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QRS14
User’s Guide

MEMS GYROSCOPE

Model QRS14

Systron Donner Inertial
Sales and Customer Service

Phone: +1 925.979.4500 **Fax: +1 925.349.1366**

E-Mail: sales@systron.com

www.systron.com

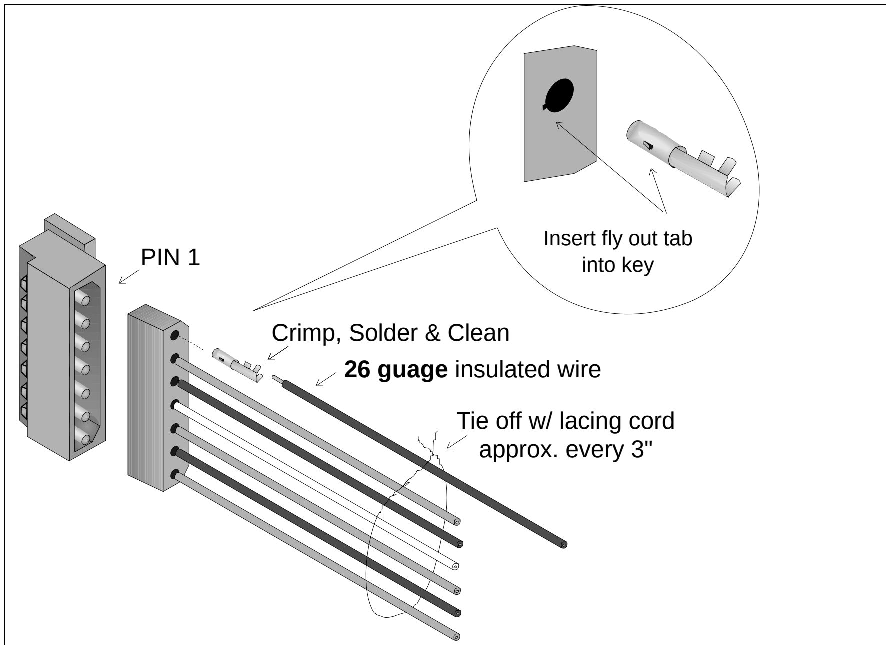
SAFETY AND HANDLING INFORMATION

- **DO NOT DROP!** The QRS14 is a precision instrument. Excessive shock can adversely affect sensor performance.
- Avoid exposing the QRS14 to electrostatic discharge (ESD). Observe proper grounding while handling.
- Insure that power leads are installed properly before applying power to the QRS14.

PATENT INFORMATION

The QRS14 is protected by the following patents: U.S. 4,654,663; U.S. 4,524,619; U.S. 4,899,587; U.S. Re. 33,479, plus other U.S. and foreign patents pending.

Figure 1. *Connector Wiring*



Recommended Color Coding	
- VDC	Violet
+ VDC	Red
Power Ground	Black
Signal Ground	Brown
Rate Output	Blue
Factory Test	N/A
Not used	N/A
Self Test	Green

Table 1. *Pin Assignments and Placement*

Pin	Standard Model QRS14-00100-102	Low Noise Model QRS14-00100-103	Enter Color Used
1	Power/signal ground	- VDC	
2	+ VDC	+ VDC	
3	Not used	Power Ground	
4	Factory Test	Signal Ground	
5	Rate Output	Rate Output	
6	Factory Test	Factory Test	
7	Self-Test	Self-Test	

