



ISRO Inertial Systems Unit Thiruvananthapuram



Actuators & Mechanisms



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

NANO AND MICRO REACTION WHEEL

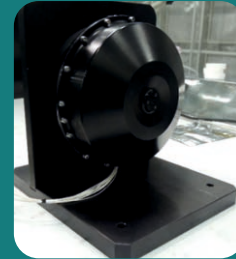
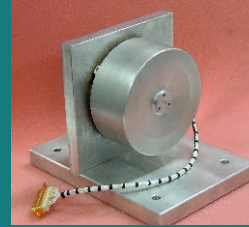


- For Nano and Mini Satellites.
- Wheel with Integrated / Modular Drive Electronics.
- Miniature Brushless DC Motor.
- PIC based / FPGA based controller.
- Provision for Digital Dynamic Friction Compensation.
- Interface: Serial, I2C.
- Life: > 1 Years

Specifications		Nano Wheel	Micro Wheel
Angular momentum @Max.Speed		15 mNms	360 mNms
Operational Speed range		+/- 6000 RPM	+/- 8000 RPM
Reaction Torque		3 mNm	18 mNm
Loss torque(max)		0.5 mNm	9 mNm
Power	Steady State @ Max Speed	< 0.6 W	< 2 W
	@ Max Speed, Torque	< 4 W	< 15 W
Unbalance	Static	0.3 gmm	0.05 gcm
	Dynamic	3.0 gmm ²	0.125 gcm ²
Mass	Wheel	150 gm	750 gm
	WDE	30 gm	750 gm
Size	Wheel (mm)	55 x 55 x 38	79 x 79 x 50.5
	WDE (mm)		155 x 155 x 27



MINIATURE REACTION WHEEL: VC -1 / 3



- Hermetically Sealed Assembly.
- Brushless DC Motor.
- FPGA based miniature wheel drive electronics.
- Digital Dynamic Friction Compensation.
- Interface- Proprietary SPI, MIL-STD-1553B and RS485.
- Life: > 5 Years.

Environmental specifications

- Vibration level : Sine 13.3g, Random 7.9g_{rms}
- Thermo vacuum level : +5°C to +50°C
- Shock : 450g

Specifications		VC - 1	VC - 3
Angular momentum@Max.speed		1 Nms	3 Nms
Operational Speed range		+/- 6000rpm	+/- 6000rpm
Reaction Torque		0.02Nm	0.02Nm
Loss torque(max)		0.01 Nm	0.01 Nm
Power Supply requirement		5V, 15V, -15V and 28-42 V	
Power	Steady State @ Max Speed	< 10 W	< 10 W
	@ Max Speed, Torque	< 20 W	< 35 W
Unbalance	Static	0.10 gcm	0.5 gcm
	Dynamic	0.25 gcm ²	1.0 gcm ²
Mass	Wheel	1.4 kg	< 2.7 kg (Integral WDE)
	WDE	0.75 kg	
Size	Wheel (mm)	φ110 x 54	φ180 x 80 (Integral WDE)
	WDE (mm)	155 x 155 x 27	



REACTION WHEEL: VC – 5 / 10 / 15 / 25 / 50



- Angular contact ball bearings with static reservoir / centrifugal reservoir
- Hermetically Sealed Assembly
- FPGA Based miniature Wheel Drive Electronics with Digital Dynamic Friction Compensation
- Interface- Proprietary SPI, MIL-STD-1553B and RS485
- Built-in booster circuit to increase 28-42V supply to 70V
- Life: > 7 Years (VC-5/10/15) / 12 years (VC-25/50)
- On orbit, More than 140 Reaction Wheels of Various capacities are currently operational.
- Cumulative On orbit life : > 8 million hours

Environmental specifications

- Vibration level : Sine 13.3 g, Random 7.9g_{rms}
- Thermo vacuum level : +5°C to +55°C
- Shock : 450g

