ARS-C152-1A

Single Axis Angular Rate Sensor
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.

Description

The Watson Industries angular rate sensor (ARS) is a solid state, single axis angular rate sensor. The ARS 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 ±400°/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. Watson ARS Gyros are solid-state devices that provide an output voltage proportional to the rate of turn applied to the sensitive axis.

The solid-state gyros 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. 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 4 holes for mounting using a 6-32 screw. 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 2G 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 will induce noticeable rate sensor bias drift.

Power

Best operation is obtained using a dual +15 and -15VDC regulated power supply, although operation is fully satisfactory down to ±12 VDC and up to ±16 VDC. Power draw of the unit is approximately 0.2Watts from each 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 ARS 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:	±400°/sec	Up to ±500°/sec available
Resolution:	0.1°/sec	
Analog Scale Factor:	40°/sec/V	
Scale Factor Accuracy:	1%	Constant temperature
Scale Factor Temp Coefficient:	3%	Over temperature range
Bias:	< 8°/sec	
Bias: Over Temp Range	±20°/sec	
Warmup Drift:	±12°/sec	
Non-Linearity:	< 0.05%	Full scale range
Bandwidth:	50 Hz	
Noise:	< 0.1°/sec rms	
Environmental		
Temperature: Operating	-20°C to +50°C	-40°C to +85°C w/ reduced spec
Temperature: Storage	-55°C to +85°C	
Vibration: Operating	2.5g rms	20 Hz to 2 KHz
Vibration: Survival	10g rms	20 Hz to 2 KHz
Shock: Survival	500g	10mS ½ sine wave
Electrical		
Input Power: Positive	12 to 16VDC	0.2W
Input Power: Negative	-12 to -16VDC	0.2W
Input Current:	10mA @ ±15VDC	
Analog Output:	±10VDC	
Analog Output Impedance:	1000 Ohm	
Physical		
Size: Including Mounting Flanges	1.13"W x 3.00"L x 2.07"H	2.9 x 7.6 x 5.3 (cm)
Weight:	2 oz	57 grams
Connection:	Wire Bundle	
Life:	> 50,000 Hrs MTBF	

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

Connections/Dimensions

Wire Color	Function
Green	**-15 VDC Power**
Black	**Ground**
Red	**+15 VDC Power**
Violet	**Angular Rate Output**
Yellow	**Bias Input**

Please note that all wires are 24 AWG and approx. 12 inches in length.

Power:

Ground (Black), +15 VDC (Red), and -15 VDC (Green). Each input voltage should be within ±5%. Higher or reverse voltages may 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 10 mA from each supply.

Output:

The signal output (Violet) is protected by 1K series resistor and will not be damaged by intermittent short circuits. These resistors protect the circuit from ringing caused by capacitive loading of long wires.
The output is 0.0 VDC at zero angular rate. Approximately 20% over-range is available.

Bias Input:

The bias input (Yellow) may be used to provide a DC bias for the output signal. The circuit will allow the output to be biased over a range of approximately ±13 VDC before saturation occurs. The bias input has a 10K input impedance. If this input is not used, the connection can be either left open or grounded with no effect on the rate output. Grounding the bias input is preferred if a low noise ground is available.

Dimensions

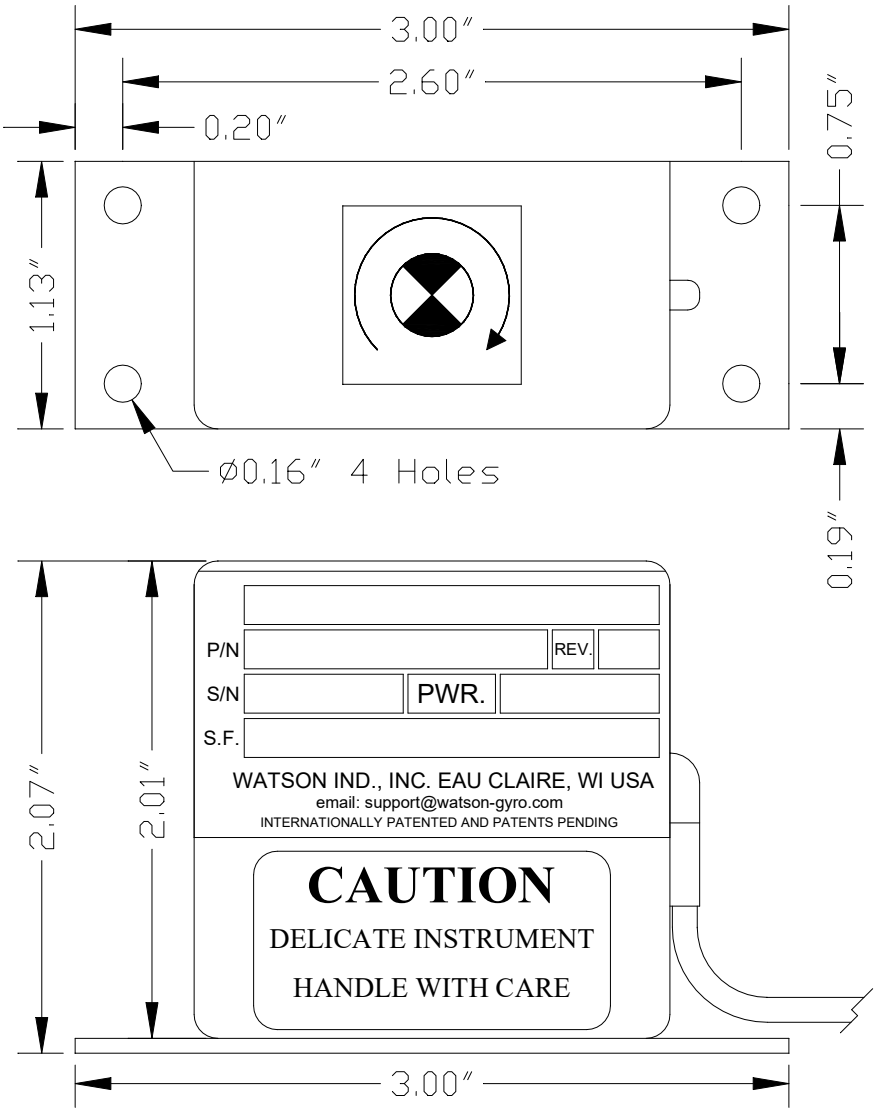

Figure 1: ARS-C152-1A Dimensions

Warning

Rough handling, dropping, or miswiring this unit is likely to cause damage.

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 one full year 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 one full year 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.