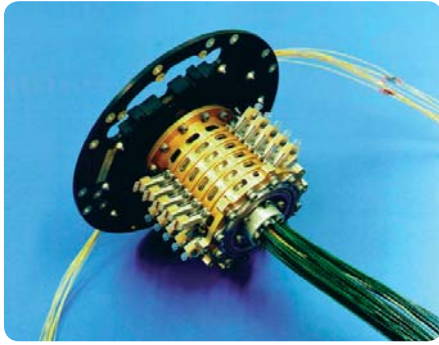


Sliprings for Space Applications



Modular Slipring for GEO Sat.

Description

MECANEX has developed, since 1975, improved technologies for space condition requirements. This type of sliprings allows power transfer and signal data circulating between solar panel and geostationary satellite.

The slipring integrates in its own volume two coarse position detectors, which type is potentiometer.

This development allows modularity in terms of tracks number. It can be adapted till 32.

Technical data

- Temp. Range: -55°C to 95°C
- Random vibrations: up to 16 g rms
- Environment: space vacuum
- Axial effort: ± 1750 N
- Radial effort: ± 2800 N
- Flexion torque: 50 Nm
- Starting torque: 1.1 Nm max (depending on track configuration)
- Detector precision: 10 deg
- Detector resolution: 10 deg

Typical applications

- SPOT 1, 2, 3, 4, 5
- EUTELSAT, ERS 1, 2
- ARABSAT, SICRAL, ASTRA1K
- ENVISAT, METOP 1, 2, 3



Cylindrical Slipring for LEO Sat.

Description

The technical aspects that have governed the qualification unit SLIP-RING for low-cost high volume applications.

The slip-ring is mainly dedicated to the signal and power transmission from the solar panels to and from the spacecraft for light-weight and low orbit satellites (LEO).

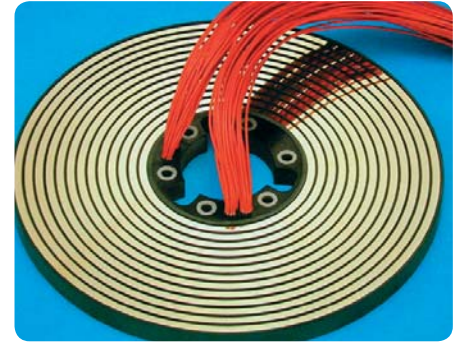
The gold-gold contact allows to build shorter and lighter slip-rings without lubrication.

Technical data

- Lifetime tested under vacuum: 15 millions of revolutions with bearings
- Signal transfer up to 500 mA
- Contact signal noise: 10-20 mΩ
- Cross talk: -70 dB at 10 kHz
- Power transfer: up to 20 A
- Starting torque fluctuation due to temperature: not significant
- Contact resistance evolution
- Static: 20 %
- Dynamic: 30 %

Typical applications

- HOTBIRD, SIRIUS, HISPASAT
- SINOSAT, NAHUEL, THAICOM



Planetary Slipring for APM

Description

This solution of planetary concept has proven the very high level of technicality.

This concept allows to implement at brush level either gold wires or carbon-graphite contact developed specifically for space application.

This slipring is a very good optimization when length is the main requirements.

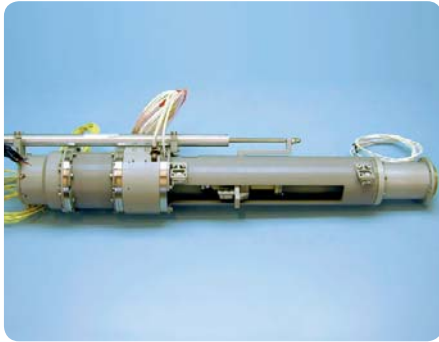
Technical data

- Length: 80 mm
- Tracks number: up to 72
- All material respect the ESA TML and CVCM specification regarding outgassing
- Insulation resistance: 100 MΩ (500V)
- Weight: 700 gr
- Max operational temp: 120°C

Typical applications

- AMOS

Positioning Mechanisms



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, connected 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.

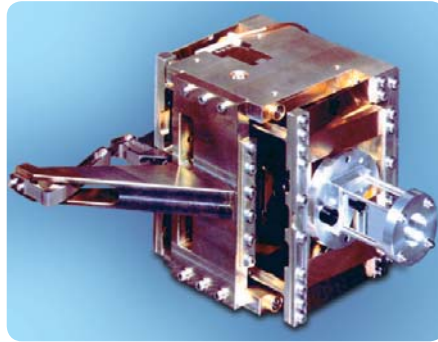
Design had also to take into account safety rules linked to manned flight and operations.

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.