Specifications		VC – 5	VC - 10	VC-15	VC-25	VC-50
Angular momentum @ Max Speed		5 Nms	10 Nms	15 Nms	25 Nms	50 Nms
Operational Speed range		+/- 3500rpm	+/- 3500rpm	+/- 3300rpm	+/- 3250 rpm	+/- 4400 rpm
Reaction Torque		0.05 Nm	0.10 Nm	0.30 Nm	0.10 Nm	0.30 Nm
Loss torque(max)		0.025 Nm				
Power supply requirement		42 V or 70 V				
Power	Steady State @ Max Speed	< 20 W			< 20 W	< 45 W
	@ Max Speed, Torque	<50 W	<95 W	<173 W	< 115 W	< 250 W
Unbalance	Static	1.0 gcm	1.0 gcm	2.0 gcm	0.20 gcm	2.0 gcm
	Dynamic	2.0 gcm ²	2.0 gcm ²	8.0 gcm ²	4.0 gcm ²	16 gcm ²
Mass	Wheel	3.8 kg	5.0 kg	6.3 kg	9.5 kg	8.8 kg
	WDE	1.7 Kg			0.75 kg	1.7 kg
Size	Wheel (mm)	Φ 260 x 96			Φ 284 x 135	Φ 356 x 138
	WDE (mm)	220 x 72 x 172			155 x 155 x 27	220 x 72 x 172



MOMENTUM WHEEL: VC -68 / 28



- Angular contact ball bearings with centrifugal reservoir
- Brushless DC Motor, Flywheel with Damper
- FPGA Based miniature Wheel Drive Electronics
- Interface- Proprietary SPI, MIL-STD-1553B and RS485
- Life: > 15 Years
- On orbit, More than 36 Nos Momentum / Transverse Momentum Wheels are currently operational.
- Cumulative On orbit life: > 1 million hours

Environmental specifications

- Vibration level : Sine 8.0g, Random 7.9g_{rms}
- Thermo vacuum level : 0°C to +55°C
- Shock : 450g

Specifications		VC - 68	VC - 28
Angular momentum		68 Nms @ 6000 RPM	28 Nms @ 6000 RPM
Operational Speed range		+/- 6000rpm	
Reaction Torque		0.1 Nm	
Loss torque(max)		0.04 Nm	
Power Supply requirement		42 V or 70 V	
Power	Steady State @ Max Speed	< 45 W	
	@ Max Speed, Torque	< 170 W	
Unbalance	Static	2.0 gcm	
	Dynamic	16.0 gcm ²	
Mass	Wheel	8.8 kg	6.0 kg
	WDE	1.7 kg	
Size	Wheel (mm)	Φ 356 x 138	
	WDE (mm)	220 x 72 x 172	



MAGNETIC SUSPENSION WHEELS



- Reaction and Momentum Wheel with Magnetic Bearing
- Wheel with 2 Axis (10 Nms / 15 Nms) and 4 Axis (68 Nms) Active Control Magnetic Bearing
- Zero Stiction and jitter free operation.
- FPGA Based miniature Wheel Drive Electronics.
- Interface- Proprietary SPI, MIL-STD-1553B and Rs485
- Life: > 20 Years
- Cumulative On orbit life : > 15,000 hrs

Specifications		MSRW-10	MSRW-15	MSMW *
Angular momentum @ Max Speed		10 Nms	15 Nms	68 Nms
Operational Speed range		+/- 4700 rpm	+/- 7000 rpm	+/- 10000 rpm
Reaction Torque		0.1 Nm	0.1Nm	0.1 Nm
Loss torque(max)		< 0.010 Nm	< 0.020 Nm	< 0.020 Nm
Power Supply Requirement		42 V or 70 V		
Power	Steady State @ Max Speed	< 20 W	< 25 W	< 40 W
	@ Max Speed, Torque	< 95 W	< 145 W	< 200 W
Unbalance	Static	1.0 gcm	1.0 gcm	2.0 gcm
	Dynamic	2.0 gcm ²	2.0 gcm ²	8.0 gcm ²
Mass	Wheel	6.3 kg	6.3 kg	13.5 kg
	WDE	1.7 kg		
Size	Wheel (mm)	Φ 260 x 96		Φ 360 x 128
	WDE (mm)	220 x 72 x 172		

