FIBER OPTIC GYROSCOPE

VG910 SERIES

Information Guide

Output	*VG910*	*Extension*	*Key Features*
differential		***H1***	***Basic model***
		H125C	***+125°C operating***
single-ended		***F1***	***Highly reliable***
digital		***D1***	***Built-in ADC***

Table of Contents

1. Introduction

1.1. Scope[1]

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 (analog models) / Annex 2 (digital model), Outline dimensions, pins assignment, axes definition in Annex 3.

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

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. For electrical diagram see Annex 4 (analog models) / Annex 5 (digital model).

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 + ½ SF · Ω **U(-) = U0 - ½ SF · Ω**

Output voltage **U(Ω)** = **U(+)**- **U(-)** = **SF·Ω**

The output voltage range is **±2V**. The output impedance is 1kOm (to GND). 2nd order LPF cutoff frequency is ~1kHz (see the diagram in Annex 7).

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(Ω) = **SF·Ω**

The output impedance is low (amplifier direct output). 3^{d} 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°C/100 [V]

Temperature output is single-ended.

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[1] *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 µV / °C (temperature sensitivity of the components of analog processing circuit)

· **SF** ~ 0.02 -0.04% / °C (temperature dependence of SLD spectrum)

♦ **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 (**VRE = 0**)

· **Noise** spectrum factor 1-5 µV/ g*Hz (direction dependent)

· **SF** is not sensitive

Sample plots of the bias and noise contributors in Annex 6.

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 (analog models)

MAIN PARAMETERS	VG910H1	VG910H125C	VG910F1
Input range (°/s)	250	280	350
Bias stability / Bias repeatability*(RMS, °/h)	2	2	1
Angle random walk (°/√h)	0.015	0.05	0.02
Bandwidth (kHz)		1	
SF stability / SF repeatability*(RMS, %)	0.02	0.02	0.01
ELECTRICAL PARAMETERS			
Start-up (s)	0.03	0.03	0.05
Powering (W)		0.5	
PHYSICAL PARAMETERS			
Dimensions (mm)		82 x 82 x 20	
Weight (gram)		150	
Volume (cl)		10	
Housing material		aluminum alloy	
ENVIRONMENT			
Temperature (operating, °C)	-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
extended range	-	+85…+125	-
Vibration (RMS, 0.02 - 2 kHz, g)	30	12	18
Shocks (g, 1 ms)	1200	500	450
RELIABILITY			
MTBF (20°C) / Lifetime (yrs)**		15	

*** Day-to-day repeatability at fixed temperature**
**** Humidity conditions applied**

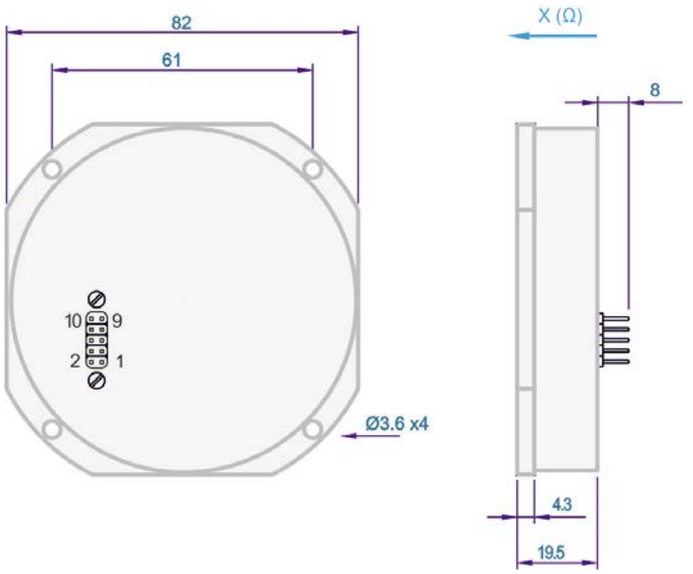
Annex 2. Product Main Parameters (digital model)

MAIN PARAMETERS	VG910D1
Input range (°/s)	250
Bias stability / Bias repeatability*(RMS, °/h)	1
Angle random walk (°/√h)	0.007
Bandwidth (kHz)	1
SF stability / SF repeatability*(RMS, %)	0.02
ELECTRICAL PARAMETERS	
Data rate (kHz)	8
Baud rate (kBd)	920
Initialization (s)	0.03
Powering (W)	0.7
PHYSICAL PARAMETERS	
Dimensions (mm)	82 x 82 x 20
Weight (gram)	150
Volume (cl)	10
Housing material	aluminum alloy
ENVIRONMENT	
Temperature (operating, °C)	-40…+70
Temperature (endurance, >2 h,°C)	-55…+85
Vibration (RMS, 0.02 - 2 kHz, g)	18
Shocks (g, 1 ms)	1200
RELIABILITY	
MTBF (20°C) / Lifetime (yrs)**	15