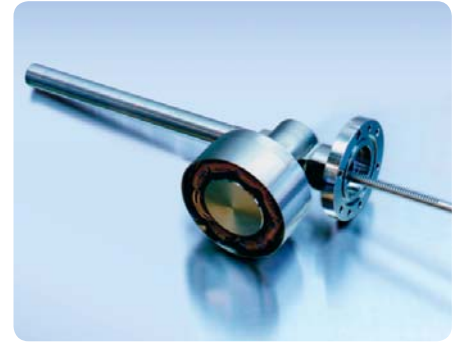
Cleanliness and dimension verification procedures have been implemented very carefully in order to achieve the very stringent requirements.

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 μ m
- 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

MECANEX has designed, manufactured, and tested a filter mechanism to collect aerosols particles from Titan (Saturne satellite) and bring them to an oven for "pyrolyse". 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 a important parameter.

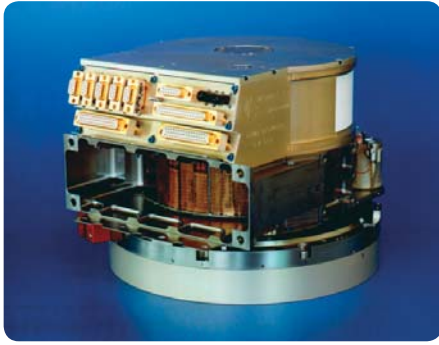
Technical data

- Chemical cleanliness:
< 10 ppb for CO₂ and CO
> 100 ppb for H₂O and H₂
- 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

Pointing mechanisms



High Accuracy Large Range Space Pointing Mechanism Articulation

Description

This high precision single axis articulation has been developed for SILEX, an optical data transfer interlinks between satellites. The mechanism associates a ball-bearing pair, an optical encoder, a torque motor and a cable-wrap for the electrical connections between the rotating and fixed parts.

A special attention on the torque performances (low torque, low noise, reproducibility) has been obtained. The hardware execution is compliant with the very high performance and quality level required by space application.

Technical data

- Angular range: 200°,
- Number of pair connections: 95,
- Number of RF connections: 2,
- Maximum acceleration: $> 1^\circ/s^2$,
- Maximum rotation speed: $> 5^\circ/s$,
- Life: $> 300'000$ cycles,
- Torque constant: 0.12 Nm/rad,
- Hysteresis: 0.4 Nm,
- Mass (with full articulation): 9 kg

Typical applications

- Coarse pointing stage of an inter satellite optical link.
- Pointing stage of an RF antenna.



Pointing mechanism for unmanned aircraft landing assistance

Description

The two-axis pointing mechanism is interfaced to be mounted on a campaign pedestal. It can be operated outside in a wide climatic range.

It provides azimuth and elevation pointing capability to an optical instrument payload of medium size.

The open or closed loop turret drive provides excellent pointing and tracking capability with hand (joystick) or automatic control.

The large gear ratio between motor and drive axis assures low power requirement. The device is run on a local standard battery.

Technical data

- Azimuth angular range: $\pm 15^\circ$
- Elevation angular range: $+38^\circ, -10^\circ$
- Pointing accuracy: ≤ 2 mrad
- Angular velocity: $23^\circ/s$
- Min. tracking speed: ≤ 0.2 mrad/s
- Temperature range: $-34^\circ C$ to $+59^\circ C$

Typical applications

- Pilot-less airplane landing assistance
- Sight system
- Surveillance system



Mirror orientation mechanism for turret sight system

Description

The two-axis mechanism of high accuracy and stability is controlled by direct drive systems with position sensors.

Associated to its drive electronics, its fast dynamical performances allow for full mirror stabilization when mounted on a vehicle in displacement on a rough terrain.

Its rugged design is suitable for military application, in particular for tank turret sight system.

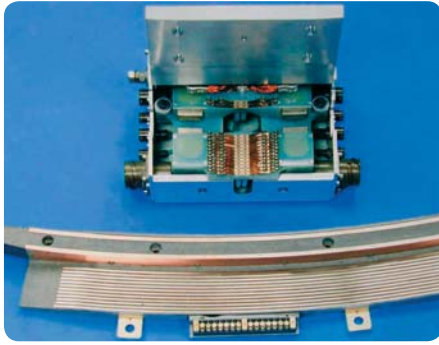
Technical data

- Azimuth angular range: $\pm 15^\circ$
- Elevation angular range: $+38^\circ, -10^\circ$
- Stabilization error: ≤ 2 mrad
- Angular velocity: $45^\circ/s$
- Min. tracking speed: 0.5 mrad/s
- Temperature range: $-46^\circ C$ to $+44^\circ C$

Typical applications

- Sight system
- Periscope head

Sliprings for Defense Applications



Slipring for Turret Type Howitzer

Description

The Brush-Block Slipring assembly performs the electrical link between the hull and the rotating turret, on the full 360° range. The electrical contact between the rotating part and the fixed part is done by brushes rubbing on metallic tracks.

The brushes are held by two Brush-Blocks, attached to the hull structure by the mean of Brush-Supports. The two Slipring segments are attached to the turret.

