Model GK-404

Vibrating Wire Readout

Instruction Manual



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1. INTRODUCTION

The Model GK-404 Vibrating Wire Readout is a portable, low-power, handheld readout unit that is capable of operating for more than 20 hours continuously on two AA batteries. It is designed for the readout of all Geokon vibrating wire gauges and transducers, and is capable of displaying the reading in either digits, frequency (Hz), period (μ s), or microstrain (μ ϵ). The GK-404 also displays the temperature of the transducer (embedded thermistor) with a resolution of 0.1 °C.

2. INITIAL SETUP

2.1 ACCESSORIES

The GK-404 is sold with the following accessories:

- GK-404-1 flying leads
- Carrying case
- Nylon strap for the carrying case
- Neck strap for the GK-404

Before use, attach the flying leads to the GK-404 as follows:

- 1. Align the red circle on the silver Lemo connector on the flying leads with the red line on the connector on the top of the GK-404.
- 2. Insert the Lemo connector into the GK-404 until it locks into place (see Figure 1).



FIGURE 1: Lemo Connector to GK-404

3. Remove the flying leads before storing the GK-404 in the carrying case.

To connect the nylon strap to the carrying case, clip both ends of the strap onto the plastic loops on the sides of the case.

Connect the neck strap to the GK-404 as follows:

1. Locate the plastic connector on the neck strap (see the figure below).



FIGURE 2: Neck Strap Connector

2. Place the larger circular hole onto the plastic nub on the back of the GK-404, with the bottom of the connector to the right (see the figure below).



FIGURE 3: Connector on GK-404

- 3. Slide the connector all the way to the right, so that the nub on the back of the GK-404 locks into the smaller hole of the connector.
- 4. Turn the connector clockwise until the bottom of the connector is pointing down (see the figure below).



FIGURE 4: Downward-Pointing Connector

Snap together the twin connectors located at the strap ends (see the figure below).



FIGURE 5: Neck Strap Connections

2.2 CONNECTING A SENSOR

Attach the GK-404-1 flying leads to the bare leads of a GEOKON vibrating wire sensor by connecting each of the clips on the leads to the matching colors of the sensor conductors, with blue representing the bare shield wire.

GEOKON makes patch cables that enable the GK-404 to read sensors with connectors attached to the readout cable.

2.3 CONNECTING A LOAD CELL

If a load cell cable has a readout cable connector attached, the GK-404 can easily connect to it using a patch cable provided by GEOKON.

If the load cell cable does not have a connector, the leads of the load cell may be connected directly to the flying leads from the GK-404. The individual leads can be identified as shown in the wiring diagram in Table 1 below.

Each sensor is read in turn by connecting either the red or black clip to the lead marked **common**. The black or red clip must be connected to the leads marked #1, #2, #3, etc. The blue clip should be connected to the cable shield wire, and the green and white clips to the cable leads marked **thermistor**.

10-pin Bulkhead PT06A-12-10P	Function	Three Gauge VW Load Cell Geokon Purple Cable	Four Gauge VW Load Cell Geokon Purple Cable	Six Gauge VW Load Cell Geokon Orange Cable
А	Gauge #1	Red	Red	Red
В	Gauge #2	Red's Black	Red's Black	Red's Black
С	Gauge #3	White	White	White
D	Gauge #4	NC	White's Black	White's Black
E	Gauge #5	NC	NC	Green
F	Gauge #6	NC	NC	Green's Black
G	Shield	All Shields	All Shields	All Shields
Н	Common	White's Black ¹	Green	Blue
J	Thermistor	Green ¹	Blue	Yellow
К	Thermistor	Green's Black	Blue's Black	Yellow's Black

¹ White's black and Green wires are switched on Geokon three gauge VW load cells prior to serial number 3313.

TABLE 1: Load Cell Wiring Diagram

3. OPERATION

To turn on the GK-404 on, press the **On/Off** button on the front panel of the unit. The initial startup screen will be displayed. After approximately one second, the GK-404 will start taking readings and display them based on the settings of the **Pos** and **Mode** buttons.

The unit display (from left to right) is as follows:

- The current Position, set by the **Pos** button, displayed as a letter, A F.
- The current Reading, displayed as a numeric value, followed by the unit of measure (set by the **Mode** button).
- Temperature reading of the attached gauge in degrees Celsius.

