 

VG103 SERIES OF MINIATURE FULLY PLASTIC

FIBER OPTIC GYROSCOPES

Information Guide

Output	Model name		Key Features
	VG103	Extension	
		PT	Basic model
differential		LN	Increased fiber length
		E	Economy design
single-ended		F1	Built-in calibration
digital		D	Embedded ADC

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1. Introduction

1.1. Scope of this Information Guide[1]

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

1.2. Product Description

The series features compact fully plastic design (no metal parts) coupled with a choice of outputs (differential, single-ended, digital) at affordable price. The basic model VG103PT offers the best combination of excellent performance and superb shock/vibration endurance (for outline dimensions, pins assignment, axes definition see Annex 1, for product specification see Annex 3).

1.3. Essential

The VG103 plastic housing is silicone sealed therefore it is not fully hermetic. Keep the product dry during its whole lifetime.

2. Electrical Characteristics

2.1. General

The VG103 requires a clean single voltage 5Vdc power source or battery supply. Voltages greater than 5.5 volts (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 2.

2.2. Differential Output

The gyro provides output voltages **U(+)** and **U(-)** 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 signal **U(Ω)** = **U(+)** - **U(-)** = **SF·Ω**

The positive and negative outputs should be connected to a differential input amplifier with high input impedance. The amplifier should have a good common mode rejection and a suitable bandwidth.

Diagnostics. Failure can be detected by **U0** reading (if drops >100 mV). **U0 = U(+) + U (-)**

2.3. Single-ended Output

The gyro provides output voltages via two leads OUTPUT, AGND.

U(Ω) = **SF·Ω**

Diagnostics. Failure can be detected by **+5V** current (**I**) change.

Failure criteria: if I > (I*+20mA) or I < (I*-10mA), where I* - factory certified value.

2.4. Digital Output

Digital signal is provided via lead/s RS232 TXD / RS422 TA (TB).

For operating modes and digital data content see Fiber Optic Gyroscope Digital Output RS232/RS422.

2.5. Temperature Output

The gyro provides temperature readings via TS lead:

V(TS) = 0.5 + t°C/100 [V]

3. Mounting Guidelines

The VG103 is typically screw mounted, but also may be adhesively mounted or clamped.

3.1. Screw Mounting Guidelines

- The mounting surface should be clean, smooth and flat.

[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.*

- Plastic washers are preferable to avoid temperature induced stress.
- Torque screws M3 max to 3 Ncm limits. Use a manual torque wrench.

3.2. Adhesive Mounting Guidelines

- Apply silicon adhesive to the bottom of the gyro.
- The mating surface should be flat and clean.
- Aim for an adhesive thickness of 0.2-0.4 mm.

3.3. Mating Frame

Resonances of the mating frame should exceed vibration frequencies. Otherwise, an extra noise at the output is possible.

3.4. Cable Routing

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

4. Embedded Design

The Fizoptika gyroscope is a complete gyro system which comprises a fiber optic sensing assembly and processing electronics. The sensing assembly (an open-loop minimum configuration) is fabricated from a single length of optical fiber by a fusion-tapering technique. Industrial silicone compounds are used to mount optical components on quartz substrates. The substrates are placed into a miniature plastic container filled with soft silicone gel for protection and mechanical stabilization. The electronics is mounted on the inner side of the top cover.

4.1. Analog Electronics Board

The minimal configuration electronics drives the internal light diode (SLD) and phase modulator (PZT) for signal conditioning. It performs precise demodulation of the optical signal to form gyro raw output (no error compensation).

4.2. Analog Output $U(\Omega) = SF \cdot \Omega$

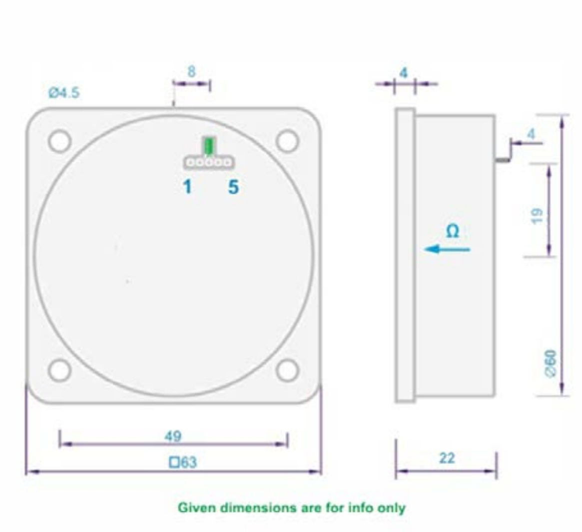
Open loop FOG does not feature bias jumps, day to day change, cross-axis errors, dead zones, g, g^2components, transients, etc inherent in other gyroscopes.

Its noise is caused by light quantum fluctuations. Initial bias variations is traced to electronics temperature sensitivity and to optical fiber imperfections. There is also magnetically induced bias caused by nonreciprocal optical effects. SF variation follows SLD spectrum temperature dependence. The typical values of the noise contributors are demonstrated by Allan variance plots in the Annex 4. For more information regarding the analog output refer to Open-loop Fiber Optic Gyroscope. Info Notes.