Environmental specifications

- Vibration level : Sine 13.3 g, Random 7.9g_{rms}
- Thermo vacuum level : 0°C to +55°C
- Shock : 450g

* Demand based production



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HIGH TORQUE REACTION WHEELS



- Reaction Wheels with higher torque (1.0 Nm to 2.5* Nm) capacity for agile missions
- Variants with Ball Bearing and 4 - Axis Actively control Magnetic bearing
- Drive Motor with High Torque capacity
- FPGA based Design with Digital DFC
- Interface- Proprietary SPI, MIL-STD-1553B and RS485
- Life: > 7 Years (Ball Bearing RW), > 20 Years (Magnetic Bearing RW)
- Cumulative On orbit life : >50,000 hrs

Environmental specifications

- Vibration level : Sine 13.3 g, Random 7.9g_{rms}
- Thermo vacuum level : +5°C to +55°C
- Shock : 450g

Specifications		1.0 Nm RWA	2.5 Nm RWA *
Angular momentum @ Max Speed		20 Nms	20 Nms
Operational Speed range		+/- 2000rpm	+/- 2000rpm
Reaction Torque		1.0 Nm	2.5 Nm
Bearing type		Ball Bearing	Magnetic Bearing
Loss torque(max)		< 0.060 Nm	< 0.025 Nm
Power Supply requirement		42 V or 70 V	
Power	Steady State @ Max Speed	< 30 W	< 40 W
	@ Max Speed, Torque	< 310 W	< 650 W
Unbalance	Static	1.0 gcm	1.0 gcm
	Dynamic	8.0 gcm ²	8.0 gcm ²
Mass	Wheel	10.0 kg	15.5 kg
	WDE	1.7 kg	1.7 kg
Size	Wheel (mm)	Φ 315 x 104	Φ 360 x 128
	WDE (mm)	220 x 72 x 172	

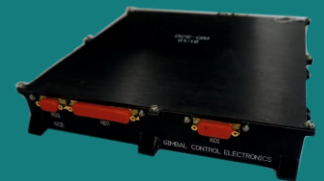
* Demand based production



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CONTROL MOMENT GYRO



- Single Gimbal CMG with control electronics
- High performance controllers for best pointing accuracy
- High bandwidth control for fast manoeuvres
- Large output torque dynamic range
- Dynamic friction compensation
- Jitter free operation
- Optimized momentum
- No launch hold-down required
- MIL-STD-1553B interface
- Heritage Bearing & Lubrication for long life
- Flown in Cartosat-3 Spacecraft

Specifications

Angular Momentum	:	25 Nms/CMG
Torque	:	16 Nm/CMG
Torque resolution	:	0.02 Nm
Bandwidth	:	10 Hz
Angular Momentum Stability	:	<0.05 %
Voltage	:	28V-42V
Max vehicle rate	:	4°/s
Mass	:	30 kg (CMG) 2.5Kg (Electronics)
Dimensions	:	692 X 354 X 264 mm (CMG) 304 X 282 X 48.6 mm (Electronics)
Power	:	35W (Steady) 150W (Peak)
Design Life	:	7 years

Environmental specifications

Vibration level	:	Sine 20 g, Random, 8g _{rms}
Temperature	:	5°C to +60°C
Radiation	:	50 krad



