



MAX-142-1A

**Single Axis Angular Rate Gyro
Owner's Manual**

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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.

CAUTION!

Watson Sensors are rugged devices that have been used successfully in a number of harsh environments. The components have been qualified to withstand a mechanical shock of 500g’s or greater, and most enclosures provide an added level of protection. However, dropping a sensor from waist height onto a hard floor can cause a shock level of 600g’s. At this level, damage is likely to occur.

Product Description

The MAX-142-1A is a single axis solid-state rate gyro. The sensor provides a voltage proportional to the rate of turn about its sensitive axis. At zero angular rate, the output is 0.0 volts (plus a bias). Full-scale output is ± 10.0 VDC for $\pm 200^\circ/\text{s}$. A dual power supply, providing regulated +15 VDC and -15 VDC, is required.

Principles of Operation

Gyroscopes (Gyros) are used to measure angular motion. Vibrating Structure Gyros are solid-state devices that provide an output voltage proportional to the rate of turn applied to the sensitive axis.

All the vibrating structure devices described here work on the basic principle of detecting coriolis forces. These forces are generated when a moving particle is rotated.

To use the Coriolis effect to detect angular rotation, a solid structure is forced to vibrate normally at its resonant frequency. This is achieved by applying an alternating voltage to the primary electrodes. The vibration provides the structure with a linear velocity component. When the structure is rotated, the coriolis forces cause the vibration motion of the structure to be coupled to another vibration mode or plane of the structure. The magnitude of this secondary vibration is proportional to the angular rate of turn.

Installation

Orientation/Mounting

The unit has 3 – 0.14” diameter mounting holes for using 6-32 screws. A mounting plate is provided for a flat surface mount. To avoid distortion, the unit must be attached to a clean, flat surface. The axis orientation is available in Figure 1. If high shock loads are expected (greater than 20G or repeated shocks greater than 10G), appropriate shock mounting should be used to prevent damage. Vibration isolation should be used if operation in 4G or greater vibration environments is expected.

Environment

Avoid mounting sites that are subject to significant temperature variation over the duration of the test. Temperature variation may induce noticeable rate sensor bias drift.

Power

Best operation is obtained using a dual +15 and -15VDC regulated power supply within $\pm 5\%$, although operation is fully satisfactory down to ± 12 VDC and up to ± 16 VDC. Power draw of the unit is approximately 1.0 Watts from positive supply and 0.5 Watts from negative supply. 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.

Calibration

The gyro is calibrated at the factory before it is shipped to the user. It is recommended that the unit be examined, preferably at the factory annually for evaluation and recalibration.

Specifications:

Angular Rate

Range:	±200°/sec	
Resolution:	0.006°/sec	
Analog Scale Factor:	50mV/°/sec	
Scale Factor Accuracy:	1%	Constant temperature
Scale Factor Temp Coefficient:	1%	Over temperature range
Bias: Room Temperature	±0.6°/sec	
Bias: Over Temp Range	±0.3°/sec	
Bias: Stability	< 20°/hr rms	Constant temp - 1hr
Warmup Drift:	±0.2°/sec	30 min
Non-Linearity:	< 0.03%	Full scale range
Bandwidth:	> 70 Hz	
Noise:	< 0.03°/sec rms	0.1 Hz to 100 Hz

Environmental

Temperature: Operating	-40°C to +85°C	
Temperature: Storage	-55°C to +85°C	
Noise Under Vibration: (0.1 to 100Hz)	< 0.1°/sec/g	12g rms (20 to 2KHz)
Vibration: Survival	12g rms	20 Hz to 2 KHz
Shock: Survival	300g (2mS ½ sine wave)	50g (11mS ½ sine wave)

Electrical

Startup Time:	< 1 sec	
Input Power: Positive	+15VDC ±5%	1.0 W
Input Power: Negative	-15 VDC ±5%	0.5 W
Analog Output:	±10VDC	

Physical

Size: Including Mounting Flanges	1.68"W x 2.98"L x 1.77"H	4.3 x 7.6 x 4.5 (cm)
Weight:	8.1 oz (0.5lb)	230 grams (0.2Kg)
Connection:	Wire Bundle	
Life:	> 40,000 Hrs MTBF	

- Specifications are subject to change without notice.
- This product may be subject to export restrictions. Export Classification ECCN 7A994.

Connections

MAX-142-1A Wire Call out	
<u>Color</u>	<u>Function</u>
Black	Ground
Brown	+15 VDC
White	-15 VDC
Blue	Rate Output *
Yellow	Built in Test

* Rate output: 0.00 VDC @ 0 °/second
-10.0VDC @ -200 °/second
10.0VDC @ +200 °/second
Scale Factor: 20°/second/Volt

Power:

Ground (Black), +15 VDC (Brown), and -15 VDC (White). Each input voltage should be within $\pm 5\%$. Higher or reverse voltages will cause component damage; a lower voltage may cause faulty operation. The power inputs should be well filtered; power line noise may cause noise to appear on the outputs. Current draw is approximately 70 mA from positive supply and 35 mA from the negative supply.

