CVX Instruments LLC

A wholly-owned subsidiary of Michigan Scientific Corporation

Precision Instrumentation Solutions

12501 Taylor Road

Charlevoix, MI 49720 USA

info@cvxinstruments.com

231-373-0161

CVX INSTRUMENTS' MISSION:

Develop and integrate specialty instruments to meet our clients' unique needs

CVX INSTRUMENTS IS A WHOLLY-OWNED SUBSIDIARY OF:

Michigan Scientific Corporation®

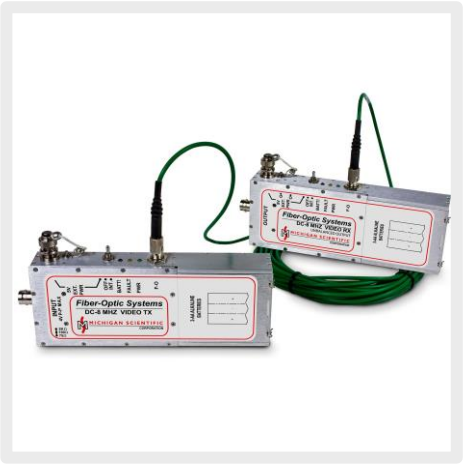
AN INDUSTRY LEADER IN:

Slip Ring Assemblies

Transducers

Instrumentation Assemblies

Wireless Telemetry



Fiber Optic Systems

Signal-conditioning electronics

Expertise and knowledge built on…

60+ years of engineering excellence

Made in America

Est. 1960 by Hugh Larsen, former director of development at General Motors.

- Core Competencies
  - Engineering Design
    - ISO 9001:2015 & AS9100 certified (including design)
    - Specialize in electromechanical devices and instrumentation, including slip rings
    - Custom specialty devices
    - Aerospace & defense applications
  - Manufacturing
    - Machining (mills, lathes, EDM)
    - Laser engraving
    - Soldering (J-STD-001)
    - Wire harnesses (IPC/WHMA-A-620)
    - Advanced manufacturing (3D printing)

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- Certifications
  - AS9100 & ISO 9001:2015
  - JCP Certified
  - J-STD-001
  - IPC/WHMA-A-620
  - NIST800-171 Compliant
- Socio-Economic
  - Small business for listed NAICS codes
  - Credit cards and purchase orders accepted
- NAICS Codes
  - 334515 (primary)
  - 541330
  - 541715
  - 335932
  - 334519
  - 335999
  - 336320

PRODUCTS AND SOLUTIONS:
SLIP RINGS

- Can include built-in encoders, frequency-to-voltage electronics, or signal conditioning electronics
- Expertise in designing systems for a wide variety of conditions:
  - Few or many connections
  - All environments/conditions
  - Low electrical resistance variation for systems with sensitive signals and measurements

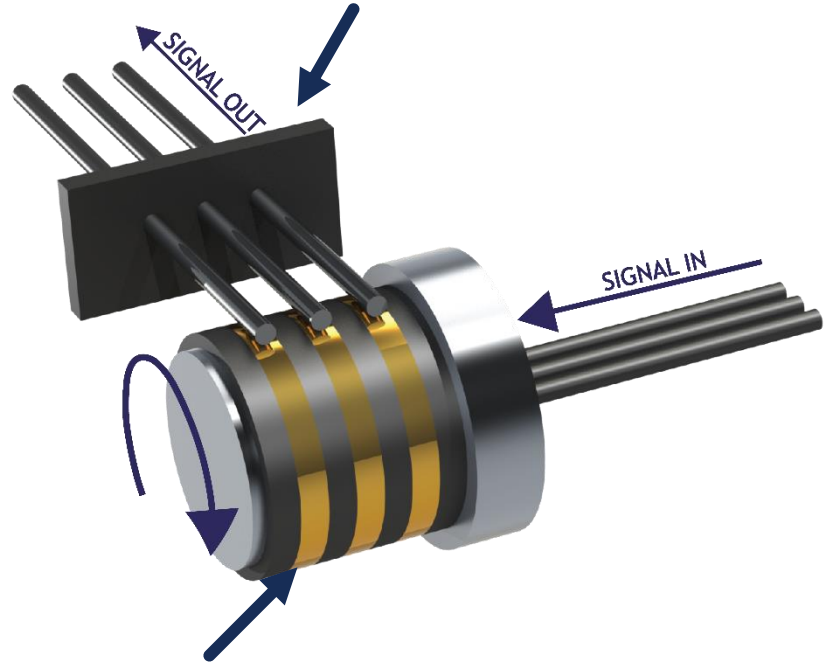
WHAT IS A SLIP RING?

