

# TRIAXIAL FLUXGATE MAGNETOMETER

## OWNER'S MANUAL

**PART NUMBER: FGM-301**



WATSON INDUSTRIES, INC.  
3035 MELBY STREET  
EAU CLAIRE, WI 54703

Phone: (715) 839-0628

Fax: (715) 839-8248

email: [support@watson-gyro.com](mailto:support@watson-gyro.com)

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Watson Industries prides itself on solving customer problems and serving their needs in a timely fashion. This manual is intended to facilitate this goal and to provide written information about your product. We ask that you carefully read this manual. Becoming familiar with the manual will help you understand the product’s capabilities and limitations, as well as provide you with a basic understanding of its operation. If, after reading the manual, you require further assistance, do not hesitate to call Watson Industries with your questions and comments.

## Introduction

This manual is intended to help in understanding the installation and operation requirements of the Watson Fluxgate magnetometer.

## Product Description

The FGM-301 is a triaxial Fluxgate Magnetometer. It consists of three toroid cores that have sensing coils arranged to give 3 axes of information about the Earth's magnetic field. Internal electronics drive the cores and signal condition the sensing coil outputs. The unit runs at a frequency of approximately 3.2 kHz to provide quick response and low power draw. Further information is available on the specification sheet at the end of this manual.

## Operation

The fluxgate magnetometer does not generate any magnetic field. This is unlike most other compasses. As a result, the magnetic field or environment near the fluxgate is not disturbed.

Operation of the fluxgate sensor is by use of a sensitive magnetic field detector. A current is applied to a coil around the detector with feed back control to balance the field to zero. By measuring the control needed to balance the field, the output of field strength is determined. This is done for each of the 3 axes. This method of magnetic field detection provides excellent output with both linearity and stability.

## Installation

### **Orientation:**

This device is intended as an Earth's magnetic field orientation sensor. Since it is triaxial and all channels have identical functioning, any sensor orientation can be made to be useful. See Figure 1 for sense orientation.

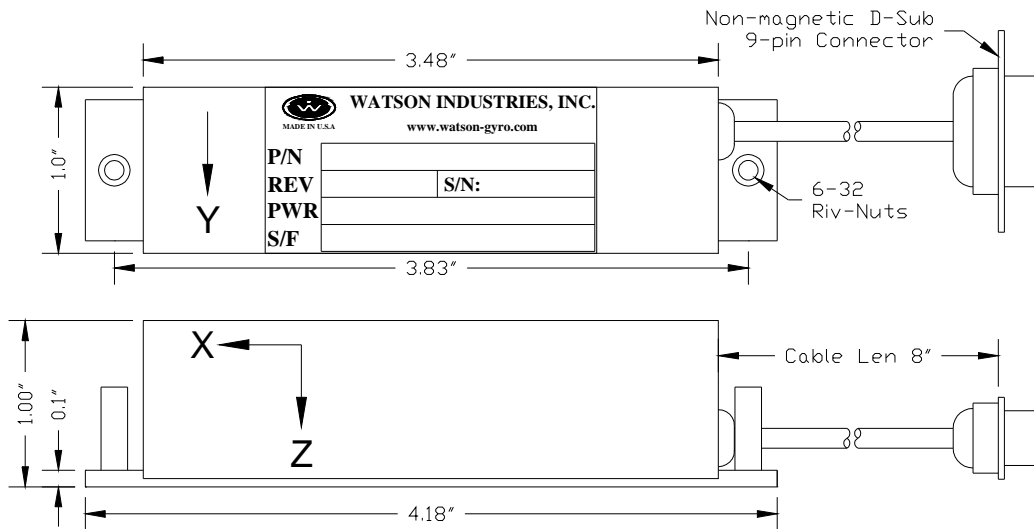


Figure 1 FGM-301 Dimensions and Axis Orientation

**Mounting:**

A mounting plate is provided for a flat surface mount (see Figure 1). Use non-magnetic hardware. Ideally, the unit should be installed at least 4 feet away from all magnetic materials. Some highly magnetic materials require even greater separation from the magnetometer unit. The unit may be adhesively mounted at any of its surfaces. If high shock loads are expected (greater than 20G or repeated shocks greater than 10G), the appropriate shock mounting should be used to prevent damage.

