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*Instruction Manual*

**Model GK-404**  
**Vibrating Wire Readout**



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Geokon, Inc. warrants its products to be free of defects in materials and workmanship, under normal use and service for a period of 13 months from date of purchase. If the unit should malfunction, it must be returned to the factory for evaluation, freight prepaid. Upon examination by Geokon, if the unit is found to be defective, it will be repaired or replaced at no charge.

However, the WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion or current, heat, moisture or vibration, improper specification, misapplication, misuse or other operating conditions outside of Geokon's control. Components which wear or which are damaged by misuse are not warranted. This includes fuses and batteries.

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## 1. Introduction

The handheld GK-404 Vibrating Wire Readout provides precise measurements of vibrating wire instruments and thermistors. The GK-404 provides complete compatibility with the GK-401 readout.

## 2. Front Panel Controls

The front panel of the GK-404 provides the following features:

- a. 16 columns x 2 lines backlit LCD.
- b. TRANSDUCER connector.
- c. ON/OFF switch.
- d. CFG (Configuration) switch.
- e. MODE switch.
- f. POS (Position) switch.



### **3. GK-404 Operation**

Install a fresh set of (2) 1.5V AA batteries per the instructions in section 6.1 Battery Installation and Replacement.

The GK-404 Vibrating Wire Readout arrives with a patch cord for connecting to the vibrating wire gages. One end will consist of a 5-pin plug for connecting to the respective socket on the bottom of the GK-404 enclosure. The other end will consist of 5 leads terminated with alligator clips. Note the colors of the alligator clips are red, black, green, white and blue. The colors represent the positive vibrating wire gage lead (red), negative vibrating wire gage lead (black), positive thermistor lead (green), negative thermistor lead (white) and transducer cable drain wire (blue). The clips should be connected to their respectively colored leads from the vibrating wire gage cable.

Push the **ON/OFF** button. The initial screen will display:

**Geokon Inc.  
GK-404 verX.X**

**Press <CFG> for  
Config Menu**

After approximately 1 second, the GK-404 will start taking readings and display them based on the settings of the **POS** and **MODE** switches. A typical reading screen for the GK-404 would be:

**Pos Reading degC  
B 5201.6Dg 24.5**

In this case, the position selected is B, the vibrating wire reading is 5201.6 Digits ( $F^2 \times 10^{-3}$ ), and the transducer temperature is 24.5° Celsius. Pressing the **MODE** switch will result in:

**Pos Reading degC  
B 2280.7Hz 24.5**

displaying the vibrating wire reading in Hertz(Hz). Pressing the **MODE** switch again will result in:

**Pos Reading degC  
B 438.5uS 24.5**

The GK-404 will continue to take measurements and display the readings until the OFF button is pushed, or if enabled, when the automatic Power-Off timer shuts the GK-404 off.

### 3.1 POS (POSITION) SWITCH

Pressing the **POS** switch will select the proper pluck settings for the vibrating wire gage that you want to read.

### 3.2 MODE SWITCH

Pressing the **MODE** switch will select the format of the vibrating wire reading: Dg (digits), Hz (hertz),  $\mu$ S (period) or  $\mu$ E (microstrain).

Each Position setting (A-F) has different preprogrammed parameters that are optimized for certain instruments. Each option also has different scaling and processing characteristics. See the table below to determine the best choice for your sensors.

POS	Use with Geokon Model No.	MODE	Calculation	Units	Frequency Sweep (Hz)
A	All	Dg Hz $\mu$ S	$F^2 \times 10^{-3}$ F T	Digits Hertz $\mu$ Sec	450-6000
B	4300BX, 4400, 4500, 4600, 4700, 4800, 4900	Dg Hz $\mu$ S	$F^2 \times 10^{-3}$ F T	Digits Hertz $\mu$ Sec	1500-3500
C	4000	$\mu$ E Hz $\mu$ S	$F^2 \times 10^{-3} \times 4.062$ F T	$\mu$ Strain ( $\epsilon$ ) Hertz $\mu$ Sec	450-1200
D	4200	$\mu$ E Hz $\mu$ S	$F^2 \times 10^{-3} \times 3.304$ F T	$\mu$ Strain ( $\epsilon$ ) Hertz $\mu$ Sec	450-1200
E	4100	$\mu$ E Hz $\mu$ S	$F^2 \times 10^{-3} \times 0.39102$ F T	$\mu$ Strain ( $\epsilon$ ) Hertz $\mu$ Sec	1500-6000
F	4300EX	Dg Hz $\mu$ S	$F^2 \times 10^{-3}$ F T	Digits Hertz $\mu$ Sec	2500-6000

