



# VibWire-201-Pro

Vibrating Wire Sensor Analyser, Logger Unit and Remote Interface



## Features:

The VibWire-201-Pro is capable of reading any Vibrating Wire sensor operating between 400 Hz and 15000 Hz which covers nearly all commercially available Vibrating Wire sensors.

The VibWire-201-Pro Handheld Readout is a portable, lightweight device that can read all Vibrating Wire sensors. It is powered by standard 4 X AA cells, has a long battery life due advanced power management and an automatic switch-off function.

The VibWire-201-pro is a read-out unit, stand-alone data logger and sensor interface for remote data acquisition systems all in one product. The readout unit can be expanded using the MUX-16/32 unit to give 16 x 4 wire or 32 x 2 wire sensor inputs.

The device supports up-to 200 User-Defined sensor configurations making it perfect for site survey applications, and is fully integrated into the free Q-LOG data acquisition and display package for remote stand-alone Applications.

A simple Windows configuration program enables full User configuration of the device. The Pre-set sensor configurations make site readings simple to Undertake. The large memory capacity means that the device can be left in place to record sensor data for long periods of time to record any important geotechnical event.

Automatic sensor configuration makes measurement and sensor test operations easy.

This instrument is available to hire. Call 0118 327 6067 or e-mail [sales@keynes-controls.com](mailto:sales@keynes-controls.com) to check availability or to place an order.



## Easy Use

The VibWire-200-Pro is the latest in a range of Keynes Control vibrating wire sensor interfaces. The device has been designed from the outset for accuracy of measurement, ease of use, flexibility full of modern features.

The auto-resonance sensor excitation removes the requirement to have any prior knowledge of the vibrating sensor operating characteristics. Autor-resonance excitation produces minimum sensor wear while obtaining optimum signal to noise measurements. The VW201 automatically assigns the sensor operating frequency details.

## Network Interfaces

The VibWire-201-Pro comes with built SDI-12 and RS-485 slave network ports for direct connection onto digital networks. measurements can be made remotely to a data logger or suitable PC data acquisition or SCADA system.



## Hardware Features

The VibWire-201-Pro has an in-built temperature compensated crystal controlled frequency reference system that maintains the device frequency and temperature measurement accuracy for long periods of time.

## Fully User Configuration

The VibWire-201-Pro supports full User sensor configuration using the free applications package called VW201Cal. This software runs under the Microsoft Windows operating system and uses the micro-USB port to talk to the device.

VW201Cal is used to set up the frequency measurements into SI units, and to set the temperature sensor calibration factors. The VW201Cal software can also assign the most common thermistor calibration factors used by most sensor manufacturers automatically.

## PC Based Data Acquisition

The VibWire-201-Pro can be connected to a Windows PC when using a SDI-12 or RS485 network media converter..

## Features

- Lightweight, Portable and Rugged.
- Supports All manufactures vibrating Wire Sensors.
- Real-time displays Frequency, Digits and SI Unit Spectra.
- FFT Spectral based algorithms for interference free measurements
- Auto-resonance Sensor Excitation. 400 to 15 KHz Range.
- Large Data Storage - 100 million readings. SD card memory storage.
- Fast Data Recording - 1 Second to 6 Hour sampling period.
- Automatic Sensor Configuration - Auto frequency range selection.
- Expandable to 32 Channels.
- Built in SDI12 and RS485 Ports for remote operations.
- Up to 200 User Defined Sensors for Site Survey Applications.
- No Programming Experience Required.
- Fully integrated into Q-LOG Data Acquisition and Display Software.

## Sensor Installation

The VibWire-201-Pro offers 2 x 4 wire sensor ports that can be used with a single sensor. The first port uses the standard sensor port that is common on all Keynes Controls vibrating wire devices. The second port uses spring loaded terminal posts that enable bare wire sensor connections to the device.