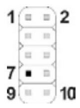
*** Day-to-day repeatability at fixed temperature**
**** Humidity conditions applied**

Annex 3. Outline Drawing, Axes Definition, Pin Assignment

VG910H1, VG910H125C, VG910D1



(Ω) –sensing axis (±3')



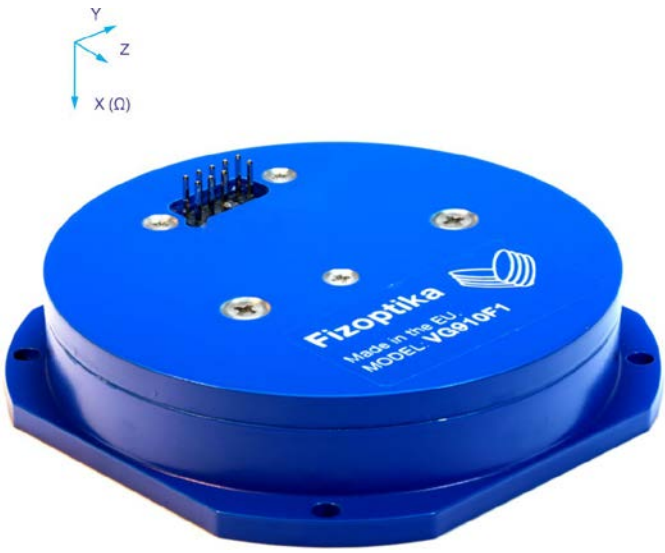
PLD-10

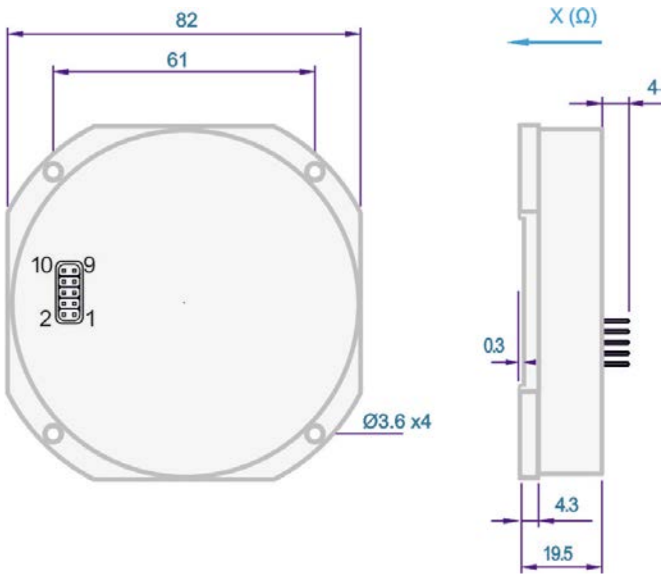
1	**+5V**
2	**NC**
3	**OUT+**
4	**NC**
5	**OUT-**
6	**GND**
7	**KEY** (cut pin)
8	**GND**
9	**TS**
10	**NC**

VG910H1
VG910H125C

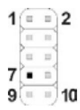
1	**+5V**
2	**NC**
3	**NC**
4	**NC**
5	**NC**
6	**GND**
7	**KEY** (cut pin)
8	**GND**
9	**RS422 TA**
10	**RS422 TB**