CMG MOMENTUM COMPENSATION SYSTEM*



Cluster Specifications

Angular Momentum	: 120 Nms per axis
Maximum Torque	: 10 Nm/CMG
Torque Resolution	: 0.02Nm
Voltage	: 28V-42V
Max vehicle rate	: 6° /s
Mass	: 70 kg
Power	: 120W (Steady), 500W (Peak)
Interface	: MIL-STD-1553B
Operating Temp. Range	: +5 - 50°C (CMG) -5 - 55°C (Electronics)
Radiation	: 20 krad
Design Life	: 7 years

- Single Gimbal CMG cluster with up to 6 CMGs configurable as per mission demands
- Accepts 3 axis torque commands/4 gimbal rate commands
- Selectable Wheel Speeds
- Singularity free operation
- High performance controllers for high pointing accuracy
- High bandwidth for fast manoeuvres
- PMSM drive for low output torque ripple
- High performance dynamic friction compensation
- In built FDI logics
- Full gimbal rotation range
- Heritage Bearing & lubrication for long life
- Long-life slip rings
- Optimum foot-print
- Vehicle rates up to 6 deg/s

* Available on demand



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SOLAR ARRAY DRIVE ASSEMBLY (SADA 400)



Features

- Power handling capacity of
 - 2.45 kW for 70 V BUS
 - 1.47 kW for 42 V BUS
- Stepper Motor (direct drive)
- Redundancy in motor winding and potentiometer
- Microstepping feature
- Four torque levels
- Position monitoring:
 - Potentiometer

Specifications

- Output torque : 5.0 Nm
- Inertia : 10 kgm²
- Step size : 0.5 deg
- Slip ring
 - Power (2.5A) : 28 nos
 - Signal (1A) : 20 nos
- Power : <30 W (Electronics + Motor)
- Mass : 6.5 kg
- Dimension : Ø 183 x 255 mm
- Design life : 15 years

Environmental specifications

- Vibration level : Sine 20 g, Random 11.8g_{rms}
- Thermo vacuum level : -30°C to +65°C
- Shock : 400g

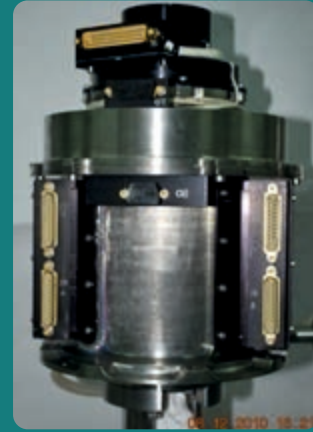
Space heritage: 15+ years



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SOLAR ARRAY DRIVE ASSEMBLY (SADA 500)



Features

- Power handling capacity of
 - 5.25 kW for 70 V BUS
 - 3.15 kW for 42 V BUS
- Stepper motor: 200 steps
- Geared drive 56:1
- Redundancy in motor winding and potentiometer
- Microstepping feature
- Four torque levels
- Position monitoring:
 - Potentiometer

Specifications

- Output torque : 35.0 Nm
- Inertia : 500 kgm²
- Step resolution : 0.032 deg
- Slip ring
 - Power (5A) : 30 nos
 - Signal (1A) : 50 nos
- Power : <30 W (Electronics + Motor)
- Mass : 9 kg
- Dimension : Ø 240x272 mm
- Design life : 20 years

Environmental specifications

- Vibration level : Sine 20 g, Random 11.8 g_{rms}
- Thermo vacuum level : -30°C to +65°C
- Shock : 800g

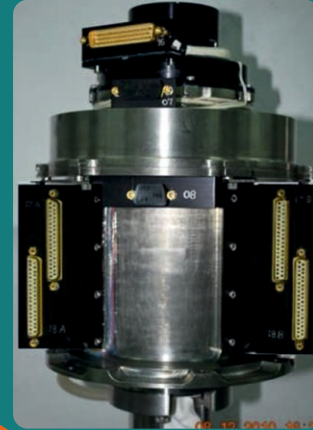
Space heritage: 12+ years



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SOLAR ARRAY DRIVE ASSEMBLY (SADA 900)