1. Rubber Protective Boot Cover
2. Sensor FFT Spectra
3. Menu-In & Power On/Off Button Press and hold for 2 seconds the "Menu Out" button. The device will be displayed. Repeat the Operation to power off the device.
4. MUX-16/32 Control Port
5. Menu-Out On On/Off Button
6. Sensor Port - 4 Wire Input  
Compatible with the VW301 & VW108 units.
7. The Vibwire-201 Pro uses 4\*AA cells to power the device. These are available from many sources and can be easily swapped on site.
8. Vibrating Wire Sensor.
9. ABS Plastic Reinforced Enclosure
10. Daylight Readable LCD Display

The LCD display is clear to read in most lighting conditions. A back light is available for low level light environments. Three levels or display brightness can be 'User assigned.

11. Backlight - LCD Screen Options for High, Low, Off.
12. User Defined Sensors - 200 options  
Use the Windows Configuration software to assign sensor details.
13. Temperature Sensor.  
Automatic temperature sensor configuration. Supports most 3rd party sensors.
14. Menu Control Buttons  
Use the Menu-in and Menu-Out buttons to select the different menu systems.
15. Use the 'Up' and 'Down' menu keys to select the menu items.
16. RS-485 Network Port
17. SDI-12 Network Port
18. 4 Wire Sensor Inputs + Earth ( Spring Terminal Post )

The 4 wire sensor port mounted at the bottom of the instrument uses a general sensor connection port. Bare sensor wires can be simply connected directly into the spring terminal posts.

19. Earth.
20. Frequency Port
21. Temperature Port

## 24. Optional Protective Waterproof Case

Keeps the device safe while traveling and on site and stores all the accessories for easy use.

25. Spare Batteries ( 4 X AA )
26. micro-USB cable for Device Configuration
27. Spare Flash memory card storage

The VibWire-301 is capable of simultaneous sampling operations for units on a network. The device supports the 'Concurrent' C! Command.

[Youtube Demonstration Video](#)

<https://youtu.be/6dAL9LGOPj0>

## Q-LOG Windows PC Data Acquisition & Display Software

A complete version of Q-LOG without any restrictions can be download from

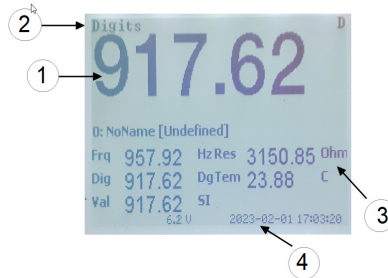
[http://keynes-controls.com/Download/QLogSetup50\\_21may2020.zip](http://keynes-controls.com/Download/QLogSetup50_21may2020.zip)

## Technical Specification

The current technical specification for the VibWire-201-Pro is shown below:

