Model VibWire-108-Modbus

8 Channel Modbus Vibrating Wire Sensor Interface

Model No. VibWire-108-Modbus

Overview

The **VibWire-108-Modbus** is a rugged, versatile, general purpose vibrating wire sensor interface for connection directly to SCADA applications and data recorders across a RS-485 network using the industry standard Modbus protocol.

The in-built frequency display can be used to show a sensor real-time frequency, an in-built speaker allows the operator to hear the sensor tone.

Sensor Excitation - Auto Resonance

All of the VibWire-108 range of interfaces utilises the auto-resonance excitation measurement technique for activating the vibrating wire sensors and taking a reading.

Terminal Port - Configuration

A terminal port menu system is used to configure this model of the VibWire-108. The menu system enables each sensor input channel to be individually configured. No programming experience or device drivers are required to configure this instrument.

- **8 x 4 Wire Sensor Inputs**
- **Resolves the VW signal to less than 0.1 Hz (industry standard 0.1 Hz)**
- **Gas Discharge Tube Sensor Protection**
- **Real-time Frequency Display - 5 digit**
- **Speaker Output**
- **Auto-resonance VW Sensor Excitation - Optimum S/N**
- **Modbus RS-485 network support**
- **Automatic VW Sensor Configuration**
- **No Prior Sensor Operating Parameters Required**
- **User Configured Pluck Control**
- **Simplified Configuration & Data Logger Support.**
- **Industry standard protocol - supported by SCADA systems**
- **Output - Frequency, Digits, SI Units, Temperature Deg C**
- **Steinhart-Hart Thermistor linearisation support**
- **Options 2 Independent Thermistor configuration**
- **SI Units, Digits and direct Frequency Outputs**
- **Industry Standard Polynomial Linearisation - direct from VW sensor calibration data sheet**
- **16 & 32 Integer & Precision 32 Bit Registers.**
- **Connects to Modbus 3rd Party Systems**

Description		
Frequency display	5-segment display	Resolution 0.1 Hz
Vibrating wire inputs	8 x 4 wire inputs	
Scan time	2 - 24 Seconds	1 to 8 channels depending on sensor operation
Line resistance	up to 2K ohms	
8 Analogue Inputs	0 - 2.5V DC 3.3K / 10 K Ω	0- 2.5 V DC Thermistor
Lightning protection	Gas discharge tube	
VW excitation range	400 - 6 KHz	
VW excitation mode	auto-resonance	
Operating voltage	9 - 18V DC	
Ceramic loudspeaker	VW sensor	Selector switch
Power Consumption		
Scanning mode	20 mA Typical	Duration 24 Seconds - 3 Sec /Chan
Display Mode	60 mA	Continuous
Modbus RS-485	2.2 mA	Continuous while waiting for commands
Slave ID	1	
Software		
VW sensor linearisation	Quadratic	$Y = A + BF + CF^2 - DT$ (T=Temperature) $Y = (Digits).\ G$ (G=Gauge Factor)
Temperature sensor linearisation	Steinhart-Hart	User-selectable via terminal port

Phone 044 118 327 6067 E-mail: sales@keynes-controls.com

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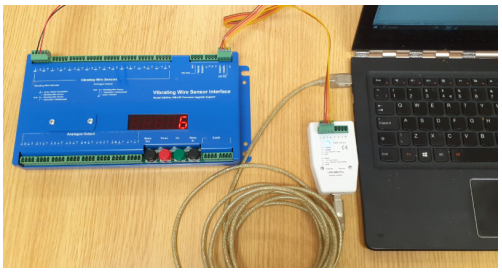

Figure 2

Figure 3

VibWire-108-Modbus connected to a Windows PC using a USB-485-Pro media converter.

Part Numbers:

VW-108-Modbus	VibWire-108 with RS 485 Digital Port
USB-485-Pro	USB to RS-485 media converter

All of the VibWire-108 models support the full 4 wire sensor input channels for frequency and temperature measurements..

