



S-Series Slip Ring User Manual



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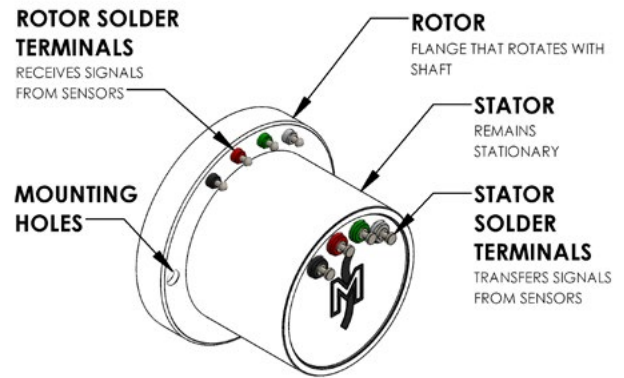
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Overview

Description

Michigan Scientific S-Series Slip Rings facilitate the transfer of both analog and digital signals from sensors mounted on a rotating shaft. With a capacity of up to 10 circuits, these slip rings are suitable for applications requiring connections to strain gauges, thermocouples, RTDs, accelerometers, and digital signals.



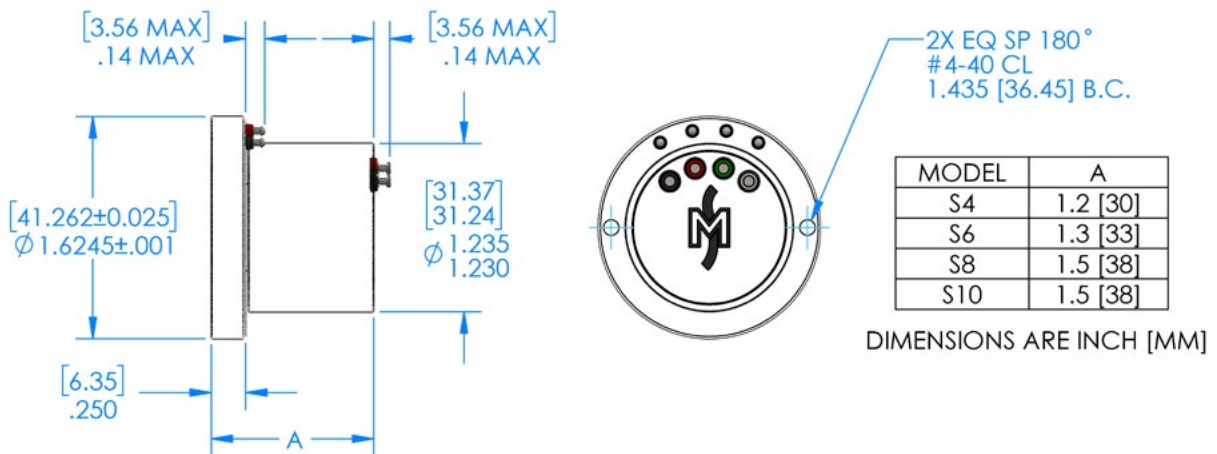
Specifications

Use the table below to reference specifications for your specific S-Series Slip Ring model.

Model	S4	S6	S8	S10
Circuits	4	6	8	10
Current Capacity per Circuit	500 mA			
Temperature Range ¹	-40 °F to 250 °F (-40 °C to 121 °C)			
Maximum RPM Rating	12,000 r/min			
Maximum Peak Noise ²	0.1 Ω			
Weight	3.9 oz (111 g)	4.0 oz (113 g)	4.1 oz (116 g)	4.2 oz (119 g)

¹For operation below 0°F (-18°C), specify low temperature lubricant.

²Resistance variation across slip ring contact



Installation Guidance

Mount Slip Ring Rotor

Use the mounting method recommendation that best suites your application. Contact Michigan Scientific customer support if additional guidance is required.



