

VG 910 series

VG910, VG910C, VG910F, VG910S

VG910 is a sensor responding on rotation by change of its output voltage (voltage between contacts "Output" and "AGnd"). VG910 incorporates "open-loop" fiber optic sensing assembly (OB) and processing electronic module. Electronics converts complex OB signal into voltage proportional to angular rate.

VG910 series may be used in environments (at environmental limits performance may differ from specified at normal conditions):

- a) at ambient temperatures -30°C...+71°C b) after expose at temperatures -60°C...+75°C
- c) at vibration 10Hz...2kHz, 6g d) after shocks 90g

TECHNICAL DATA Table 1. Summary of main characteristics

	VG910/ VG910S	VG910C	VG910F
Physical Weight (gram) Size (mm)	130 (estimated) dia 80 x 20 (without flanges and connector)		
Power Total consumption (Watt) Power supply (V) Activation time (sec)	< 1.5 $+ 5^{+0.5}_{-0.1}$ $\pm 12^{+4}_{-3}$	< 1 $+ 5^{+0.5}_{-0.1}$	< 1.5 $+ 5^{+0.5}_{-0.1}$
Performance Bias variation (day-to-day, steady state, ° /s, 1sigma) (warm-up, ° /s) (OTR, ° /s) Bias (20° C, ° /s) Scale factor variation (day-to-day, steady state, %)	0.005 < 0.01 < 0.2 < 0.4 < 0.4	0.005 < 0.03 < 0.4 < 0.8 < 0.6	0.002 < 0.002 < 0.02 < 0.04 < 0.2

(warm up, %)	< 0.4	< 0.6	< 0.2
(OTR, %)	3 - 8	3 - 8	3 - 8
Scale factor (mV/° /s)	55 ± 20%	11 ± 20%	9.9 ± 20%
Scale factor linearity (% full scale)	10	10	5
Random walk (°/s sqrt Hz)	0.002	0.002	0.001
Frequency range (Hz)	0...1000	0...1000	0...450
Operating input range (° /s)	± 200	± 200	± 300
MTBF (hrs, @20° C)	30,000		

steady state = warm up completed; **OTR** = operating temperature range

Table 2. **Other estimated parameters (non specified)**

	VG910	VG910C	VG910F
Sensitivity to magnetic field	1-3 ° /hr / Gauss		
Response to vibration (synchronous)	0.001-0.005 ° /s / g * Hz within operating frequency bandwidth		
SF dependence on supply voltage	0.1% / V	0.1% / V	0.1% / V
Bias dependence on supply voltage	0.01° /s /V	0.01 ° /s / V	0.0003 ° /s / V
Warm up period	1min	1 min	15 s
Bias sensitivity to temperature gradient	1-10 ° /hr / ° C/min		

STRUCTURE VG910 contains two main modules: Sensing optical module (OB) - a fiber optic ring interferometer comprising 100m fiber sensing coil, two fused fiber optic couplers, fiber optic polarizer, piezoceramic phase modulator (PZT), SLD module, photo receiving module. Electronic module - PCB implemented in SMT technique which converts complex OB output into rate proportional voltage. (in C and F types photo receiving module is integrated with

processing electronics). Photo receiving module is based on Si pin photodiode. Optical components are mounted inside a sealed aluminum case. Processing electronics is mounted in the separate volume. External electrical connection is performed via 10-pin 2 rows connector.

OPERATION In a ring interferometer light is divided in two beams traversing fiber coil in opposite directions. After traveling beams are combined (interfere) in the coupler with a phase difference caused by rotation (Sagnac phase). Ratio between rate and Sagnac phase is determined by coil diameter and fiber length. For higher sensitivity PZT modulator is used. Electronics controls PZT oscillation and SLD current to achieve certain condition of the optical output. Conditioned optical output is processed to get rate proportional voltage. VG910 starts operation just (< 0.5 s) power is on (Number of start-up is unlimited). Its voltage is a function of angular rate W and ambient temperature (t°). Within the input range an approximation is given by the following expression

$$U(W, t^\circ) = SF \cdot W \cdot [1 + s(t^\circ)] \cdot [1 - p(W/W_{max})^2] + B(t^\circ) + N$$

where SF - scale factor, B(t°) - bias (offset voltage); N - output noise (random voltage); s(t°) - SF temperature variation; p - nonlinearity parameter. After overrating (no limit) VG910 recovers normal mode in parts of second. At low rates nonlinearity is negligible. Scale factor variation s(t°) is caused by temperature sensitivity of electronics components and SLD wavelength temperature dependence. Bias temperature change belongs mainly to analog detection errors. Noise N is caused by light intensity natural fluctuations and thermal noise of electronics components. Noise spectrum is uniform in the working frequency range. When gyro is exposed to a harsh environments such as shocks, vibrations and strong magnetic fields additional errors appear. VG910 output is uncompensated. To achieve specified performance its data should be corrected (modeled). Bias and scale factor temperature dependence is taken into account.

DESCRIPTION OF 10 PIN I/O CONNECTOR FUNCTIONS

TYPES	PIN NUMBER	PIN NAME	DESCRIPTION
POWER INPUTS	1	+5Vdc	+5 Volts DC regulated 4.9 to 5.5 VDC. Ripple 50mV max. Current temperature dependent , 200mA Max (150mA @ 20° C)

	2	+12Vdc (VG910 only)	+12 Volts DC regulated from 9 to 16 VDC. Ripple 50mV max. Current 30mA (!) Voltage must exceed +7V while +5V is on.
	4	-12Vdc (VG910 only)	-12 Volts DC regulated from -9 to -16 VDC. Ripple 50mV max. Current 30mA
	6, 8	DC return, Gnd	DC return line for +5VDC, +12VDC, -12VDC, Ground
SIGNAL OUTPUTS	3	OUTPUT	Gyro output voltage proportional to rotation, scale factor 10mV/deg/s (50 mV/deg/s for VG910). Differential input recommended.
	5	DC return, Agnd	DC return or Analog ground to use with OUTPUT. Differential input recommended.
OTHERS	7	KEY	Cut pin polarizing connector
	9, 10	Non used	Spare or technological