

PRODUCT SPECIFICATION FOR THE RRS01
RANGE OF SINGLE AXIS RATE SENSORS

RRS01-00-0100PS

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THIS SPECIFICATION IS INCOMPLETE WITHOUT THE FOLLOWING DOCUMENTS:						

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NOTICE: This Product Specification defines product performance under the declared conditions only. This Specification does not constitute any form of warranty as to the suitability or fitness of the Product for any particular purpose.

1. GENERAL

1.1 Scope

This Product Specification defines the performance and interface characteristics for the RRS01 range of single axis solid state rate sensors and is the primary document for customer reference.

All rate sensors bearing the part number RRS01 are designed to meet the requirements of this specification. Appendix A gives preliminary details for future variants.

1.2 Applicable Documents

Drawing RRS01-00-0103

1.3 Physical Characteristics

RRS01 single axis rate sensors are stand-alone units comprising a Silicon VSG resonator ring with integrated drive and signal conditioning electronics.

The RRS01 range of sensors operate at angular rate ranges up to 350 deg/sec and are designed to provide high performance and reliability within a harsh physical environment.

The sensors are driven from a bipolar d.c. supply and give a bipolar d.c. output proportional to rate of rotation.

The sensors have a BIT test input and provide a temperature sensor output that can be used for rate compensation.

All electrical connections are made via a 9 pin array provided on the base.

For further construction details refer to section 3.

2. PERFORMANCE CHARACTERISTICS**2.1 Performance**

Parameter	Model Number		
	RRS01-01	RRS01-05	TBD
Rate Range	$\pm 110^\circ/\text{s}$	$\pm 50^\circ/\text{s}$	
Scale Factor:			
Nominal	18.18mV/ $^\circ/\text{s}$	40.00mV/ $^\circ/\text{s}$	
Setting (20 $^\circ\text{C}$)	$\pm 1.0\%$	$\pm 1.0\%$	
Linearity	$\pm 1.0\%$ of full scale	$\pm 1.0\%$ of full scale	
Variation with temperature	$\pm 3.0\%$	$\pm 3.0\%$	
Repeatability	$\pm 0.05\% 1\sigma$	$\pm 0.05\% 1\sigma$	
Bias:			
Setting (20 $^\circ\text{C}$)	$\pm 0.3^\circ/\text{s}$	$\pm 0.3^\circ/\text{s}$	
Variation with temperature	$\pm 3.0^\circ/\text{s}$	$\pm 3.0^\circ/\text{s}$	
Repeatability (switch on at constant temperature)	0.03 $^\circ/\text{s} 1\sigma$	0.03 $^\circ/\text{s} 1\sigma$	
g sensitivity	0.002 $^\circ/\text{s/g}$	0.002 $^\circ/\text{s/g}$	
g ² sensitivity	2 $^\circ/\text{hr/g}^2$	2 $^\circ/\text{hr/g}^2$	
Bandwidth (-90 $^\circ$)	>50Hz	>50Hz	
Noise:			
In band	<0.35 $^\circ/\text{s rms}$	<0.30 $^\circ/\text{s rms}$	
In band and operating under vibration (see 4.2)	<0.45 $^\circ/\text{s rms}$	<0.40 $^\circ/\text{s rms}$	
Start time	<300ms	<300ms	
Commanded BIT rate output offset (see 6.2.5)	0.40V to 1.00V	0.40V to 1.00V	

3. DESIGN, CONSTRUCTION, PRODUCTION

The RRS01 Rate Sensor is a hermetically sealed (welded) unit. The sensor housing is made from an all Kovar metal construction. During its assembly the unit is evacuated and dry filled with nitrogen.

The sensor electronics is mechanically isolated from the housing with electrical connections made via a small flexible circuit. External connections are via nine hermetically sealed pins on one face.

Each sensor is digitally programmed for scale factor and bias, and is functionally tested over the full operating temperature range.

The sensor is designed to be mounted to the customer application by use of adhesives (application notes are available).

4. ENVIRONMENTAL CONDITIONS**4.1 General**

The RRS01 Rate Sensor is fully sealed and has been designed for use in applications where the unit can be exposed to repeated excursions of temperature, humidity, vibration, and shock during normal operation.