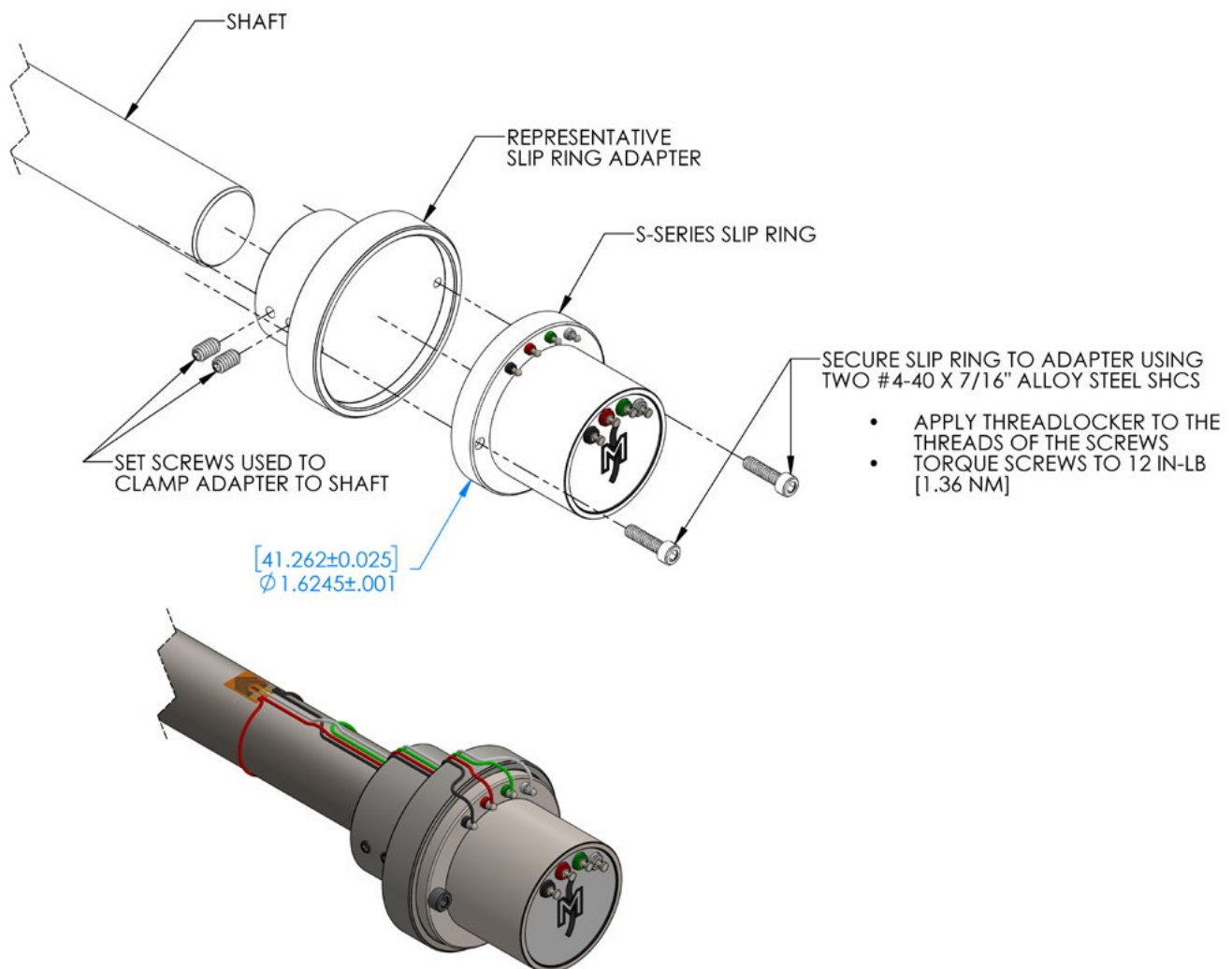
IMPORTANT! Mount the slip ring rotor flange concentric and perpendicular to the axis of rotation. Follow the alignment guidance under Validate Total Indicated Runout (TIR) on page 7 to ensure optimal performance.

1. Mount with a Rotor Adapter

If the shaft diameter is smaller than that of the slip ring rotor, a rotor adapter is needed to accurately mount the slip ring. See Appendix A for Michigan Scientific Rotor Adapter accessory details and design guidance.

1.1. Rotor Adapters for Over the Shaft Wire Routing

In solid shaft applications, the instrumentation wires will route along the outside diameter of the shaft, over the rotor adapter, and secured as shown below.

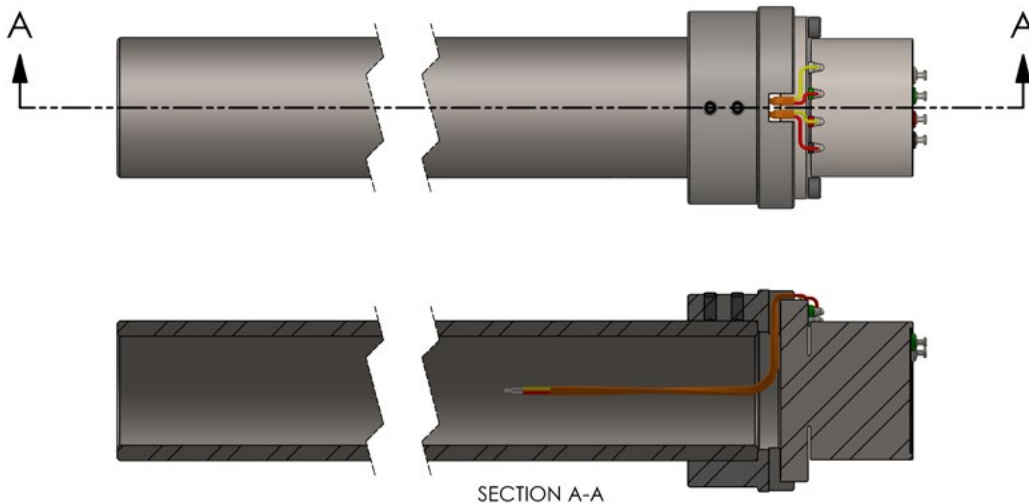
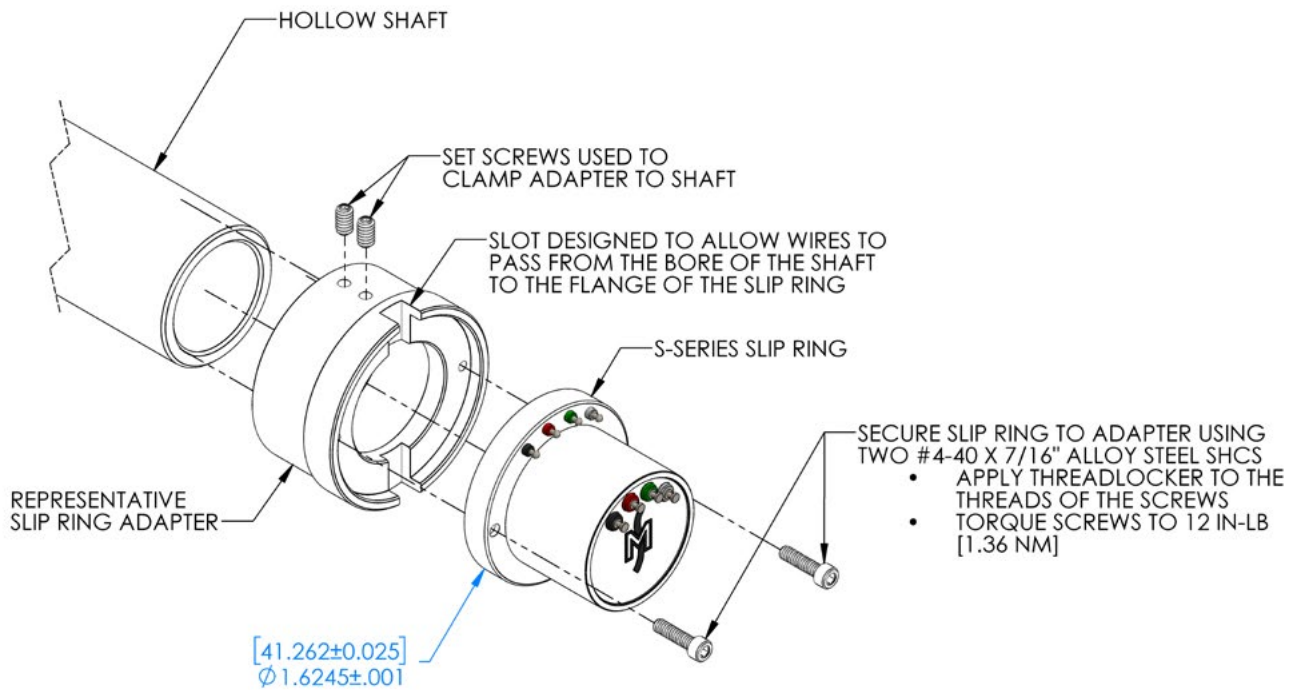


