

Acceleration Measurement System (AMS)

Flight-Proven Inertial Navigation

PERFORMANCE

Complete Internal Redundancy
300 Hz Acceleration Bandwidth
Better than 1 μg Resolution
Excellent Bias Stability: 0.33 μg typ.
Low-Noise:
0.5 μg rms 0- 10 Hz
24 μg rms 10- 300 Hz
Dynamic Range:
+/- 25 milli-g (Low-g)
+/- 1.3 g (High-g)
Temperature Range: 0 to 40°C

POWER INPUT

28V DC Nominal, 7.6 Watts
SERIAL DATA OUTPUT (RS-422)
For X, Y, and Z Axes:

Delta Velocity
Raw Acceleration
Filtered Acceleration
Accelerometer Temperature
Accelerometer Bias Estimation

ON-BOARD DATA PROCESSING

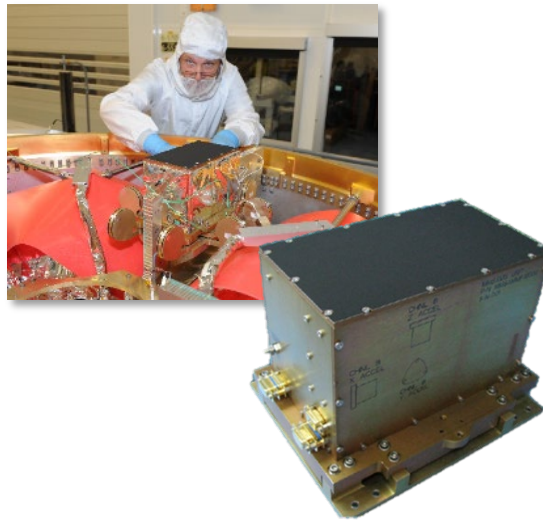
For X, Y, and Z Axes:
Acceleration Filtering
Calibration
Axis Alignment
Temperature Compensation

FULLY TESTED AND QUALIFIED

MIL-STD-461 EMC Tests
Thermal Vacuum Cycling/Outgassing
Shock and Vibration
EEE Parts Control per EEE-INST-002
Radiation Hardened to 100Krad TID

SIZE / WEIGHT

8" L x 10" W x 8" H , 7.4 kg



P/N: MMSAMMFA1000

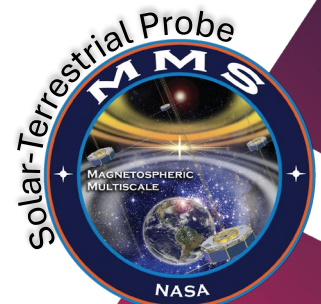
ZIN developed the AMS for to navigate a fleet of four satellites in precise formation for NASA's MMS mission. **ZIN's Flight-proven (TRL-9) AMS is the first system accurate enough to provide closed-loop thrust control to allow flight of multiple satellites in formation.** ZIN's AMS Flight units launched on the MMS satellite constellation in 2015 and have operated failure-free since. ZIN delivered additional units in 2020 to support NASA's OSAM-1 mission.

ZIN's AMS uses three high-performance accelerometers to measure triaxial acceleration data. The AMS has integrated on-board data processing to apply filtering, calibration, axis alignment, and temperature compensation.

The AMS outputs inertial navigation data to the spacecraft's Flight computer via its RS-422 interface, including Delta Velocity, Bias Estimation, and Processed Acceleration.

The AMS is completely internally redundant, containing two independent "sides" for cross-strapping applications. The AMS is a proven TRL9 Flight design, meeting NASA requirements for EMC, Shock, Vibration, Thermal Vacuum, Outgassing, and EEE-INST-002 parts control.

- ❑ High Performance Inertial Navigation System for Space Flight Applications
- ❑ Designed, Tested, and Implemented on NASA's Magnetospheric Multiscale (MMS) Satellite Constellation
- ❑ Provides precise Delta Velocity and Acceleration measurements using three high-performance accelerometers
- ❑ Complete internal redundancy for High-Reliability applications.
- ❑ Space-Rated design meets EMC, Shock, Vibration, Thermal Vacuum, Outgassing, and EEE-INST-002 parts control requirements.



ZIN Technologies



Voyager Space External Use
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Acceleration Measurement System (AMS)

Model: MMSAMMFA1000

Technical Specifications

	Min	Typ	Max	Units	Conditions
Acceleration Frequency Response					
Frequency Response	300			Hz	3-dB Bandwidth
Passband Flatness, 0-10 HZ		0.0005	0.001	dB	
Passband Flatness, 10-300 HZ		1.98	2.02	dB	
Acceleration Bias / Scale Factor					
Bias, Absolute		1.8	4	milli-g	
Bias, Drift		107	138	µg	Temp: 0-40 °C, 5 Year
Scale Factor Drift, Unit		375	872	ppm	Temp: 0-40 °C, 5 Year
Scale Factor Drift, Unit + Calibration		545	1112	ppm	Temp: 0-40 °C, 5 Year
Acceleration Noise					
Raw Acceleration Noise, 0-10 Hz		0.5	1	µg nms	
Raw Acceleration Noise, 10-300 Hz		24	50	µg nms	
Random Walk		0.74	1.2	(µm/s)/rt-s	
Acceleration Linearity				ppm	INL Error, ppm of Full-Scale Input
Acceleration Resolution	1.0			µg	
Acceleration Temperature Error		0.12		°C	
Acceleration Dynamic Range					
Low-g Mode	+/- 25			milli-g	
High-g Mode	+/- 1.3			g	For ground-based testing
Acceleration Bias Stability		0.33	1	µg	12 Hour Std Dev
Power					
Input Voltage	20	28		V	
Power Consumption		7.6	8.2	W	Typ: 28V Input, accelerometer saturated Max: 34V Input, 3 accelerometers saturated
Temperature					
Operating Temperature (Full Performance)	0		40	°C	
Operating Temperature (Reduced Performance)	-20		45	°C	
Survivability	-30		60	°C	
Serial (RS-422) Data Output					
Raw Acceleration Output Rate		1		KHz	Bandwidth: 300 Hz
Filtered Acceleration Output Rate		8		Hz	Bandwidth: 1 Hz
Delta Velocity, Accelerometer Temperature and Bias Estimation Output Rate		4		Hz	
Mechanical					
Axis Orthogonality			60	arc-sec	Per-Axis deviation from Coordinates Box
Size	8" L X 10" W X 8" H				
Weight	7.4 kg				
Environmental Tests					
Weight					
Sine Vibe: 12.5g, 5-50Hz			Random		
Vibe: 14.1g nms, 20-2000Hz					
Thermal Vacuum: 8.5 cycles, -5 to 45° C					
EMC: CE01, CE03, CE07, RE01, RE02					
CS01, CS02, CS06, RS03					

