



## FIBER OPTIC GYROSCOPE

### VG910 SERIES

#### Information Guide

Output	VG910	Extension	Key Features
<i>differential</i>		<i>H1</i>	<i>1200 g shocks</i>
		<i>H125C</i>	<i>+125°C operating</i>
<i>single-ended</i>		<i>F1</i>	<i>Highly reliable</i>
<i>digital</i>		<i>D1</i>	<i>Built-in ADC</i>

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## 1. Introduction

### 1.1. Scope<sup>1</sup>

This guide describes fiber optic gyroscope main features. Suggestions on product use, handling and installation are given.

### 1.2. Product Description

The Fizoptika gyro is a complete gyro system which comprises a [fiber optic sensing assembly](#) and analog processing electronics. The sensing assembly (an open-loop minimum configuration) is fabricated from a single length of optical fiber by a fusion-tapering technique.

The series features robust and reliable design coupled with a choice of outputs (differential, single-ended, digital).

The basic model VG910H1 features excellent durability and high performance.

See product main parameters in **Annex 1**, outline dimensions, pins assignment, axes definition in **Annex 2**.

With an exclusive technology of precise polarization control all models acquire [Minimum Magnetic Sensitivity](#) about 0.6°/h/Gauss and may be used without heavy magnetic shielding for most applications.

### 1.3. Essential

The gyro housing is silicone sealed. Keep the product dry during its whole lifetime.

Do not drop. Excessive shock can damage the unit.

Use standard ESD practices when handling the unit

## 2. Electrical Characteristics

### 2.1. Powering

The gyro requires a clean and stable 5Vdc (±5%) power supply. Voltages greater than 5.5V (or reversing polarity) can cause some components to heat and eventually fail. Smooth voltage transient at power-on is recommended.

See the electrical diagrams in **Annex 3**.

### 2.2. Differential Output

The gyro provides output voltages via two leads (OUT+, OUT-) each biased at **U0=1V** to Common lead (GND).

$$U(+) = U0 + \frac{1}{2} SF \cdot \Omega \quad U(-) = U0 - \frac{1}{2} SF \cdot \Omega$$

$$\text{Output voltage } U(\Omega) = U(+)- U(-) = SF \cdot \Omega$$

The output voltage range is **±2V**. The output impedance is 1kOm (to GND). 2<sup>nd</sup> order LPF cutoff frequency is ~1kHz (see the diagram in **Annex 3**).

**Diagnostics.** If gyro fails, **U0 ≠ 1V**.

The SF and bias are slightly sensitive to supply voltage. The sensitivity coefficients are individual for each unit. Values for reference: SF – 0.05%/V, bias – 0.1 mV/V.

The outputs can be used in either single-ended or differential mode. Differential mode offers the best performance since the common mode errors and noise are minimized.

### 2.3. Single-ended Output

Advanced processing electronics performs continuous bias calibration at frequency 2.4 kHz to eliminate electronic component of the drift. Output voltage is provided via two leads - OUTPUT, AGND (Analog Ground).

$$U(\Omega) = SF \cdot \Omega$$

The output impedance is low (amplifier direct output).

3<sup>d</sup> order LPF cutoff frequency is ~ 1kHz.

Avoid ground loops to read true gyro signal. Cables shielding is also recommended.

### 2.4. Temperature Output

The gyro provides temperature data via TS lead:

$$V(TS) = 0.5 + t^{\circ}C/100 \quad [V]$$

Temperature output is single-ended.

<sup>1</sup> The information presented in this document is believed to be correct. Fizoptika accepts no liability for any errors it might contain and reserves the right to alter specifications without prior notice. All pictures shown are for illustration purpose only. The actual product may vary due to the ongoing product enhancement.

## 2.5. Digital Output

The digital model incorporates an analog processing circuit and digital circuit integrated into a single PCB. It is equipped with precise 24-bit ADC and powerful processor. The digital signal (RS422, 920kBd, 8kHz rate) contains angular rate raw data and set of gyro parameters used for data compensation and built-in test. Read more in [Fiber Optic Gyroscope Digital Output](#).