Features

- Power handling capacity of
 - 10.5 kW for 70 V BUS
 - 6.3 kW for 42 V BUS
- Stepper motor : 200 steps
- Geared drive 56:1
- Redundancy in motor winding and potentiometer
- Microstepping feature
- Four torque levels
- Position monitoring:
 - Potentiometer

Specifications

- Output torque : 35.0 Nm
- Inertia : 500 kgm²
- Step resolution : 0.032 deg
- Slip ring
 - Power (10 A) : 30 nos
 - Signal (1A) : 50 nos
- Power : <30 W (Electronics + Motor)
- Mass : 10 kg
- Dimension : Ø 240 x 272 mm
- Design life : 20 years

Environmental specifications

- Vibration level : Sine 20 g, Random 11.8 g_{rms}
- Thermo vacuum level : -30°C to +65°C
- Shock : 800g

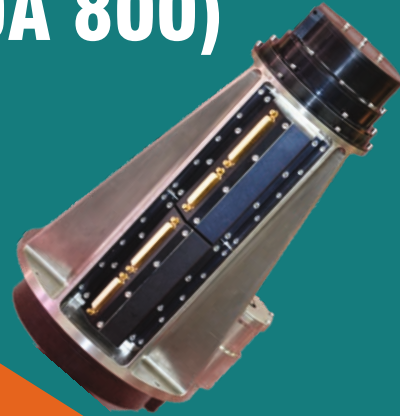
Space heritage: 2+ years



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SOLAR ARRAY DRIVE ASSEMBLY (SADA 800)



Features

- Power handling capacity of
 - 21 kW for 70 V BUS
- Stepper motor : 200 steps
- Geared drive 56:1
- Redundancy in motor winding and potentiometer
- Microstepping feature
- Four torque levels
- Position monitoring:
 - Potentiometer

Specifications

- Output torque : 35.0 Nm
- Inertia : 750 kgm²
- Step resolution : 0.032 deg
- Slip ring
- Power (10 A) : 60 nos
- Signal (1A) : 50 nos
- Power : <30 W (Electronics + Motor)
- Mass : 15 kg
- Dimension : Ø 240 x 432 mm
- Design life : 20 years

Environmental specifications

- Vibration level : Sine 20 g, Random 11.8 g_{rms}
- Thermo vacuum level : -30°C to +65°C
- Shock : 400g

Space heritage: 2+ years



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DRIVE ELECTRONICS FOR SADA



Serial Interface
(SDE 400)



MIL1553B Interface
(SDE 600)

Features

- Capable of driving SADA 400/500/800/900 mechanism
- Open and close loop operations
- Commandable different drive rates and torque levels
- Motor driving scheme : 128 μ steps / 48 μ steps / Full width
- Linear stepper motor drive
- Stepper Motor driven by the secondary outputs (15 V)
- Redundancy in drive circuit

Specifications

- Acquisition mode : 1.5/s for direct drive
: 0.1/s for geared drive
- Normal mode : 1 rev/orbit
- Potentiometer linearity : 1 deg maximum
- Power input : 42 V/70 V on demand
- Power : < 30 W (Electronics + Motor)
- Mass and dimension
 - SDE 600 : 3.35 kg/ 292 x 168 x 100 mm
 - SDE 400 : 2.7 kg/ 264 x 217 x 76 mm

Environmental specifications

- Vibration level : Sine 20 g, Random 17.7 g_{rms}
- Thermo vacuum level : -30° C to +65° C
- Shock : 400 g