5. Precautions and Recommendations

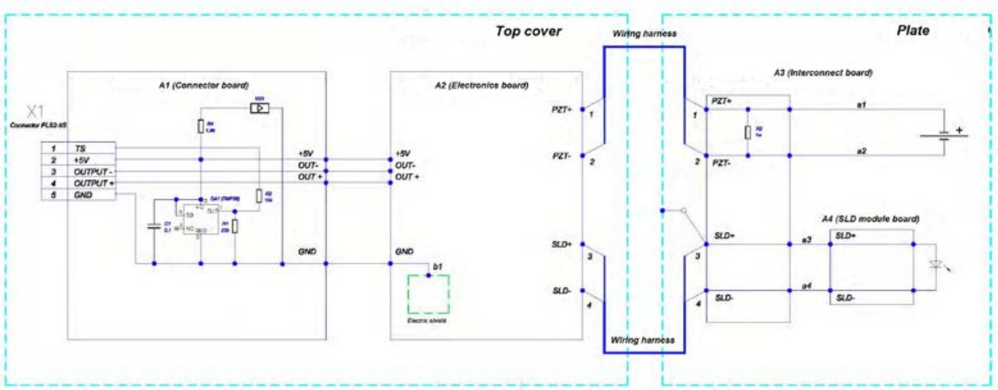
- Do not drop. Excessive shock can damage the unit.
- Treat as an ESD component
- Keep dry
- Power off before connecting

Annex 1. Outline Drawings, Axes Definition, Pin Assignment



1	TS
2	+5V
3	OUT-
4	OUT+
5	GND

Annex 2. Electrical Diagram

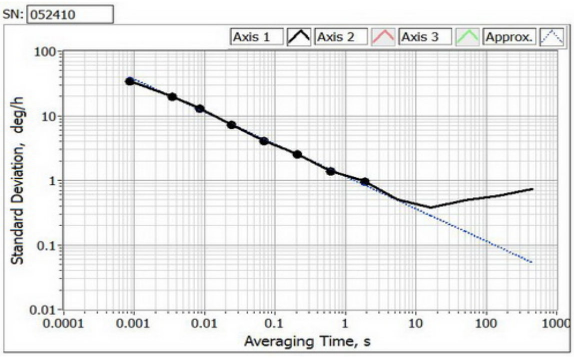


Annex 3. Product Specifications*

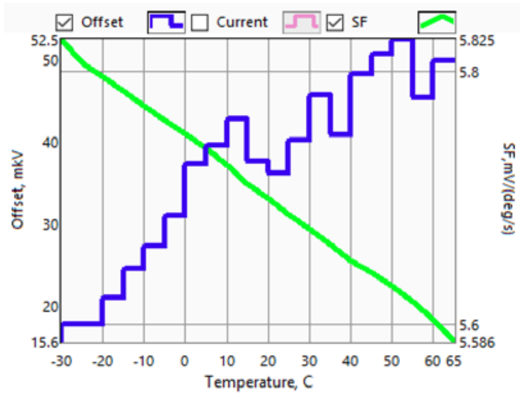
MAIN PARAMETERS	
Input range (°/s)	350
Frequency range (kHz)	0-1
Angle random walk (°/√h)	0.02
Bias stability / Bias repeatability** (RMS, °/h)	2
SF stability / SF repeatability** (RMS, %)	0.02
Start-up (s)	0.03
Powering (W)	0.5
PHYSICAL PARAMETERS	
Dimensions (mm)	63 x 63 x 22
Weight (gram)	60
Volume (cl)	7
Housing material	Hard plastic
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)	750
RELIABILITY	
MTBF (20°C, h)***	100 000
Lifetime (yrs)	15

*** Basic model. See respective datasheets for other models of the series.**
**** Day-to-day repeatability at fixed temperature**
***** Humidity conditions applied**

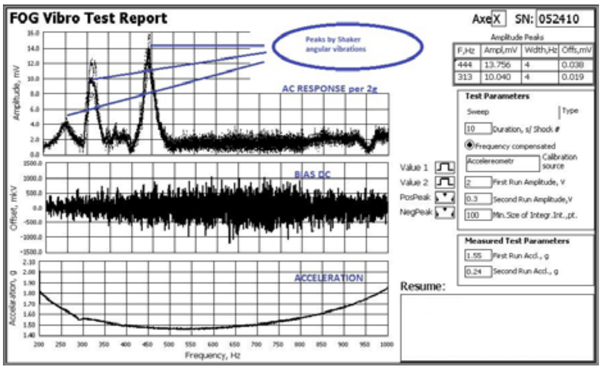
Annex 4. Typical Test Data



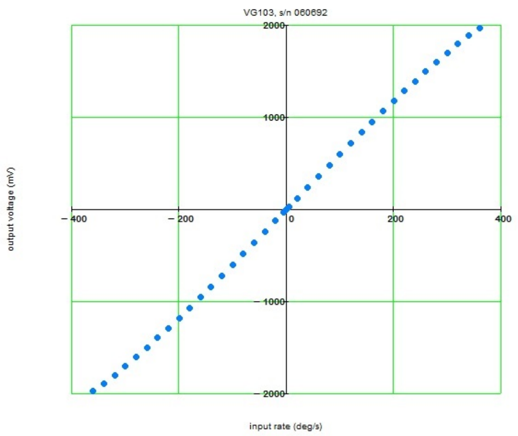
Allan Variance Plot



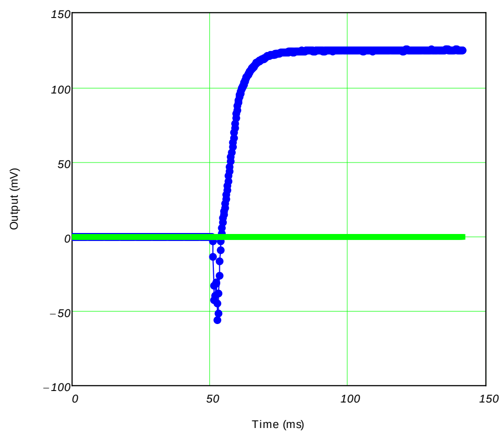
Main Parameters (Bias, SF) vs Temperature
(output is non-compensated)



Output Components (AC, DC) vs SINE Vibration
(1.5g, sweep from 200Hz to 1kHz)



Output Voltage vs Angular Rate



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