CAMPBELL SCIENTIFIC®
WHEN MEASUREMENTS MATTER

AVW200 series
Vibrating Wire Interfaces

Greatly Reduces Signal Noise

Spectral analysis technology[a] (VSPECT™) plus high resolution for better readings

Overview

Campbell Scientific's AVW200-series interface modules allow the measurement of vibrating-wire strain gauges, pressure transducers, piezometers, tiltmeters, crackmeters, and load cells. These sensors are used in a wide variety of structural, hydrological, and geotechnical applications because of their stability, accuracy, and durability.

The AVW200 series uses an innovative spectral-interpolation method for measuring the sensor's resonant frequency. With the spectral-interpolation method, the module excites the vibrating wire sensor, measures the response, performs a Fourier transform on the response, and returns the result with a resolution better than 0.001 Hz - all within two seconds. Because spectral analysis can distinguish signal from noise on the basis of frequency content, this method offers improved immunity to competing noise.

The AVW200-series modules also provide many self-checking diagnostics such as vibrating element signal strength, signal-to-noise ratio, vibrating element signal decay ratio, and incorrect signal response. These diagnostics can be running in the background to give continual feedback of the condition for each sensor.

VSPECT Description

To provide better vibrating-wire measurements, Campbell Scientific developed the vibrating-wire spectral-analysis technology (VSPECT). This innovative, patented technology delivers the most accurate measurement for vibrating-wire sensors. VSPECT observes the incoming sensor signal, performs a Fourier transform and a spectral analysis (transforming the time series into individual sinusoidal components in the frequency spectrum), and determines the sensor frequency by identifying the largest signal in the acceptable range and disregarding noise.

VSPECT POWERED

Benefits and Features

- Provides better measurements by significantly reducing incorrect readings caused by noise sources
- Self-checking diagnostics give continual feedback on sensor condition
- High resolution - less than 0.001 Hz (industry standard is 0.1 Hz)
- Low current drain
- Interfaces both temperature and frequency measurements from vibrating-wire sensors
- Interfaces two vibrating-wire sensors; more sensors may be connected if an AM16/32B multiplexer is used
- Supports standalone capability by using a wireless model (AVW206, AVW211, AVW216)

Models/Datalogger Communications

All of the models can communicate with the datalogger using RS-232 or SDI-12. Three of the models also include an internal spread spectrum radio that allows them to communicate wirelessly.

Model	Where Used	Power	Frequency	Communicates with
AVW200	not applicable (base model)			
AVW206	U.S., Canada	250 mW[b]	910 to 918 MHz	RF401A, RF401 or RF430
AVW211	Australia, New Zealand	250 mW[b]	920 to 928 MHz	RF411A, RF411 or RF431
AVW216[c]	Europe	50 mW	2.45 to 2.482 GHz	RF416[c] or RF432[c]

[a]The VSPECT technology is protected under U.S. Patent No. 7,779,690.

[b]Older AVW206 modules (serial # < 11224) and older AVW211 modules (serial # < 11676) had 100 mW radios. Newer modules that have 250 mW radios must use OS 5 or higher for their operating system.

[c]No longer legal in the European Union (EU).

Datalogger Connections

When using SDI-12, a three-conductor cable is required; Campbell Scientific recommends the CABLE3CBL cable. When using RS-232, the module attaches to the datalogger's RS-232 port via the 009876-001 null modem cable, or attaches to control ports on a CR800, CR850, CR1000, or CR3000 datalogger via the 010657 data cable.

Specifications

Electrical specifications are valid over a -25° to +50°C range unless otherwise specified. Non-condensing environment required.

- Measurement Speed: The AVW200 Vibrating-wire measurement (DF measurement) and the Half Bridge thermistor measurement (SE measurement) combined take less than 2 s per measurement. The DF measurement time depends on the beginning and ending frequency range selected and will take between 1.4 to 1.6 s. The Half Bridge thermistor measurement (SE) takes 60 ms or 70 ms depending on the integration time selected. The thermistor measurement integrates for 20 ms (50 Hz) or 16.66 ms (60 Hz) with a positive excite and then 20 ms or 16.66 ms with a negative excite.

Vibrating-Wire Inputs

- Description: Differential Coil+ (V+) and Coil- (V-) outputs/inputs for direct connection excite and resonant frequency measure of vibrating-wire transducers. ±2.5 V (5 V peak-to-peak) or ±6 V (12 V peak-to-peak), logarithmic sine wave frequency excitation programmable from 100 Hz to 6.5 kHz, followed by frequency domain measurements via digital signal processing for excellent noise rejection.
- Basic Resolution: 24-bit
- Input Voltage Range: ±250 mV differential
- Measurement Resolution (-55° to +85°C): 0.001 Hz RMS
- Accuracy (-55° to +85°C): ±0.013% of reading
- Input Resistance: 4.75 kΩ

Thermistor Inputs

- Description: A half-bridge ratiometric measurement. The value returned is in Ohms. This can be used for temperature correction of the vibrating-wire measurement.
- Basic Resolution: 24-bit
- Input Voltage Range: ±2500 mV single-ended
- Measurement Resolution (-55° to +85°C): 0.001 Ω RMS
- Accuracy (-55° to +85°C): ±0.25% of reading[d]
- Input Resistance: 5 kΩ for the thermistor input T- (5 kΩ 0.1% completion resistor).

Digital Control Ports

- Description: 3 digital control ports (C1 – C3). C1 functions as an SDI-12 I/O communication port. C2 functions as a Clk output for multiplexer control. C3 functions as a Reset output for multiplexer control.
- Input State: high 2.5 to 5.3 V; low -0.3 to 1.0 V
- Input Hysteresis: 1.32 V
- Input Resistance: 100 kΩ
- Output Voltages (no load): high 5.0 V ±0.1 V; low <0.1 V
- Input Resistance: 330 kΩ

Communication

- RS-232: Non Isolated
- Baud Rates: Selectable from 1200 to 38.4 kbps. ASCII protocol is one start bit, one stop bit, eight data bits, and no parity.
- SDI-12: Control Port 1 is configured for SDI-12 Sensor asynchronous communication. Meets SDI-12 Standard version 1.3.

System

- Program Execution Interval: 1 s
- Processor: Hitachi H8S 2324 (16-bit CPU with 32-bit internal core)
- Memory: Either 128 or 512 kB of SRAM; 2 MB of OS Flash.
- Clock Accuracy: ±10 minute per month. The clock is not compensated over temperature. The AVW200-series module synchronizes with the datalogger clock every execution interval (datalogger instruction AVW200).

CE Compliance

- Standard to Which Conformity Is Declared: IEC61326:2002

Power Requirements

- Voltage: 9.6 to 32 Vdc
- Typical Current Drain @ 12 Vdc:

  Quiescent, Radio Off: ~0.3 mA

  Radio Duty Cycling 1 s (includes quiescent current): ~3 mA

  Radio always on: ~26 mA (radio transmit current 100 mA)

  Active RS-232 communication: ~6 mA (3 s after communication stops the current will drop to the quiescent current)

  Measurement: ~25 mA (averaged over the 2 s)

Operating Temperature Range

- Standard: -25° to +50°C
- Extended:
  AVW200: -55° to +85°C
  AVW206, AVW211: -45° to +85°C
  AVW216: not available

Physical

- Dimensions: 21.6 x 11.18 x 3.18 cm (8.5 x 4.5 x 1.2 in)
- Weight: 0.43 kg (0.95 lb)

Warranty

- One year against defects in materials and workmanship

[d]*Thermistor interchangeability, resistance of the wire, and thermistor linearization errors should also be considered for the termistor accuracy.*