Electronics Requirements Document — Inertial Measurement Unit (IMU)

Introduction

This document defines the electronics-level requirements for the Inertial Measurement Unit (IMU) used within the Flight Management System (FMU). The IMU provides motion, acceleration, and environmental sensing data required for flight control and navigation. The requirements below specify performance, interface, power, thermal, timing, and redundancy constraints necessary to ensure reliable operation within the target airborne system architecture.

IMU Requirements

IMU-001 The IMU shall measure angular rate up to 2000.00 dps with a maximum noise density of 4 mdps/sqrt(Hz).

IMU-002 The IMU shall measure acceleration up to 16.00 g with a maximum noise density of 0.120 mg/sqrt(Hz).

IMU-003 The IMU shall provide redundant motion sensing (two independent gyroscope/accelerometer devices).

IMU-004 The IMU shall provide redundant pressure sensing (two independent barometer devices).

IMU-005 The IMU shall support minimum data output rates of 1000 Hz for gyro/accel, 100 Hz for magnetometer, and 50 Hz for barometer.

IMU-006 The IMU shall generate data-ready interrupts, active-high 3.3 V CMOS, with a minimum pulse width of 0.050 ms.

IMU-007 End-to-end latency from data-ready interrupt to FMU-completed SPI read shall be less than or equal to 2.0 ms.

IMU-008 The IMU shall operate from 5.0 V input and generate regulated 3.3 V supply rails for sensors.

IMU-009 The IMU steady-state current shall be less than or equal to 80 mA with heater off; and less than or equal to 280 mA steady-state and less than or equal to 400 mA peak with heater on.

IMU-010 The IMU shall hold board temperature at 45 °C for ambient temperature between -20 °C to 40 °C with the heater on.

IMU-011 The IMU shall deliver valid sensor samples within 500 ms after enable, and shall resume data flow within 200 ms after FMU re-init without requiring a power cycle.

IMU-012 The IMU shall use SPI Mode 0 with 3.3 V CMOS I/O and support FMU SPI clock rates up to 10 MHz.