## 2.6. Effect of Environment

### ♦ Temperature

- **Bias** ~ 0.1-1  $\mu\text{V} / ^\circ\text{C}$  (temperature sensitivity of the components of analog processing circuit)
- **SF** ~ 0.02 -0.04% /  $^\circ\text{C}$  (SLD spectrum temperature effect)

### ♦ Magnetic field (minimized response, non-shielded)

- **Bias** ~ 0.6°/h/Gauss (X axis, nonadjustable natural response)
- **SF** is not sensitive

### ♦ Vibration

- **Bias** is not sensitive ( $\text{VRE} = 0$ )
- **Noise** spectrum factor 1-5  $\mu\text{V} / \text{g} \cdot \text{Hz}$  (direction dependent)
- **SF** is not sensitive

See Test Data Samples in **Annex 4**.

## 3. Mounting Guidelines

The VG910 is typically screw mounted.

### 3.1. Screw Mounting

- The mounting surface should be clean, smooth and flat.
- Torque screws M3 max to 3 Ncm limits. Use a manual torque wrench.

### 3.2. Mating Frame

Resonances of the mating frame and the gyro to frame joints (adhesive or mechanical) should exceed vibration frequencies. Otherwise, an extra noise at the output is possible because the gyro may acquire much higher levels of vibration compared to the mating frame.

### 3.3. Cable Routing

Use flexible cables with a low weight per length. Make sure that cable bending does not result in contacts stress.

## Annex 1. Product Main Parameters

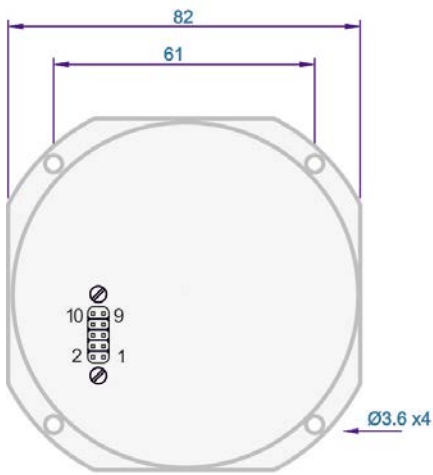
MAIN PARAMETERS	VG910H1	VG910H125C	VG910F1	VG910D1
Input range (°/s)	250	280	350	250
Bias stability / Bias repeatability(RMS, °/h)	2	2	1	1
Angle random walk (°/√h)	0.015	0.05	0.02	0.007
Bandwidth (kHz)	1	1	1	1
SF stability / SF repeatability(RMS, %)	0.02	0.02	0.01	0.02
<b>ELECTRICAL PARAMETERS</b>				
Start-up (s)	0.03	0.03	0.05	0.03
Powering (W)	0.5	0.5	0.5	0.7
Data rate (kHz)	-	-	-	8
Baud rate (kBd)	-	-	-	920
<b>PHYSICAL PARAMETERS</b>				
Dimensions (mm)	82 x 82 x 20	82 x 82 x 20	82 x 82 x 20	82 x 82 x 20
Weight (gram)	150	150	150	150
Volume (cl)	10	10	10	10
Housing material	Al alloy	Al alloy	Al alloy	Al alloy
<b>ENVIRONMENT</b>				
Temperature (operating, °C)	-40...+70	-40...+70	-40...+70	-40...+70
extended range	+70...+85 (optional)	+70...+125 (> 1 h)	-	-
Temperature (endurance, >2 h, °C)	-55...+85	-55...+85	-55...+85	-55...+85
extended range	-	+85...+125	-	-
Vibration (RMS, 0.02 - 2 kHz, g)	30	12	18	18
Shocks (g, 1 ms)	1200	500	450	1200
<b>RELIABILITY</b>				
MTBF (20°C) / Lifetime (yrs)*	15	15	15	15

\* Humidity conditions applied

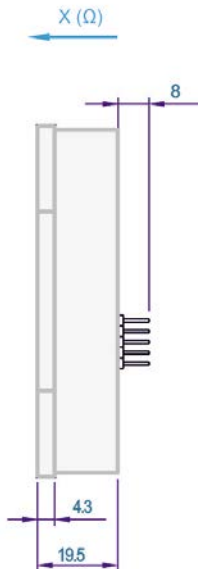
**Annex 2. Outline Drawings, Axes Definition, Pin Assignment**



