ISRO Inertial Systems Unit

Thiruvananthapuram

Inertial Sensors

"THE DREAM OF YESTERDAY
IS THE HOPE OF TODAY
AND THE REALITY OF TOMORROW"

DTG and mini DTG

DTG

mDTG

- 2 Axis inertial class Gyro
- Used in all ISRO's Launch Vehicle, Spacecraft and Interplanetary missions
- Flight proven in 65 spacecrafts and 45 Launch vehicle missions
- Performed life more than 10 yrs in 7 spacecraft missions
- Life demonstrated for more than 23 years

Specifications	DTG	mDTG
Max Rate Capability (deg/sec)	60	60
Operating Speed (RPM)	6000	9000
Torque Scale Factor (deg/hr/mA)	125	250
Drift Stability (deg/hr)	0.05	0.05
Scale Factor Error(ppm)	< 50	< 50
Size (mm)	Ø76 x 85	Ø 58 x 66
Mass (kg)	1.5	0.6

Environmental specifications

- Thermo vacuum level : $20^{o}C$ to $+60^{o}C$

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CERAMIC SERVO ACCELEROMETER

- Ideal for high accuracy aerospace applications
- Pendulous force re-balanced analog accelerometer
- Based on quartz flexure technology
- Inducted in all launch vehicle and inter-planetary missions

Spectrum of applications

- Interplanetary probes and spacecrafts for precise liquid engine cut-off.
- Launch Vehicles and aircraft for precision inertial navigation
- RLV and re-entary vehicles for control.
- Seismometry

Peformance Indices		
Parameters	**Specification**	
	CSA 150	**CSA 600**
Range (g)	± 25	± 25
Resolution (µg)	<1	<1
Scale Factor (mA/g)	-1.2 ± 10%	-1.2 ± 10%
Non Linearity (µg/g2)	30	30
Bias (mg)	±15	±15
Misalignment (arc sec)	± 400	± 400
Bandwidth (Hz)	>400	>400
Mass (gm)	50	50
Power (w)	0.5	0.5

Stability Parameters		
Parameters	**Specification**	
	CSA 150	**CSA 600**
Scale factor in - run (ppm)	10	10
Scale fctor stability (ppm) warmup-warmup	50	100
Bias stability-in run (µg)	10	10
Bias warmup -warmup stability (µg)	50	200

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DIGITAL CERAMIC SERVO ACCELEROMETER

High Accuracy Pendulous Digital Navigation Grade Sensor.

Servo electronics and High Resolution Voltage to Frequency Convertor integral to the Sensor

Performance Indices

Specification		
Range	:	± 25g
Resolution	:	<0.002 m/Sec/Pulse
Scale Factor	:	4500± 15% pps/g
Bias Stability	:	10 µg
Bias Warm up to Warm up Stability	:	50 µg
S/F Warm up to Warm up Stability	:	50 ppm
Bandwidth	:	>300 Hz
Mass	:	90 gm
Power	:	1.6 W

Key features

- DC in Digital Out sensor.
- Monolithic flexure technology.
- Electronics integral of the sensor.
- Hermetically sealed dry sensor.
- Built in temp sensor.

Applications

- Human rated Launch Vehicle.
- High accuracy long duration navigation.

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ISRO RING LASER GYRO DIGITAL (ILGD)

Ideal sensor for high dynamic range applications

Features

- Indigenous technology- both design and fabrication
- Refractive optics based square cavity laser resonator
- RF excited, low voltage operation
- Vacuum compatible
- Integral electronics, DC-In Angle out
- Heritage – Launch vehicle & Chandrayaan Lander

Parameters	Aircraft	Launch Vehicle	Inter planetary Lander
Absolute Values			
Range in °/s	±400	±180	±30
Scale Factor in arc sec/pulse	0.7666		
Nonlinearity in ppm	10		
Asymmetry in ppm	10		
Absolute Bias in °/hr	±1		
Stability Parameters			
Scale factor Stability in ppm	10		
Bias stability-In run in °/hr	0.015	0.03	0.005
Bias stability- Day to Day in °/hr	0.1		
Angle Random Walk in °/√hr	0.005	0.009	0.003
Environment			
Vibration- Random in grms	13.5		
Thermal in °C	0 to 70		
General			
Mass in kg	1.0	1.5	1.5
Size in mm	ø100 x 80	ø135 x 100	ø135 x 110
Power in W	5	7	7

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TUNING FORK RATE GYRO

Features

- Solid state vibratory gyroscope
- High Rate capability
- Single element sensing unit
- High Reliability
- Very Low SWAP
- Application : Launch Vehicle, UAV

Specifications

Parameter	Specification
Input Range	100°/s
Threshold & Resolution	0.01°/s
Null stability	0.1°/s
Scale factor	300 mV/deg/s
Mass	70 grams
Power	2.8 W
Volume	Ø38mm x 41mm

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ISRO CORIOLIS RESONATOR GYRO

For Rate Stabilisation Applications MEMS Technology

Analog Outputs

Range	:	±30 deg/sec
Scale Factor	:	30 mV/°/sec
Bias Instability	:	<0.01 °/sec
Bandwidth	:	40±5Hz

Additional Outputs

- Temperature
- Health Monitoring
- Oscillator Frequency

Supply Voltage	:	±2.5V
Power	:	<0.5W
Electrical Interface	:	MDM 15Pin
Size	:	75 x 55 x 25 mm
Mass	:	80g
Vibration –		
Sinusoidal	:	10 g Random(overall) 13.5grms

Designed and qualified for LV environment

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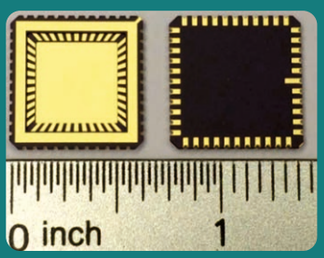
IISU SCL MEMS ACCELEROMETER (ISMA)



State of the art MEMS sensor

- Indigenous MEMS accelerometer
- Jointly developed by IISU & SCL
- Sensor + readout IC as MCM in an LCC44 chip
- Analog voltage output
- Customizable bandwidth: 50 Hz to 100 Hz
- Applications: Bending mode accelerometer for Launch Vehicle and other aerospace applications

Specifications

Range	:	±4 g
Scale factor	:	1 V/g
Bias Instability	:	100 μg
Size	:	45 x 45 x 30 mm
Power	:	< 0.5 W
Mass	:	< 100 gms

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