MICHIGAN SCIENTIFIC corporation

Michigan **S**cientific **C**orporation (**MSC**) provides engineering services specializing in the design and manufacturing of slip ring assemblies, transducers, signal conditioning, electronics, and data acquisition. Incorporated in 1960, MSC has a staff of nearly 100 engineers, technicians, machinists, and fabricators.

We have two facilities to support our customers:

In **Milford, Michigan** is a 10,000 sq. ft. facility that supports customer engineering services. Electronics and mechanical design, CAD, FEA, and instrumentation support are performed at this facility.

In **Charlevoix, Michigan** is a 15,000 sq. ft. facility concentrating on the design and manufacturing of our instrumentation slip ring assemblies. Strain gage based transducers are also manufactured at this location.

Michigan Scientific Corporation has developed a broad base of technology to aid our customers. We will help find solutions to our customers' problems through engineering consultation. If necessary, we will configure commercially available equipment or design and manufacture the needed equipment. This approach has required us to invest in a wide range of capabilities. Several of our engineering capabilities are listed below.

The design and manufacturing of:

- Instrumentation slip ring assemblies
- Transducers
- Signal conditioning electronics
- Data acquisition systems such as the ProDAS

Engineering services include:

- Instrumentation support and expertise
- Data analysis
- Failure analysis
- Product redesign
- Dynamic simulations
- Strain gage based transducer design and fabrication

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Operating Usage Characterization

MSC has experience in providing usage characterization for electromechanical components and other devices. The following are typical measurement parameters used to accomplish this:

1. Vibration
2. Acceleration
3. Force
4. Torque
5. Temperature
6. Pressure
7. Speed
8. Duty cycle

Field Data Collection Capability

Customer owned and operated vehicles are instrumented to measure loads, temperatures, accelerations, speeds, strains, pressures and other parameters. The instrumentation is designed to withstand unattended operation in vehicles in the field for up to 3 years. We can provide correlation analysis of lab test procedures to field usage and lab test failures versus field failures. We also provide services to collect test information from field vehicles.

Laboratory Testing

Based upon measured or estimated service operation, we have the capability to set up laboratory testing to develop and validate components.

Applied Statistics

MSC uses applied statistics when required for:

1. Failure analysis
2. Lab test to field correlation
3. Reliability forecasts
4. Benefit analysis of potential design changes

Strain Gaging and Transducer Capabilities

In addition to offering a standard line of transducers, MSC develops and fabricates a variety of vehicle component transducers that measure vehicle weight, frame twist, drive torques, brake torques, pedal forces, pitman arm forces and tire patch forces on vehicles in the field.

NOTE:

Continued product improvement necessitates that Michigan Scientific reserve the right to modify the specifications listed in this catalog without notice.

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Printed Circuit Design

We have experience in computer aided design (CAD) of multiple layer printed circuit boards. Our CAD system supports the complete process of design and layout of complex printed circuit boards including:

1. Schematic entry with simulation capability
2. PCB component auto-placement
3. PCB manual and autotrace routing
4. Gerber file generation with full checkplot capability and NC drill file generation
5. Bill of materials listing
6. Forward and backward design annotation

Our staff has experience in testing the PCB to verify that it was manufactured to specifications. We have the capability to populate the PCB with components from the bill of materials list and have facilities to test the final product in various environments while collecting test data for processing and analysis.

In House Machining

Our Charlevoix facility houses a machine shop where we manufacture slip ring assemblies, test fixtures, prototype assemblies, transducers and a variety of other components.

Electromechanical Systems Analysis, Design and Development

MSC uses computer dynamic simulations of complex non-linear systems for failure analysis. Following the analysis, we redesign the systems to eliminate identified failure modes. This type of work has been done in various applications including failure analysis of major equipment installations in nuclear power plants. This type of analysis is also used in the design and development of Michigan Scientific electromechanical instrumentation systems for use in severe vehicular environments.

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Slip Ring Design and Manufacturing

Michigan Scientific has been designing and manufacturing slip ring assemblies since 1960. We produce about 1800 standard assemblies per year. The standard units range from 4 to 36 circuits. Our slip rings are instrumentation quality assemblies designed to be used with strain gage, thermocouple and other rotating sensors. In addition to our standard assemblies, we design and manufacture approximately 200 custom slip rings per year.

We have manufactured assemblies for the following custom slip ring applications:

1. Sealed for operation submersed in oil
2. Used in hard vacuum, some outer space applications
3. A 240 channel assembly NASA used to test centrifugal compressors
4. Sealed to operate in all weather applications
5. Assemblies with through holes used to mount over rotating shafts
6. A 52 circuit assembly NASA used for helicopter wind tunnel tests
7. Assemblies with internal encoders and resolvers
8. Units with internal tachometer generators
9. Units with customer specified connectors
10. Units with both instrumentation and power circuits

Michigan Scientific has a complete engineering, design, manufacturing and testing facility which enables us to produce only the highest quality slip ring assemblies.

Metallurgical Laboratory

MSC conducts studies on precious metal contacts concerning wear life, contamination and connection quality. We have experience in precious metal sliding contact failure mode determination and problem correction.

Plastic and Rubber Molding Facility

We have the capability to mold parts for slip rings and components for other systems.

Signal Amplifiers and Instrumentation

MSC manufactures strain gage and thermocouple amplifiers for use with our slip ring assemblies. Superior data accuracy is achieved by locating precision amplifiers on the rotating side of the slip ring. This greatly improves signal quality because the amplifiers are located closer to the sensors which reduces errors due to long lead wires, connector resistance variations, electro-magnetic interference, slip ring contact resistance or temperature gradients across slip ring contacts.

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