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WHEN MEASUREMENTS MATTER

CDM-VW300 Series

Dynamic Vibrating-Wire Measurement Modules

Dynamic Measurements with Standard Single-Coil Sensors

Dynamic Vibrating-Wire Interface with Spectral Analysis

Overview

The CDM-VW300 and CDM-VW305 modules are designed to interface with standard single-coil circuit vibrating-wire sensors such as strain gages, load cells, pressure transducers, crackmeters, and tiltmeters. They provide dynamic measurements at rates of 20 to 333 Hz for these sensors. The CDM-VW300 is the two-channel version and the CDM-VW305 is the eight-channel version.

These modules use an excitation mechanism that maintains the vibrating-wire sensor in a continuously vibrating state. The module measures the resonant frequency of the wire between excitations using a spectral analysis algorithm[a] with similarities and enhancements to that used with the AVW200 device. The spectral analysis approach provides very fine measurement resolution and also limits the influence of external noise by discriminating between signal and noise based on frequency content.

Benefits and Features

- Interfaces to standard single-coil vibrating-wire sensors
- Two or eight simultaneously sampled channels per module; synchronizable across multiple modules
- Dynamic measurement rates of 20 to 333 Hz
- Static measurement at 1 Hz made simultaneously with the dynamic measurement
- Spectral interpolation approach provides superior noise immunity and measurement resolution compared to time-domain period-averaging approach
- Excitation method provides frequent low-energy pulses to maintain a continuous resonant vibration in the sensor
- Thermistor input for each vibrating-wire channel is sampled at 1 Hz
- Datalogger communications via CPI
- User configurable, onboard post-processing of the data including frequency output conversion, temperature conversion, and rainflow histogram collection

Note:
[a]The spectral analysis method is protected under U.S. Patent No. 7,779,690. An additional U.S. Patent is pending that relates to the dynamic vibrating-wire measurement technique.

Technical Details

In addition to the dynamic vibrating-wire measurement, the modules make several auxiliary measurements. A static vibrating-wire measurement is made once each second, along with the dynamic measurements, which provides finer measurement resolution and greater immunity to external noise sources. The modules include a thermistor input channel paired with each vibrating-wire channel, featuring high-precision 24 bit measurements at a 1 Hz rate. Lastly, a rich set of diagnostic parameters is provided with the vibrating-wire data.

Modules have the capability to simplify post-processing of data by computing common values internally. Vibrating-wire data can be reported as measured frequency or as the frequency squared with a multiplier and offset applied. The thermistor data is reported as resistance or is converted to degrees Celsius using the thermistor's Steinhart-Hart coefficients. These modules also can internally compile rainflow histograms from the final data and report the values at user-specified intervals.

Specifications

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

Vibrating-Wire Inputs

- Description: Each channel has two terminals for connecting to the coil of the vibrating-wire sensor. Both vibrating-wire terminals are labeled ***VW*** and the polarity of the wiring is arbitrary. The sensor is excited and measured through the same connections. Sinusoidal excitation is applied for a few cycles of the wire oscillation. The wire is maintained in a continuously vibrating state. Excitation voltage varies automatically to maintain the desired return signal strength.
- Input Resistance: 5 kΩ
- Excitation Voltage Range: 0 to ±3 V (6 V peak-to-peak)
- Excitation Voltage Resolution: 26 mV
- Dynamic Measurement Rates: 20, 50, 100, 200[b], and 333.33[b] Hz
- Measurement Frequency Accuracy: ±(0.005% of reading + Measurement Resolution)
- Sustained Input Voltage without Damage: -0.5 V to +7.1 V
- Measurement Resolution (typical values for a 2.5 kHz resonant sensor):

Sample Rate (Hz)	Noise Level (Hz RMS)
1	0.005
20	0.008
50	0.015
100	0.035
200[b]	0.11
333[b]	0.45

- Sensor Resonant Frequency Range:

Sample Rate (Hz)	Minimum Sensor Frequency (Hz)	Maximum Sensor Frequency (Hz)
20	290	6000
50	290	6000
100	580	6000
200[b]	1150	6000
333[b]	2300	6000

Thermistor Inputs

- Description: Each channel has two terminals for connecting to the thermistor. Both thermistor terminals are labeled ***T*** and the polarity of the wiring is arbitrary. The measurement is a half-bridge configuration with the excitation circuitry and completion resistor integrated into the module.
- Completion Resistor: 4.99 kΩ 0.1%
- Excitation Voltage: 1.5 V
- Resolution: 0.002 Ω RMS @ 5 kΩ thermistor resistance
- Accuracy: 0.15% of reading (thermistor accuracy and resistance of the wire should be considered as additional errors)
- Measurement Rate: 1 Hz

Communication

- CPI: Used for connection to the datalogger. Baud rate selectable from 50 kbps to 1 Mbps. Allowable cable length varies depending on baud rate, number of nodes, cable quality, and noise environment, but can be as long 2500 ft under proper conditions.
- USB: USB 2.0 full speed connection is available for attaching the device to a PC. This port is provided to configure the module, send updates, and communicate with the Dynamic Vibrating-Wire Toolbox software. The USB port is not provided for use within a permanent data collection system.

Power Requirements

- Voltage: 9.6 to 32 Vdc
- Typical Current Drain
  CDM-VW300: 115 mA @ 12 V
  CDM-VW305: 190 mA @ 12 V

Physical

- Dimensions: 20.3 x 12.7 x 5.1 cm (8 x 5 x 2 in)
- Mounting: Standard mounting is to a 1 in. grid. Optional DIN rail mounting available.
- Operating Temperature: -25° to +50°C (standard), -55° to +85°C (extended)

Warranty

- One year against defects in materials and workmanship

Note:
[b]These scan rates will be supported in future dataloggers.