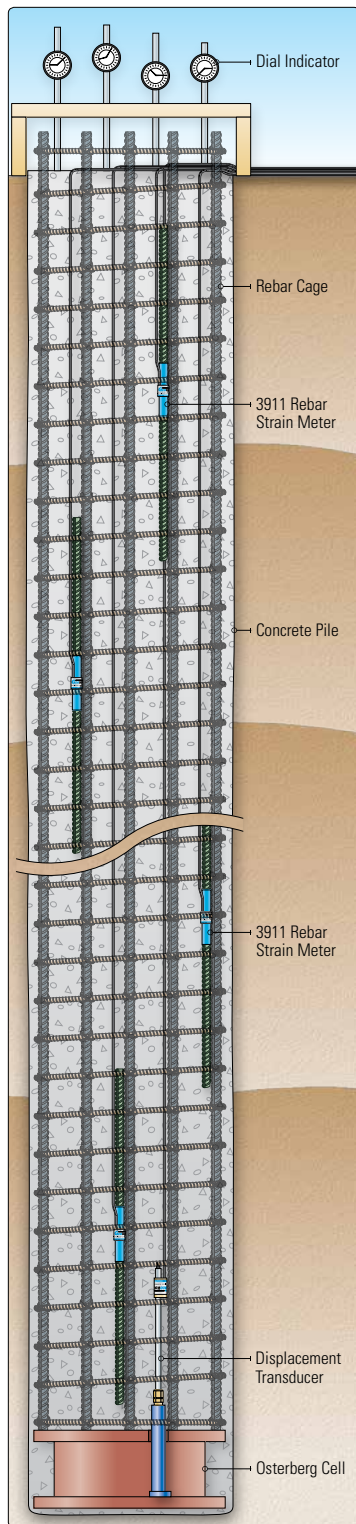
Advantages and Limitations

The main advantage of the Model 3911 and 3911A Rebar Strainmeters lies in their ruggedness. They are virtually indestructible so that, if the cable is adequately protected, they are safe from damage during concrete placement.

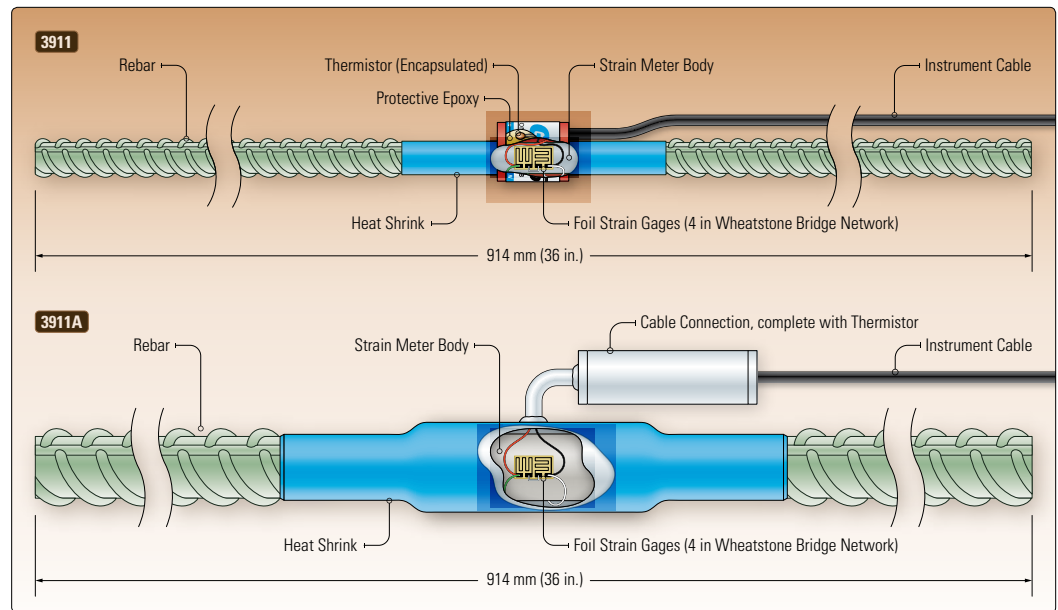
They are particularly suitable for use where dynamic strain measurements are required in addition to static strains. They are also useful where existing readout systems or dataloggers are not capable of reading vibrating wire sensors. Where long cables are used, remote sense techniques are employed to minimize temperature effects.

Both models are individually calibrated and tested for weld strength. They are sealed against moisture, but may not be suitable for applications where long term monitoring is required. In these applications modified versions, with waterproof seals, are preferable (please contact **GEOKON®** for more information).

The Model 3911 “Sister Bar” is very easy to install. The Model 3911A requires the services of an experienced welder, who can guarantee full-strength welds.



● Installation of the Model 3911 as used in a concrete pile test.



● Illustration of the Model 3911 "Sister Bar" and Model 3911A Rebar Strainmeters and their various components.

System Components

The Model 3911 and 3911A are comprised of two lengths of Grade 60 rebar welded to a central section of high-strength steel to which 4 electrical resistance strain gages are attached in a full Wheatstone Bridge circuit (2 axial, 2 Poisson). The central section is de-bonded from the surrounding concrete by means of a plastic sleeve.

A thermistor is also built in, which enables the measurement of temperatures and aids in the evaluation of thermally induced strains.

Readouts and Cables

The 3911 Series sensors are read using the Model GK-502 Readout. Alternatively the Micro-800 or Micro-1000 Datalogger can be used.

The 3911 Series sensors use the Model 04-375V9 4-pair cable.

Technical Specifications (3911/3911A)

	3911	3911A
Standard Range	3000 $\mu\epsilon$	3000 $\mu\epsilon$
Sensitivity	0.025% F.S.	0.025% F.S.
Accuracy ¹	$\pm 0.25\%$ F.S.	$\pm 0.25\%$ F.S.
Linearity	0.25% F.S.	0.25% F.S.
Bridge Resistance	350 Ω	350 Ω
Temperature Range ²	-20°C to +80°C	-20°C to +80°C
Rebar Sizes	#4 (Sister Bar)	#6, 7, 8, 9, 10, 11
Length	914 mm	914 mm

¹Accuracy established under laboratory conditions.

²Other ranges available on request.