INSTALLATION

A. Connector Assembly

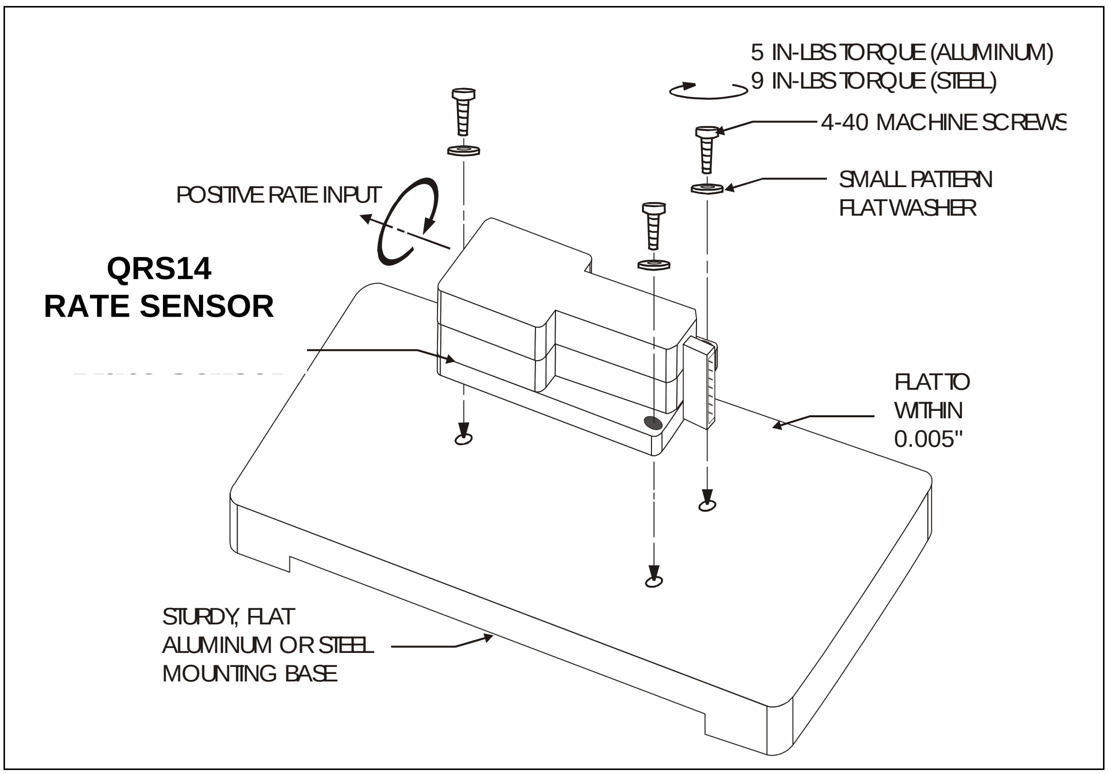
1. The Mating Connector (MOLEX 5264-7 or equivalent) packaged with the QRS14 comes unassembled so that you can customize the wire lengths to your particular installation. You can use the recommended color-coding given in **Table 1**, or use your own coding system. *In either case, record the color codes you use in the spaces provided in* **Table 1**.

2. Cut 26 gauge insulated wire (stranded). Allow 2-4" beyond what you think you'll need to provide strain relief in your wire routing. Strip 1/4" insulation from the end of each wire. Pre-tin, clean and trim off the excess. Proper wire preparation is the key to a good solder bond; a clean soldering iron tip will help insure an uncontaminated solder joint.

3. Install each wire into the connector termination (see **Figure 1**) and crimp the wire into place with needlenose pliers. Make sure there is a good mechanical connection. Solder wires using a small-tipped 650-700° F iron for 3-5 seconds.

4. Check **Table 1** for proper pin assignment. Insert each pin into the proper hole, carefully aligning the flyout tab to the keyway (see detail in **Figure 1**). Be careful not to bend near the solder joint to avoid strand separation. Secure the wire bundle with lacing cable about every 3". Don't over-tighten the lacing. Insure that there is no stress on the wire terminations at either end.

Figure 2. *QRS14 Mounting Diagram*



B. Mounting

1. Prepare the mounting surface. It should be sturdy and rigid, and must be flat within 0.005 inches. If the mounting surface flexes or vibrates, the QRS14 will respond to the movement as an input.

