

How To Specify A Slip Ring

Many of the more than 10,000 slip ring designs are available for use in their existing configuration or they may be modified to meet your specific requirements. New designs can also be created to meet the most demanding specifications.

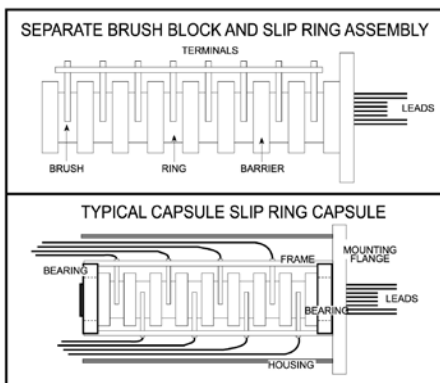
Our engineers are experienced in a wide range of slip ring applications. A very active in-house quality program solicits the best inputs from all of our many concurrent engineering groups, from start to finish.

This section is designed to guide you through the process of specifying a slip ring. We've outlined below the major considerations that a slip ring engineer will need to know about your application.

Basic Slip Ring Design

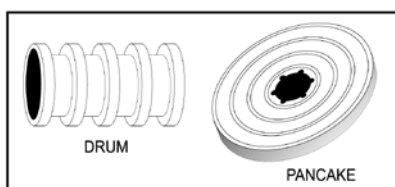
Throughout these pages, you will see three basic terms used for slip rings:

1. Slip Ring Capsule - A fully integrated unit with a housing and bearings.
2. Slip Ring Separates - Separate slip ring rotor and brush blocks for mounting in your system.
3. Twist Capsule - A limited rotation device used typically in scanning applications where continuous rotation is not required.



There are two basic slip ring configurations to consider based on space allocation in your system:

1. The more common drum approach where each ring is adjacent to the next along the centerline, somewhat like the threads on a bolt and
2. The platter approach where the rings are concentric with one another like the grooves on a flat surface. The pancake approach is used when length is at a premium but diameter is less restrictive.



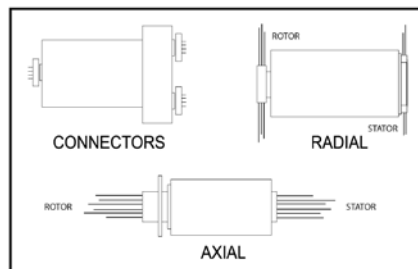
Defining the Mechanical Envelope

The envelope is, of course, largely dictated by the space available in the system. The slip ring engineer should be given the maximum space available in the system so all existing candidate designs can be considered. It is imperative that the space required for the slip ring be specified in the early stages of the system design and that it be consistent with the structural and electrical demands.

Defining System Interface Requirements

The slip ring engineer will need to know these system interface considerations:

1. Can the slip ring mount directly on the center line or is a through-bore required in the slip ring? A through-bore can be used to mount the slip ring on a shaft or used for routing hydraulic lines, pneumatic lines, fiber optic rotary joint, wave guide, etc.
2. How will the slip ring attach to the system? A slip ring must be mounted with a flexible coupling on one side of the unit. Hard mounting on both the rotor and stator will cause the slip ring to fail prematurely by translating system load into the slip ring bearing structure.
3. How should the electrical connections to the slip ring be made? Is it desirable to have connectors integral with the slip ring on both the rotor and stator, or would flying leads on one or the other ends be desirable? And if flying leads are preferred, should they exit the rotor / stator in a radial or axial direction, and what length should the leads be?



Defining Electrical Requirements

The specified current enables the slip ring engineer to propose a unit with the appropriate cross-sectional area of the rings, brushes and lead wires. The specified voltage dictates the spacing between adjacent rings and brushes. It is helpful in achieving the most cost effective and smallest practical envelope not to rate all circuits at the maximum level. For example, if you need 20 circuits total, three of which must carry ten amps, designate three for high current. Don't insist on 100% functional interchangeability by specifying that all 20 circuits carry ten amps. And, if ten amps is a surge current with a continuous current of only two amps, tell us that, too. There is no reason for you to

pay for ten amps continuous capacity when you only need two amps.