Installation Guidance

Mount Slip Ring Rotor

1.2. Rotor Adapters for Through Bore Wire Routing

When instrumentation wires are routed through the bore of a shaft, a rotor adapter can be purchased or designed with a slot to allow the wires to pass from the bore of the shaft to the outside rotor flange of the slip ring as shown below.

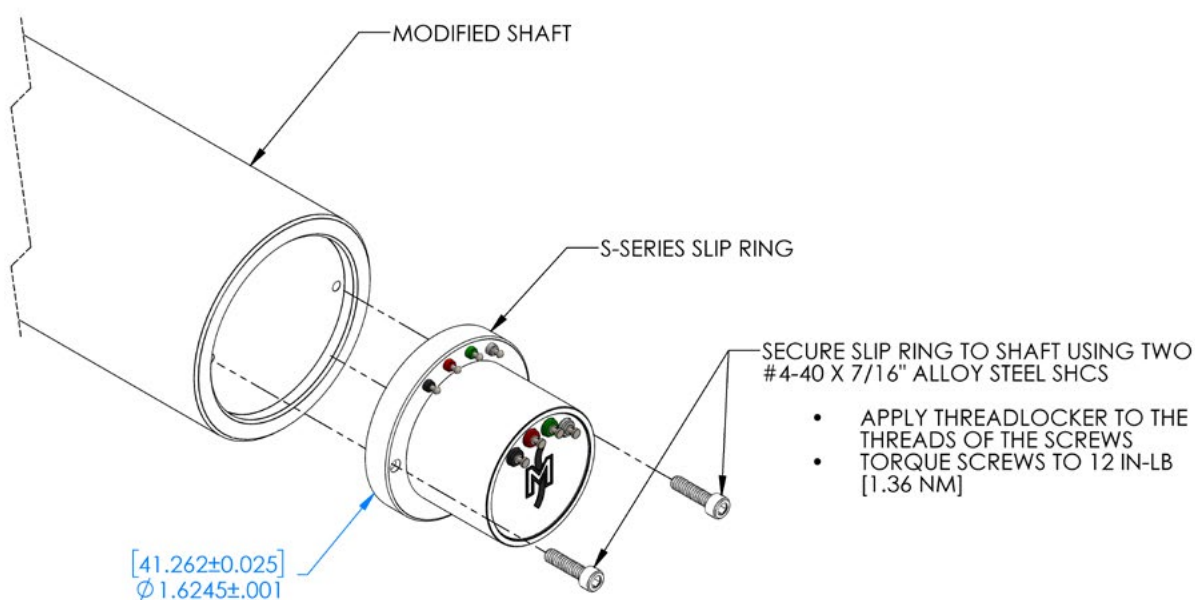


Installation Guidance

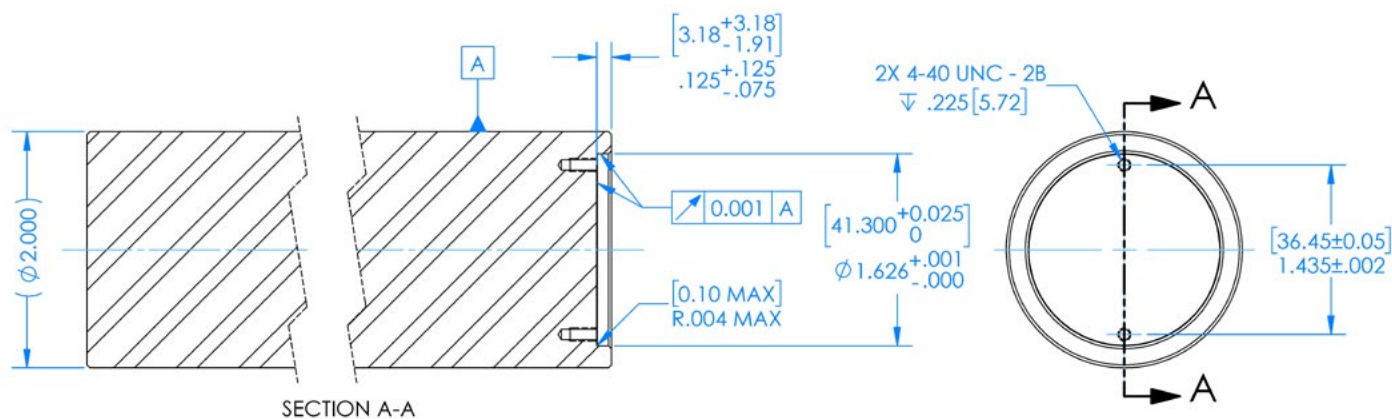
Mount Slip Ring Rotor

2. Mount Directly to Shaft

If the shaft in application can be modified, the slip ring can be directly mounted to the shaft without the need for a rotor adapter.



