



ISRO Inertial Systems Unit Thiruvananthapuram



Space Systems & Facilities



“THE DREAM OF YESTERDAY
IS THE HOPE OF TODAY
AND THE REALITY OF TOMORROW”

HIGH DYNAMIC NAVIC RECEIVER



- Capable of receiving GPS, NavIC and GAGAN signals
- Tuned for extreme speed, acceleration and jerk conditions
- Capable of working at high thermal, vibration and shock conditions
- SBAS/GAGAN Enabled
- MIL grade design

- Completely designed in-house
- Flown in GSLV Mk3 M1/ Chandrayaan Mission
- In regular production for PSLV, GSLV and GSLV Mk3 missions
- Current Applications
 - Closed loop guidance for long duration missions
 - Preliminary Orbit determination of satellites

Specifications			
Channels	NavIC: 7 GPS: 12 GAGAN: 2	Acceleration Jerk Velocity	15 g 20 g/s 15 km/s
RF Frequency	L5: NavIC L1 (GPS, GAGAN)	Accuracy	15 m 0.3 m/s
Interfaces	Power: +5V, 5W Data: Mil1553	Weight	~0.6kg

The receiver need external antenna and LNA for functioning



DIGITAL MEMS RATE GYRO PACKAGE



- Single box, DC IN 1553 B output.
- MEMS rate sensors based on Coriolis vibratory rate resonators.
- Dual redundant configuration.
- Meets Digital Auto Pilot requirement.

Specifications

Rate range	: 10 deg/s
Scale factor	: 1V/deg/s
SF non-linearity	: 0.5%
Null stability	: < 0.05deg/s
Power	: 10 W
Mass	: 4kg

Inertial Navigation System with the flight heritage of 1 Mission



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MEMS RATE & ACCELERATION PACKAGE



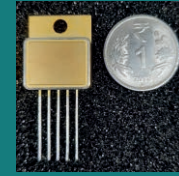
- Single box, DC IN 1553 B output.
- Three axis rate measurement based on MEMS Coriolis vibratory rate sensors.
- Lateral acceleration measurement using Ceramic Servo Accelerometers.

Specifications

Rate range	:	50 deg/s
Scale factor	:	200 mV/deg/s
Null stability	:	< 0.1 deg/s
Acceleration range	:	+/-5 g
Scale factor	:	150 μ g
Null stability	:	< 500 μ g
Power	:	8.5 W
Mass	:	2.3 kg



DC-DC CONVERTERS



Features

- ISRO's in-house designed HMC DC-DCs
- Built-in EMI Filter to meet MIL-STD-461C
- High Frequency of operation – 500kHz
- Short Circuit Protected
- Excellent Transient Response
- Input ranges: 24V to 45V and 45V to 75V
- No cross regulation effects
- High voltage outputs: up to $\pm 45V$
- Output voltage customizable from 1.8V to 16V

Specifications

DC-DC Type	Output Power (W)	Size (mm x mm x mm)	Mass (gms)
Single output	8	40.00 x 28.40 x 10.00	27
Dual output	8	66.00 x 34.22 x 11.00	35
Triple output	20	66.00 x 34.22 x 11.00	55
Triple output	50	76.20 x 50.80 x 12.50	110
POL HMC	10	21.08 x 17.78 x 6.10	9



ROTARY TRANSDUCER



- Sensor to measure angular displacement.
- Incremental and Absolute Types.
- High life, no contacting elements.
- Applications in robotic joints, precision mechanisms, precision actuators and rotary machine tools.
- Custom design shall be done on demand.

Specifications

Principle of Working	:	Inductive coupling
No. of Poles	:	256
Accuracy	:	± 3 arc-seconds
Input Excitation	:	1V, 10 KHz (Typical)
Substrate	:	Aluminium
Assembly Type	:	Separate Rotor and Stator
Air Gap (Nominal)	:	100-300 μm
Overall size (mm)	:	ϕ 45.72 ID x ϕ 110 OD x 16 height
Mass	:	200 grams
Operative Temp.	:	-20°C to 80°C



HIGH RESOLUTION ABSOLUTE OPTICAL ENCODER

Features

- Absolute High Resolution High Accuracy Space Grade Optical Encoder.
- Resolution and Accuracy: ± 3 arc-sec (19 bit).
- Pancake Type; Hollow inner rotor, outer stator.
- Totally Indigenous Design and Realization.
- Completely space grade electronics.
- FPGA based Electronics Resolution Improvement and Control.
- Customizable for each application.
- Interface- RS422.