4.2 Climatic / Mechanical

The unit will operate in the following climatic / mechanical environments with the performance specified in Section 2:

Parameter	
Temperature (operating)	-40 to +75°C
Humidity	95% RH test to MIL-STD-810E Method 507.3
Vibration	0.0005g ² /Hz at 20Hz rising to 0.05g ² /Hz from 100Hz to 2KHz
Shock	1000g 1mS half sine 60g 30mS half sine
Salt Fog	MIL-STD-810E Method 509.3
Atmospheric Pressure (operating)	100,000 ft test to MIL-STD-810E Method 500.3

4.3 Electromagnetic Compatibility

4.3.1 Conducted Susceptibility

At frequencies other than the unit resonator frequency, the unit will operate to the performance specified in Section 2 with the following ripple on the power supply:

Ripple (mV pk-pk)	Frequency Range
<50mV	100Hz to 12KHz
<20mV	12KHz to 400MHz

At the resonator frequency (13.5KHz to 14.5KHz) and its third harmonic frequency (40.5KHz to 43.5KHz), the power supply ripple should not exceed 0.3mV pk-pk.

5. INTERCHANGEABILITY

Any RRS01 Rate Sensor with the same part no. extension (e.g. -01, -02, -03 etc) is fully interchangeable with another unit of the same build standard.

6. INTERFACES**6.1 Mechanical Interface**

The mechanical interface and space envelope are as defined in Figure 1.

The weight of the unit is less than 35 grammes.

6.1.1 Axis Definition

The sensing axis is as defined in Figure 1.

6.2 Electrical Interface

Electrical connections are made through a 9 pin array on the base of the unit.

The pin connections are as shown below:

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Pin Number	Function
1	Positive Supply (+5V)
2	Alarm BIT Output (not available)
3	Commanded BIT Input
4	Negative Supply (-5V)
5	Temperature Sensor Output
6	0V
7	Rate Output
8	Rate Reference
9	Chassis Ground

6.2.1 Power Supply Requirements (pins 1,4 & 6)

The unit performs to specification with the following electrical supplies:

Supply Voltage, $\pm V_s = \pm 4.85V$ to $\pm 5.25V$

Supply Current, is less than 60mA from each supply rail.

Notes: (1) The unit is not protected against reverse supply connection.

(2) Absolute maximum supply voltage without damage is $\pm 6V$ (when correct polarity is observed).

6.2.2 Rate Output (pin 7)

The full scale output range is $\pm 2V$.

The output voltage is bipolar with respect to Rate Reference and is proportional to the applied rate.

6.2.3 Rate Reference (pin 8)

The Rate Reference is the 0V reference for the Rate Output.

The Rate Reference is nominally 0V with respect to the power supply 0V.

6.2.4 Temperature Sensor Output (pin 5)

This is a bipolar output with respect to 0V.

The scale factor of the temperature sensor is $16.9mV/^\circ C$ with an output at $20^\circ C$ of $0V \pm 0.5V$. The signal increases positively for increasing temperature.

6.2.5 Commanded BIT Input (pin 3)

When this input is connected to 0V, the rate output is given an offset as defined in paragraph 2.1.

6.2.6 Alarm BIT Output (pin 2)

This signal is currently not available and the pin should be left unconnected. It will however become available in a future version of the sensor and its characteristics are given below:

This will be a bipolar output with respect to 0V.

+2.4V \pm 0.1V will indicate that the sensor system is operating correctly
-2.4V \pm 0.1V will indicate a fail condition.

6.2.7 Chassis Ground (pin 9)

This pin is connected to the case.

7. RELIABILITY

The MIL HDBK 217F predicted MTBF for the RRS01 is > 300,000 hours for the Airborne Inhabited Fighter and Airborne Uninhabited Cargo environments at 45 deg C.

8. MAINTAINABILITY

The RRS01 Rate Sensor requires no maintenance.

9. SAFETY

At time of issue of this Product Specification no special safety precautions regarding usage have been identified.

10. DESIGN ASSURANCE PROVISIONS

A design proving programme will be implemented to demonstrate that the RRS01 Rate Sensor conforms with the characteristics defined in this specification. A Certificate of Design (C of D) will be prepared for this product.

