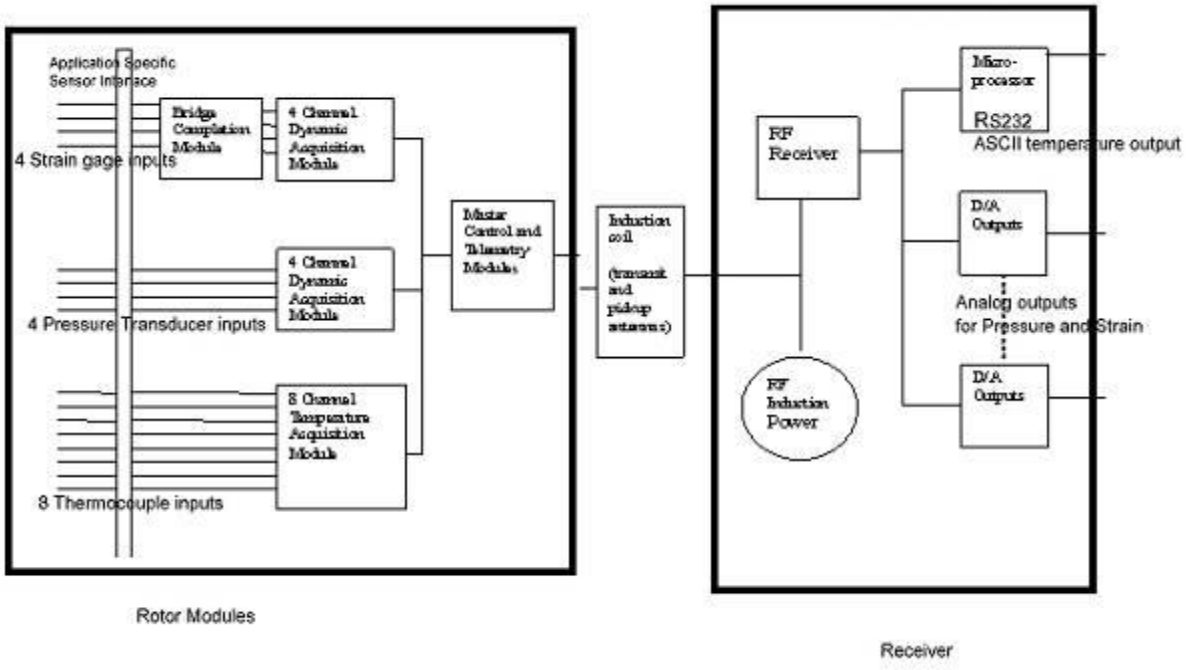
Accumetrics - The World's Leader in Rotor Telemetry Technology

Rotor Telemetry Basics

When sensors are mounted on rotating structures - whether it is a turbine rotor, helicopter blade, train wheel or automotive drive shaft -- getting the signals off the rotating equipment can be a significant challenge simply because direct wire connection is not possible. Sometimes slip rings are used but the sliding contacts wear and produce electrical noise, often corrupting low level sensor signals.

Digital Telemetry replaces older Analog techniques

Beginning in the 1960s, rotor telemetry systems used analog FM (frequency modulation) transmission, usually operating in the FM broadcast band. This technique suffers from many disadvantages, including interference and noise, temperature-related frequency drift, "drop-outs" and calibration shifts. For demanding applications, FM has generally been replaced by digital telemetry techniques because the receiver needs only to distinguish a "one" from a "zero" to preserve the full integrity of the data. Further, in digital telemetry systems, multiple signals can be combined by a multiplexer prior to digitizing, allows many sensors to be combined into one composite digital data stream prior to transmission. This eliminates the need for many transmitters and receivers in many multi-channel applications.



