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NORTHROP GRUMMAN

Inertial Rate Sensors (LRS-2000/2002/2001)

The LRS-2000 two-axis Rate Sensor Assembly (RSA) was developed to support gun and turret stabilization applications with high accuracy, gun-hard, low cost and high mean time between failure (MTBF) for the most demanding military ground vehicle environmental and performance requirements.

It functions as part of a larger system that provides added protection from enemy gunfire or improvised explosive devices for the urban warfighter by allowing soldiers to fire the stabilized weapon from inside the vehicle.

Description

A key component of the LRS-2000 is its dual-axis gyroscope that offers superior accuracy and high reliability. Its accuracy is enhanced by a servo-electronics card that is specifically tailored to maximize the performance of the rate sensor. The enclosure provides shock

and vibration design features that protect both the gyroscope and circuit card assembly from damage greater than 2,770 g's both in the field and during integration and maintenance. The LRS-2000 RSA is Electromagnetic Interference (EMI) protected and provides high-accuracy stabilization and targeting capabilities in a small package, while offering high reliability with an estimated MTBF of more than 100,000 hours.

Applications

- Fully qualified for gun/turret stabilization for ground combat applications
- Airborne and marine applications
- Gimbal and platform stabilization
- Tactical missile and targeting applications
- Camera, antenna and radar pointing and stabilization

Advantages

- Random drift of <math><1^\circ</math> per hour
- High shock capability with internal shock mounts for the LRS-2000 and LRS-2002 (shock capable to >2,770 g's for 0.1 msec)
- Water sealed ruggedized enclosure
- EMI (MIL-STD-461E) protection
- MTBF of more than 100,000 hours
- Analog card outputs scale factor is selectable to accommodate legacy requirements
- Two analog signal outputs respond to orthogonal angular inputs
- Commercial off-the-shelf product with a lead time of less than 10 months after receipt of order

LRS-2000 Two-Axis Rate Sensor Assembly	
Performance	
Qualified	Abrams Tank
Random Drift	<1°/hr, 1 σ
Scale Factor	166.7 mVdc/deg/sec
Bandwidth (Adjustable)	75 Hz (-90°)
Characteristics	
Dimensions	Length: 4.24 in. (10.77 cm), Width: 4 in. (10.16 cm), Height: 1.91 in. (4.85 cm)
Weight	<1.8 lb (0.82 kg)
Temperature	-40°C (-40°F) to +85°C (+185°F)
Shock	2,770 g's, 0.1 msec, half sine
Input Voltage	18-30 Vdc
Rate Range	60°/sec (Continuous)
2-Axis Analog Full Range	± 10 Vdc
SF Linearity	<1%
Threshold	0.003°/sec
Vibe (Operating)	50 grms, 0-2000 Hz
EMI	MIL-STD-461E
MTBF	>100,000 hours
Features	
Angular Rates	2-axis analog outputs
Sensor	One dual-axis gyro, One servo card, Ruggedized enclosure

LRS-2002

The LRS-2002 two-axis rate sensor is being developed as a miniaturized version of the LRS-2000. It has a smaller enclosure that provides both analog and digital RS-422 rate outputs with shock isolators and EMI protection.

LRS-2002 Two-Axis Miniature Rate Sensor Assembly	
Performance	
Qualified	Future product
Random Drift	<1°/hr, 1 σ
Scale Factor	83 mVdc/deg/sec
Bandwidth (Adjustable)	100 Hz (-90°)
Characteristics	
Dimensions	Length: 4 in. (10.16 cm), Width: 2 in. (5 cm), Height: 1.59 in. (4.04 cm)
Weight	<0.75 lb (0.34 kg)
Temperature	-40°C (-40°F) to +85°C (+185°F)
Shock	2,770 g's, 0.1 msec, half sine
Input Voltage	18-30 Vdc
Rate Range	150°/sec (Continuous)
2-Axis Analog Full Range	± 10 Vdc
SF Linearity	<1%
Threshold	0.003°/sec
Vibe (Operating)	50 grms, 0-2000 Hz
EMI	MIL-STD-461E
MTBF	>100,000 hours
Features	
Angular Rates	2-axis analog and digital outputs RS-422
Sensor	One dual-axis gyro, One servo card, Ruggedized enclosure

LRS-2001

Developed for the F-35, the three-axis LRS-2001 rate sensor uses two dual-axis gyroscopes with digital RS-422/485 rate outputs.

LRS-2001 Three-Axis Rate Sensor Assembly	
Performance	
Qualified	F-35
Random Walk	<0.05°/√hr
Scale Factor	200 ppm
Bandwidth	100 Hz (-90)
Characteristics	
Dimensions	Length: 5 in. (12.7 cm), Width: 2 in. (5 cm), Height: 1 in. (2.54 cm)
Weight	<0.65 lb (0.29 kg)
Temperature	-25°C (-40°F) to +71°C (+159°F)
Shock	62 g, 0.8 msec, half sine
Input Voltage	±15 Vdc, +5 Vdc
Rate Range	285°/sec (5 sec)
SF Linearity	<1%
Threshold	0.003°/sec
Vibe (Operating)	14.2 grms, 0-2000 Hz
EMI	MIL-STD-461E
MTBF	>100,000 hours
Features	
Angular Rates	3-axis digital outputs RS-485 and RS-422
Sensor	Two dual-axis gyros, Three electronics cards packages, one base plate
Output Messages	200 Hz

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