**Environment:**

High level AC magnetic fields, such as from large transformers, motors, or soldering guns, are to be avoided as being potentially damaging to the circuitry, even if the system is not powered. Exposure to high DC magnetic fields are to be avoided since this can produce a lingering self-magnetization of the sensor, which can cause distortion of the zero field bias.

**Power:**

This unit has an internal regulator to allow operation over a wide voltage input range. Best operation is obtained at 12 VDC level, although operation is fully satisfactory down to 6 VDC and up to 16 VDC. Power draw of the unit is about 0.6 Watts. Internal capacitors are provided to remove a reasonable level of power line noise, however, capacitors should be added for long power line wiring or if noise is induced from other loads on the circuit.

## Analog Outputs

The analog outputs are operational amplifier driven so they are limited in drive capacity. Each analog output has a 1000 ohm resistor in series internal to the FGM to eliminate oscillations from high capacitance loads. Table 1 below has the output connector pin assignments. The mating connector is a non-magnetic 9 – pin D- Sub female. All outputs are referenced to ground.

<u>Signal</u>	<u>Pin</u>	<u>Range</u>	<u>Output Range</u>	<u>0 VDC</u>	<u>Scale Factor</u>
Ground	1	N/A	N/A	N/A	N/A
+12 VDC (Power Input)	2	6 to 16V	N/A	N/A	N/A
X Magnetometer	7	±700mGauss	±3.5V	0mg	200mGauss/V
Y Magnetometer	8	±700mGauss	±3.5V	0mg	200mGauss/V
Z Magnetometer	9	±700mGauss	±3.5V	0mg	200mGauss/V

Table 1 Pinouts

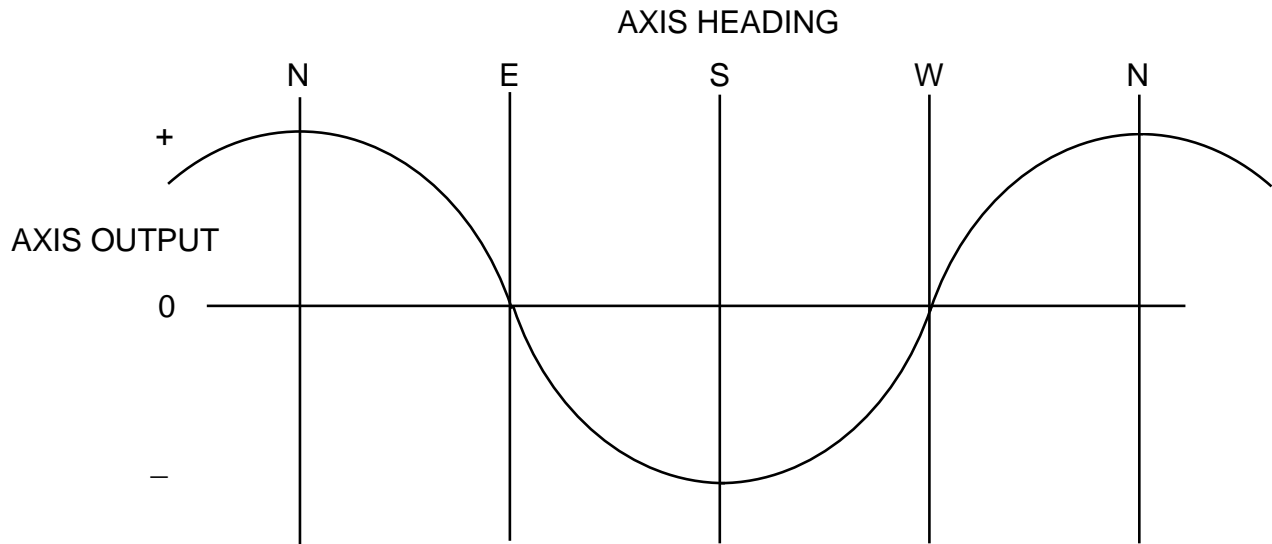


Figure 2 FGM-301 Signal Format

## Specifications

### Magnetic

Range: X, Y, Z	±700 mGauss	±70,000 nTesla
Analog Scale Factor:	±200 mGauss/V	±3.5V Output
Scale Factor Accuracy:	2%	
Scale Factor Matching Between Axes:	< 0.2%	
Scale Factor Temp Coefficient:	±100 ppm per °C	Typical
Bias: X, Y, Z	< 5 mGauss	
Non-Linearity:	< 0.01%	
Bandwidth:	30 Hz	
Noise:	< 0.3 mGauss rms (Typical)	<10 uGauss in 1 Hz bandwidth
Output Ripple:	< 0.2 mGauss P-P	

