VibWire-108/101

Temperature Compensation Equation

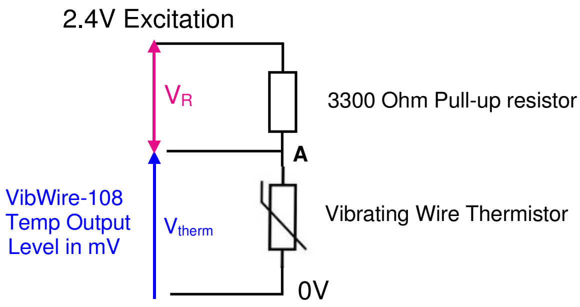
Introduction

The following technical note shows how to obtain the thermistor resistance values for a vibrating wire temperature sensor connected to the temperature input of the VibWire-101 or VibWire-108 interfaces.

The VibWire-108/101 vibrating wire sensor interface supports the 4 wire sensor interface. Due to the wide range of temperature sensors used in vibrating wire sensors, it is not possible to pre-define the temperature output values from the interface in engineering units.

Both the VibWire-108 and 101 units give the temperature values in mV. The calculation for temperature from the sensor thermistor is shown below

The circuit below shows the VibWire-108 temperature input with pull-up resistor completion



The VibWire-101 and 108 models use 2.4 V excitation for the sensor thermistor.

V_{therm} = Voltage across thermistor

V_R = Voltage across pull up resistor

Example. A VibWire-108/101 provides an output temperature value of 1086 mV then

$I_{therm} = (2.4 - V_{therm}) / 3300$ where 3300 = pull-up resistor value where $V_{therm} = 1.086$ V

therefore

I_{therm} = (Excitation volt - V_{therm}) / $3300_{(\text{Pull-up Resistor})}$ = (2.4 - 1.086) / 3300 = 1.414 / 3300 = 0.398 mA

using Ohms Law

Note 1086 mV = 1.086 Volts

The Resistance of the Thermistor is calculated

$R_{therm} = V_{therm} / I_{therm} = 1.086 / 0.000398$ = 2727.4 Ohm

Now 2727.4 ohms is the resistance of the thermistor at the at temp (T)

Temperature Conversion

The thermistor resistance value is converted to temperature using the Steinhart-Hart Equation.

$$T = \frac{1}{C_1 + C_2 . \ln R_{therm} + C_3 (\ln R_{therm})^3}$$

where T = absolute temperature in Kelvin R_{therm} in Ohms.

Conversion to Deg C is

$$T(C) = \frac{1}{C_1 + C_2 . \ln R_{therm} + C_3 (\ln R_{therm})^3} - 273.15$$

The sensor data sheet will show for the thermistor a calibration equation similar to that below. The values for the parameter C_1, C_2, & C_3 will be listed.

$$(1/T) = C_1 + C_2 . \ln(R_{therm}) + C_3 . \ln(R_{therm})^3 - 273.15$$

Example

In Vibrating Wire sensors is the 44005RC Precision Epoxy NTC Thermistor is commonly used for temperature monitoring applications.

The data sheet for this product can be downloaded at

http://www.aquabat.net/downloads/1350009-2.pdf – The thermistor data sheet is valid to 11/12/2013
refer to the manufactures data sheet for the latest information.

An example Excel spreadsheet that demonstrates the temperature calculations can be downloaded at

http://www.aquabat.net/downloads/ThermistorWorksheet.xls

Example

The VibWire-101 is can be set to give ratiometric or mV temperature values from the built in thermistor of a vibrating wire sensor. depending upon the sensor configuration. Ratiometric values are calculated between the 3300 Ohm pull up resistor and thermistor resistance and is value between 0 – 1. The Vibwire-101 has returned a value of 0.663 from the thermistor.

In the spreadsheet below the VW-101 gives a temperature value (Ratiometric) of 0.663. The constants A, B and C are from the calibration data sheet. The spreadsheet below shows the temperature to be 7 Deg C,

ThermistorWorksheet.xls Screen image

Calculation of temperature based on voltage ratio

Voltage ratio	0.663	Input
Excitation (Ohm)	3300	Fixed
Thermistor resistance	6905	Calculated
Thermistor R0	3000	Thermistor property
A	1.41E-03	Thermistor property
B	2.37E-04	Thermistor property
C	1.02E-07	Thermistor property
Inv Temperature	3.57E-03	
Temperature (Celsius)	7.0	Calculated value

Steinhart-Hart Calibration Parameters obtained from calibration data sheet.

Temperature value