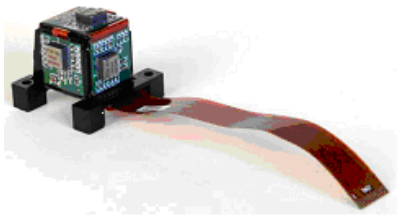
Inertial Measurement System (IM^3)

Using proven technology, Archangel Systems has refined a six axis Inertial Measurement Unit (IMU) System in a single ¾" cube with reduced noise, bias drift and random walk. This cube measures and thermally compensates accelerations in 3 orthogonal axes (local X, Y and Z) and rotational velocities in three orthogonal axes (about local X, Y and Z). The IMU sensor is the enabling technology for AHRS, ADAHRS, INS and other stability products used in land, sea and air vehicles.



IM3 Shown with FPC Cable

The majority of sensors available today incorporate either high cost components such as fiber optics that make them too expensive for use in most applications or sensors that require user temperature calibration and compensation. Fiber optic gyros are also too heavy and large to be used in many advanced applications. The IM^3 contains power conditioning, inertial MEMS sensors and processing. All outputs of the IM^3 are temperature calibrated and compensated. Outputs are available as asynchronous serial TTL Compatible RS232 (Serial 1).

From inception, Archangel has focused on the use of low-cost solid-state gyros, which conventional wisdom maintained could not be used because of excessive drift and other characteristics. Using the new paradigm, Archangel has eliminated the typical characteristics which have limited the use of solid state IMU devices. Through four generations of development in inertial sensing Archangel has refined its IM^3 to the point where it now provides accuracy and usability beyond the demands of all relevant standards.

Pin	Pin Definition	Pin	Pin Definition
1	DVALID	7	UART RX
2	Reset *	8	UART TX
3	Reserved (SPISS_ICSPC)	9	Reserved (SPI_RX)
4	Reserved (GPIO_ICSPD)	10	Reserved (SPI_TX)
5	Reserved (SPI_CLK)	11	Analog Power
6	Digital Power	12	GND

Table 1: Pin Definitions

Analog power input can be 10 VDC to 16 VDC. Digital power input is 5 VDC. Both powers are required for operation. Serial outputs and inputs are TTL compatible.

Reversal of pins during installation will result in permanent damage and voids warranty. Unused/Reserved pins should be left floating.

- 6 axis IMU in a single cube
  - 3 linear accelerations
  - 3 rotational velocities
  - Inertial angles
- 0.035˚/s/√Hz Rate Noise (Typical)
- 1 mg/√Hz Accelerometer Noise (Typical)
- Software Compensation
- System Solutions Available
- 6g powered shock survival
- 20g unpowered shock survival
  - See Application Note
- Flex PCB Interface
  - 1 mm Pitch
- Custom Units Available
  - Special Order
  - Higher Gyro Rates

Figure 1: Pin Identification

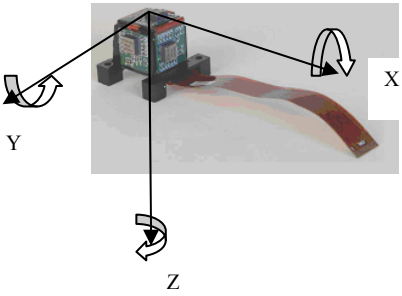


Figure 2: IM3 Sensitive Axes

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Electrical, Mechanical and Output specifications		
Mechanical		
	Size	Body – 1.1" x 1.1" x 1.1" (L x W x H) Body with Frame – 1.4" x 1.4" x 1.3"
	Interface	FPC Connector Mate: MOLEX #52610-1271
	Weight	20.5 gram
	Shock	6 g pk, 11 ms (operational), 20 g pk unpowered
	Vibration	4.34 g (0 – 2000 Hz)
	Temperature	-40 °C to +85 °C operating, -55 °C to +125 °C non-operating
	Humidity	DO-160E Category B 95% non-condensing
Electrical		
	Power (Analog)	10 – 16 V DC, 12 V DC (Nominal), 40.0mA
	Power (Digital)	4.75 – 5.25 V DC, 5V DC (Nominal), 200mA (maximum)
Inputs/Outputs		
	UART Tx	Asynchronous Transmit, TTL Compatible
	UART Rx	Asynchronous Receive, TTL Compatible
	Reset*	TTL compatible reset
	Data Valid	TTL compatible output
Data Resolution		
	Body Rates	0.0006˚/second @ 200 Hz
	Accelerations	50 µg @ 200 Hz
Data Accuracy (Gyro IMU Mode)	Random Walk	2.5˚/√hour (C1) 5.2˚/√hour (C2)
	Bias Drift	15˚/hour
	Stability	50˚/hr/year
	Scale Factor Accuracy	0.1% of Full Scale
	Scale Factor Drift	300 ppm, 1 sigma
	Cross Axis	0.13% maximum
Data Accuracy (Accelerometer)	Bias Drift	0.2 mg
	Scale Factor Accuracy	0.10% of Full Scale
	Scale Factor Drift	500 ppm, 1 sigma
	Cross Axis	0.13% maximum
Data Accuracy		
(AHRS Mode)	Angle accuracy	± 0.5˚ static
		± 1.0˚ dynamic

Dynamic Range (Linear)	- C1	±150˚/s	±10 g
	- C2	±300˚/s	±10 g

Bandwidth (3 db)	Rates	8 Hz
	Accelerations	5 Hz
Output Data Rate (ODR)		100 Hz

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Electrical, Mechanical and Output specifications

Shelf Life	Unpowered	>20 years

Modes of Operation

The IM^3 Inertial Measurement Unit supports the following modes of operation. Refer to the IM3 Interface Control Document (ICD-IM3) for details on the message formats.

Mode	Description
IMU	Outputs delta angles and delta velocities
AHRS	Outputs inertial angles and inertial rates

Application Notes

The IM^3 is designed to be mounted inside a case providing EMC/RFI protection and power conditioning. Shock operations in excess of 6g require mechanical isolation. See Interface Control Document (ICD) for further details.

Ordering Information

Part Number	Description	Angular Rates	Outputs
IM^3-C1-1	Inertial Measurement Unit	X/Y/Z = 150˚/sec	IMU
IM^3-C1-2	Inertial Measurement Unit	X/Y/Z = 150˚/sec	IMU/AHRS
IM^3-C2-1	Inertial Measurement Unit	X/Y/Z = 300˚/sec	IMU
IM^3-C2-2	Inertial Measurement Unit	X/Y/Z = 300˚/sec	IMU/AHRS
IM^3-C3-2-1	Inertial Measurement Unit	X/Z = 300˚/sec, Y = 150˚/sec	IMU/AHRS Compact Frame
IM^3-C3-2-2	Inertial Measurement Unit	X/Y/Z = 300˚/sec	IMU/AHRS Compact Frame
EVB-IM3-U	Evaluation Board	N/A	N/A

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