Slip ring assemblies are made up of precious metals that transfer rotating electrical signals through a ring and brush interface.

Rotating Electrical Connections to:

- **Strain gauges**
- **Thermocouples**
- **Accelerometers**
- **Ethernet/digital signals**
- **Power**
- **Other sensors**

Brushes – remain stationary



Rings – rotate

SLIP RING TYPES

End of Shaft

- Mounts to the end of a shaft
- Easy Installation
- Economical
- Optional encoder
- Weatherproof options
- Integrated amplifiers

Tubular

- Mounts directly onto/over a shaft
- Optional encoder
- Weatherproof option
- Integrated amplifiers

Custom

- Full integration into customer equipment
- Based on customer specifications

PRODUCTS AND SOLUTIONS:
SIGNAL AMPLIFICATION AND CONDITIONING

- Variety of precision, low-noise differential amplifiers
- Dependable in noisy environments
- Excellent choice for spinning sensors or for improved signal quality
- Temperature
  - Built-in cold junction compensation
  - Eliminates potential error associated with inserting a slip ring within a TC circuit
- Strain
  - Stable bridge excitation voltage
  - Adjustable gain and shunt-cal resistor
  - Remote shunt-cal and bridge-excitation-kill control
- Digitization
  - Convert any analog signal into a digital stream
  - For rotating applications, reduces the number of slip ring connections required

SIGNAL CONDITIONING AND AMPLIFICATION TYPES

Temperature

- Built-in cold junction compensation
- Eliminates potential error associated with inserting a slip ring within a TC circuit
- Linearize thermocouple outputs

Digitization/Multiplexing

- Convert analog signals into a digital stream
- Multiple analog singles can be embedded into a single serial stream

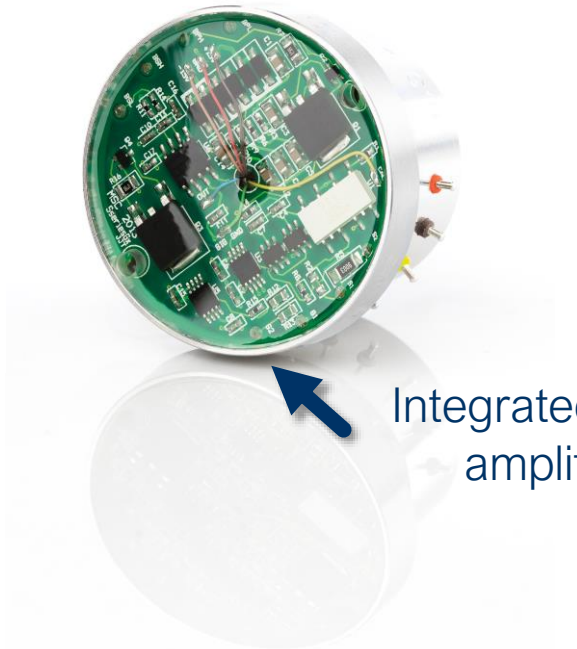
Strain

- Stable bridge excitation voltage
- Adjustable gain and shunt-cal resistor
- Remote shunt-cal and bridge-excitation-kill control

PRODUCTS AND SOLUTIONS:
HYBRID INSTRUMENTS - SLIP RINGS WITH BUILT IN ROTATIONAL SENSORS

Rotation sensors

Built-in encoder and
Frequency to Voltage
converting electronics



Integrated signal
amplifiers

OTHER UNIQUE INSTRUMENTS AND SENSING APPLICATIONS: TRUESLIP SENSOR

- Optically measures X and Y velocity
- Internally calculates side slip
- Custom integration into client vehicles
- Works in variety of road/ground surface conditions and all lighting

- Applications:
  - Traction control systems development
  - Autonomous vehicle traction and terrain feedback
  - Electric vehicle development

OTHER UNIQUE INSTRUMENTS AND SENSING APPLICATIONS: IN-LINE SIGNAL CONDITIONING

- Used in conjunction with encoders, hall-effect sensors, and other devices
- Converts frequency to voltage
- Can count encoder pulse train to convert to angular position (0-360°) and angular velocity (RPM)

Thank You

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