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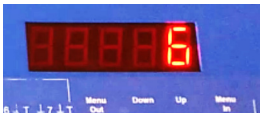
Measurement Data:	
Number of channels	8 x 4-wire VW inputs - user-selectable
VW sensor coil resistance	to 2K Ohm (standard) - other ranges on request
Distance of VW sensor to interface	0 .. 10 Km depending on cabling.
Frequency range	400 - 6 KHz (standard) - other ranges on request
Frequency resolution measurement accuracy	32-bit resolution 0.001 Hz
Long-term stability	± 0.05 % FS max. (Per year)
Temperature Range	- 50 to 70 Deg C
Temperature resolution	0.1 oC +/- 0.2 Deg Thermistor 10 K Ohm standard 3.3 K Ohm on request
Temperature accuracy	± 0.2 oC / 0.2 oF RS-485 version only
Thermistor measurement	A half-bridge ratio-metric measurement - Value returned in Deg C. - Is used for temperature compensation on VW measurements.
Thermistor excitation	2.5 V DC 50 ppm / Deg C
Input resistance	10K Ohm 0.1 % completion resistor (Standard)
Units	Freq (Hz) / Digits (Hz2/1000) / SI Units
Display only - resolution	5 Digit - 0.1 Hz
Electrical Data:	
Voltage supply	RS-485 10.5 to 16V DC
Current compensation RS-485 option only:	Typical values are @ 12 V DC excitation
Idle mode	2.2 mA
Active / measurement	20 mA data transmission 60 mA including frequency display
	These values may change slightly between sensors. Use figures as a guide only.
Measuring time:	
warm up	500 ms
response	3 seconds per channel depending on the VW sensor being used (Typical)
Length of data lines RS-485	0 .. 1000m
RS-485 address mode	
General Data:	
Dimensions (mm)	L =260 W = 127 D = 38
Material	Powder - coated aluminium
Operating Temperature	-20 to + 65 Deg C
Data Types	Raw & Engineering Units
Digital port	RS-485, 9600 Baud, 8-bit, 1 stop bit, even parity - other speeds on request
CE conformity	CE conformity according to EN 61000-6
Weight	500 g
Digital communications	
Terminal port	9-way male - 9600 Baud 8 data, no parity, N stop
RS485 port - Modbus	9600 baud, 1 Start bit, 8 Data, Even parity bit, 1 Stop

Figure 4. Real-time Sensor Frequency

Number of Channels to Scan



Scanning Channel Indicator

Modbus Registers

16 / 32 Bit - Modbus Data Format

The Modbus version of the instrument stores data into a series of 4 byte registers as shown below. Information is stored as a floating point 4 byte number. The data is Hex format with the high word being the first 2 bytes and the last being in the next 2 bytes as shown. The VibWire-108-Modbus supports both 16 and 32 bit format registers. Full register addresses are shown in the product User manual. The tables below show only a summary of the registers available for Modbus operations.

System Information

The last 2 registers in the VibWire-108 are used to check the data integrity. Register with address 32 increments upon the completion of an instrument scan and is used to show that the instrument is still operating.

Register with address 34 increments when the VibWire-108 receives a new Modbus 'Read Input Registers' FC=04 command. .

Address: 0..40 – Unused registers return 0.

32 Bit Floating Point Registers

The tables below show how the registers holding the VibWire-108 32 bit - floating point data is stored.

Address Offset	Parameter	Description
0	Chan-0 Freq	High order word
1		Low order word
2	Chan-1 Freq	High order word
3		Low order word
4	Chan-2 Freq	High order word
5		Low order word
6	Chan-3 Freq	High order word
7		Low order word
8	Chan-4 Freq	High order word
9		Low order word
10	Chan-5 Freq	High order word
11		Low order word
12	Chan-6 Freq	High order word
13		Low order word
14	Chan-7 Freq	High order word
15		Low order word

Address Offset	Parameter	Description
16	Chan-0 Temp	High order word
17		Low order word
18	Chan-1 Temp	High order word
19		Low order word
20	Chan-2 Temp	High order word
21		Low order word
22	Chan-3 Temp	High order word
23		Low order word
24	Chan-4 Temp	High order word
25		Low order word
26	Chan-5 Temp	High order word
27		Low order word
28	Chan-6 Temp	High order word
29		Low order word
30	Chan-7 Temp	High order word
31		Low order word
32	Number of Modbus read attempts	High order word
33		Low order word
34	Number of Scans	High order word
35		Low order word

	2 Bytes	2 Bytes
Floating Point Data Value	High Word	Low Word

16 Bit Integer Registers

The tables below show how the registers holding the VibWire-108 16 bit Integer data are stored.

Address: 128..148 – Unused registers return 0.