**VG910H1, VG910H125C, VG910D1**

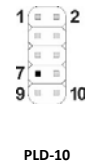


(Ω) –sensing axis (±3°)



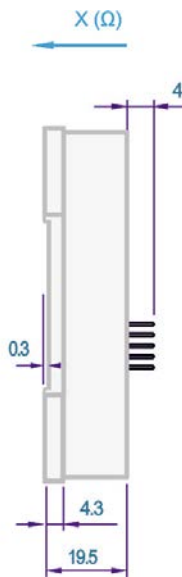
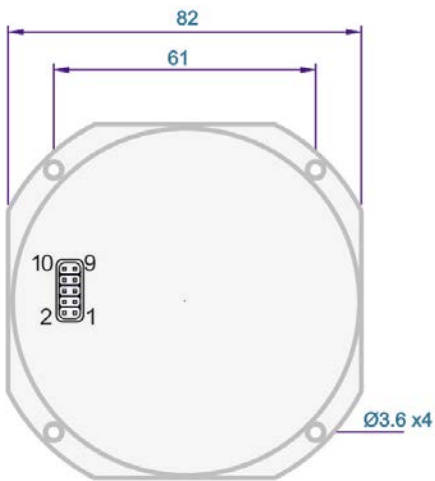
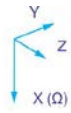
1	+5V
2	NC
3	OUT+
4	NC
5	OUT-
6	GND
7	KEY (cut pin)
8	GND
9	TS
10	NC

**VG910H1  
VG910H125C**

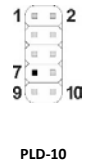


1	+5V
2	NC
3	NC
4	NC
5	NC
6	GND
7	KEY (cut pin)
8	GND
9	RS422 TA
10	RS422 TB

**VG910D1**



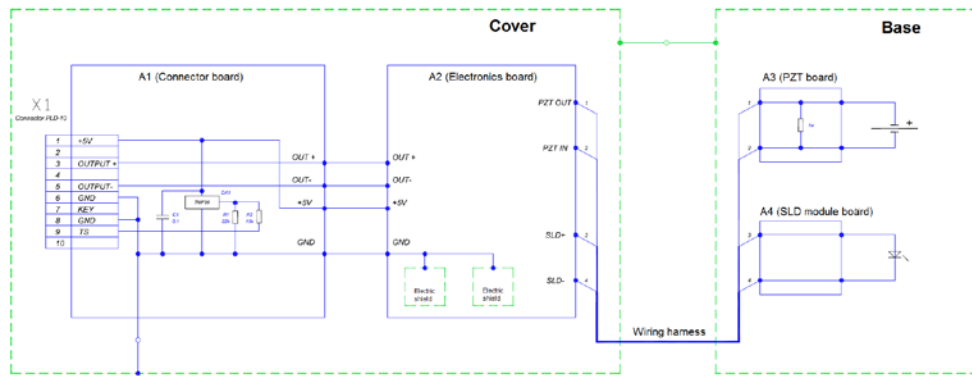
1	+5V
2	NC
3	OUT
4	NC
5	AGND
6	GND
7	KEY (cut pin)
8	GND
9	TS
10	NC



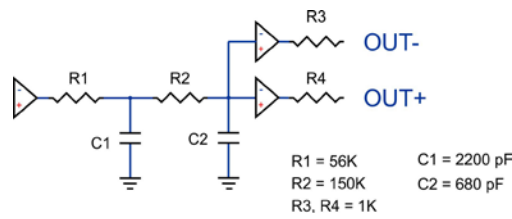
(Ω) –sensing axis ( $\pm 3^\circ$ )