A cleaning device, composed of a brush which can be manually actuated by a lever, is provided to clean the signal tracks during maintenance operation

Technical data

- Power transfer: up to 1200 A
- Number of tracks: 16 (2 power, 14 signal)
- MTBF: 10'000 hours
- Cross-Talk: -40 dB ($50\Omega \pm 5m\Omega$ at 150 kHz)
- Humidity: 95%
- Temp. range: -60°C to +120°C
- Weight: 43 kg

Typical applications

- M109 Turret



Slipring for Turret Type LAV+MBT

Description

The slip-ring concept is a cylindrical assembly able to rotate in both directions. It consists of 32 signal tracks and 2 power tracks.

The assembly concept is simple. The slipring is made by stacking up the tracks on a hollow shaft (alternate with isolation).

An air channel has been integrated and has the most outward position.

All the connection joints are different to prevent making mistakes during assembly.

At low temperatures, lubrication on the bearings is a critical aspect. MECANEX SA has been experienced in the field of lubrication for many years.

Technical data

- Power transfer: 150 A
- Temp. range: -40°C to +60°C
- Rotational speed: 60°/sec
- Acceleration: 2 rad/sec²
- Starting torque: 1.1 Nm
- MTBF: 50'000 hours
- Cross-Talk: -40 dB ($50\Omega \pm 5m\Omega$ at 60 Hz)
- Flow rate air passage: 33 L/sec

Typical applications

- LAV Turret



Slipring for Radar

Description

The slipring has followed a complete qualification phase, before starting the serie production.

The component includes nine IF channels for receiving signals and eight tracks for AC and DC power.

The slipring was designed to support shocks and vibrations and to be dust and water proof.

The main critical specification identified during the development was cross talk and insertion loss. The requirements were met due to very special design approach which gives MECANEX a very good skill in term of electrical requirements.

Technical data

- Cross-Talk: -55 dB (75Ω at 42 MHz)
- Insertion loss: less than 1 dB at 42 MHz)
- Electrical noise: less than 20 mΩ
- Lifetime: 30'000 hours
- Temp. range: -30°C to + 60°C
- Humidity: 100%
- Shock and Vibrations: MIL-Spec

Typical applications

- Mobile radar system

Sliprings for Machinery



Long Life Slipring

Description

MECANEX bring a depth of experience in the field of long life Slipring, and results are available at R&D department.

The life is measured in number of revolutions, or better, linear sliding distance in kilometres, that is related to rotation velocity, size, material and environmental parameters. Adapted solutions to your specifications are offered.

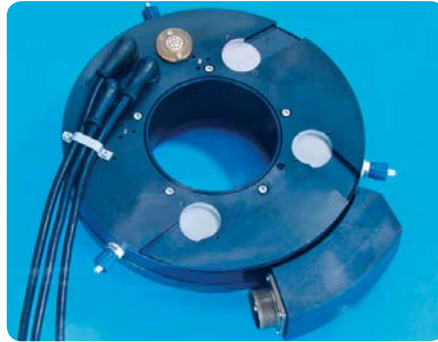
This type of Slipring has also experienced aggressive environmental conditions.

Technical data

- Linear speed: up to 13 m/s
- External diameters: up to 550 mm
- Temperature range: -30 ; +80°C
- Number of kms: up to 100'000
- Power ring: up to 350 A
- Signal ring: up to 200 MHz bandw.
- Environment: ex. glassfiber, silicon

Typical applications

- Glass Machinery
- Textile machinery



Hybrid Slipring

Description

The Slipring defined in this section combines electrical data and hydraulic or pneumatic transfer lines. This device is used in a wire bending machine. Tightness was an important issue and satisfactorily achieved. For electrical transfer, specific coupling between brush contact and ring has been developed, which can be considered as dry lubricated and protected against corrosion.

This electro-mechanical component is a completely custom designed item.

Technical data

- Rotational speed: 60 rpm
- Pressure:
 - 7 bars (pneumatic)
 - 200 bars (hydraulic)
- Starting torque:
 - 10 Nm (pneumatic)
 - 50 Nm (hydraulic)

Typical applications

- Machine-tool for Bending Wires
- Spot welding robots



Modular Slipring

Description

The main advantage of this Slipring concept is the modularity. It can be adapted to your applications in terms of number of rings and geometry. It is a low cost concept ideal for low electrical requirements. Optional rings and associated brushes can be easily added to adapt the standard design.

This device is composed of separate on-the-shelf parts (rings, insulators and brushes contact). Maintenance can be placed by customer with no special tool or procedure

Technical data

- Number of rings: up to 60
- Type of transfer: from 100 mA up to 20 A
- Ring diameter: up to 80 mm
- Electrical resistance: 100 mΩ
- Electrical noise: 50 mΩ (signal)

Typical applications

- Packaging Machinery