Where:

T = Period (1/F) in  $\mu$ Sec

F = Frequency in Hertz

### 3.3 CFG SWITCH

Pressing the CFG switch will cause the GK-404 to enter the Configuration Menu. The LCD screen will display:

**GK-404 verX.X**  
**Config Menu**

From this menu several GK-404 operating parameters may be set. Use the **POS** switch to select the various parameters and the **MODE** switch to select each parameter's options. Press **CFG** twice at any time to exit the Configuration Menu and return to the Readings Screen.

#### 3.3.1 BACKLIGHT:

Press **MODE** to turn the LCD backlight ON or OFF.

#### 3.3.2 BATTERY VOLTAGE:

This is a bargraph display of the power remaining in the (2) 1.5V AA cells, with **F** for FULL and **E** for EMPTY. The GK-404 is capable of continuous operation for greater than 24 hours on a fresh set of batteries.

#### 3.3.3 CONTRAST:

Press the **MODE** switch to adjust the contrast of the LCD display in 10% increments.

#### 3.3.4 POWERTIMER:

Press the **MODE** switch to select automatic shut-off after 5 minutes, 15 minutes or 30 minutes. You may also disable the Powertimer so that the GK-404 will only shut off if the front panel **ON/OFF** switch is pressed. Note that these times apply only if no front panel switches are pressed. The timer will reset and start over each time a front panel switch is pressed. When the GK-404 does shut off, all settings are saved to internal memory and will restore the next time the GK-404 is turned on. Also note that the times indicated are approximate.

### 3.4 ON/OFF SWITCH

To turn the GK-404 ON, press the **ON/OFF** switch. To turn the GK-404 OFF, press and hold the **ON/OFF** switch until **Saving Settings** is displayed. Release the **ON/OFF** switch to turn the GK-404 OFF. All settings are stored on shut off and will be restored the next time the GK-404 is turned on.

### 3.5 DEFAULT SETTINGS

Factory default settings may be restored at any time by pressing and holding the CFG and POS buttons when turning the GK-404 ON. The factory default settings are:

POS	B
MODE	Dg
BACKLIGHT	OFF
CONTRAST	50%
POWER-OFF TIME	5 minutes

#### **4. Low Battery Indication and Auto-Off**

The GK-404 continuously monitors the status of the (2) 1.5V AA cells, and when their combined voltage drops to 2V, the message **Batteries Low** is displayed on the screen. A fresh set of 1.5V AA batteries should be installed at this point. If the battery voltage drops to 1.8V, the message:

**REPLACE  
BATTERIES**

is displayed on the screen, and the GK-404 will shut itself off. All settings are still saved in internal non-volatile memory.

### **5. Maintenance**

#### **5.1 Battery Installation and Replacement**

(2) 1.5V AA Batteries need to be installed in the GK-404. Alkaline batteries are the best choice and a set is provided with the GK-404 Readout. Use a #1 Phillips screwdriver to remove the battery compartment cover located in the back of the readout and install the batteries following the polarities indicated inside the battery compartment. Reinstall the battery compartment cover.

Never use two different types of batteries or mix old batteries with new. This could cause batteries to leak and permanently damage the readout. Although alkaline batteries are highly recommended, standard “AA” batteries can be used.

#### **5.2 Cleaning**

A clean cloth can be used to wipe down the GK-404 Readout. No solvents should be used as they may damage the case of the readout.

#### **5.3 Calibration**

The readout should be sent periodically (every 12 months) back to the manufacturer for inspection, cleaning, and calibration. A nominal fee will be charged for the service, but it is highly recommended.