The GK-404 will continue to take measurements and display readings until the unit is turned off, either manually, or if enabled, by the Auto-Off timer. See Section 3.3 for information on the Auto-Off timer. To turn off the GK-404 manually, press and hold the **On/Off** button until Saving Settings is displayed, then release the button. All user settings are stored at shut off and will be restored the next time the GK-404 is turned on.

3.1 POS (POSITION) BUTTON

Use the **Pos** button to change the GK-404 pluck settings. Each Position setting (A-F) has different preprogrammed parameters that are optimized for certain instruments. Each option also has different scaling and processing characteristics. The table below details the correct position to use with the various models sold by GEOKON.

Position	A B		C	D	E	F		
Use with Geokon Models:	All	4300BX 4400 4500 4600 4700 4800 4900	4000	4200	4100	4300EX		
Mode 1:		Dg		με		Dg		
Units:	C	ligits		μStrain(ε)				
Calculation:	F ²	² x10 ⁻³	F ² x10 ⁻³ x4.062	F ² x10 ⁻³ x3.304	F ² x10 ⁻³ x0.39102	F ² x10 ⁻³		
Mode 2:			Hz					
Units:			Hertz					
Calculation:			F = Freque	uency in Hertz				
Mode 3:			ł	ιS				
Units:			μSec					
Calculation:			T = Period (
Frequency Sweep: (Hz)	450-6000	1500-3500	450-	1200	1500-3500	2500-6000		

TABLE 2: Position Specifications

3.2 MODE BUTTON

Pressing the **Mode** button will select the format of the vibrating wire reading. The available options are Dg (digits), Hz (hertz), μ S (period), and $\mu\epsilon$ (microstrain). Only positions C, D, and E support the $\mu\epsilon$ microstrain format.

3.3 CONFIGURATION (CFG) BUTTON

Pressing the **Cfg** button will cause the GK-404 to enter the Configuration Menu. The LCD screen will display:

GK-404 verX.XX Config Menu

From this menu, several GK-404 operating parameters may be set. Use the **Pos** button to select the various parameters and the **Mode** button to select each parameter's options. Press **Cfg** twice at any time to exit the Configuration Menu

and return to the Readings Screen. Parameters available from the Configuration Menu are as follows:

BACKLIGHT:

Press Mode to turn the LCD backlight on or off.

BATTERY VOLTAGE:

This is a bar graph display of the power remaining in the two 1.5V AA cells, with F for FULL and E for EMPTY. The GK-404 is capable of continuous operation for greater than 20 hours on a fresh set of batteries.

CONTRAST:

Press the **Mode** button to adjust the contrast of the LCD display in 10% increments.

AUTO-OFF:

Press the **Mode** button to select automatic shutoff after five minutes, 15 minutes, or 30 minutes. The Auto-Off may be disabled so that the GK-404 will only shut off if the front panel **On/Off** button is pressed. The Auto-Off will activate only if no front panel buttons are pressed for the specified amount of time. The timer will reset each time a button is pressed. When the GK-404 powers down, all settings are saved to the internal memory, and will restore the next time the GK-404 is turned on.

Note: The times mentioned above are approximate.

3.4 DEFAULT SETTINGS

Factory default settings can be restored by pressing and holding the **Cfg** and **Pos** buttons when powering on the GK-404. The factory default settings are:

Position: B Mode: Dg Backlight: Off Contrast: 50% Power-off Time: Five minutes

4. MAINTENANCE

4.1 LOW BATTERY INDICATION AND AUTO-OFF

The GK-404 continuously monitors the status of the two 1.5V AA cells. 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 will be displayed on the screen; the GK-404 will then shut off. All settings are still saved in the internal nonvolatile memory.

4.2 BATTERY REPLACEMENT

Alkaline batteries are the best choice for use in the GK-404. A set of two 1.5V AA batteries are installed in the GK-404 at the factory. To replace the batteries, use a #1 Phillips screwdriver to remove the battery compartment cover located at the back of the readout. Install a new set of 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, carbon zinc A batteries can be used.

4.3 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.

4.4 CALIBRATION

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

5. TROUBLESHOOTING

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

SYMPTOM: UNIT WILL NOT COME ON

□ Internal batteries are either dead or installed backwards.

