ELECTRO-OPTIC SYSTEMS

The dramatic increase of sophisticated gimbaled electro-optic sensor systems that provide battlefield information has led to major developments in supporting hardware. These EO systems require an enormous amount of data to be transmitted across the rotating axes as well as power and other signals. Moog has always been one step ahead of these requirements with the development of high bandwidth slip rings, twist capsules, fiber optic rotary joints and multiplexing technologies.

Moog has participated in the development of many of the major airborne and ground-based EO systems The Abrams Tank Commander's Independent Thermal Viewer (CITV) has used our slip ring assembly to allow continuous rotation on the azimuth axes since the program's inception. The Bradley armored vehicle also uses Moog's slip ring on the azimuth axis of its Commander's Independent Viewer (CIV); in addition the CIV uses a Moog's twist capsule on the elevation axis.

Moog slip rings and twist capsules are used extensively in airborne EO systems. The latest upgrade to the F-18 Hornet's EO sensor suite, Advanced Targeting Forward Looking Infrared (ATFLIR), utilizes a Moog slip ring to allow continuous rotation in the roll axis and a twist capsule for scanning, or limited rotation, in the elevation and yaw axes. The Low Altitude Navigation and Targeting Infrared for Night (LANTIRN), and its successor Sniper, pods used for EO targeting and navigation on the F-16 uses Moog slip rings and twist capsules exclusively. The Predator UAV, LAMPS helicopter, and Apache helicopter all "see in the dark" because Moog hardware transmit data and power reliably.

FEATURES

- Multiple contact technologies suited for the application
  - Monofilament wire brush
  - Multiple precious metal fiber brush
  - Composite brush
- Environmental sealing
- EMI Shielding
- FEA structure analysis
- High shock and vibration capabilities
- Wide operating temperature envelope
- Vertical integration of position sensors and ancillary products
- High frequency bandwidth
- High reliability and life
- Redundant bearing designs

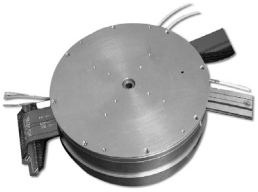
TYPICAL APPLICATIONS

- Blade de-ice
- Blade position
- Tip lights
- Flight controls
- FLIR systems
- Target acquisition systems
- Weapon stations

ELECTRO-OPTIC SYSTEMS SLIP RING DESIGNS

Low Profile Azimuth Slip Rings

System height is often the primary concern of the EO gimbal designer. Moog has the solution with its patented broadband platter slip ring design. This broadband technology allows the slip ring designer to package multiple high speed data lines on slip ring platters, and then "stack" these platters with their accompanying brush blocks into a very low profile design. Power rings as well as discrete signals and video can also be placed on these slip ring platters. This has led to a dramatic decrease in typical slip ring height or length over traditional slip ring "drum-style" designs.



High Speed Data

The dramatic improvement in image quality, the use of multi-sensors, and increased communication requirements have driven the need for EO Systems to significantly increase transmission speeds of data channels with every generation of upgrade. We have EO slip rings that handle as many as two dozen data channels at over 400 Mbps each, for an aggregate bandwidth of 12 Gpbs. Slip ring/fiber optic rotary joint hybrid designs contain both copper lines for power and signals, as well as fiber lines for fiber optic signals.

Design and manufacturing techniques have been developed and patented that increase signal bandwidth while controlling crosstalk and EMI/EMC. A arrange of solutions is available to handle data channels such as GigE, Fibre Channel, and IEEE1394 to name just a few. These high speed data solutions are being used in existing EO system as well as turret, radar, and other advanced technology applications.

Poly-Twist or Twist Capsules

In most cases gimbaled EO systems require continuous, unlimited rotation on just one axis, typically the azimuth or roll axis. In this case slip rings are the ideal solution for transmitting signals across the rotating interface. Normally the other axes (pitch, elevation, or yaw), require only limited rotation, i.e., less than 360 degrees. This allows the use of a Poly-Twist to transmit electrical power and signals. By the use of wrapping flexible circuits , the Poly-Twist designer is able to increase circuit density, decrease weight, and improve system reliability over traditional cable wraps. The long life, low and consistent torque, and the small size make Poly-Twists the best solution for scanning, or limited rotation axes in EO systems.

Poly-Twists — How They Work

Poly-Twists resemble slip ring assemblies in size and appearance and provide multiple turns of rational freedom. They operate by winding and unwinding flexible circuit tapes wrapped around a central shaft in a configuration resembling a clock spring. The central shaft is generally supported by ball bearings, but bearing-less assemblies are available. One end of the shaft is fastened to the shaft, with lead wires extending from the shaft either axially or radially. The other end of the tape is fastened to the Poly-Twist frame, which is usually considered stationary. Stator lead wire terminations may also be either axial or radial. The flexing element is the key to the low torque and long life of the Poly-Twist. The stress on the flexible circuit is well below its endurance stress limit producing very low torque levels and very long operational life.

ELECTRO-OPTIC SYSTEM SLIP RING DESIGN DIMENSIONS INCHES (MILLIMETERS)