VIBRATING WIRE STRESSMETERS

GEOKON®

MODEL 4300

Model 4300EX (front), Model 4300BX (center) and Model 4300NX (rear) Vibrating Wire Stressmeters.

APPLICATIONS

The Model 4300 Series Stressmeters are designed to measure stress changes in elastic rocks and are especially suited for…

- Mine openings
- Tunnels
- Support pillars
- Shafts

OPERATING PRINCIPLE

The actual calibration of the gauge depends upon many factors, including, the host rock elastic constants, the prestress applied during installation, the orientation of the stressmeter with respect to the principal rock stress direction, and platen contact area. Thus, the accuracy of the gauge reading is largely indeterminate, and the indicated stress magnitude can only be approximate.

A coil and magnet assembly located close to the wire is used to excite the wire and sense the resultant frequency of vibration. In use, a pulse of varying frequency is applied to the coil and magnet assembly, causing the wire to vibrate at its resonant frequency. The wire continues to vibrate, and a signal at the gauge frequenc, is induced in the pickup coil and transmitted to the readout box where it is conditioned and displayed.

In theory, where the effective modulus of the stressmeter (approximately 28 GPa [4 x 106 PSI]) is more than two times the modulus of the host rock, conversion of the guage readings to changes in stress does not require an accurate knowledge of the rock modulus. This is the reason for using the term stressmeter for this device. However, in most rocks (especially in harder rocks), the modulus must be known to improve the accuracy of the stress measurements. Calibration curves provided in the instruction manual give sensitivity factors for materials of different moduli. It should be noted that as the rock modulus changes by a factor of 10, the gauge factor changes only by a factor of two.

ADVANTAGES AND LIMITATIONS

The 4300 Series Stressmeters provide high sensitivity, very high range, and long-term stability for extended monitoring periods. They are corrosion resistant, waterproof, easily installed, and suitable for remote readout. Model 4300 Stressmeters are available in three standard sizes: EX (Model 4300EX), BX (Model 4300BX) or NX (Model 4300NX).

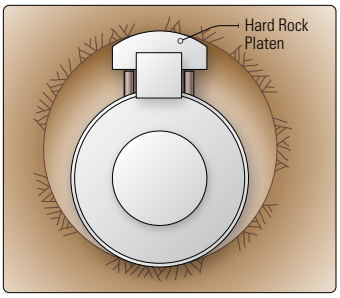
The stressmeter is a uniaxial device. To completely evaluate stress changes in a given plane, stressmeters installed at 0°, 45°, and 90° orientations, are required.

The design is an improvement of the stressmeter developed for the U.S. Bureau of Mines (U.S. Patent 3889525). By reorienting the vibrating wire to be at 90° with respect to the loading platens, the gauge has been given a high initial sensitivity coupled with a virtually unlimited range of increasing stresses. Installation procedures have been modified to permit the gauge to be wedged into place at much higher preloads than hitherto possible, which extends the range of tensile stress changes that can be measured.

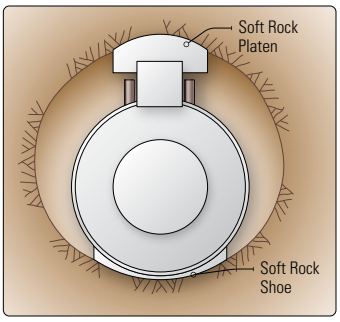
A thermistor is located inside the stressmeter to enable simultaneous measurement of temperatures.

High temperature versions (up to 200 °C) are also available (please contact GEOKON for details). The gauge is constructed of corrosion resistant materials and should have an indefinite lifetime even under the most severe conditions.