2. Mount the QRS14 using three small flat washers and 4-40 machine screws or equivalent. Refer to **Figure 2** for location of mounting holes. Be sure that washers lie flat with no interference from the side of the case. *Note that the sensitive axis orientation is parallel to the mounting surface.*

3. Tighten screws to 5 in-Ibs of torque for mounting onto aluminum or 9 in-lbs for steel. Over-torquing may damage the case.

C. Connection

1. *Verify power supply polarity before connecting the QRS14. The instrument's internal electronics are NOT protected against reverse-polarity power.*

2. Connect the wires, referring to **Figure 1** and **Table 1**. Note the different pin designations associated with each model.

3. Connect the power ground to the common (ground) of the power supply. Signal ground is provided as a reference terminal for the rate output signal. There is an internal jumper between signal ground and power ground. (-103 model only) Case grounding provides a shield for the internal electronics and should make good contact with other chassis or shield grounds.
4. Minimize impedance of the supply power lines at the sensor. If you are using cables longer than three feet (3'), it is recommended to use solid tantalum bypass capacitors (10 μf or more). Place the capacitors between the power lines and ground within 6" of the terminals on the rate sensor.
5. Shield power input lines if you are operating the QRS14 in the presence of high levels of electromagnetic interference (EMI). Sources of EMI include switching power supplies and radio transmitters.
6. Insert a presampling filter when using an analog-to-digital (A-D) converter with the QRS14. Set the bandwidth of the presampling filter at 1/4 to 1/3 of the sampling frequency.

OPERATION AND TROUBLESHOOTING

When properly installed and connected, the QRS14 should meet or exceed the specifications listed on page 7. If you do not achieve this level of performance when operating your QRS14, one of the following suggestions should resolve the problem. If not, please prepare a summary of your findings and call an Applications Engineer at Systron Donner Inertial: +1 866.234.4976.

A. Self Test

Before conducting more detailed tests or troubleshooting, determine if the QRS14 is performing its basic functions. You can conduct a basic self-test by shorting pin 7 to the power ground. Measure the Rate Output (pin 5), with input power applied and the QRS14 stationary.

You should measure the following at the Rate Output, pin 5:

QRS14-0XXXX-102: 0.5 Vdc **QRS14-0XXXX-103:** 1.0 Vdc

B. Bias Not In Specification

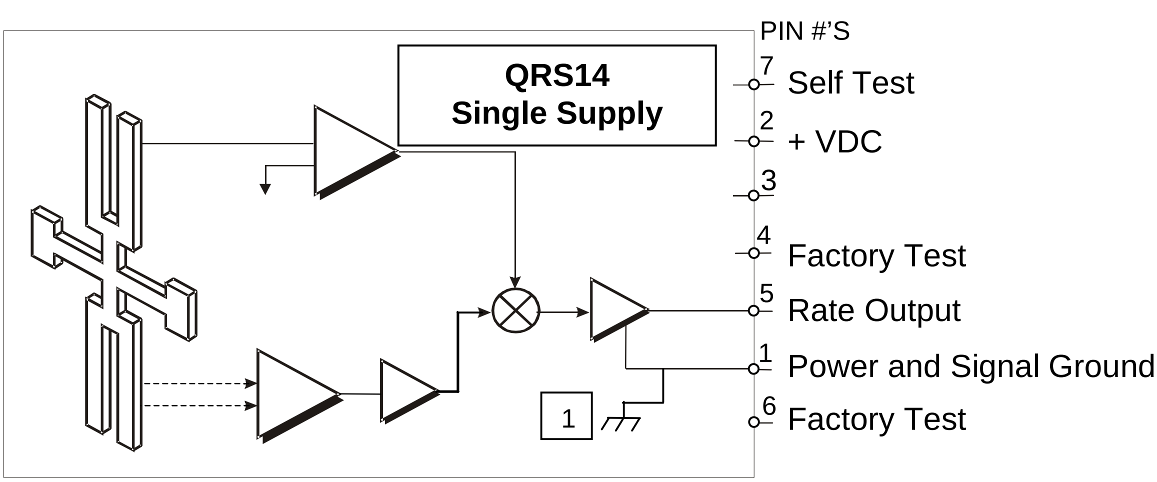
1. *Structural Vibrations or Mounting Surface Movements.* The QRS14 responds to very small angular rates. Observed voltage outputs, thought to be noise or bias, may result from real input motions caused by structural vibrations or mounting surface movements. Test the QRS14 with all potential vibration sources shut off and compare performance with previous results. Alternatively, move the QRS14 to a different mounting location or change the sensitive axis direction.