Physical Size (Excluding boot cover)	Height 184 mm - Width 74 mm - Depth 32 mm
Weight	125 g
Battery	4 x AA - 2000mAH
Auto-logging no back light	6 mA - standby - 340 Hours continuous use 20 mA/Hr with display - Low 50 mA/Hr with display mode - Full brightness 150 mA/Hr with MUX-16/32 - Peak (Note-1)
Communication Ports	1 x RS-485 Slave - 1200 Baud, 8 data, 1 stop, no parity 1 x SDI-12 -- 1200 auB data, 1 stop, no parity 1 x micro USB configuration port
External Power Supply	10 - 15V DC @ 100 mA min specification
Vibrating Wire Measurements	
Analogue Input	24 Bit Sigma Delta Differential Coil (V+) and Coil(V-) for direct connection sensor, excitation and resonant frequency measuremer Digital signal processing for excellent noise rejection.
Sensor Excitation	Auto-resonance - Fully automatic frequency selection
Operating Frequency	400 - 15 KHz
Measurement Resolution	0.001 Hz RMS - 20 to 70 Deg C
Measurement Accuracy	± 0.014% of reading - 20 to 70 Deg C
Spectral Analysis	1024 line FFT - with data weighting
Resolution	0.001 Hz
Window Function	Hamming
Update Rate	0.25 Sec typical
SI Units	Hz, Digits (Hz2/1000), Eng Units (Quadratic Cal Factors)
Temperature Measurements	Used for temperature compensated vibrating wire measurements, and stand-alone temperature sensors for Geotechnical applications. Ratio-metric measurement. See Note 1.
Analogue Input	24 Bit Sigma Delta
Measurement Range	- 50 to 100 Deg C
Measurement Accuracy	± 0.25 % of reading - 20 to 70 Deg C
SI Units	Deg C
Cal Factors	Steinhart-Hart factors Beta Value - lower performance using Beta
Bridge Type	Half Bridge
Expansion Options	1..32 - 2 Wire Freq inputs 1..32 - Temp (thermistor) inputs 1..16 - 4 Wire vibrating wire sensor inputs
Scan rate	2 Sec/Chan - using expansion module 250 ms update to screen
Memory Expansion	1 x SD Card = 1 .. 32 GB
Storage file format	CSV - Comma Separated Variables
Logging Rates	Internal to flash card 1s, 10s, 1 Min, 10 Min, 1 Hour, 6 Hours MUX-16/32 Expansion
16 x 4 Wire Mode	30 Sec/Chan
32 x 2 Wire	1 minutes
Pre-set Sensor Configurations	20 user defined sensors options
File Type Format	DOS
Operating Temp Range	-20 to 75 Deg C
Storage temperature	>5 Deg C with batteries installed.

## Real time Results

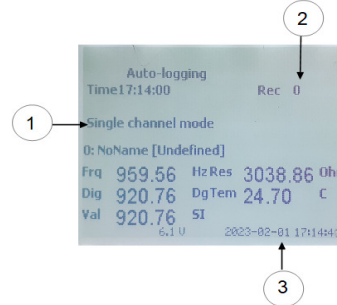


Display Units - Hz / Digits / SI  
Display Screen Type - Freq / Digits / SI / Spectra

1 = Real-time Result 2 = Units 3 = Temperature 4 = Clock

## Data Recording

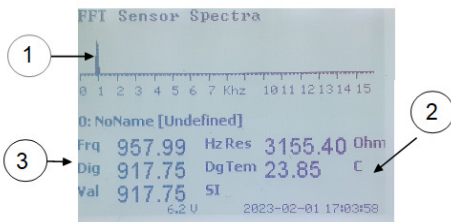
The Status Screen below is for the automatic data recording.



1. Scan Type 2. Record Number 3. Real-time Clock

The image above shows the simple display used to show the status of the data recording operation. Measurements are stored in text format for easy processing using a spreadsheet..

## Spectra Display





1. Sensor Spectra 2. Temperature 3. Real-time Results

Spectra will show the sensor fundamental and harmonic signal components.

## Easy Access Results.

The VibWire-201-Pro uses a simple menu system to display the measurements in an easy to understand format.

Simply press the   buttons to to switch between the different results screens.



## SDI-12 / RS-485 Supported Commands

The following commands are supported by the VibWire-201-Pro and are used by data loggers and data acquisition systems. The commands have been included to allow the VibWire-201-Pro to operate easily with third party data loggers that support industry standard SDI-12 command set.

**Start Measurement:** m0! d0! – is the main command required to start a measurement and return the data to a logger unit or PC data acquisition system.