Reference the recommended dimensions and tolerances below to modify an existing shaft.

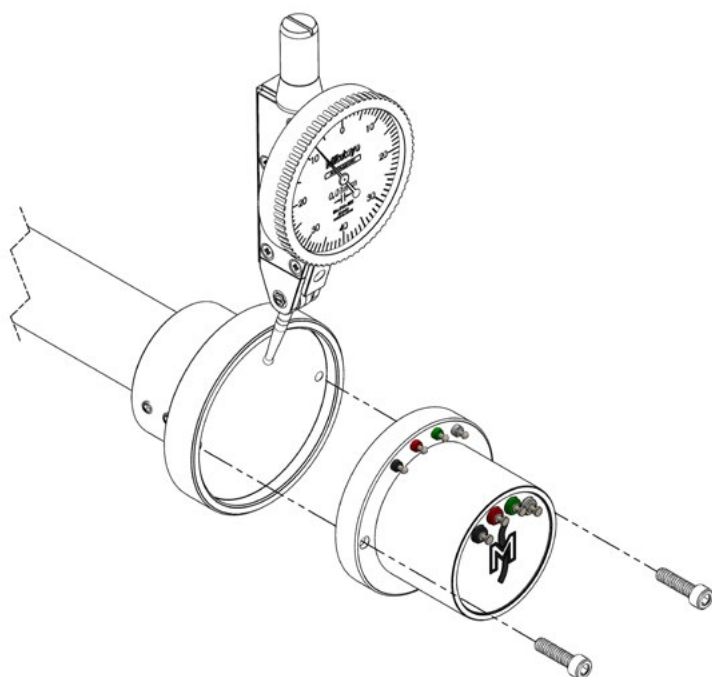


Installation Guidance

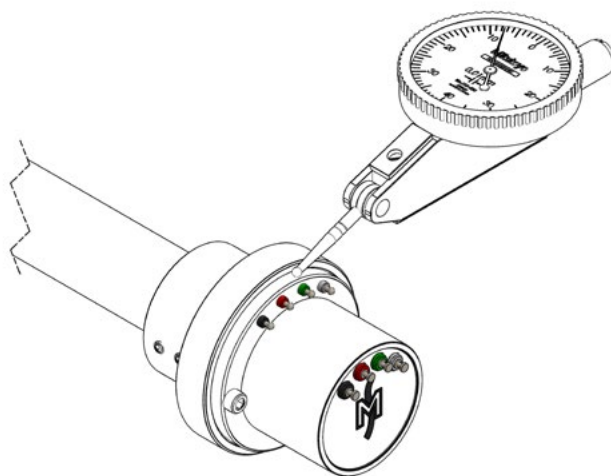
Validate Total Indicated Runout (TIR)

For proper mounting, the slip ring's total indicated runout (TIR) must not exceed 0.001" in the axial or radial directions. Follow these steps below to validate the runout:

- Measure the axial (or face) runout on the mounting surface of the adapter or shaft where the slip ring will be installed.
- Install the slip ring onto the adapter or shaft.
- Measure the radial runout on the flange of the slip ring rotor.



Axial Runout Measurement



Radial Runout Measurement



IMPORTANT! Failure to mount the slip ring rotor flange concentric and perpendicular to the axis of rotation can lead to significant vibrations, especially at high RPMs. These vibrations can cause uneven forces on the electrical contacts, which may degrade signal quality and reduce the slip ring's lifespan.

Installation Guidance

Restrain Slip Ring Stator

A stator restraint ensures that the slip ring stator remain stationary on the machinery or equipment on which it's installed. This allows the slip ring rotor to spin relative to the stator and maintain continuous electrical contact through the unit's brushes and rings. Failure to properly restrain the stator will cause the instrumentation wires to twist and break, resulting in device failure.