11. PACKING

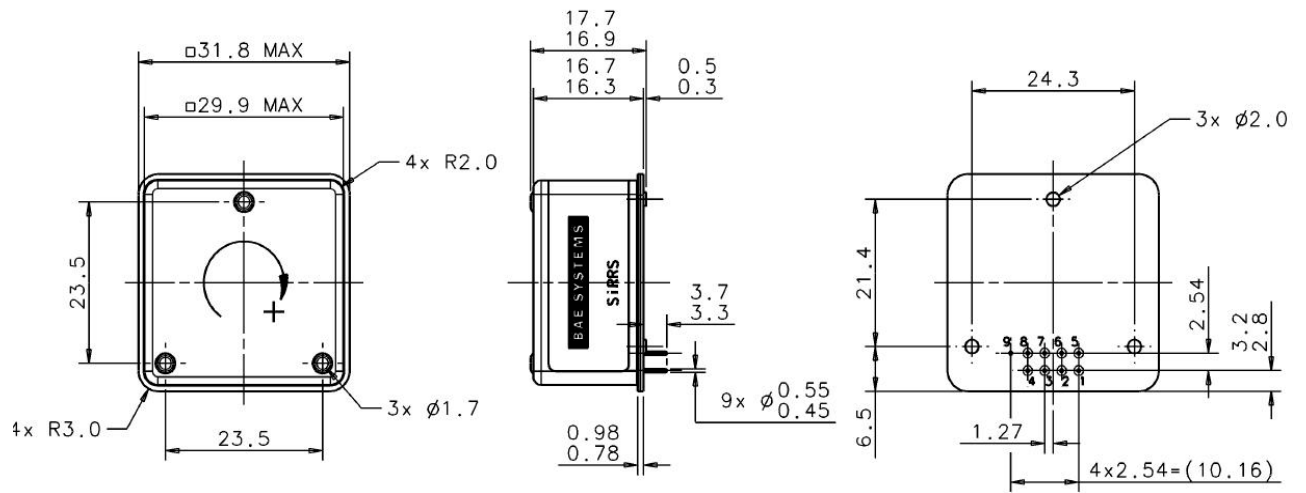
Packaging shall, in general, be to Commercial Packaging standards conforming to DEF STAN 8141 giving protection for short term storage.

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All dimensions in millimeters

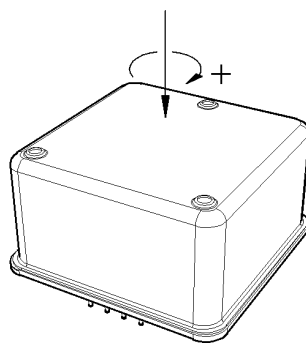


Figure 1 RRS01 Rate Sensor

APPENDIX A

A1. FUTURE VARIANTS

A1.1 Performance

Parameter	Model Number		
	RRS01-02	RRS01-03	RRS01-04
Rate Range	± 200°/s	± 300°/s	± 25°/s
Scale Factor:			
Nominal	10.00mV/°/s	6.67mV/°/s	80.00mV/°/s
Setting (20°C)	±1.0%	±1.0%	±1.0%
Linearity	±1.0% of full scale	±1.0% of full scale	±1.0% of full scale
Variation with temperature	±3.0%	±3.0%	±3.0%
Repeatability	±0.05% 1σ	±0.05% 1σ	±0.05% 1σ
Bias:			
Setting	±0.3°/s	±0.3°/s	±0.3°/s
Variation with temperature	±3.0°/s	±3.0°/s	±3.0°/s
Repeatability (switch on at constant temperature)	0.03°/s 1σ	0.03°/s 1σ	0.03°/s 1σ
g sensitivity	0.002°/s/g	0.002°/s/g	0.002°/s/g
g ² sensitivity	2°/hr/g ²	2°/hr/g ²	2°/hr/g ²
Bandwidth (-90°)	>50Hz	>50Hz	>35Hz
Noise:			
In band	<0.45°/s rms	<0.55°/s rms	<0.15°/s rms
In band and operating under vibration (see A1.2 below)	<0.55°/s rms	<0.65°/s rms	<0.25°/s rms
Start time	<300ms	<300ms	<300ms
Commanded BIT rate output offset (see 6.2.5)	0.28V to 0.72V	0.17V to 0.43V	0.40V to 1.00V

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A1.2 Climatic / Mechanical

Parameter	
Temperature (operating)	-40 to +75°C
Humidity	95% RH test to MIL-STD-810E Method 507.3
Vibration	0.0005g ² /Hz at 20Hz rising to 0.05g ² /Hz from 100Hz to 2KHz
Shock	1000g 1mS half sine 60g 30mS half sine
Salt Fog	MIL-STD-810E Method 509.3
Atmospheric Pressure (operating)	100,000 ft test to MIL-STD-810E Method 500.3