Description	Master	VibeWire-201 Response
Acknowledge active	a!	a\r\n
<b>Send ID:</b> provided to complement SDI-12 protocol	a!!	a13 KEYNES VERDO 001\r\n Part Description assigned by Keynes
<b>Address Query</b> identifies instrument address and commonly used on single instrument operations only.	?!	a\r\n
<b>Change Address:</b> used to change instrument address from a (initial) to b new ID for network operations	aAb!	Where a = ID number 0 - 9 (standard) / (a..z) Enhanced SDI-12 0 - 9 / a - z for RS485
<b>Start Measurement</b> instruct an instrument to make measurement	aM!	b\r\n  a : b = number 0 - 9 or a - z a0261\r\n ****
<b>Concurrent measurement:</b> Used for starting a measurement for all instruments on a network at the same time.  This command frees RS-485 bus for other devices	aC!	instrument with address 'a' returns 1 x 4 wire reading in 1 second.
<b>MUX-16/342 Expansion Unit</b>	32 x 2 Wire Measurements <b>aM2!</b> aD0! aD1! aD2! aD3! - 16 x Freq <b>aM3!</b> aD0! aD1! aD2! aD3! - 16 x Freq	a0268\r\n  initial response only after receipt of instruction and no response when data ready signal is sent.
<b>Thermistor 1 &amp; 2</b>	16 x 4 Wire Measurements <b>aM2!</b> aD0! aD1! aD2! aD3! aD4! aD5! aD6! aD7! D0-D4 = Frequency D4-D7 = Temperature	+xxxx.x+xxxx.x+xxxx.x+xxxx.x\r\n
<b>Thermistor Type 1</b> Temperature sensor settings  Parameters from the sensor calibration sheet Steinhart-Hart Parameters Thermistor resistance/temp calculation	VibeWire-201 supports 3 thermistor types aXT1RE! aXT1T0! = 25 aXT1BET!	Resistance at 25 Deg C T0 - generally 25 Deg C Beta Value
<b>Thermistor Type 2</b> Temperature sensor settings  Parameters from the sensor calibration sheet Steinhart-Hart Parameters Thermistor resistance/temp calculation	aXT1ST0! aXT1ST1! aXT1ST2! aXT1ST3!  aXT2RE! aXT2T0! = 25 aXT2BET!	A in Steinhart-Hart B in Steinhart-Hart C in Steinhart-Hart D in Steinhart-Hart  Resistance at 25 Deg C T0 - generally 25 Deg C Beta Value
Page 36 of the User Manual shows sample calibration data sheet using these factors	aXT2ST0! aXT2ST1! aXT2ST2! aXT2ST3!	A in Steinhart-Hart B in Steinhart-Hart C in Steinhart-Hart D in Steinhart-Hart
<b>VW Sensor Input Channel Settings</b>  Sets the process option for frequency calculations	aXCH0FN!  F = Frequency type N = VW Channel 0 .. 7	0 = output in Hz 1 = output in digits = F <sup>2</sup> /1000 2 = use formula A + B*digits + C*digits <sup>2</sup> + D*temperature digits = Frequency in units of Hz <sup>2</sup>
<b>Thermistor Temperature Calculation</b>	aXT1TYn! a = ID n = integer 0 .. 2	0 = resistance ratio - thermistor data sheet (R <sub>r</sub> /R <sub>25</sub> ) 1 = Beta value calculation $1/T = 1/T_0 + \log(r)/\text{Beta}$ where $r = R_r/R_{25}$ 2 = Steinhart-Hart equation $1/T = A + B(\ln R_r/R_{25}) + C(\ln R_r/R_{25})^2 + D(\ln R_r/R_{25})^3$

Additional items commonly used with the VibWire-201-Pro Unit



USB-SDI12-Pro

### Isolated USB to SDI12 Converter

This device connects and isolates the VibWire-201-Pro to a Windows PC remotely across the SDI-12 digital network. The device supports all of the Keynes Controls SDI-12 sensors and interfaces, including many 3rd party devices.



USB-RS485-Pro

### Isolated USB to RS485 Converter

This device connects and isolates the VibWire-201-Pro to a Windows PC remotely across the RS-485 digital network. The device supports all of the Keynes Controls sensors and interfaces, including many 3rd party devices.