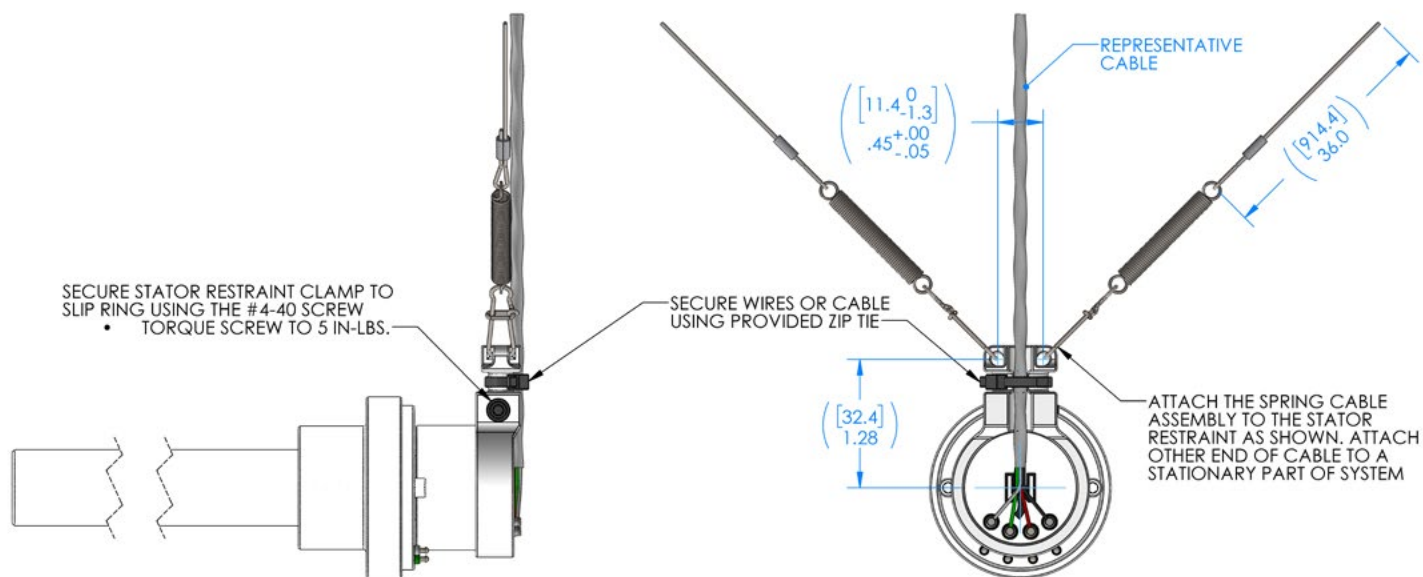
Michigan Scientific recommends using one of the two restraining options outlined in this section.

! IMPORTANT! In all applications, note the following important considerations when restraining your S-Series Slip Ring:

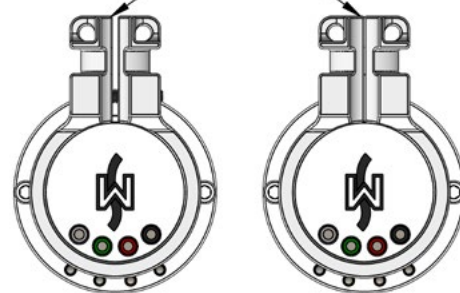
- Do not restrain the slip ring using the instrumentation wires or cable connected to the stator.
- Always use a flexible connection to restrain the stator and avoid using a hard-mounted bracket.

1. S-Series Stator Restraint

Michigan Scientific offers an S-Series Basic Stator Restraint Kit to easily secure the stator housing to a stationary part of your system to prevent its rotation. The restraint also allows for restraining cables/wires using a zip tie.



THE GAP IS DESIGNED TO CLOSE WHEN PROPERLY TIGHTENED



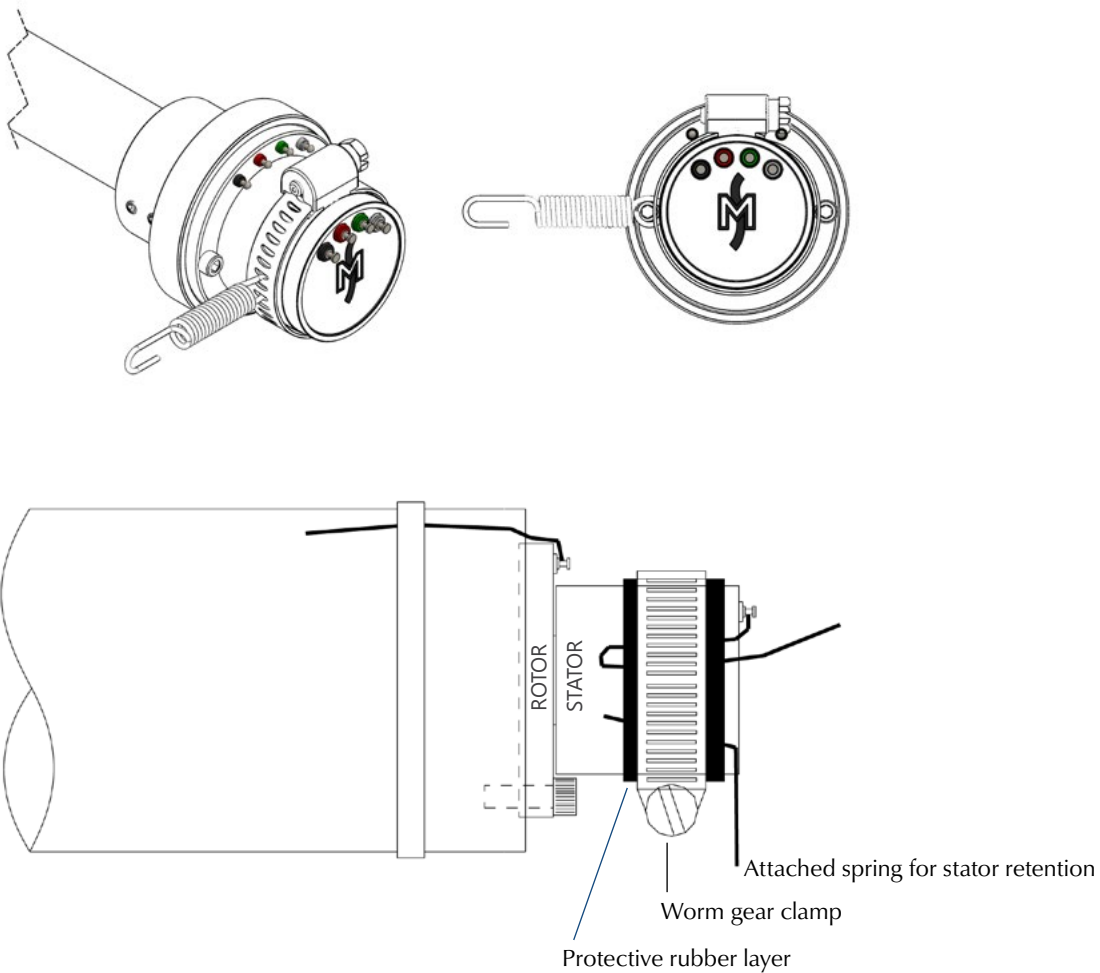
! IMPORTANT! Temperature Limitation:
Do not use this clamp in environments exceeding 235 °F (112 °C). High temperatures can cause the plastic to relax, potentially loosening its hold on the stator housing.