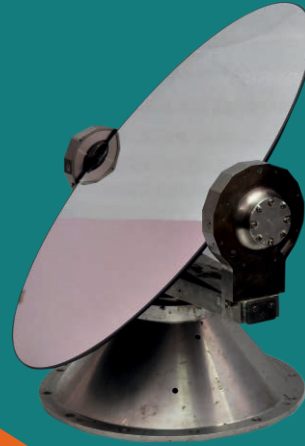
Space heritage: 11+ years



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SCAN MIRROR MECHANISM FOR IMAGING APPLICATIONS



- Drives a scan mirror about two axes to generate a 2D imagery of earth from geostationary platform
- Application in imaging payloads for meteorology.
- Micro-controller and FPGA based electronics.
- Limited Angle Torquer (LAT) and noncontact inductive angle encoder with high precision servo for precise mirror positioning.
- Redundant electronics
- Over 160000 successful scans in orbit .

Mass : 10.5 kg (Electronics)
12.5 kg (Mechanism)
Average power : 35 W
Life : 15 Yrs [TID 100 Krad]

Environmental specifications

Vibration level : Sine 8.0g, Random 8.3g_{rms}
Thermo vacuum level : 0°C to 60°C
Shock : 500g

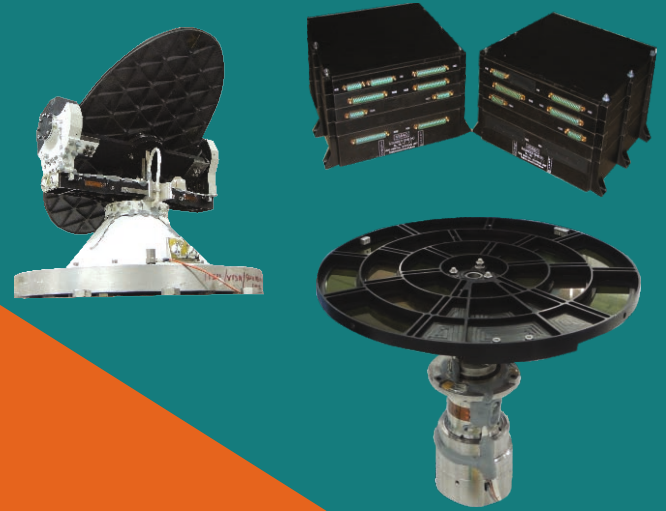
Specifications

Field of Regard (FOR) : 24° E-W x 19° N-S
Active scan field : 18° E-W x 18° N-S
Scan type : Bi-directional
Scan rate (EW) : 10°/sec
(NS) : 223.12 μR/STEP
Scan modes : Two modes of operation
(i) Full frame mode : 18°E-W x 18° N-S (1408 lines)
(ii) Program mode : 18° E-W x Programmable N-S lines
Mirror offset
Resolution (EW/NS) : 139.45 μR / 223.12 μR
Scan linearity : <5 arc sec [EW/NS]
Scan repeatability : <1 arc sec [EW/NS]
Nadir position accuracy : <200 arc sec



SCAN MIRROR & FILTER WHEEL MECHANISM FOR SOUNDING APPLICATIONS

- Drives a scan mirror in two dimensions in synchronism with a filter wheel for better SNR
- Micro-controller and FPGA based electronics (Main and Redundant)
- LAT as actuators and noncontact inductive angle encoder with high dynamic servo for mirror pointing
- Programmable modes of operation
- Over 75,000 successful scans in orbit
- Application in advanced meteorological satellites



Specifications

Field of Regard (FOR)	: 24° E-W x 21° N-S
Active scan field	: Programmable
Scan type	: Bi-directional
Step size (EW)	: 140 μ R/STEP
(NS)	: 1120 μ R/STEP
Scan modes	: Program Mode
	Any sector (min 1°x1°, max 10°x10°) in FOR
Offset resolution (EW)	: 280 μ R
(NS)	: 1120 μ R

Scan linearity	: <5 arc sec [EW/NS]
Scan repeatability	: <1 arc sec [EW/NS]
Nadir position accuracy	: <200 arc sec
Filter wheel speed	: 600 rpm
Filter wheel jitter	: <100 μ sec
Mass	: 13.0 kg (Electronics)
	12.5 kg (Mechanism)
Average Power	: 35W
Life	: 15 yrs [TID 100 Krad]