VG910D1





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

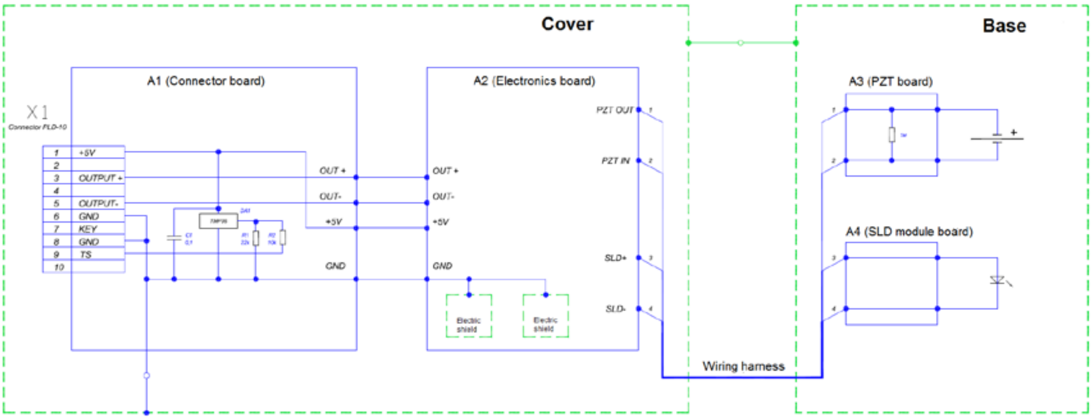


PLD-10

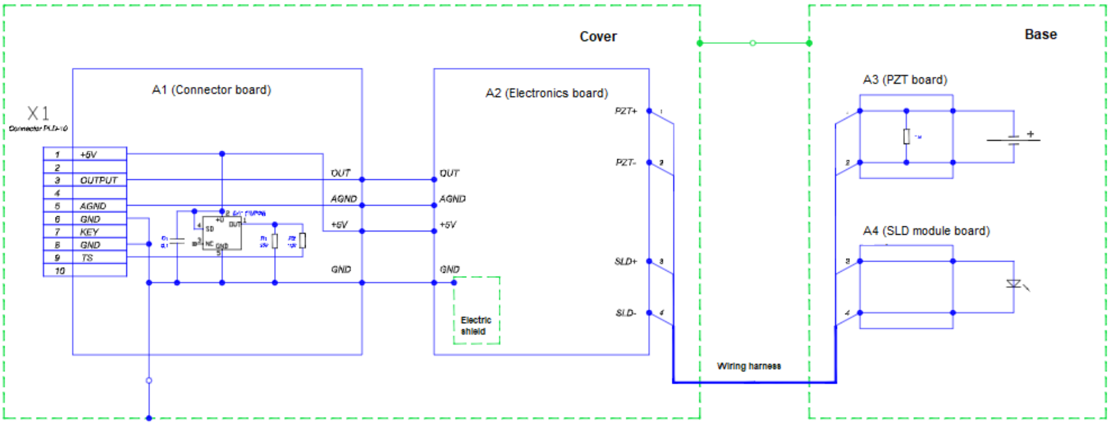
(Ω) –sensing axis (±3')

VG910F1

Annex 4. Electrical Diagram (analog models)