**VG910F1**

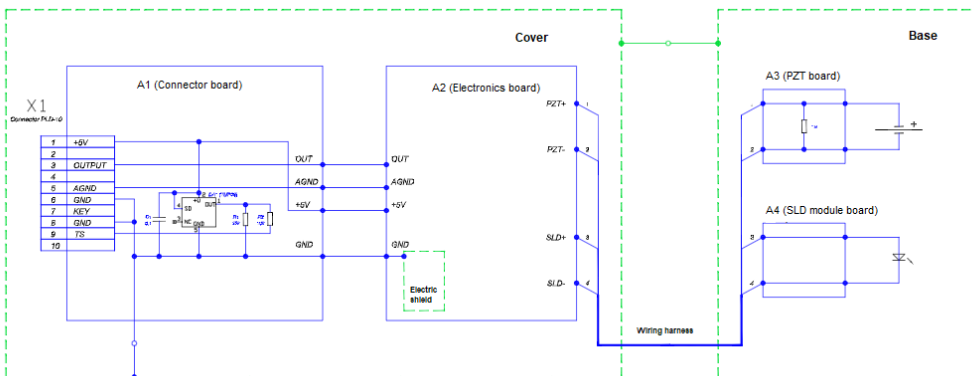
Annex 3. Electrical Diagrams



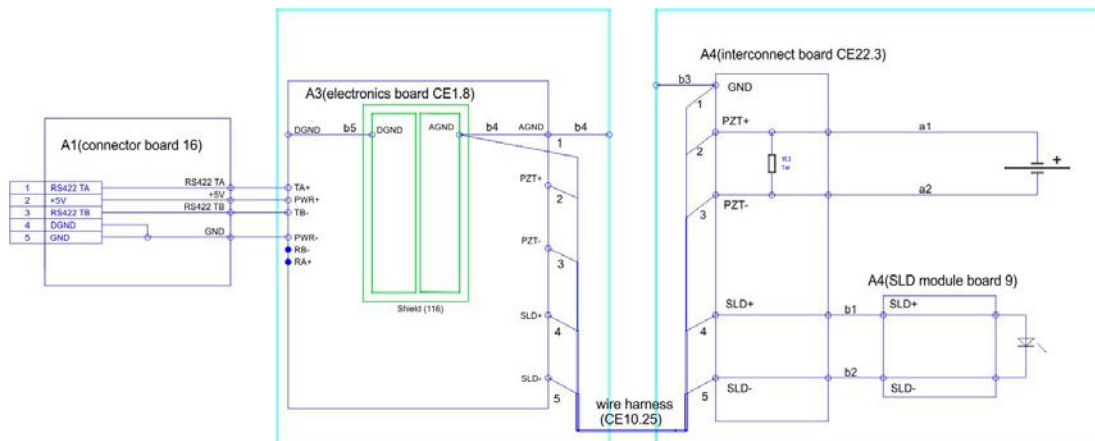
VG910H1, VG910H125C



Output LP filter diagram

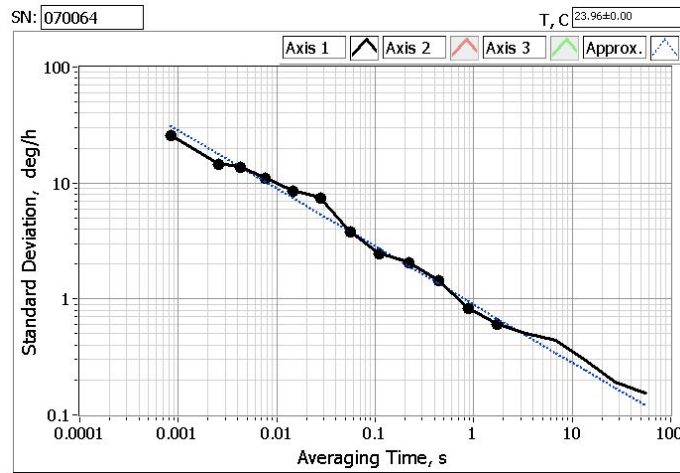


VG910F1

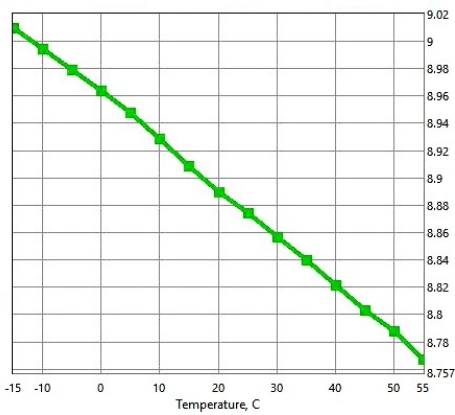


VG910D1

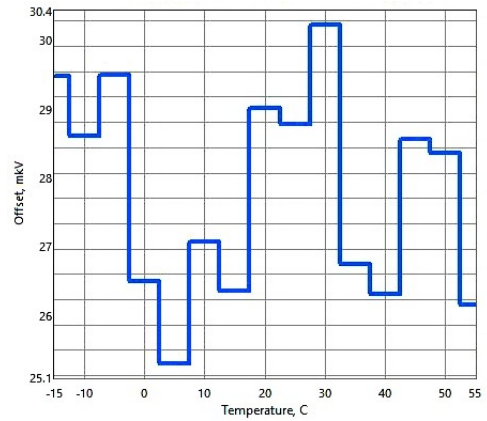
Annex 4. Test Data Samples



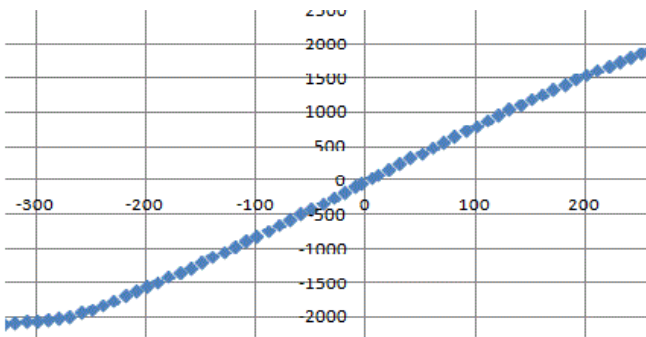
Allan Variance Plot