Installation Guidance

Restrain Slip Ring Stator

2. Worm Gear Clamp Stator Restraint

In applications where the standard stator restraint cannot be installed due to space or temperature constraints, use a worm gear clamp with an attached spring for stator retention. To ensure a secure and damage-free installation, insert a rubber layer between the clamp and the stator housing. Connect the spring to a fixed component of the system to counteract stator rotation.



Installation Guidance

Connect Instrumentation Wires

1. Select Wire Type

Use small-stranded wire (28 or 30 is recommended with a maximum of 24 AWG) to route instrumentation wires from the instrumented shaft to the solder terminals on the slip ring.

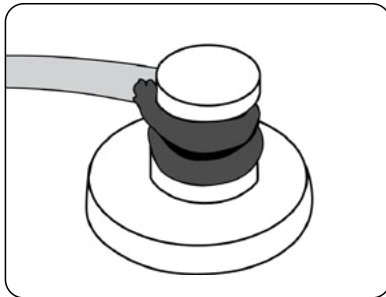
2. Manage Wires

Allow instrumentation wires sufficient strain relief. Secure wires to the shaft with adhesive, weld straps, or zip ties to avoid fatigue and terminal damage and protect them from abrasion, pinching or interference with moving parts.

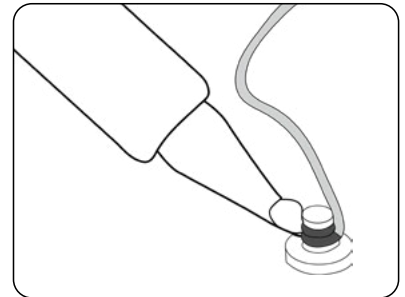
3. Solder Wires to Terminals

Follow the steps below to solder the instrumentation wires to the slip ring terminals.

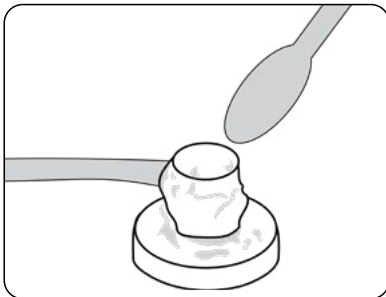
STEP 1: Wrap the wire around each terminal.



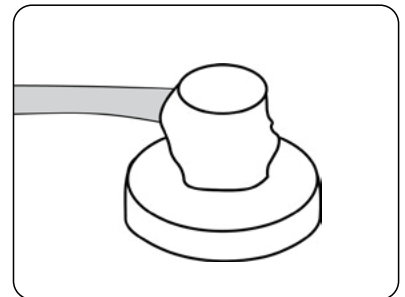
STEP 2: Solder the coiled, partially stripped wire to the terminal. Use an 80 watt solder iron (660 °F/350 °C if temperature-controlled). Hold the iron on the terminal for 2-3 seconds or until the moment that the solder flows to both the wire and terminal.



STEP 3: Remove all flux from the solder terminal with a proper flux remover and cotton swab.



STEP 4: If environmental protection is required, apply a protective coating (such as an electronics grade silicone sealant) to the exposed wires and terminals.



NOTE: Thermocouple leads require a specific flux. For further guidance on soldering thermocouple wires to an S-Series Slip Ring, refer to [Technical Note 102-C](#) at michsci.com.

Sensor Applications

Strain Gauges

Strain gauges, known for their sensitivity to subtle resistance shifts, are typically connected in a Wheatstone bridge configuration. These versatile bridge circuits are fundamentally categorized as full bridge (employing four active strain gauges), half bridge (utilizing two active strain gauges), and quarter bridge (with a single active strain gauge). In slip ring applications, the classification further considers the number of active strain gauges located on the rotating side. For a comprehensive explanation, refer to [Technical Note 101](#) at michsci.com.

To improve signal to noise ratio, Michigan Scientific offers compact Strain Gage Amplifiers that can mount directly to a rotating shaft. These products provide substantial signal amplification, ranging from 100 to 2000 times the original bridge output and ensure precise voltage regulation for the bridge excitation. Visit michsci.com to learn more about Michigan Scientific [Strain Gage Amplifiers](#) for facilitating accurate measurements even in challenging environments characterized by electrical interference, low strain magnitudes, high rotational speeds, or significant vibration.

Thermocouples

Maintaining a uniform temperature across the slip ring is crucial because its components are not made of thermocouple material. Temperature differences between the rotor and stator terminals can introduce measurement errors (a 5 °F difference will result in a 5 °F error, for example). To mitigate this, ensure the slip ring temperature remains consistent. If heat originates from the shaft, thermal insulation (like a plastic disk) can be placed between the shaft end and the bottom of the slip ring rotor. Baffles or additional insulation around the slip ring can shield it from other uneven heat sources. For further details, refer to [Technical Note 102, 102-B, & 102-C](#) at michsci.com.

Alternatively, Michigan Scientific [Rotating Thermocouple Amplifiers](#) can be used in thermocouple applications to bypass these thermal challenges entirely and produce accurate and dependable temperature measurements. Visit [michsci.com](#) to learn more.