Environmental specifications

Vibration level	: Sine 8.0g, Random 8.3g _{rms}
Thermo vacuum level	: 0°C to 60°C
Shock	: 500g



FILTER WHEEL MECHANISM FOR ASTROSAT



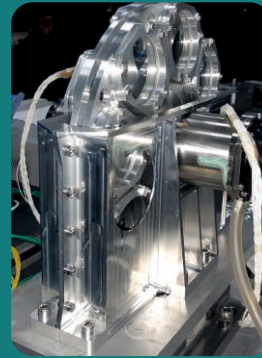
- Three filter wheels and three independent drive electronics in a single package
- Flight proven stepper motor for drive and Electronics for precision Filter positioning.
- Provision to protect focal plane from solar flux in orbit.
- Command selectable filter placement in the optical path.
- Application in Astronomical Payloads

Specifications

Step size	:	1.8°/step
Position accuracy	:	5 arc min
Position repeatability	:	5 arc min
Time to reach safe position	:	20 sec max for 360 deg.
Direction of filter selection	:	Bi-directional
Measurement accuracy	:	30 arc min
Mass	:	4.0 Kg
Average power	:	7W
Vibration	:	Random - 9.9 grms [Random] all 3 axes
Life	:	10 Yrs [TID 25 K rad]



FILTER WHEEL DRIVE MECHANISM



- Aditya-L1: First Indian Mission to Study Sun
- Indian Solar Observatory at Lagrangian Point (L1)
- Continuously Imaging the Sun without any Occultation's / Eclipses in 200-400 nm Band
- Two Filter Wheel Mechanisms each with 8 filter slots
- Study of Solar Photosphere and Chromosphere
- Stepper motor based continuous rotation drive mechanism
- Filter identification by Hall sensors

Specifications

Filter Angular position	:	At every 45°
Number of Mechanisms	:	2 mechanisms (with independent drives)
Home Position Accuracy	:	<1.8° (one step size)
Position Accuracy	:	±15 arc-min
Position Repeatability	:	±15 arc-min
Direction of Rotation	:	Bi-directional
Speed of Rotation	:	45° within 1s
Settling time	:	500 ms
Mass	:	0.85 kg per mechanism 1.256 kg for electronics

Power	:	<6 watt per channel (motor + electronics)
Motor Power Dissipation	:	< 3 watt (per motor)



SINGLE AXIS SCAN MECHANISM



- Used for Sea Surface Temperature Measurements
- Imaging in two LWIR bands ($11\ \mu\text{m}$ and $12\ \mu\text{m}$)
- Enhanced Ocean Colour Data and Potential Fishing Zones by way of simultaneous monitoring of sea surface temperatures
- Wide Angle torquer based Limited angle drive mechanism
- Bi Directional Scanning
- FPGA based drive Electronics

Specifications

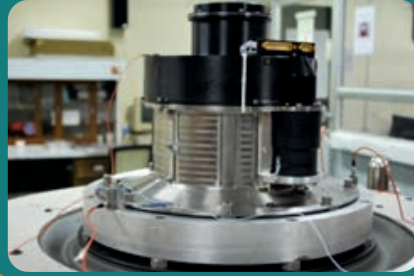
Type of Scan	:	Sector scan
Imaging Field	:	Nadir $0^\circ \pm 47.6^\circ$
Scanning	:	Bi-directional
Imaging	:	Unidirectional
Scan Rate	:	$18^\circ/\text{sec}$
Total time for one frame	:	20.5 sec
Space View position	:	$+90^\circ$
Blackbody View position	:	-90°
Position Accuracy	:	$\pm 150\ \mu\text{Rad}$ (peak to peak)
Step Size	:	$384\ \mu\text{Rad}$
Mass	:	2.8 kg (Electronics)
	:	2.5 kg (Mechanism)

