

# Autoresonant Options for Dynamic Vibrating Wire Measurements

## Applications

Autoresonant Vibrating Wire Sensors are ideally suited where long term reliability and the need for dynamic measurements are required. Applications include...

- Bridge Testing
- Wind Turbines
- Responses to Earthquakes
- Response to wind or traffic loading
- Response to wave action



• Vibrating Wire sensors: Model 4150 Strain Gauge, Model 4500 Piezometer and Model 4420 Crackmeter (left to right).

## Operating Principle

Autoresonant Vibrating Wire Sensors expand the possibilities of dynamic monitoring while retaining the inherent long-term stability of **GEOKON**'s line of vibrating wire instruments.

Autoresonant sensors are particularly useful where low frequency dynamic measurements are required on structures in adverse environments over extended periods of time. Typical applications include the monitoring of wind turbines, bridges, traffic effects and structures that may be subject to earthquake or wind loading.

**GEOKON** offers three types of autoresonant sensor.

One type uses a custom sensor and an electronic adaptor (Model 4500CPR), another uses the standard vibrating wire sensor and one of two electronic adaptors (Model 8020-42 SCA) and the third type is a custom sensor with internal electronics (AR Series).

## 4500CPR

The Model 4500CPR comprises a custom vibrating wire sensor, in which two independent coils are used in a phase-locked loop to keep the gauge oscillating at its resonant frequency, and a signal conditioner which excites the gauge and provides a 4-20 mA or frequency output with a 100 Hz dynamic range.

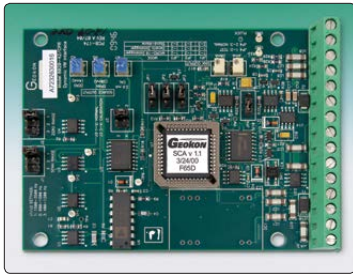
## 8020-42 SCA Single Coil Autoresonant Adapter

Historically, autoresonant vibrating wire gauges have employed two coils (as in the 8020-42CPR). One, the Transmit (excitation) coil, provides a phase synchronous pulse (pluck) to maintain oscillation, and the second, the Receive (reading) coil, recovers the vibrating wire signal. The two coil approach, while dependable, adds to the cost and imposes a mechanical limitation to the design and construction of the gauge.

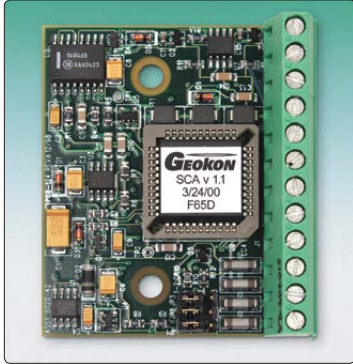
The 8020-42 Single Coil Autoresonant (SCA) adapter is a device that allows the standard (single coil, or two coils in series) vibrating wire gauges to be driven in an autoresonant mode, instead of its usual "Pluck and Read" mode.

The SCA adaptor excites the VW sensor using a "pluck sustained" circuitry where the gauge wire is kept vibrating by "injecting" a short pulse synchronous to the gauge frequency. This system can be used for monitoring dynamic changes up to 20 Hz. The adaptor can be multiplexed thereby allowing for use with several sensors.

Two versions of the 8040-42 SCA are available, the 8020-42 which provides a continuous frequency output, and the 8020-42CPR which provides a 4-20 mA and a frequency output with a dynamic range of 20 Hz.



● Model 8020-42CPR Dynamic Vibrating Wire Interface.



● Model 8020-42 Single Coil Autoresonant Adapter.



● Model 4500AR "Autoresonant" Piezometer.

## AR Series

The AR Series is designed to be used with readout systems that can read frequency but do not have the capability to "pluck" the VW gauge. This sensor has built-in electronics that, upon power-up, cause the gauge wire to vibrate in a continuous mode at its resonant frequency until the power is removed. Continuous operation has no effect on the gauge life. The output from the sensor is a 5 volt DC square wave at the sensor frequency. A DC voltage input (6-24 volts) is required to excite the gauge. The current consumption is approximately 21 mA at 12 VDC. The gauge output is independent of the input voltage.

As with most **GEOKON** vibrating wire sensors, the AR sensor includes a thermistor for measuring temperature. The signals from the VW transducer are high level frequency and will interfere with the thermistor output if left powered during the period that the thermistor is being read. If the temperature reading is important the power to the VW transducer should be switched off while the temperature is taken.

The AR option was originally designed for incorporation with the 4500 Series VW piezometers, but is available for most **GEOKON** sensors with frequency ranges between 1200-4500 Hz (please contact **GEOKON**).

## Technical Specifications

Model	Input	Output
4500CPR	±12 VDC at 50 mA (max)	4-20 mA; Frequency <sup>1</sup> (100 Hz dynamic range)
8020-42	+12 VDC at 50 mA (max)	Frequency (20 Hz dynamic range)
8020-42CPR	+12 VDC at 50 mA (max)	4-20 mA; Frequency (20 Hz dynamic range)
4500AR	+12 VDC at 25 mA (max)	Continuous Frequency at 5 volt level (20 Hz dynamic range)

<sup>1</sup>Open collector output—requires external pull-up termination resistor.

## Requirements, Limitations and Advantages

Model	Transducer	Limitations	Advantages
4500CPR	Custom VW transducer with 2 independent coils <sup>1</sup>	Current output span limits must be tuned to each sensor; Cannot be multiplexed; Only available for VW sensors with frequency ranges between 1200-4500 Hz	100 Hz dynamic range
8020-42 <sup>2,3</sup>	Standard VW transducer <sup>1</sup>	Frequency output only; 20 Hz dynamic range; Only available for VW sensors with frequency ranges between 1200-4500 Hz	Capable of being multiplexed
8020-42CPR <sup>2,3</sup>	Standard VW transducer <sup>1</sup>	Default current output span limits set from 4 mA (1500 Hz or 2250 digits) to 20 mA (3500 Hz or 12250 digits), full range of each transducer occupies a portion of this span <sup>4</sup> ; 20 Hz dynamic range; Only available for VW sensors with frequency ranges between 1200-4500 Hz	Capable of being multiplexed
4500AR	Custom VW transducer with integral electronics <sup>1</sup>	Only available for VW sensors with frequency ranges between 1200-4500 Hz	High level output, good noise immunity, can be read by dataloggers that read frequency but cannot excite VW sensors; Capable of being multiplexed <sup>5</sup>

<sup>1</sup>Standard, single vibrating wire transducers only; supplied separately.

<sup>2</sup>Not compatible with the 6 gauge Model 4350-3 or 4350HT-3 Biaxial Stressmeters.

<sup>3</sup>Specially wired Model 4900 Load Cells are required to ensure compatibility; please contact **GEOKON** for details.

<sup>4</sup>Limits may be factory adjusted, as required, anywhere within the 1200-4500 Hz span.

<sup>5</sup>Either switch (multiplex) power and signal, or power continuously and multiplex the signal.