2. *Bias Shifts Caused by Ground Loops.* Ground loops may cause a bias shift that affects instrument performance. Check the wiring layout for ground loops.

3. *Crosstalk Between sensors.* Two or more QRS14's directly connected from the same power supply can possibly crosstalk, increasing bias or noise generation for each unit. First, eliminate power supplies as a cause of crosstalk (see #4 below). Then, test a single QRS14 after disconnecting all others. If the noise or bias decreases, consider electrical isolation using an R-C Pi filter network on each of the lines to the individual sensors.

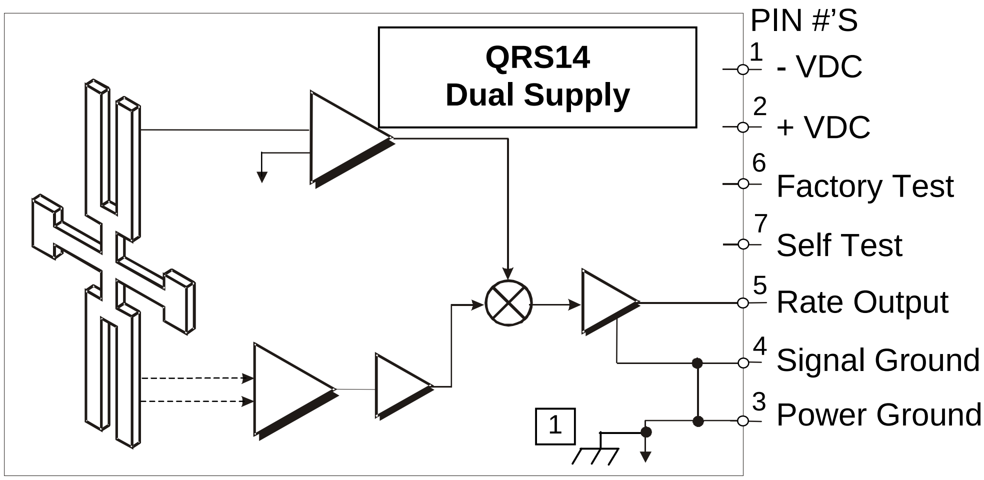
4. *Switching Power Supplies.* Some switching power supplies may cause a bias or noise increase in the output of the QRS14. Run one QRS14 from a quality bench linear power supply, such as a Lambda Model LQD 422, or from a set of batteries, to see if the switching power supplies are the problem. If the bias/noise decreases, put a 100-uf capacitor and a 0.1μf ceramic bypass capacitor between the power supply lines and ground within 6" of the QRS14 before reconnecting the switching power supplies.

Figure 3. *Connection Diagram for Part Number QRS14-0XXXX-102*



1 Power and signal ground tied to chassis internally.

Figure 4. *Connection Diagram for Part Number QRS14-0XXXX-103*



1	Chassis is tied internally to power return.

C. Output Tone at 340 Hz

Under certain conditions of shock and/or vibration, the QRS14 can emit a narrow-bandwidth tone in the region of 340 Hz (±20 Hz). This tone is usually not observable in output signals, because the sensor has an approximate corner frequency of 50 Hz with a signal rolloff of -12 dB per octave. If the tone becomes significant in your application, an appropriate filter may be used.

NOTE: Due to the QRS14's inherent sensing element design characteristics, there is notable vibration sensitivity at approximately 340 Hz. Subjecting the unit to extended periods of vibration at or near this frequency can negatively affect output.