Typical Specifications	
Type	Pancake type
Resolution	19 bit
Accuracy	± 3 arc-sec
Radiation Level	20 krad
Power	1.5 W
Operating speed	± 100 deg/sec
Design Life	7 years

Motor position feedback sensor for Control Moment Gyro and Mechanisms



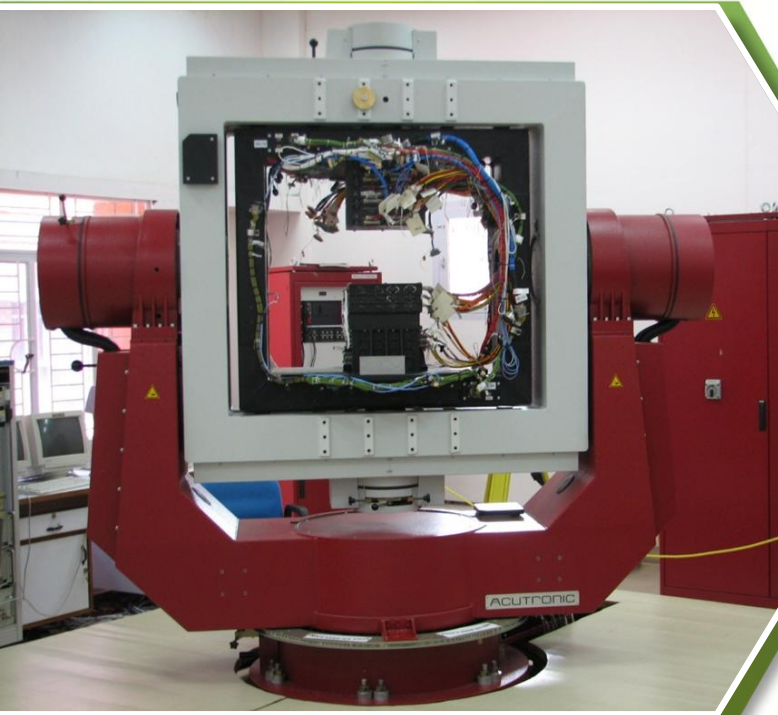
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3-Axis Angular Motion Simulator

- This has three gimbals designated as Inner, Middle and Outer, which are used to simulate the flight motion on the inertial systems.
- Systems under test are mounted on the base plate of the inner gimbal and electrical connectivity is extended to the packages through slip rings.



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Major Specification

Position Accuracy	:	1 arcsec
Rate Stability	:	1 ppm
Rate Accuracy	:	10 ppm
Slip Rings	:	145 Numbers
Wobble	:	< 2 arcsecs
Orthogonality	:	< 3 arcsecs
Bandwidth	:	50, 20 & 20 Hz for Inner, Middle & Outer

- Calibration of inertial systems for launch vehicles and Spacecraft application
- Tests include, Multiposition test, Rate test, Static Navigation test, Short term stability test, All Attitude test, Angular oscillation test.

▶ 3-Axis Angular Motion Simulator with Thermal Chamber

- *High Dynamic 3-Axis Motion Simulator with Thermal Chamber on the Middle Gimbal.*
- *Heating by Heaters and cooling by evaporating Liquid Carbon Di-Oxide.*



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Temperature
Sensitivity tests &
Regular calibration
of inertial systems
for launch vehicle &
spacecraft
applications

Major Specification

Position Accuracy	: 1 arcsec
Rate Stability	: 1 ppm
Rate Accuracy	: 10 ppm
Slip Rings	: 145 Numbers
Wobble	: < 2 arcsecs
Orthogonality	: < 3 arcsecs
Bandwidth	: 50, 20 & 20 Hz for Inner, Middle & Outer
Temperature Range	: -20° C to 100° C

► 2-Axis Position/Rate Table

This is a 2-Axis Position/Rate Table with unique configuration of Vertical Outer Axis and Inner Axis orthogonal to Outer Axis..



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Exclusive calibration of
ILGDs.