Address Offset	Parameter	Description
128	Chan-0 Freq	Integer Word
129	Chan-1 Freq	Integer Word
130	Chan-2 Freq	Integer Word
131	Chan-3 Freq	Integer Word
132	Chan-4 Freq	Integer Word
133	Chan-5 Freq	Integer Word
134	Chan-6 Freq	Integer Word
135	Chan-7 Freq	Integer Word
136	Chan-0 Temp	Integer Word
137	Chan-1 Temp	Integer Word
138	Chan-2 Temp	Integer Word
139	Chan-3 Temp	Integer Word
140	Chan-4 Temp	Integer Word
141	Chan-5 Temp	Integer Word
142	Chan-6 Temp	Integer Word
143	Chan-7 Temp	Integer Word

Address Offset	Parameter	Description
144	Number of Modbus read attempts	Integer word
145	Number of Scans	
146-148	0	Integer Word

	2 Bytes
Word Data Value	Word

Modbus Register Types

Address Range		Modbus Data Format
0 .. 40	30001+	Floating point format (Standard)
128 .. 148	30129+	16 bit
256 .. 296	30257+	32 bit
384 .. 424	30385+	32 bit high resolution

Calibration Factors

All of the Keynes Controls instruments range use the following calibration equations to convert frequency in Hz into SI units:

$X = A + Bd + Cd^2 - Dt$ where d = $F^2 / 1000$ (Digits) in m Hz^2
and D = Temperature Correction Coefficient
t = temperature in Deg C

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

A	Constant term	B	Linear term
C	Quadratic term	D	Thermal expansion

Device Internal Terminal Port Menu System

The following procedure is for the **VibWire-108-SDI12**, **VibWire-108-RS485**, and **VibWire-108-Modbus** models only.

Start the Terminal emulator software and configure the communications port to **9600 Baud, 8 data bits, 1 stop bit, No parity**

Main Menu

1 System Maintenance
2 Thermistor type 1
3 Thermistor type 2
4 Diagnostics
5 Channel 0
6 Channel 1
7 Channel 2
8 Channel 3
9 Channel 4
A Channel 5
B Channel 6
C Channel 7
U Up. T Top.

Figure 7

Thermistor type 1

1 Type	1
2 Resistance at T0 (ohms)	3000
3 T0 (Celsius)	25
4 Beta	5234
5 Steinhart-Hart 0th order (A)	3.35E-3
6 Steinhart-Hart 1st order (B)	2.56E-4
7 Steinhart-Hart 2nd order (C)	2.08E-6
8 Steinhart-Hart 3rd order (D)	7.30E-8

U Up. T Top.

Fig mm

Figure 8

Sample VW Sensor Configuration

Channel 0

1 Frequency proc	2
2 Thermistor type	1
3 Cal A	-1.26E+02
4 Cal B	6.52E-02
5 Cal C	3.42E-07
6 Cal D	-1.40E-02

U Up. T Top.

Figure 9

Beta Value temperature calibration factors.

Often available sensor data sheets but calculations based on using them are less accurate than the Steinhart-Hart Calculations.

Figure 9 shows a sample setup for sensor input Channel-0. The instrument will return data values in engineering units,
Figure 8 shows the thermistor calibration settings..

Terminal Port Operation.

Any modern terminal emulator software can be used with the VibWire-108-Mobus instrument to make configuration changes.

Hardware Required: 9 Pin RS232 Crossover cable.
USB to RS232 Converter.

Driver Software : Not required.

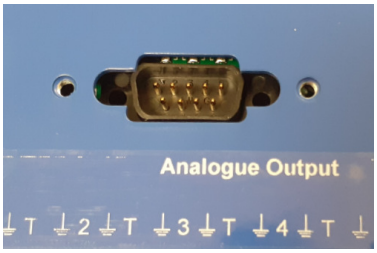
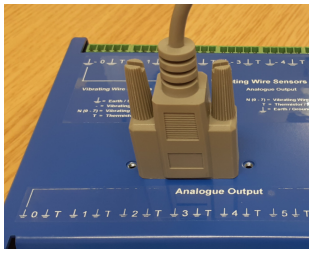


Figure 7. 9 pin RS232 Terminal Port



9 pin RS232 Crossover cable attached to the RS232 Port

9 Pin Crossover cable attached to RS232 to USB converter.

Simply connect the cross over cable to the instrument and RS232 converter and install on to a PC. Activate the terminal port software at the settings shown above and the device main menu will appear. Make changes and disconnect.