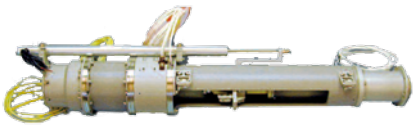
Positioning Mechanisms

08.12

MSL Drive Mechanism



Description

The MSL (Material Science Laboratory) drive mechanism is a high precision linear actuator with a very large speed range. This mechanism was designed to work in a high vacuum environment in the International Space Station. Its purpose is to displace an oven with a large speed stability at low speed and to measure the position of the oven. Two different motors, conected together through a clutch mechanism, are used to achieve the very large speed range.

The main difficulty was to implement a clutch mechanism able to transmit the specified torque in the very limited available volume and with restricted electrical power consumption.

Design had also to take into account safety rules linked to manned flight and operations.

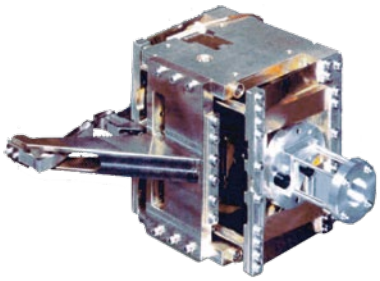
Technical Data

- Speed: processing: 10^{-8} to 0.2 $\cdot 10^{-3}$ m/s
  quenching: 10^{-3} to 0.1 m/s
- Stroke: 204 mm
- Operating temperature:
  +10°C to +60°C
- Pressure: ambient to 10^{-5} Torr
- Lifetime: 2 years of operation in orbit

Typical Applications

- Linear displacements of components in laboratory or in space environment

Corner Cube Mechanism



Description

The Corner Cube Mechanism (CCM) is a part of an interferometer. Its purpose is to displace very precisely a corner cube (mirror) in the optical path of the interferometer. The present mechanism was developed for the IASI instrument of the METOP satellite.

The main design drivers were the speed control, the operational lifetime and the limitation of the exported forces and torques to the optical bench. Two different mechanical elements compose the CCM, the mirror linear actuator and the compensation device. Both elements are based on flexible structures. Cleanliness and dimension verification procedures have been implemented very carefully in order to achieve the very stringent requirements.

Technical data

- Speed: 132.5 mm/s
- Average speed tolerance: < ±0.5 mm/s
- Instantaneous speed variation: < ±1 mm/s
- Maximum stroke: ±10.3 mm
- Measurement accuracy of the position:
  < 0.01 mm
- Stability of the origin during life: < 10 µm
- Tilt of the mirror: < 30 arcmin
- Lifetime: 7.3 $\cdot 10^{8}$ cycles

Typical applications

- Small linear displacements of optical devices

Aerosol Collector Pyrolysor

Description

RUAG Space has designed, manufactured, and tested a filter mechanism to collect aerosols particles from Titan (Saturn satellite) and bring them to an oven for "pyrolise". The main difficulties of this mechanism were to withstand big thermal differences and the level of cleanliness required. So, tightness was an important issue and was solved by laser welding.

A specific choice of material was necessary to ensure the functionality after seven years under vacuum conditions with very few displacements.

Specific equipment (toolings) has been implemented to avoid any organic particles pollution.

Power consumption was also an important parameter.

Technical data

- Chemical cleanliness:
  < 10 ppb for CO_2 and CO
  > 100 ppb for H_2O and H_2
- Thermal variation from -200°C to +650°C (around oven)
- Tightness: better than 10^{-8} mbl/s

Typical applications

- Space scientific mechanisms for planetary explorations

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