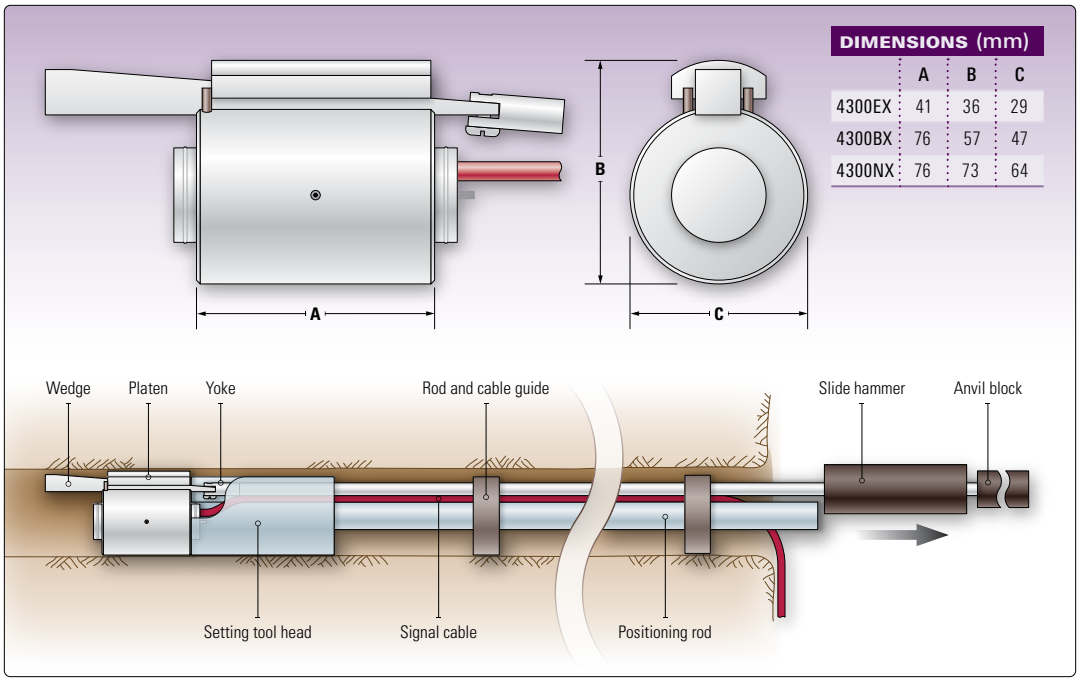
DIMENSIONS AND INSTALLATION DETAILS



Model 4300 installation in hard rock.



Model 4300 installation in soft rock, using a soft rock shoe and soft rock platen.



DIMENSIONS (mm)

	A	B	C
4300EX	41	36	29
4300BX	76	57	47
4300NX	76	73	64

Model 4300 details and installation tool assembly.

SYSTEM COMPONENTS

The stressmeter is installed in boreholes up to 30 meters deep by means of a setting tool, which is used to drive a wedge so that a platen is expanded against the side of the borehole (see illustration above). When used in soft rocks and coal, a soft rock shoe and soft rock platen are used to increase the area of contact. Diamond drill holes are preferable.

Boreholes drilled percussively should have their walls smoothed by incorporating a reaming shell in the bit.

The stressmeter can be read using Model GK-404/GK-406 Readout, the LC-2 Series Dataloggers, or the 8600 Series Dataloggers.

TECHNICAL SPECIFICATIONS

Range in Compression[1]	35 to 100 MPa
Range in Tension	3 MPa
Resolution[1]	2 to 140 kPa
Temperature Range[2]	–20 °C to +80 °C
Maximum Borehole Depth	30 m
Borehole Diameter	(4300EX) 37 to 39 mm (4300BX) 59 to 61 mm (4300NX) 75 to 77.5 mm

[1]Depends on rock modulus. [2]High temperature versions (to 200 °C) available on request.

ORDERING INFORMATION

EX BOREHOLE (38 mm)

4300-1EX-H: Vibrating Wire Stressmeter, with wedge/platen assembly, integral plucking coil and thermistor. Hard rock.
4300-1EX-S: Vibrating Wire Stressmeter, with wedge/platen assembl, integral plucking coil and thermistor. Soft rock.
4300-2EX-H: Wedge/platen assembly. Hard rock.
4300-2EX-S: Wedge/platen assembly. Soft rock.
4300-3EX: Installation tools for depths up to 15 m, with carrying case with GO/NO GO gauges.
4300-5EX: Setting rod assembly with tool attached, includes guides.

BX BOREHOLE (60 mm)

4300-1BX-H: Vibrating Wire Stressmeter, with wedge/platen assembly, integral plucking coil and thermistor. Hard rock.
4300-1BX-S: Vibrating Wire Stressmeter, with wedge/platen assembl, integral plucking coil and thermistor. Soft rock.
4300-2BX-H: Wedge/platen assembly. Hard rock.
4300-2BX-S: Wedge/platen assembly. Soft rock.
4300-3BX: Installation tools for depths up to 15 m, with carrying case with GO/NO GO gauges.
4300-5BX: Setting rod assembly with tool attached, includes guides.

NX BOREHOLE (76 mm)

4300-1NX-H: Vibrating Wire Stressmeter, with wedge/platen assembly, integral plucking coil and thermistor. Hard rock.
4300-1NX-S: Vibrating Wire Stressmeter, with wedge/platen assembly, integral plucking coil and thermistor. Soft rock.
4300-2NX-H: Wwedge/platen assembly. Hard rock.
4300-2NX-S: Wedge/platen assembly. Soft rock.
4300-3NX: Installation tools for depths up to 15 m, with carrying case with GO/NO GO gauges.
4300-5NX: Setting rod assembly with tool attached, includes guides.

ANCILLARY

02-187V3-E: Red PVC Cable, 5 mm (0.187") Ø, 2 twisted pairs, for the above.
02-187V3-M: Red PVC Cable, 5 mm (0.187") Ø, 2 twisted pairs, for the above.
4300-4: Extra Setting Rod set, 1.8m

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