## Connecting the VibWire-201-Pro to a PC



The VibWire-201 can be easily connected directly to a Windows PC using one of the optional USB media converters.. Use the Q-LOG software to view readings in a panel meter of the chart..

The VibWire-201-Pro can be used by any suitable 3rd party SDI-12 or RS485 media converter



## Stand-alone Data Recording

The VibWire-201-Pro can act as a stand-alone data recorder in 'Single Channel' and 'Multiplexer' modes.

Readings are stored on a SD memory card.

In 'Single Channel' mode the VibWire-201-Pro offers high speed data recording capability and has recording intervals from 1 second to 6 hours. The 1 second logging period enables the VibWire-201-Pro to be used for static as well as dynamic measurement applications. .

1. MUX-16/32 Expansion Unit.
2. Channel Indicator .

Channel expansion Unit Offers  
 32x2 Wire = Frequency inputs  
 32x2 Wire = Temperature inputs  
 16x4 Wire = Frequency & Temperature

$$\text{Digits} = \frac{\text{Frequency}^2}{1000} \frac{(\text{Hz}^2)}{1000}$$

## Sensor Information

A calibration report should be provided with each vibrating wire sensor and it will contain all the information required to convert Hertz, the frequency value output by the sensor into appropriate SI units (e.g., displacement, pressure etc..)

1. If the values in the Calibration Report are in digits, use the following equation  $\text{Digits} = \frac{\text{Frequency}^2}{1000} \frac{(\text{Hz}^2)}{1000}$

to convert the VibWire-201-Pro frequency values from Hertz to digits

2. Use the Gauge Factors and Polynomials Coefficients provided in the Calibration Report to calculate the sensor SI units.

The VibWire-201-Pro uses:

Calibration equation.  $\text{Natural Units} = A(R1)^2 + B(R1) + C + K(T1-T0) - (S1-S0)$  (Equ 1)

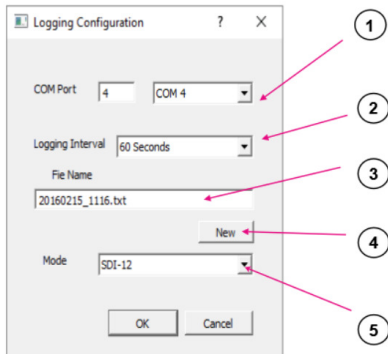
and this is expanded to:  $= C(R1-R0)^2 + B(R1-R0) + A + K(T1-T0) - (S1-S0)$  (Equ 2)

when initial conditions in the measurements are involved. where  $S0 = \text{Initial Condition (SI unit)}$   $S1 = \text{Current reading}$   
 $T0 = \text{Initial temperature (Deg C)}$   $T1 = \text{Current temperature}$

The additional terms used in equation 2 only change the constant parameter ( A ) when used.

## Free Issue - Q-LOG Data Acquisition and Display Software

The VibWire-201-Pro is fully integrated into the Keynes Controls free Q-LOG application software. The Q-LOG software offers the User a Windows environment to control the measurement operations for a device connected to a Windows PC across either of the RS-485 or SDI-12 networks. No programming skills required to use this device.



Logging Configuration Window

## Remote Network Configuration

Q-LOG software working in collaboration with the VibWire-201-Pro enables the device to be used easily in sensor test systems. The recorded data files are uniquely time stamped and open directly into spreadsheet packages such as Microsoft Excel and OpenOffice Calc.