### Environmental

Temperature: Operating	-50°C to +85°C	
Temperature: Storage	-50°C to +85°C	
Vibration: Operating	3g rms	100 Hz to 1 KHz
Vibration: Survival	4g rms	100 Hz to 1 KHz
Shock: Survival	200g	10mS ½ sine wave

### Electrical

Input Power:	6 to 16VDC	< 1W
Input Current:	55mA	
Analog Output:	±3.5VDC	
Analog Output Impedance:	1000 Ohm	

### Physical

Axis Alignment:	< 0.3°	
Size: Including Mounting Flanges	1.0W x 4.18"L x 1.0"H	2.5 x 10.6 x 2.5 (cm)
Weight:	3.1 oz	88 grams
Connection:	9 pin male "D" subminiature	
Life:	> 50,000 Hrs MTBF	

- Specifications are subject to change without notice.
- This product may be subject to export restrictions. Export Classification ECCN 6A996.

## **WARNING**

1. Rough handling or dropping of this unit is likely to cause damage.
2. Over-voltage and/or miswiring of this unit will cause damage.
3. The non-magnetic connectors supplied with the unit must be used to preserve accuracy. The user must use non-magnetic hardware to install the unit.
4. This unit should be protected against prolonged exposure to high humidity and/or salt air environments.

## **Disclaimer**

The information contained in this manual is believed to be accurate and reliable; however, it is the user's responsibility to test and to determine whether a Watson Industries' product is suitable for a particular use.

Suggestion of uses should not be taken as inducements to infringe upon any patents.

## **Warranty**

Watson Industries, Inc. warrants, to the original purchaser, this product to be free from defective material or workmanship for a period of two full years from the date of purchase. Watson Industries' liability under this warranty is limited to repairing or replacing, at Watson Industries' sole discretion, the defective product when returned to the factory, shipping charges prepaid, within two full years from the date of purchase. The warranty described in this paragraph shall be in lieu of any other warranty, express or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose.

Excluded from any warranty given by Watson Industries are products that have been subject to abuse, misuse, damage or accident; that have been connected, installed or adjusted contrary to the instructions furnished by seller; or that have been repaired by persons not authorized by Watson Industries.

Watson Industries reserves the right to discontinue models, to change specifications, price or design of this product at any time without notice and without incurring any obligation whatsoever.

The purchaser agrees to assume all liabilities for any damages and/or bodily injury that may result from the use, or misuse, of this product by the purchaser, his employees or agents. The purchaser further agrees that seller shall not be liable in any way for consequential damages resulting from the use of this product.

No agent or representative of Watson Industries is authorized to assume, and Watson Industries will not be bound by any other obligation or representation made in connection with the sale and/or purchase of this product.

## **Product Life**

The maximum expected life of this product is 20 years from the date of purchase. Watson Industries, Inc. recommends the replacement of any product that has exceeded the product life expectation.



## **Customer Service**

All repairs, calibrations and upgrades are performed at the factory. Before returning any product, please contact Watson Industries to obtain a Returned Material Authorization number (RMA).

### **Return Address & Contact Information**

Watson Industries, Inc.  
3035 Melby Street  
Eau Claire, WI 54703  
ATTN: Service Department  
Telephone: (715) 839-0628      Fax: (715) 839-8248      email: support@watson-gyro.com

### **Returning the Product**

Product shall be packaged making sure there is adequate packing around all sides. Correspondence shall include:

- Customer's Name and Address
- Contact Information
- Equipment Model Number
- Equipment Serial Number
- Description of Fault

**It is the customer's responsibility to pay all shipping charges from customer to Watson Industries, including import and transportation charges.**