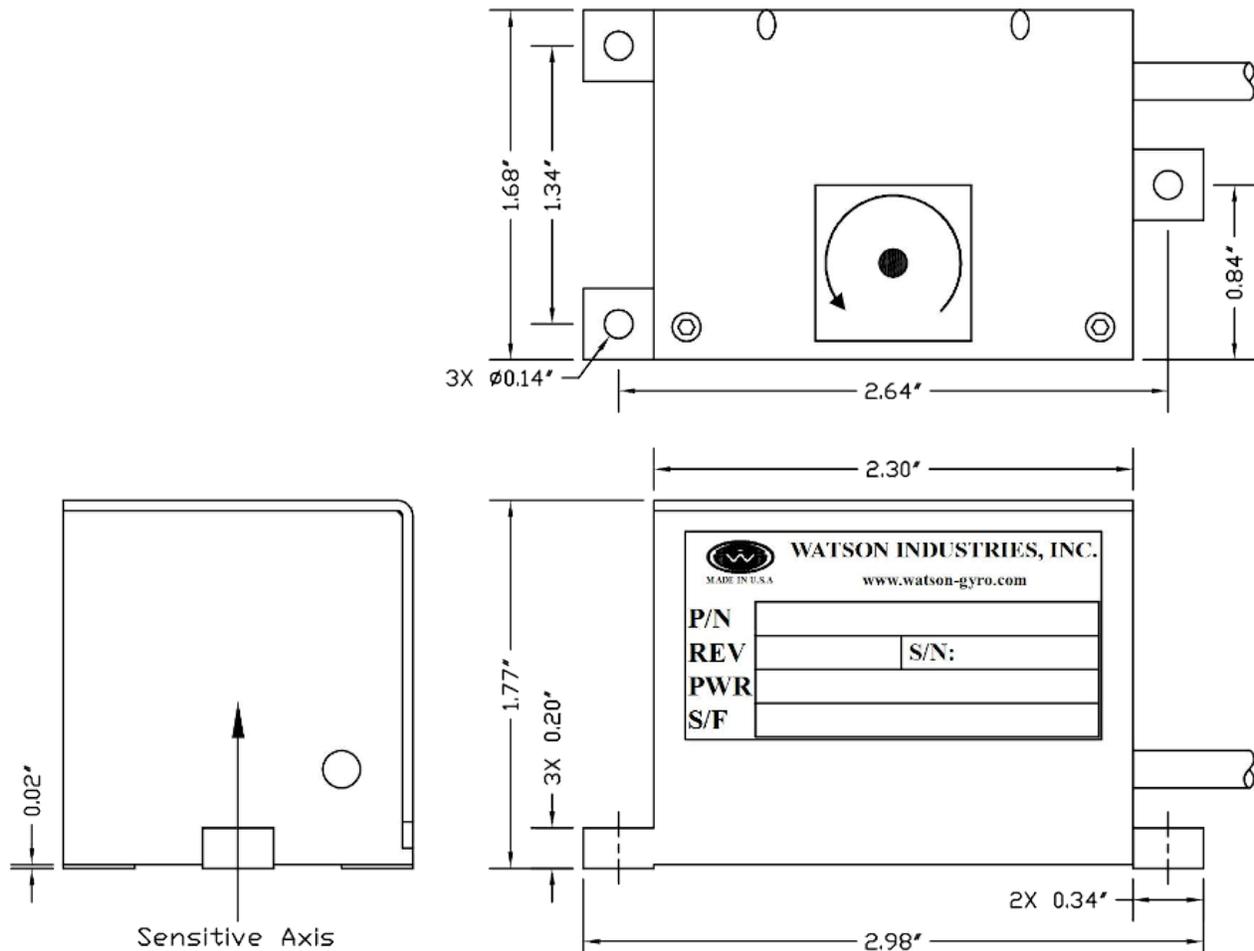
Output:

The signal output (Blue) has a 500 ohm output resistance. The output signal is referenced to Ground (Black). The output is $\pm 10\text{VDC}$ for ± 200 deg/sec. The output is 0.0 VDC at zero angular rate. Approximately 30% over-range is available.

Built In Test:

The Built in Test (Yellow) is a TTL output. High level – the gyro is operating, Low level – gyro fault. Output impedance is 200 ohms.

Dimensions



MAX-142-1A

Warning

Rough handling or dropping of this unit is likely to cause damage.
Over-voltage and/or miswiring of this unit will cause damage.
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.