1. Enter Comm Port identified for USB media converter
2. Data Recording Sample Rates  
- (1s, 5s, 10s, 1 min, 10 min, 1 hour, 6 Hours 60 Secs)
3. Log Filename - 20160215\_1116.txt (time stamped file)
4. New Button - Automatically create a new time stamped log file. Unique file each time selected.
5. Network Type Selection - SDI-12

## Network Application

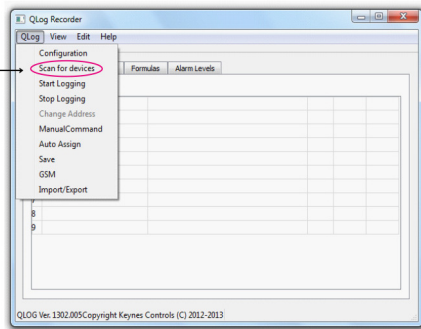
### Digital Networks

1. SDI12 range 1 ,, 100 meter 1 ,, 10 Devices..
2. RS485 range 1 .. 1 Km 1 ,, 20 Devices.

The VibWire-201-Pro can be connected onto a SDI-12 network for local measurements or for longer distances, on to an RS-485 network.

The VibWire-201-Pro operates as a slave sensor interface only and cannot be used to power any additional networked sensors..

Select the 'Scan for devices' menu option.

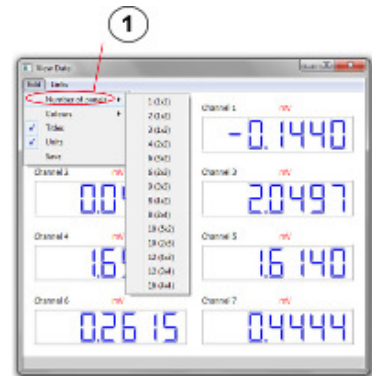


Scan for the VibWire-201 connected to a network.

## Panel Meter Display

The Q-Log software can be used to display the device measurements for instruments deployed on to one of the digital networks. The software supports panel meters and chart displays. The display can be configured to show results in raw frequency and SI units.

The software supports the device expansion for 16 x 4 wire and 32 x 2 wire operations. The device setup option is selected from a pull down list.



Common Keynes Controls device identifier strings.

Product	ID string
VibWire-201-Pro	13KEYNESVWRD0A001
VibWire-101 VW sensor interface	13KEYNESCOVW101A011
VibWire-108 VW sensor interface	13KEYNESCOVW108A016
PIEZO-RM water level sensor	13KEYNESCOPIRESR001
Barom-SDI-12 barometer	13KEYNESCOBAROMR003
I-P-I	13KEYNESCOPIINCL005
AquaDAT sensor interface	13KEYNESCOAQUDAT008
Single channel strain gage	13KEYNESCOSTRAIN027

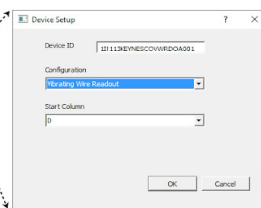
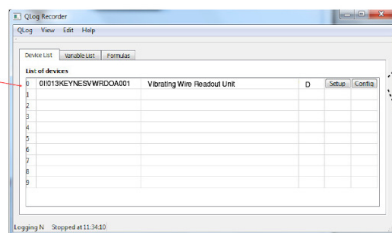


Fig-16

Q-LOG Devices List Window.