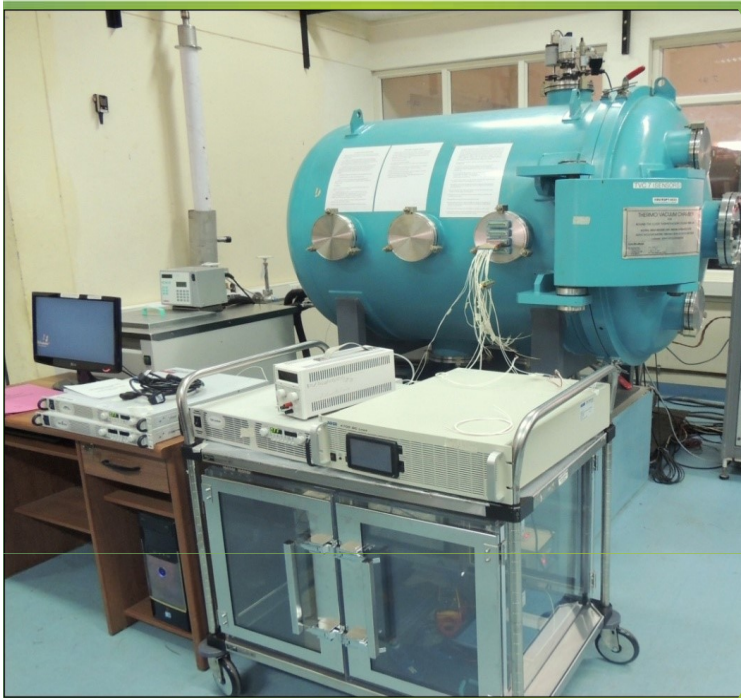
Major Specification

Position Accuracy	:	1 arcsec
Rate Stability	:	1 ppm
Rate Accuracy	:	10 ppm
Bandwidth	:	50 & 20 Hz for Inner & Outer Axis
Payload Dimension	:	450 mm Dia x 400 mm High
Payload Weight	:	: 40 Kgs



Thermovacuum Chamber

Horizontal Thermovacuum chamber mounted on Seismic foundation.



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**Thermovacuum testing
on inertial systems used
in launch vehicles and
spacecrafts**

Major Specification

- Test Volume : 700 mm ϕ x 650mm Height x 1100 mm length (sector shroud)
- Ultimate Vacuum : 1×10^{-6} mbar
- Temperature range : - 50 °C to +100 °C.
- Pumping system ; Two Turbo molecular pumps

Thermal Test facility

Thermal cycling test of Inertial sensors & systems in a vibration free environment



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Thermal testing of Inertial sensors & systems as per qualification and acceptance level specifications.

Major Specification

Test Volume : 1000 x 1000 x 1000 mm
Temperature range : -40°C to +180°C

Vibration Test Facility

Electrodynamics air cooled vibration shaker having turnion mounted vibrator body and slip table which help to simulate the test on articles in all three axes.



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**Vibration & Shock testing
of Structural , Qualification
and Fight model of Inertial
Sensors , Systems and
Spacecraft Mechanisms**

Specification

Sine Force Peak	:	35.6KN
Random Force rms	:	35.6KN
Half Sine Bump Force (Shock)	:	106.75KN
Armature Resonance (Fn)	:	2650Hz±5%
Usable Frequency Range	:	5Hz to 3000Hz
Armature Diameter	:	440mm/640mm
Slip Table Size	:	600mm x 600mm



Semi Anechoic Chamber

- *Semi Anechoic Chamber consisting of Chamber & Control Room.*
- *SAC is totally shielded from the external interferences by steel enclosures and offers more than 110 dB attenuation.*



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Radiated Emission Measurements and Radiated Susceptibility Tests on Systems and sub systems of launch vehicle and spacecraft deliverables.

Major Specification

Dimension : 4.9 x 4.1 x 3.0 Meters (SAC)
2.9 x 4.1 x 3.0 Meters (CR)

Frequency Range : 30 MHz to 40 GHz



Climatic Test Facility

Chamber for Humidity testing of Inertial sensors and systems



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Used for Humidity testing of qualification model sensors and systems as per IS 8252.

Major Specification

Test volume : 600 x 600 x 600 mm
Temperature range : -10⁰ C to +100⁰ C
Humidity range : 10 to 95% RH



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