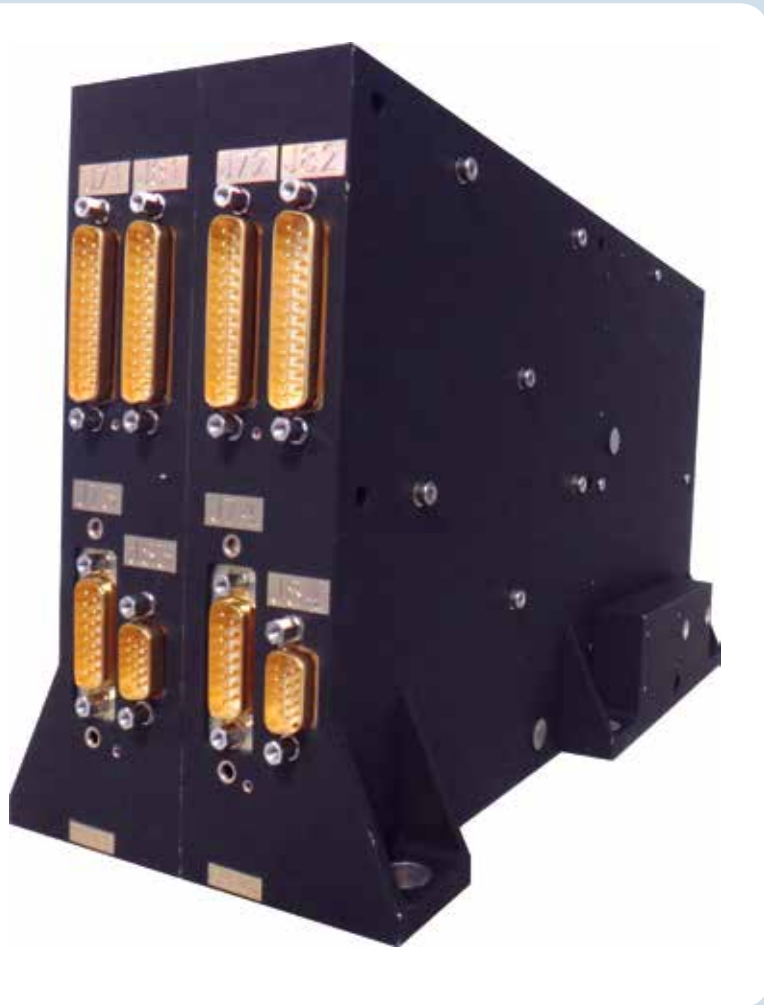


## Mechanism Drive Electronics (MDE)

Jena-Optronik's **electronic motion control equipment**, which drives and controls instrument mechanisms for space applications.



The MDE serves a range of mechanism assemblies as part of Earth observation instruments, satellite antenna systems, scanning systems or other satellite applications where a rotating mechanism assembly shall be operated.

It features state-of-the-art closed loop trajectory tracking control algorithms for precise tracking of scan profiles and robust feedback control.

### MDE Highlights

- High reliability, autonomous self-protection of electronics and mechanism
- Flexible and adjustable FPGA based controller design, no software implementation
- Operation during launch
- Fully space qualified MDE equipment based on proven flight heritage in space instrument projects
- Fully redundant (see photo), optional single half-box (non redundant) available



## Mechanism Drive Electronics (MDE) Performance

Control System	Agile Mirror Control	Large Inertia Control
Controller	Flexible cascaded control loop with feed forward control and rate limiter, FPGA based, adjustable	
Principle	Fast mirror scan operation with discontinuous scan profile varying from 50 to 700 deg/sec	Speed controlled operation from 22 to 50 rpm of large payload with exported torque restrictions
Inertia	up to 0.03 kg.m <sup>2</sup>	wide range from 3 to 25 kg.m <sup>2</sup>
Synchronisation	external	internal, zero crossing indication
Performance	Agile Mirror Control	Large Inertia Control
Position Error	< 0.01 deg	< 0.15 deg
Speed Error	< 1.75 %	< 27.8 ppm
Maximum exported torque		< 0.1 Nm
Controlled Mechanism		
Motor	3-phase synchronous motor, drive current up to 3A peak	main and redundant windings
Encoder	21 bit, digital RS422 interface and 12V & 5V supply	fully redundant
HALL sensors	Open collector interface	fully redundant
Size & Mass		
Dimensions	280 mm x 2*40 mm x 180 mm (L x W x H) 280 mm x 116 mm x 180 mm (L x W x H)	envelope without mounting feet (redundant) overall envelope (redundant)
Mass	2*2.4 kg (redundant)	including Power Control Module (PCM)
Temperature		
Operational	-30 °C ... +60 °C	Qualification level
Non-operational	-40 °C ... +70 °C	
Interfaces		
On/Off Control	Low voltage command and status interface	optional
Data and Sync	UART and RS422 interface	
Analog Monitoring	Temperature, Secondary Voltage, Primary Current	
Digital Monitoring	All secondary currents, motor phase currents, DC-link current and voltage	
Primary Power	36V to 52V, unregulated power bus	down to 31V in survival mode
Input Power	Agile Mirror Control	Large Inertia Control
Nominal average	< 28 W incl. 8 W for mechanism	< 25 W incl. 8 W for mechanism
Maximum average	< 54 W incl. 27 W for mechanism	< 71 W incl. 42 W for mechanism
Maximum peak	< 100 W incl. 65 W for mechanism	
Reliability		
	R=0.961, 575 FIT, T I/F = 20°C R=0.9992	non redundant half MDE unit, 7.5 years full cold redundancy MDE unit
Mission Life Time	21 years (operating and storage)	7.5 year operating in LEO orbit
Operations	Agile Mirror Control	Large Inertia Control
Operational Modes	Park (hall-sensor open loop control) Standby Scan Profile Constant Speed Fixed Position	Safe Standby  Constant Speed Fixed Position