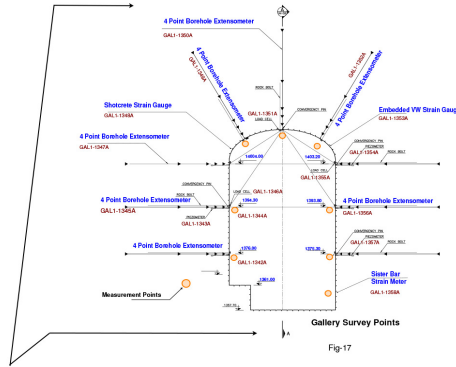
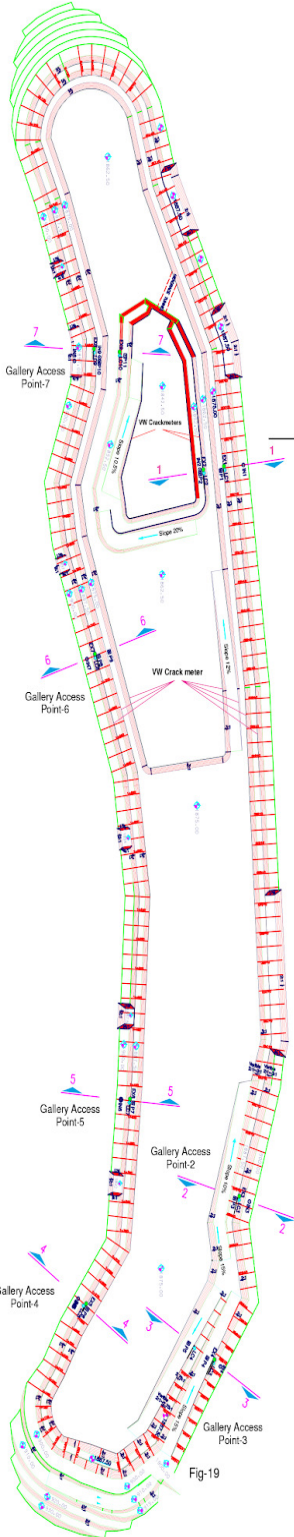
# VibWire-201-Pro

Vibrating Wire Sensor Analyser, Logger Unit and Remote Interface



## Site Survey

The VibWire-201-Pro is an ideal tool to undertake site surveys. Individual projects can be created and the route around a site defined using the sensor identification numbers. The device currently stores up to 20 pre-defined sensor type calibration factors, and up to 200 Individual sensors. A simple to use Windows program enables the sensor types, calibration factors and serial numbers to be grouped together into a project file. Each project file is loaded into the VibWire-201 using the USB port.



The image above shows a sample chamber of a tunnel construction that is to be instrumented for a measurement programme.

Table 3 below shows a summary of the sensor details used in the project. The table shows that 6 different sensor types from different manufacturers are in use.

Each of the individual sensor types will have its calibration factors assigned.

Description	Manufacturer	Part No.	No Sensor	Site Location
4 Point Borehole Extensometer	Slope Indicator	51836140	4	GAL1-1342A
Piezometer	Encardio	EPP-40V	1	GAL1-1343A
4 Point Borehole Extensometer	Slope Indicator	51836140	4	GAL1-1344A
Load Cell	Encardio	ELC-31V	1	GAL1-1345A
4 Point Borehole Extensometer	Slope Indicator	51836140	4	GAL1-1346A
Embedded Strain Gauge	Encardio	EDS-20V-E	1	GAL1-1347A
Shotcrete Strain Gauge	Encardio	EDS-30V	1	GAL1-1348A
Load Cell	Encardio	ELC-31V	1	GAL1-1349A
4 Point Borehole Extensometer	Slope Indicator	51836140	4	GAL1-1350A
4 Point Borehole Extensometer	Slope Indicator	51836140	4	GAL1-1351A
4 Point Borehole Extensometer	Slope Indicator	51836140	4	GAL1-1352A
Embedded Strain Gauge	Encardio	EDS-20V-E	1	GAL1-1353A
Piezometer	Encardio	EPP-40V	1	GAL1-1354A
Load Cell	Encardio	ELC-31V	1	GAL1-1355A

## Device Software Features

- Sensor Name**  
User Defined for sensor calibration sheet.
- Process Options** Hz , Digits, SI Units
- Temperature Sensor Type**  
Preset or User Defined Factors
- Write Configuration Button.**  
Store sensor setup into the device.

## VW201Cal Device Software

The calibration factors for each sensor are taken directly off the data sheet supplied by the sensor manufacturer and written into the device.. No programming experience is required,

Once the VibWire-201-Pro is configured for 'Single Measurement' mode the Site measurement projects can be easily undertaken. The sensor measurements are taken in the order they are defined and written to the SD memory card.

## VW201Cal Windows Software