Be aware that voltage surges and spikes are the major cause of system slip ring failures. Moog Components Group uses a conservative approach to circuit design, however, it is not uncommon in some power supply systems to see voltage spikes ten or more times the normal operating voltage. We strongly recommend surge protection on all power supplies.

Most smaller slip rings will satisfactorily conduct signals to 50 megabits / sec. Special slip rings can be used to pass broadband signals from DC to 1 gigahertz and data rates of 500 megabits or even higher. Cross-talk, insertion loss and bit error rate information can be projected, if tested for actual values, when data rates, formats and impedances are defined. The appropriate shielding techniques will be incorporated to meet the system requirements.

Defining Mechanical Requirements

1. Operating speed (rpm) is an important design parameter. Almost any slip ring can operate successfully at speeds to 100 rpm although many applications only require operation at a few rpm. Slip rings are routinely used to instrument test jet turbine engines operating at speeds in excess of 20,000 rpm. The operating speed, in conjunction with the diameter, dictates the surface speed of the ring relative to the brush and hence the internal design approach and material selection.
2. What rotational life is necessary for your application? Will the unit oscillate or rotate at a continuous speed?

Defining the Environment

The environment in which the slip ring must survive is a key factor. Operating temperature range is important in specifying the proper lubricant. And if the slip ring will operate exposed to the elements or to a hostile environment, integral seals must be included in the design. Any unusual shock or vibration should also be specified.

Your Slip Ring Requirements

For assistance on your slip ring requirements, please complete the *Slip Ring Application Specification Sheet* located on page 7, you can either fax or call and speak with one of our engineers about your optimum slip ring solution.

Many of the slip ring designs and manufacturing processes described are proprietary and are covered under one or more U.S., European or Japanese patents. The information provided is intended to assist the system engineer in initial discussions and is not intended as a specification.

Slip Ring Application Specification Sheet

Please provide as much information as possible, enter NA for those questions that are not critical or important to you. Do not be concerned if you do not have all of the specifications that are requested, we are happy to work with as little or as much information as you can provide. However, the more complete your response, the more thorough our analysis.

Company Information

| | | | | | |
|--------------------|--|---------------------|--------------------------------------|--|--|
| Company Name _____ | | | Contact _____ | | |
| Division _____ | | | <input type="checkbox"/> Buyer | | |
| Address _____ | | | <input type="checkbox"/> Engineer | | |
| _____ | | | <input type="checkbox"/> Other _____ | | |
| City _____ | | State/Country _____ | Zip/Post Code _____ | | |
| Phone _____ | | FAX _____ | E-mail _____ | | |

1) Description of Application: _____

Commercial
 Industrial
 Military
 Other

2) Type of Slip Ring

Capsule Separate Brush Block Other _____
 Separate Slip Ring Poly-Twist (for ± °) _____

3) This Application is: New Retrofit / Replacement Type of Application: _____

Current Supplier: _____ Part Number: _____

4) Estimated Annual Quantity: _____ Price Target: _____ Production Start Date: _____

Estimated Life of Program: _____ Tooling \$ Available: _____

5) Size Constraints - Mechanical and additional requirements (i.e. resolver, motor, hydraulics, pneumatics, optical channel, etc):

6) Specifications:

Number of Rings: _____

Size: Length _____
 Diameter _____
 Bore _____

Wear (Life): Hours (or Yrs) _____
 at Duty Cycle _____

Operating Temp Range (°C):
 Min _____ Max _____ Norm _____

Pressure: Norm _____ Min _____

Vibration: ___ g's @ ___ Hz Shock ___ g's

Sealing: None Dust & Splash
 Water Spray Submersion

Rotational Speed: Norm _____

Oscillatory Motion: Yes _____ No _____

Torque: Max Starting _____ gm-cm

Weight (Max): _____

Lead Length: Rotor _____ Stator _____

Connectors: Rotor _____ Stator _____

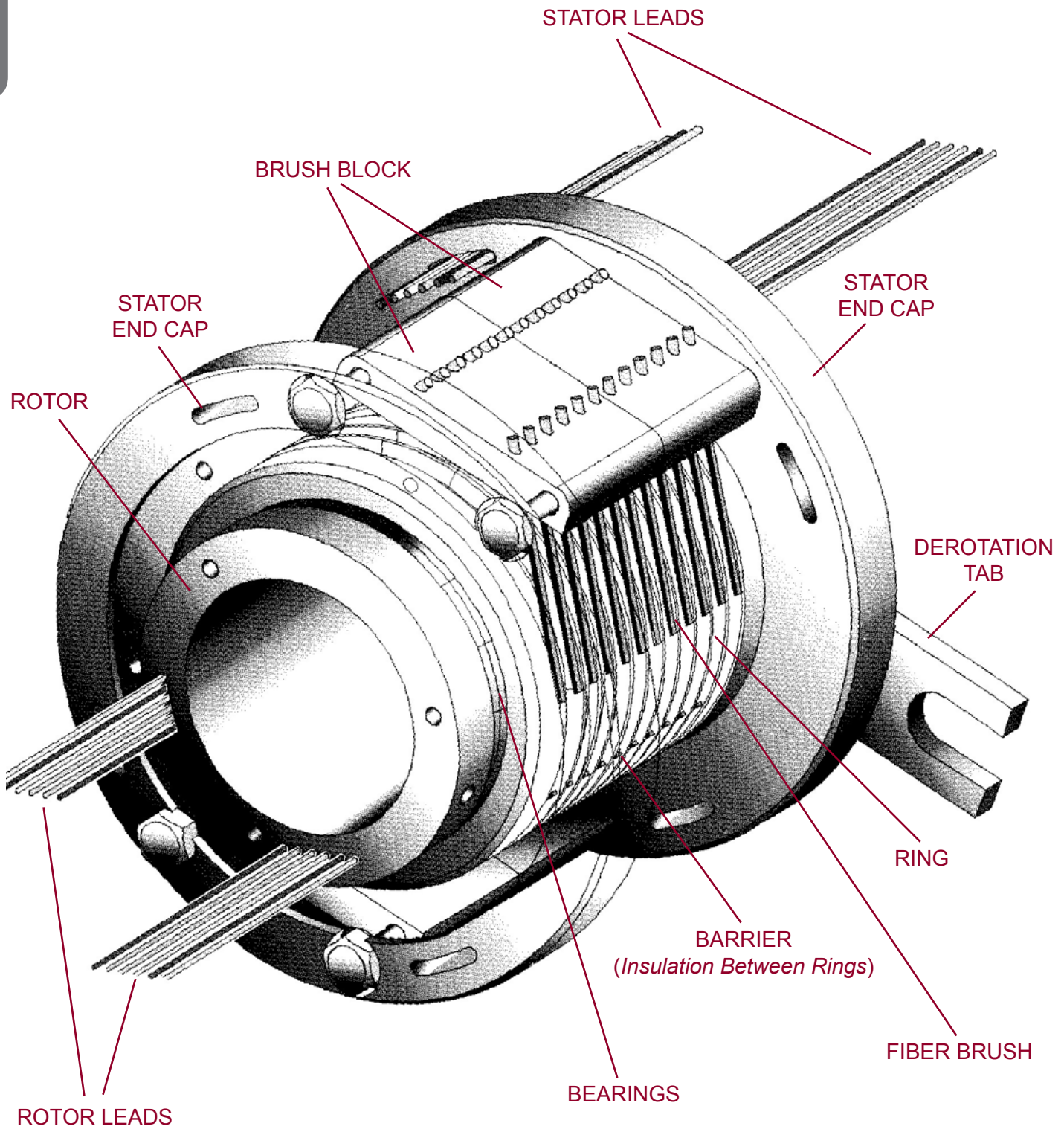
Lead Exits: Rotor Axial _____ Radial _____
 Stator Axial _____ Radial _____

| Circuit Function | No. Ring | Current (amps) | | Working Volts | Data Protocol | Digital Risetime* or Freq. (Hz) | Crosstalk Isolation (dB) |
|------------------|----------|----------------|-----|---------------|---------------|---------------------------------|--------------------------|
| | | Normal | Max | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

*If unknown please specify protocol or data rate.



Components Of A Slip Ring



Note: Outer housing is removed for clarity.