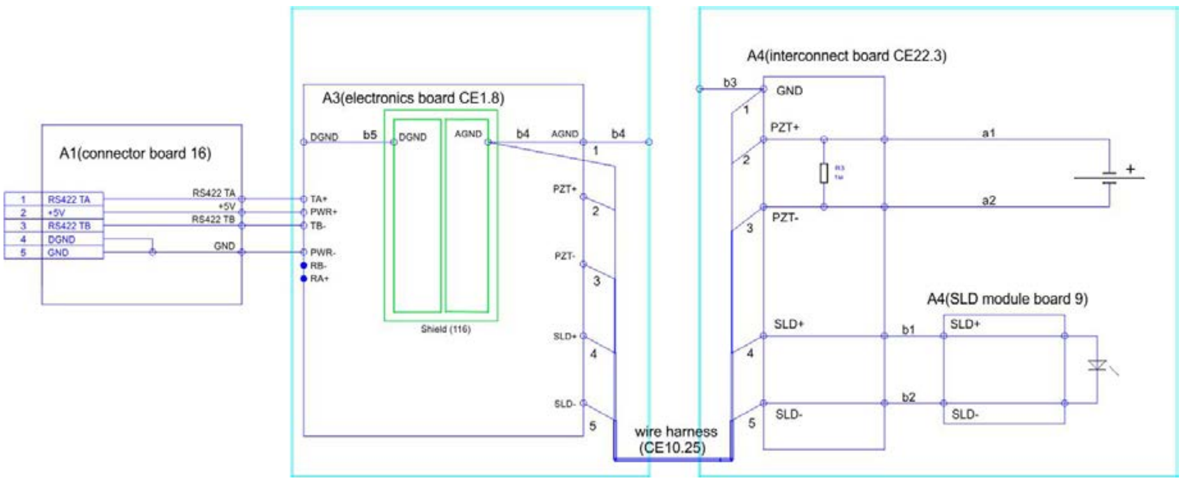


VG910H1, VG910H125C

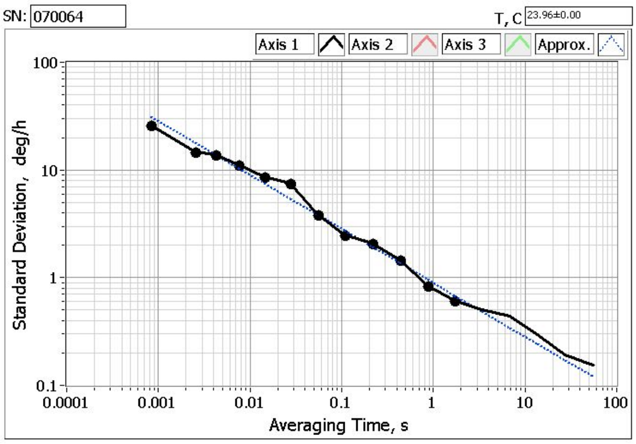


VG910F1

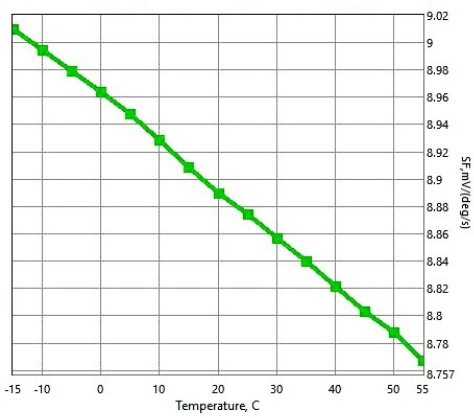
Annex 5. Electrical Diagram (digital model)



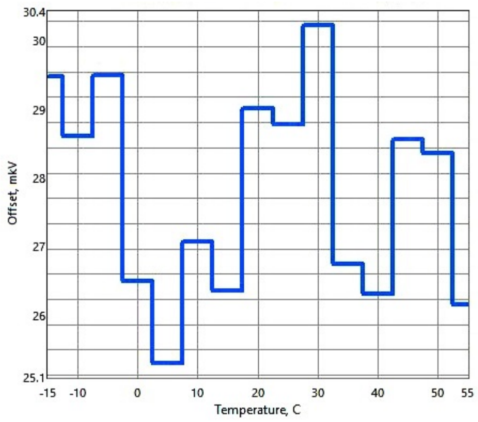
Annex 6. Typical Test Data



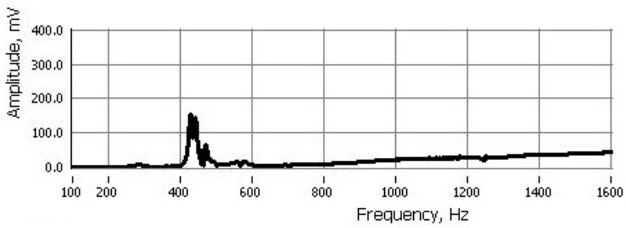
Allan Variance Plot



SF vs Temperature



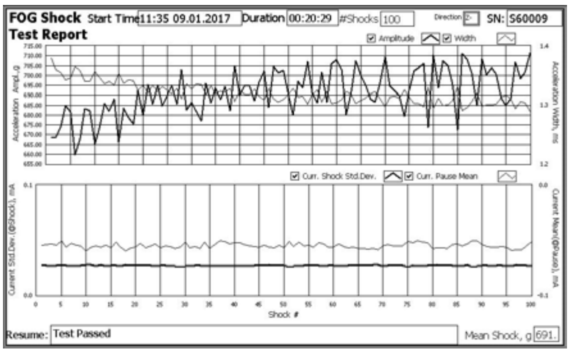
Bias vs Temperature



Output Components (AC) vs SINE Vibration

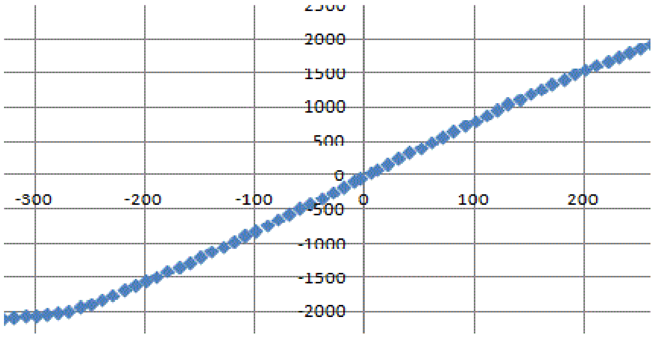
(1 g normalized)

[the peak is due to shaker angular resonance]

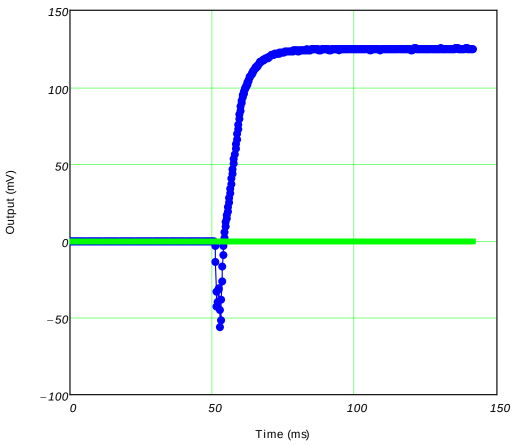


Shock Test Record (Y Direction)

(~690g x 1.3ms)



Output Voltage vs Angular Rate



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

Annex 7. Output LP filter diagram