SYMPTOM: VIBRATING WIRE GAUGE MEASUREMENT SHOWS DASHES

□ Check alligator clip connections to vibrating wire gauge leads. if okay, check gauge with ohmmeter. It should read between 90 and 180 ohms. If gauge resistance is okay, check readout with another gauge. If it still does not work, consult the factory to schedule return and repair of readout.

SYMPTOM: VIBRATING WIRE GAUGE READING UNSTABLE

□ Improper position selected. Verify gauge model number against the recommended setting (see Table 2 in Section 3.1). If position setting is correct, the gauge is either marginal or there may be a strong source of electromagnetic interference nearby.

SYMPTOM: 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 the thermistor checks out okay, consult factory to schedule repair of readout. Note: dashes will display if no thermistor is connected.

SYMPTOM: DISPLAY SHOWS WEIRD CHARACTERS

□ Switch the GK-404 to the ON setting while pushing the **Cfg** and **Pos** buttons at the same time, to restore the unit to its factory default settings.

6. LIMITS OF LIABILITY

The GK-404 Vibrating Wire Readout has been developed specifically for use with GEOKON vibrating wire gauges and, as such, GEOKON 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 gauge data processing, it is recommended that the problems be double checked using another measurement system.

In addition, the readout is provided **as is** and GEOKON 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 one year from the date of purchase. In addition, there is a one-month grace period to the warranty for a total of 13 months.

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

Overall, GEOKON 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:	0.1 Hz, 0.1 µS, 0.1 Digit
Measurement Accuracy:	±0.025% of Full Scale (6000 Hz)

TABLE 3: Vibrating Wire Readout

A.2 TEMPERATURE READOUT

Sensor Type	9:	Thermistor, YSI 44005, Dale #1C3001-B3, Alpha #13A3001-B3
Sensor Acc	uracy:	0.5 Celsius
Measureme	ent Range:	20 to 50 Celsius
Measureme	ent Resolution:	0.1 Celsius
Measureme	ent Accuracy:	±1.0% of Full Scale

See Appendix B for more information.

TABLE 4: Temperature Readout

A.3 PHYSICAL

Display:	16 columns x two lines LCD
Dimensions:	120 mm (4.72") x 65 mm (2.56") x 22 mm (0.87")
Weight: Approx.	145 grams (5.1 ounces) with two AA alkaline batteries installed
Temperature Range:	-20 to +50 Celsius
Battery:	Two AA 1.5 volt alkaline.
Operating Time:	Minimum 24 hours continuous at +25° Celsius

TABLE 5: Physical Specifications

A.4 TRANSDUCER PLUG PIN OUT

Pin # on 5-pin LEMO (HGG.0B.305.CLLP)	Wire Color	Flying Leads Alligator Clip Boot Color	Description
1	Red	Red	VW Gauge+
2	Black	Black	VW Gauge-
3	White	White	Thermistor+
4	Green	Green	Thermistor-
5	Bare	Blue	DrainWire

TABLE 6: Transducer Plug Pinout

B.1 3KΩ THERMISTOR RESISTANCE

Thermistor Types:

- YSI 44005, Dale #1C3001-B3, Alpha #13A3001-B3
- Honeywell 192-302LET-A01

Resistance to Temperature Equation:

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

EQUATION 1: 3kΩ Thermistor Resistance

Where:

T = Temperature in °C LnR = Natural Log of Thermistor Resistance $A = 1.4051 \times 10^{-3}$ $B = 2.369 \times 10^{-4}$ $C = 1.019 \times 10^{-7}$

Note: Coefficients calculated over the -50 to +150 °C span.

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

TABLE 7: 3KΩ Thermistor Resistance

B.2 10KΩ THERMISTOR RESISTANCE

Thermistor Type: US Sensor 103JL1A

Resistance to Temperature Equation:



EQUATION 2: 10KΩ Thermistor Resistance

Where:

$$\begin{split} T &= \text{Temperature in }^{\circ}\text{C} \\ \text{LnR} &= \text{Natural Log of Thermistor Resistance} \\ \text{A} &= 1.127670 \times 10^{-3} \\ \text{B} &= 2.344442 \times 10^{-4} \\ \text{C} &= 8.476921 \times 10^{-8} \end{split}$$

 $D = 1.175122 \times 10^{-11}$

Note: Coefficients optimized for a curve **J** Thermistor over the temperature range of 0 $^{\circ}$ C to +250 $^{\circ}$ C.

