VW Piezometer

User Manual

Model PZ-1050 & PZ-1100

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Contents

Introduction

The vibrating wire type of piezometer is designed by fixed at both ends of a cylinder by a set of vibrating wire type sensing elements. A set of electromagnetic coils is used to excite the vibration of the steel-string. By measuring the vibration frequency of the steel-string, the pressure value acting on the induction element can be calculated by using the correction coefficient to measure the lateral direction of soil at different depths and in different soil layers changes in water pressure and pore water pressure can be analyzed here. The stability of the retaining wall and soil layer and the analysis to verify whether the water pressure used in the design stage is in line with the actual situation. The selection of construction methods and steps and the construction period of the excavation project are of the great reference value.

Application

Widely used in measuring groundwater level and monitoring borehole pressure in boring, dams, ducts, wells, mining wells, tunnels, road construction, and embedment surfaces.

Typical application includes:

- Monitoring water level.
- Monitoring water pressure at a slope.
- Monitoring water pressure in an earth dam.
- Monitoring water pressure in reclamation soil.

Features

- Inconel Alloy Pressure Sensor: Sensor core was cover by stainless and Inconel which enable to prevent demagnetize problem in order to extend the lifetime and stable data output.
- Mechanical Locking: Sensor core designed by Mechanical Locking structure to avoid the bubbles caused by traditional pouring glue to affect the numerical accuracy.
- Built-in Temperature Sensor: Follow AEC-Q200 high precision temperature sensing instrument.
- Multi-layer cable Sealed: Built-in double-layer waterproof device to connect the signal line to enhance the waterproof function.

Specifications

Sensor Type	Vibration Wire
Range	50psi(PZ-1050) or 100psi(PZ-1100)
Resolution	0.025%F.S.
Accuracy	±0.1% F.S.
Over Range	150%
Filter	50-mircron
Operating Temperature	Thermistor (-40 to +125 °C)
Material	SUS316 stainless steel
Dimension	20 X 115 mm

Taking Readings

➢ VW Data Recorder

Initial reading test of VW Piezometers prior installation, below we using the DGSI VW Data Recorder to measure VW Piezometers signal.

Recorder	Wire Colors	Function
VW	Red	Vibrating Wire
VW	Black	Vibrating Wire
TEMP	Green	Thermistor
TEMP	White	Thermistor

(1) Connect signal cable from the sensor to the data recorder.

(2) Choose unit：Hz + Thermistor.

(3) Select the frequency range：「C」1400~3500 Hz.

(4) The recorder displays the VW reading in Hz and a temperature reading in degrees C.

➢ Connection to VWdot

Connect signal cable from the sensor to the VWdot datalogger:

VWdot	Wire Colors	Function
F	Red	Vibrating Wire
F	Black	Vibrating Wire
T	Green	Thermistor
T	White	Thermistor

(1) Set sweep=C

(2) The VWdot displays the VW reading in Hz and a temperature reading in degrees C.

➢ Description

(1) VW Piezometers pressure signal readout close to the 0 psi reading of the factory checklist while non-force status, but it's normal to be not exactly the same.

(2) VW Piezometers temperature signal readout should be close to the ambient temperature.

(3) VW Piezometers pressure calculation method, please refer to the next section.

Calculating Pressure

- Apply ABC factors to readings in Hz as shown below.

(1) Choose the ABC factors for psi or kg/cm^2.

(2) Pressure in psi or kg/cm^2 = (A x Hz^2) + (B x Hz) + C

Remark ：

Hz is the frequency reading in Hertz, and A, B, and C are ABC factors on the sensor calibration record.

- Calculating Changes in Pressure

Subtract the initial reading from the current reading.

$\Delta Pressure = Pressure_{(current)} - Pressure_{(initial)}$

A positive value indicates increased pressure. A negative reading indicates decreased pressure.

Calculating Temperature

VW piezometers are equipped with a thermistor, which gives a varying resistance output as the temperature changes. The green and white leads of the instrument cable are normally connected to the internal thermistor.

- To read temperatures using VW data recorder

VW data recorder will read the thermistor and display the temperature in degrees C.

- To read temperatures using an ohmmeter

Resistance value at 25 °C : 3000 ohms

Resistance to Temperature Equation:

$$T(°C) = \frac{1}{A + B(LnR) + C(LnR)^3} - 273.15$$

Where;

T = Temperature in °C

LnR = Natural Log of Thermistor Resistance

A = 1.4051×10^{-3}

B = 2.369×10^{-4}

C = 1.019×10^{-7}

Appendix A : VW Piezometer Calibration Certificate

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VW Piezometer Calibration Certificate

Item	:	VW Piezometer	Date of Calibration	:	2017/2/7
Model No.	:	PZ1100	Range	:	100 psi
Serial No.	:	00098	Temperature	:	25.8 ℃

Pressure	Frequency Reading (Hz)			Polynomial	Error< ±0.1%
psi	Test 1	Test 2	Avg	psi	FS
0	2982.6	2982.6	2982.6	0.0183	-0.018%
20	2853.2	2853.3	2853.3	19.9779	0.022%
40	2717.0	2717.0	2717.0	39.9833	0.017%
60	2572.8	2572.9	2572.9	60.0107	-0.011%
80	2419.5	2419.6	2419.6	80.0256	-0.026%
100	2255.4	2255.5	2255.5	99.9842	0.016%

Polynomial Factor	A	B	C
psi	-2.815346E-05	9.993035E-03	2.206636E+02
kg/cm^2	-1.979390E-06	7.025821E-04	1.551423E+01

Pressure in psi or kg/cm^2 = (A x Hz^2) + (B x Hz) + C
where Hz is frequency in Hertz

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Wire Colour Code
Red-Black : Vibrating Wire
Green-White : Thermistor

Appendix B : Thermistor Resistance Versus Temperature

Temperature (℃)	Resistance (Ohms)	Temperature (℃)	Resistance (Ohms)
-40	99630	45	1312
-35	71970	50	1082
-30	52560	55	896.6
-25	38790	60	747
-20	28910	65	625.3
-15	21750	70	525.9
-10	16510	75	444.3
-5	12650	80	376.9
0	9766	85	321.1
5	7602	90	274.6
10	5962	95	235.8
15	4710	100	203.2
20	3746	105	175.7
25	3000	110	152.5
30	2418	115	132.8
35	1960	120	116
40	1599	125	101.6