## **6. TROUBLESHOOTING**

Listed below are a few commonly experienced problems and remedial action. Contact the factory should a problem arise not explained herein.

### **6.1 Unit will not come on**

Internal batteries are either dead or installed backwards.

### **6.2 Vibrating wire gage measurement shows dashes**

Check Alligator Clip connections to vibrating wire gage leads. If okay, check gage with Ohmmeter. It should read between 90 and 180 ohms. If gage resistance is okay, check Readout with another gage. If still doesn't work consult the factory to schedule return and repair of Readout.

### **6.3 Vibrating wire gage reading unstable**

Improper **POS**ition selected. Verify gage model number against the recommended setting. If switch **POS**ition is correct, the gage is either marginal or there may be a strong source of electro-magnetic interference nearby.

### **6.4 Thermistor measurement shows dashes**

Check Alligator Clip connections to Thermistor leads. If okay, check Thermistor with Ohmmeter. It should read between 10K ohms and 2.4K ohms (0 to +30 degrees Celsius). If Thermistor checks out okay consult factory to schedule repair of Readout. Note: Dashes will display if no Thermistor is connected!

## **7. Limits of Liability**

The GK-404 Vibrating Wire Readout has been developed specifically for use with Geokon, Inc. vibrating wire gages and, as such, Geokon, Inc. assumes no responsibility for its use with other systems. Every effort has been made to ensure reliable operation, but the user must be aware that there is no warranty against uninterrupted or trouble-free operation. For the user conducting particularly unusual or sensitive analysis, or for those not familiar with vibrating wire gage data processing, it is recommended that the problems be double checked using another measurement system.

Also, the readout is provided 'as is' and Geokon, Inc. assumes no responsibility as to results, performance, or interpretation associated with the GK-404 Vibrating Wire Readout. Warranty shall cover parts (except batteries) and labor for a period of 1 year from the date of purchase. In addition, there is a 1-month grace period to the warranty for a total of 13 months.

We reserve the right to revise this publication and/or readout from time to time with no obligation to notify users of these changes.

**All things considered, Geokon, Inc., is not liable for any claims, injuries, or damages caused directly or indirectly by the proper or improper use of the GK-404 Vibrating Wire Readout, beyond the purchase price of the Readout.**

## **APPENDIX A - SPECIFICATIONS**

### **A.1 Vibrating Wire Readout:**

Excitation Range: 400 Hz to 6000 Hz, 5-volt square wave

Measurement Resolution:   0.1Hz  
                                  0.1uS  
                                  0.1Digit

Measurement Accuracy:    +/-0.025 % of Full Scale (6000 Hz)

### **A.2 Temperature Readout:**

Sensor Type: Thermistor, YSI 44005, Dale #1C3001-B3, Alpha #13A3001-B3

Sensor Accuracy:  $\pm 0.5^\circ$  Celsius

Measurement Range:  $-15^\circ$  to  $+60^\circ$  Celsius

Measurement Resolution:  $0.1^\circ$  Celsius

Measurement Accuracy: +/- 1.0% of Full Scale

### **A.3 Physical:**

Display: 16 Columns x 2 Lines LCD

Dimensions: 120mm (4.72") x 65mm (2.56") x 22mm (0.87")

Weight: Approx 145 grams (5.1 ounces) with (2) "AA" alkaline batteries installed

Temperature Range:  $-20^\circ$  to  $+50^\circ$  Celsius

Battery: (2) "AA" 1.5 volt alkaline.

Operating Time: minimum 24 hours continuous at  $+25^\circ$  Celsius

## **APPENDIX B - ACCESSORIES**

The following accessories arrive with the GK-404 Vibrating Wire Readout:

1. Vibrating wire gage interconnect cable (flying leads).
2. GK-404 Vibrating Wire Readout manual.
3. "AA" Alkaline batteries (2).
4. Carrying case with shoulder strap.