Resistance Temperature Detectors (RTDs)

4-Circuit RTDs are recommended for higher accuracy temperature measurements. Two wires supply a constant current to the RTD and the other two wires measure the voltage drop directly across the RTD element. Since very little current flows in the voltage measurement wires (and their associated slip ring channels), their resistance (including the slip ring contact resistance in these paths) has a negligible effect on the measurement. This method effectively eliminates the impact of instrumentation wire and slip ring resistance.

Accelerometers

S-Series Slip Rings are compatible with MEMS based accelerometers and certain piezoelectric-based accelerometers. In applications with piezoelectric accelerometers, S-Series Slip Rings require the use of accelerometers with integrated electronics, specifically ICP® (Integrated Circuit Piezoelectric) or IEPE (Integrated Electronics Piezo-Electric) types. These sensors incorporate an amplifier to convert their native high-impedance charge signal into low-impedance voltage signal.

Digital Signals

S-Series slip rings are capable of transmitting various types of digital signals, including industry-standard communication protocols such as Ethernet, and CAN bus.

Maintenance & Storage

Proper maintenance and storage are essential for ensuring the longevity, reliability, and accuracy of your Michigan Scientific S-Series Slip Ring. Follow the guidelines below to protect and maintain the optimal performance of your slip ring. For repairs, calibration, or any service needs, contact Michigan Scientific or your authorized representative. Unauthorized service attempts may void the warranty and compromise the product performance.



Electrical Hazard Warning! Disconnect all power sources from the slip ring and connected equipment before inspecting, cleaning, or handling the slip ring.

Maintenance

Contamination Prevention: Avoid exposing the slip ring to excessive dust, dirt, liquids, or corrosive substances, particularly near the bearings and electrical interfaces.

- Periodically wipe the exterior housing with a clean, dry, lint-free cloth. If necessary, lightly dampen the cloth with isopropyl alcohol (IPA). Never spray cleaner directly onto the slip ring assembly. Avoid harsh solvents that could damage the housing material or bearings.
- Keep solder terminals clean and free of debris or oils. If needed, use a dedicated electrical contact cleaner suitable for precision connectors, applying it sparingly according to the product instructions.
- Never disassemble the slip ring housing. Doing so voids the product warranty and can damage sensitive internal components (brushes, rings, bearings). Contact Michigan Scientific if internal service is required.

Inspection

Perform the following checks periodically, especially before critical measurements:

Housing: Check the slip ring housing for any signs of physical damage, such as dents, cracks, or deformation. Inspect any external wiring for damage, fraying, or stressed connections.

Solder Terminals: Examine the slip ring solder terminals for bent pins, signs of corrosion, or contamination.

Rotor: Gently rotate the slip ring rotor (when uninstalled if possible) to feel for smooth operation. Any grinding, binding, or excessive resistance could indicate an internal issue requiring service.

Mounting: Ensure that the mounting hardware is secure and the slip ring is properly aligned, preventing unnecessary stress on the unit.

Storage

Follow the instructions below to properly store and protect the slip ring when not in use.

ENVIRONMENT	PROTECTION
• Store the slip ring in a clean, dry environment. • Avoid storage locations with: • extreme temperatures (aim for stable room temperature). • high humidity. • exposure to direct sunlight for prolonged periods. • corrosive fumes or excessive dust.	• Whenever possible, store the slip ring in its original packaging or a dedicated protective case. • Protect electrical connectors using dust caps or store in a way that prevents contamination or physical damage to the pins/sockets. • Do not place heavy objects on top of the slip ring assembly. • Do not store with cables tightly wrapped or kinked to avoid damage to the conductors or connector strain reliefs.

Troubleshooting

Excessive Electrical Noise / Signal Interference

PROBLEM	SOLUTION
Oxidation/contamination on slip ring electrical contacts (if idle for months)	Operate the slip ring at moderate (half-rated) speed for 5-10 minutes to clear contacts.
Improper grounding or shielding	Verify that the slip ring housing, cabling shields, and connected equipment share a proper common ground and that shield connections are intact.
Electromagnetic Interference (EMI) from nearby sources (motors, power lines, etc.)	Route signal cables away from EMI sources, use shielded cables, and ensure proper shield grounding.
Worn internal contacts	If noise persists after running-in and checking grounding/shielding, contact Michigan Scientific support.
Ground loop	Review system grounding; ensure only one ground reference point for the signal path if possible.

No signal / Open Circuit / Infinite Resistance

PROBLEM	SOLUTION
Loose or disconnected cable	Check and secure all connections to the slip ring (stator and rotor side).
Damaged wires or solder terminals	Visually inspect wires for cuts, abrasions, or kinks. Inspect solder terminals on the rotor and stator of the slip ring assembly. Test wire continuity with a multimeter if possible. Replace damaged wires.
Faulty sensor or external instrumentation	Test the sensor and instrumentation independently of the slip ring if possible.

Intermittent Signal / Signal Dropout

PROBLEM	SOLUTION
Loose or vibrating connection	Check and secure all connections and ensure adequate strain relief for wires.
Oxidation/contamination on slip ring electrical contacts (if idle for months)	Operate the slip ring at moderate (half-rated) speed for 5-10 minutes to clear contacts.
Excessive vibration in the application affecting contacts	Assess the mounting and operating environment for sources of excessive vibration. Improve damping or mounting if possible.
Worn internal contacts (brushes/rings)	Contact Michigan Scientific support for evaluation/repair.

Rough Rotation / Physical Binding

PROBLEM	SOLUTION
Bearing failure	Stop use immediately and contact Michigan Scientific support.
Improper mounting (misalignment, excessive force)	Loosen mounting bolts slightly and check rotation. Remount carefully, ensuring alignment and following any torque specifications.
Physical damage to housing or shaft	Stop use immediately. Inspect for damage and contact Michigan Scientific support.