D. Technical Assistance

We want you to be thoroughly satisfied with our product. If you have questions or need assistance in operating your QRS14, please call us. You can reach an Applications Engineer at Systron Donner Inertial by calling 866-234-4976.

Table 2. *QRS14 Specifications*

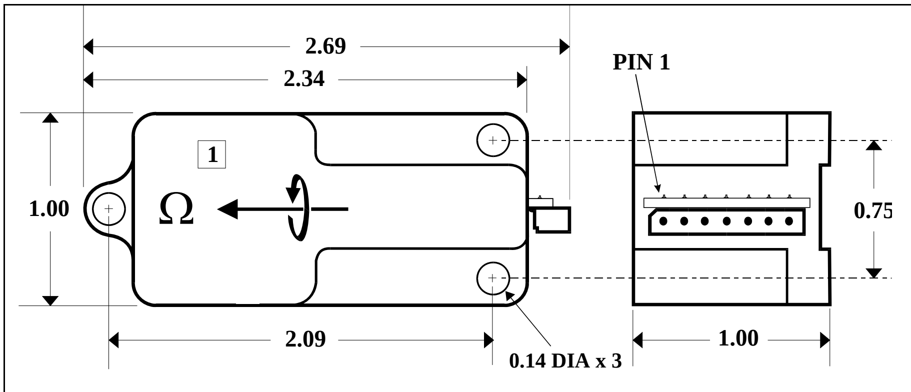
QRS14 Standard Part Numbers		
	Single Power Supply QRS14-00100-102	Dual Power Supply QRS14-00100-103

Power Requirements		
Input Supply Voltage	+9 *to* +18 VDC	+ and - 9 *to* + and - 18 VDC
Input Supply Current (max)	<20 mA	<25 mA (each supply)

Performance		
Range	±100°/sec	±100°/sec
Scale Factor (±2%)	15 mV/°/sec	50 mV/°/sec
S.F. Over Operating Temperature	< 4% from ambient	< 4% from ambient
Bias (initial offset)	+2.5 ±0.045VDC	+0.0 ±0.075VDC
Bias Stability		
Short-term (100 sec constant temperature)	< 0.05°/sec	< 0.05°/sec
Long-term (one year)	< 1.0°/sec	< 1.0°/sec
g Sensitivity (all axes)	< 0.06°/sec/g	< 0.06°/sec/g
Over Operating Environments	< ±3.0°/sec, < ±6.0°/sec 1000° Range	< ±3.0°/sec < ±6.0°/sec 1000° Range
Linearity Error	< 0.05% of F.R	< 0.05% of F.R
Output Noise (to 100 Hz)	< .05°/sec/√Hz	< .02°/sec/√Hz (50-200°/s) < .03°/sec/√Hz (500-1000°/s)
Bandwidth (-90° Phase shift)	> 50 Hz	> 50 Hz
Resolution and Threshold	< 0.004°/sec	< 0.004°/sec
Start-up time	< 2.0 sec	< 2.0 sec
Operating Life	10 years, typical	10 years, typical

Environments	
Operating Temperature	-40° C to +85° C
Storage Temperature	-55° C to +100° C
Vibration Operating	5 g_{rms} 20 to 2K Hz random
Vibration Survival	10 g_{rms} 20 to 2K Hz random, 5 min/axis
Shock	200 g pk, 2 ms, ½ sine

Figure 5. *Outline Details for Model QRS14*



1. Angular Rate applied as shown will produce a Positive Output.
2. Unit of measure in INCHES.
3. WEIGHT is less than 50 Grams.

CONTACT INFORMATION

Systron Donner Inertial
2700 Systron Drive, Concord, California 94518

Customer Service: PH: +1 925.979.4500 · FAX: +1 925.349.1366
Sales and Technical Support: +1 866.234.4976
E-Mail: sales@systron.com · Website: www.systron.com