## **APPENDIX C - CONNECTOR PIN OUTS**

### **C.1 Transducer Plug Pin Out**

5-pin LEMO HGG.OB.305.CLL P	Wire Color	Alligator Clip Boot Color (Flying Leads)	Description
1	Red	Red	VW Gage +
2	Black	Black	VW Gage -
3	White	White	Thermistor +
4	Green	Green	Thermistor -
5	Bare	Blue	Drain Wire

## APPENDIX D - THERMISTOR TEMPERATURE DERIVATION

**Thermistor Type: YSI 44005, Dale #1C3001-B3, Alpha #13A3001-B3**

**Resistance to Temperature Equation:**

$$T = \frac{1}{A + B(\ln R) + C(\ln R)^3} - 273.2$$

where: T = Temperature in °C.

LnR = Natural Log of Thermistor Resistance

A =  $1.4051 \times 10^{-3}$  (coefficients calculated over the -50 to +150° C. span)

B =  $2.369 \times 10^{-4}$

C =  $1.019 \times 10^{-7}$

**Resistance versus Temperature Table:**

Ohms	Temp	Ohms	Temp	Ohms	Temp	Ohms	Temp	Ohms	Temp
201.1K	-50	16.60K	-10	2417	+30	525.4	+70	153.2	+110
187.3K	-49	15.72K	-9	2317	31	507.8	71	149.0	111
174.5K	-48	14.90K	-8	2221	32	490.9	72	145.0	112
162.7K	-47	14.12K	-7	2130	33	474.7	73	141.1	113
151.7K	-46	13.39K	-6	2042	34	459.0	74	137.2	114
141.6K	-45	12.70K	-5	1959	35	444.0	75	133.6	115
132.2K	-44	12.05K	-4	1880	36	429.5	76	130.0	116
123.5K	-43	11.44K	-3	1805	37	415.6	77	126.5	117
115.4K	-42	10.86K	-2	1733	38	402.2	78	123.2	118
107.9K	-41	10.31K	-1	1664	39	389.3	79	119.9	119
101.0K	-40	9796	0	1598	40	376.9	80	116.8	120
94.48K	-39	9310	+1	1535	41	364.9	81	113.8	121
88.46K	-38	8851	2	1475	42	353.4	82	110.8	122
82.87K	-37	8417	3	1418	43	342.2	83	107.9	123
77.66K	-36	8006	4	1363	44	331.5	84	105.2	124
72.81K	-35	7618	5	1310	45	321.2	85	102.5	125
68.30K	-34	7252	6	1260	46	311.3	86	99.9	126
64.09K	-33	6905	7	1212	47	301.7	87	97.3	127
60.17K	-32	6576	8	1167	48	292.4	88	94.9	128
56.51K	-31	6265	9	1123	49	283.5	89	92.5	129
53.10K	-30	5971	10	1081	50	274.9	90	90.2	130
49.91K	-29	5692	11	1040	51	266.6	91	87.9	131
46.94K	-28	5427	12	1002	52	258.6	92	85.7	132
44.16K	-27	5177	13	965.0	53	250.9	93	83.6	133
41.56K	-26	4939	14	929.6	54	243.4	94	81.6	134
39.13K	-25	4714	15	895.8	55	236.2	95	79.6	135
36.86K	-24	4500	16	863.3	56	229.3	96	77.6	136
34.73K	-23	4297	17	832.2	57	222.6	97	75.8	137
32.74K	-22	4105	18	802.3	58	216.1	98	73.9	138
30.87K	-21	3922	19	773.7	59	209.8	99	72.2	139
29.13K	-20	3748	20	746.3	60	203.8	100	70.4	140
27.49K	-19	3583	21	719.9	61	197.9	101	68.8	141
25.95K	-18	3426	22	694.7	62	192.2	102	67.1	142
24.51K	-17	3277	23	670.4	63	186.8	103	65.5	143
23.16K	-16	3135	24	647.1	64	181.5	104	64.0	144
21.89K	-15	<b>3000</b>	<b>25</b>	624.7	65	176.4	105	62.5	145
20.70K	-14	2872	26	603.3	66	171.4	106	61.1	146
19.58K	-13	2750	27	582.6	67	166.7	107	59.6	147
18.52K	-12	2633	28	562.8	68	162.0	108	58.3	148
17.53K	-11	2523	29	543.7	69	157.6	109	56.8	149
								55.6	150