Environmental specifications

Vibration level	:	Sine 20g, Random $11.8g_{\text{rms}}$
Thermo vacuum level	:	0°C to 55°C



PAYLOAD STEERING MECHANISM



- To steer the payload camera
- Stepper Motor Drive
- Geared drive (80 : 1)
- Coarse and Fine resolver for precise position monitoring
- Interface - serial
- Power supply 28-42V

Environmental specifications

Vibration level : Sine 20 g,
Random 7.9 grms
Thermo vacuum level : -10 o C to +50 o C

Specifications

Step Size	:	+ 0.0225°
Pointing accuracy	:	+ 0.1°
Stability	:	<0.1 arc sec
Drive shaft torque	:	40Nm
Position monitoring	:	Coarse & Fine resolver
Motor Peak Power	:	<30W
Resolver accuracy	:	± 25 arc min (coarse) ± 10 arc sec (fine)
Mass	:	13.5 kg (Mechanism) 5kg (Electronics)
Design life	:	15 years

Space heritage : 12+ years

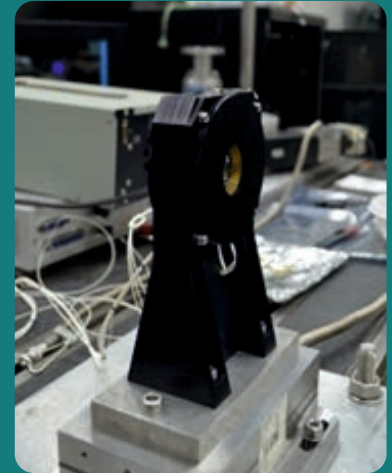


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RETARDER MECHANISM

- Designed to hold the retarder optics used for spectro-polarimetric observations
- Continuous Unidirectional rotation at 6rpm
- Position Accuracy of less than 5arc min
- Angular Contact Ball bearings with self lubricating cages.
- Miniature Hybrid Stepper Motor
- PWM based microstepping drive electronics with speed control.
- Lock Anti Phase Dual PWM drive scheme for precision zero crossing of motor current.
- Fault detection and Isolation logics for hall sensor failure



Parameters

Retarder Optics
Speed of Rotation
Position Accuracy
Drive Motor
Power
Overall Size
Mass
Life

Specifications

(\varnothing 35 X 8) mm
6 rpm
5 arc min
Hybrid Stepper Motor
< 4W for 0.4Nm
(90 x 62 x 175)mm
1.5 kg
> 5years



PRECISION SCAN MECHANISM

Single axis precision scan mechanism with control electronics



- Continuous rotation (Bidirectional)
- Precision speed control & position information
- Selectable Speeds
- Robust mechanical design with launch hold down
- Heritage Bearing & lubrication for long life
- BLDC motor
- Custom designs on demand
- RF rotary joint
- More than 10 million cycles of on orbit operation
- Redundancy in motor and electronics

Typical Specifications

Speed	:	20.5 rpm (nominal)
Speed Stability	:	$\pm 0.1\%$
Voltage	:	28V-42V
Mass	:	13 kg (Mechanism), 3 kg (Electronics)
Payload Inertia	:	$>2 \text{ kgm}^2$
Dimensions	:	Mechanism: $\text{Ø } 187\text{mm}$, Height 462.5mm Electronics: 236 X 226 X 90 mm
Power	:	$<32 \text{ W}$
Design Life	:	7 years

Environmental specifications

Vibration level	:	Sine 20 g, Random 11.8g _{rms}
Temperature	:	-0°C to +55°C (Mechanism) -15°C to +55°C (Electronics)



ISRO Inertial Systems Unit
Thiruvananthapuram - 695 013





ISRO Inertial Systems Unit

Thiruvananthapuram



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