Ohms	Temp	Ohms	Temp	Ohms	Temp	Ohms	Temp	Ohms	Temp	Ohms	Temp	Ohms	Temp	Ohms	Temp
32,650	0	7,402	32	2,157	64	763.5	96	316.6	128	148.4	160	76.5	192	42.8	224
31,029	1	7,098	33	2,083	65	741.2	97	308.7	129	145.1	161	75.0	193	42.1	225
29,498	2	6,808	34	2,011	66	719.6	98	301.0	130	142.0	162	73.6	194	41.4	226
28,052	3	6,531	35	1,942	67	698.7	99	293.5	131	138.9	163	72.2	195	40.7	227
26,685	4	6,267	36	1,876	68	678.6	100	286.3	132	135.9	164	70.8	196	40.0	228
25,392	5	6,015	37	1,813	69	659.1	101	279.2	133	133.0	165	69.5	197	39.3	229
24,170	6	5,775	38	1,752	70	640.3	102	272.4	134	130.1	166	68.2	198	38.7	230
23,013	7	5,545	39	1,693	71	622.2	103	265.8	135	127.3	167	66.9	199	38.0	231
21,918	8	5,326	40	1,637	72	604.6	104	259.3	136	124.6	168	65.7	200	37.4	232
20,882	9	5,117	41	1,582	73	587.6	105	253.1	137	122.0	169	64.4	201	36.8	233
19,901	10	4,917	42	1,530	74	571.2	106	247.0	138	119.4	170	63.3	202	36.2	234
18,971	11	4,725	43	1,480	75	555.3	107	241.1	139	116.9	171	62.1	203	35.6	235
18,090	12	4,543	44	1,432	76	539.9	108	235.3	140	114.5	172	61.0	204	35.1	236
17,255	13	4,368	45	1,385	77	525.0	109	229.7	141	112.1	173	59.9	205	34.5	237
16,463	14	4,201	46	1,340	78	510.6	110	224.3	142	109.8	174	58.8	206	33.9	238
15,712	15	4,041	47	1,297	79	496.7	111	219.0	143	107.5	175	57.7	207	33.4	239
14,999	16	3,888	48	1,255	80	483.2	112	213.9	144	105.3	176	56.7	208	32.9	240
14,323	17	3,742	49	1,215	81	470.1	113	208.9	145	103.2	177	55.7	209	32.3	241
13,681	18	3,602	50	1,177	82	457.5	114	204.1	146	101.1	178	54.7	210	31.8	242
13,072	19	3,468	51	1,140	83	445.3	115	199.4	147	99.0	179	53.7	211	31.3	243
12,493	20	3,340	52	1,104	84	433.4	116	194.8	148	97.0	180	52.7	212	30.8	244
11,942	21	3,217	53	1,070	85	421.9	117	190.3	149	95.1	181	51.8	213	30.4	245
11,419	22	3,099	54	1,037	86	410.8	118	186.1	150	93.2	182	50.9	214	29.9	246
10,922	23	2,986	55	1,005	87	400.0	119	181.9	151	91.3	183	50.0	215	29.4	247
10,450	24	2,878	56	973.8	88	389.6	120	177.7	152	89.5	184	49.1	216	29.0	248
10,000	25	2,774	57	944.1	89	379.4	121	173.7	153	87.7	185	48.3	217	28.5	249
9,572	26	2,675	58	915.5	90	369.6	122	169.8	154	86.0	186	47.4	218	28.1	250
9,165	27	2,579	59	887.8	91	360.1	123	166.0	155	84.3	187	46.6	219		
8,777	28	2,488	60	861.2	92	350.9	124	162.3	156	82.7	188	45.8	220]	
8,408	29	2,400	61	835.4	93	341.9	125	158.6	157	81.1	189	45.0	221]	
8,057	30	2,316	62	810.6	94	333.2	126	155.1	158	79.5	190	44.3	222]	
7,722	31	2,235	63	786.6	95	324.8	127	151.7	159	78.0	191	43.5	223]	

TABLE 8: 10KΩ Thermistor Resistance



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