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WHEN MEASUREMENTS MATTER

# CDM-VW300 Series

*Dynamic Vibrating-Wire Measurement Modules*


# Dynamic vibrating-wire measurements

## Uses patented VSPECT™ technology for noise immunity and industry-leading quality[a]

## 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 the patented vibrating-wire spectral-analysis technology (VSPECT™). VSPECT 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

*[a]The dynamic vibrating-wire measurement technique is protected under U.S. Patent No. 8,671,758, and the vibrating-wire spectral-analysis technology (VSPECT™) is protected under U.S. Patent No. 7,779,690.*

## 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[b] (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[c] | 0.11 |
| 333[c] | 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

[b] *The effective resolution (precision) of the output is limited by noise and varies with the sample rate.*

[c] *These scan rates will be supported in future dataloggers.*