Troubleshooting

Incorrect Sensor Reading

PROBLEM	SOLUTION
Incorrect wiring (e.g., bridge completion, polarity, TC type mismatch)	Verify wiring meticulously against sensor and slip ring diagrams. Ensure correct TC extension wires are used.
Noise or high resistance affecting low-level signals	Address noise/resistance issues as described previously.
Thermal gradients across slip ring (for thermocouples)	Ensure stable operating temperature. Allow the slip ring to stabilize thermally if experiencing drift. Use differential measurement techniques if possible. Refer to Michigan Scientific guidance on TC measurements (Tech Notes 102, 102-B, & 102-C).
Incorrect scaling or calibration in DAQ/instrumentation	Verify software/hardware setup for the specific sensor.

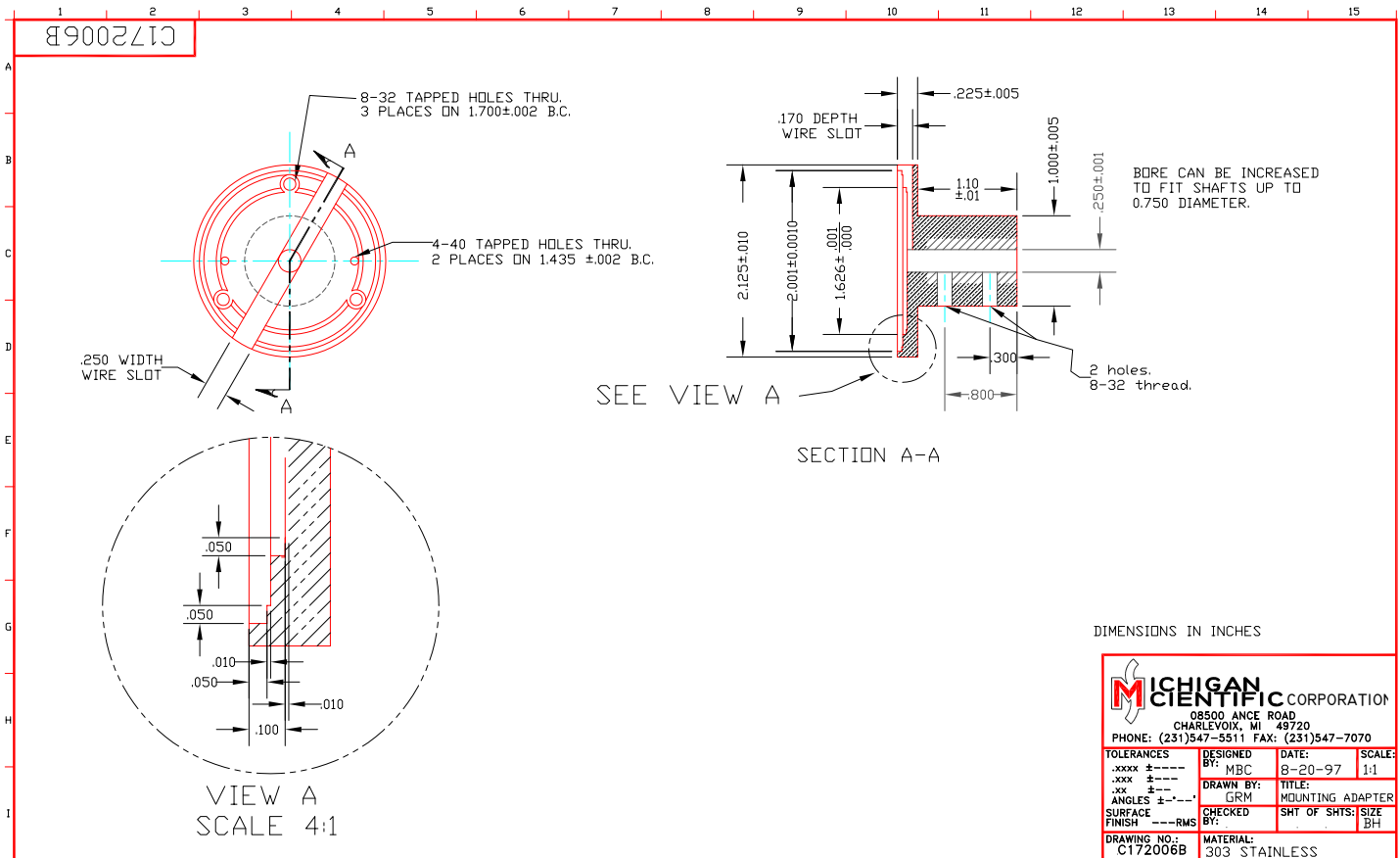
Overheating

PROBLEM	SOLUTION
Exceeding current or speed ratings	Verify operating parameters against slip ring specifications. Reduce current/speed if exceeded.
Bearing failure causing excessive friction	Stop use immediately. Check for binding/rough rotation. Contact Michigan Scientific support.
High operational temperature	Ensure that the operating environment is within specs. Consider forced air cooling if appropriate and allowed for the model.
Internal short circuit	Stop use immediately. Disconnect power. Check resistance between circuits and to ground. Contact Michigan Scientific support.

Appendix A: Rotor Adapters

Michigan Scientific Rotor Adapter Accessory

A Michigan Scientific Rotor Adapter accessory can be ordered in the standard configuration below or modified to fit shaft diameters from 0.250 in [6.4 mm] to 0.750 in [19 mm]. This model includes a slot for routing wires from the bore of a shaft to the slip ring's outer flange. For modifications or custom solutions, contact our engineering team.



Rotor Adapter Design Guidance

Reference the recommended dimensions and tolerances below to fabricate a rotor adapter. Contact our engineering team for further design guidance.