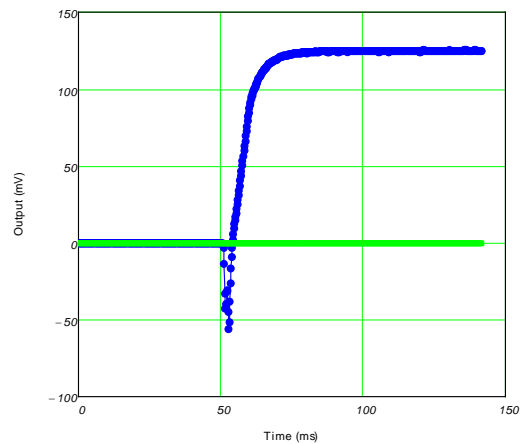
SF vs Temperature



Bias vs Temperature



Output Voltage vs Angular Rate



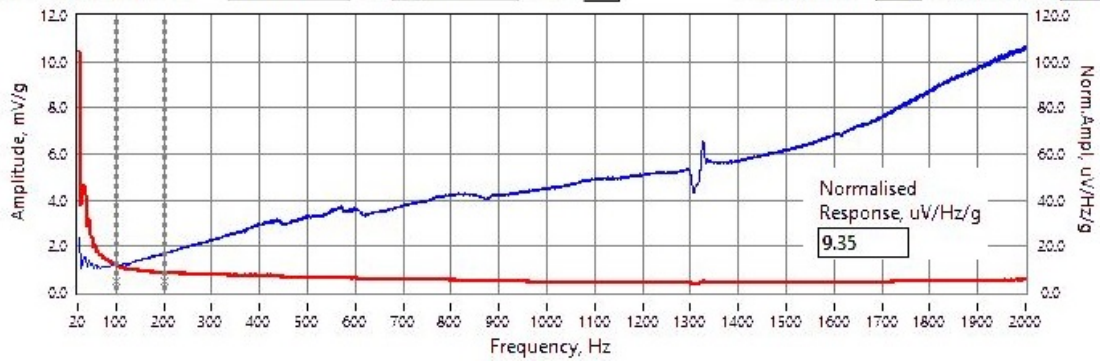
Power-on Transient (ms) as Gyro Rotates 20 deg/s,  
time resolution 0.2ms



### Vibro Test Report

VG910H1 SN Q68900 Axe X

Response  Normalised



Output Components (AC) vs SINE Vibration

### Vibro Test Report

VG910H1 SN Q68900 Axe X

Vib.On  Vib.Off

