

Multi Purpose Drive Electronics

The Multi Purpose Drive Electronics (MPDE) is designed to drive most different mechanisms on-board of satellites.



The Multi Purpose Drive Electronics (MPDE) is a generic two-axis stepper motor controller capable of operating various types of mechanisms such as antenna pointing mechanisms, solar arrays or thruster pointing mechanisms. It has been optimized for operation at low micro-vibrations and is compatible with a high number of actuators. The MPDE comprises two electrically identical units, which are intended to be operated in cold redundancy.

Each unit contains an isolated DC/DC converter as well as a control module. Both units are controlled via a MIL1553 TC/TM interface, which optionally may be replaced by another TC/TM interface to adapt it to different satellite platform concepts. The main feature of the MPDE is its high flexibility, its large degree of autonomy as well as its high drive performance allowing a wide range of drive applications.

Features

- 2+2 (redundant) interfaces
- Minimized generation of micro-vibrations
- Half-/Full-/up to 64 micro-steps
- Current mode outputs
- Autonomous start-up
- Flexible configuration via EEPROM
- Different drive operations: Target (drive to position), Cruise (rotate at constant speed), Trajectory (track user-defined path, on-line or off-line processing)
- Kinematic control: Limitation of speed, acceleration and jerk
- Collision control: Drive range limitation, end switch processing
- Actuator configuration: Up to 8 default actuator settings (kinematic limits, current amplitude, current waveform) available

Interfaces

- Baseline: MIL-STD-1553B TC/TM
- Optional: UART (RS-422), Can-bus, SpaceWire
- Different primary power bus options: 50V, 30V, other voltages on request
- On/off: High power command interface
- Discrete TM: Power status, unit temperature
- Thermistor acquisition interfaces
- Potentiometer: user-defined calibration tables, deadband detection, coarse/fine option for high-precision pointing
- Switch: end-stop, reference position

Performance

- Start-up time: <500ms
- MIL-1553 TM rate: up to 16 Hz
- Motor Drive voltage: up to 60 V
- Drive current: up to 0.7 A with 8-bit at resolution
- Motor speed: 0 - 500 equivalent full-steps per second
- Thermistor acquisition: $\pm 1.3^{\circ}\text{C}$ in a range of -50° to $+140^{\circ}\text{C}$; $\pm 0.5^{\circ}\text{C}$ in reduced range
- Potentiometer acquisition: $\pm 0.07\%$ of full-scale, 12-bit
- Speed jitter: <0.02%
- Standby power consumption: < 8 W
- Motor driver efficiency with respect to primary power): >75%
- Failure rate: < 820 failures per 10^9 hours per redundant unit
- Magnetic moment: < 0.015 Am^2

Protections

- Output power limitation for motor driver
- Over-current protection of motor driver
- Solid-state relay on each motor drive output to isolate motors with large inter-winding coupling

Physical / Environment

- Size: $300 \times 250 \times 123 \text{ mm}^3$
- Weight: < 5 kg
- Operating temperature: -30°C to $+60^{\circ}\text{C}$
- Non-operating temperature: -40°C to $+70^{\circ}\text{C}$
- Minimum switch-on temperature: -30°C
- Radiation: cumulative dose typ. 50 kRad (Si), higher values with additional shielding

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