Once the data are digitized, the bits are organized for transmission in serial fashion. This organization must include provisions for synchronizing the receiver to the digitizing process. Usually "frame synchronizing" bits are combined with the data to allow the receiver to process the information appropriately. Digital data on a radio frequency

carrier may be modulated in several ways, including frequency shift keying (FSK), phase shift keying (PSK), and amplitude shift keying (ASK). In simple modulation techniques, there are only two possible states in these keying processes, encoding a single bit, such as either 0° or 180° in PSK. In more complex modulation schemes, more that one bit can be encoded in a modulation symbol. For example quadrature phase shift keying (QPSK) employs four different phase states to encode two bits of data.

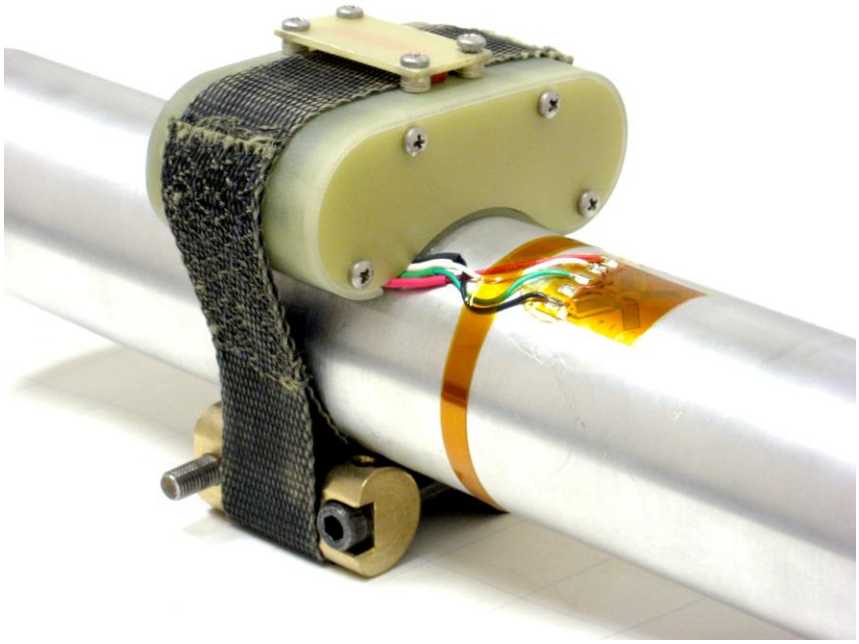
Key Considerations in Applying Rotor Telemetry Systems

In planning a telemetry application, it is important to begin with two key questions:

1. Will the application require just a single data channel or multiple channels?
2. Is the need for testing short term (up to about 200 hours) or long term?

The answers to these two questions will have significant impact on equipment selection. There are, for example, single-channel, battery-powered rotor telemetry systems that are designed to allow easy installation for short term testing. A much more sophisticated system, however, is required to provide continuous long term monitoring of multiple sensors on rotating equipment. One of the first issues to be addressed is where the telemetry components may be located on the rotor. It is usually desirable to mount these components close to sensors but that isn't always possible. In some applications, space constraints or environmental conditions -- such as temperature -- force the user to route the sensor leads to a more practical location. In many cases, telemetry systems are supplied in customized split collars that clamp onto the user's shaft. In other cases, special Kevlar straps will suffice to hold telemetry components to the shaft for short term tests. In all cases, the rotational speed and mounting diameter must be considered to determine the centrifugal load applied to telemetry components. Most telemetry components will withstand 10,000 Gs or more.

Providing power to operate the telemetry components is often an important issue. Battery power is generally the easiest to apply, but has obvious limitations. For continuous duty or long term testing, induction power is the preferred approach. Induction power involves coupling energy at high frequency through a rotary transformer. This requires rotor and stationary coils or single turn loops to be positioned with relatively close spacing, typically between 0.25 and 0.50 inches. In applications where the rotating member experiences significant radial or axial motion relative to stationary mounting surfaces, application of induction power may be extremely difficult.



Finally, it is important to carefully consider the sensors that will be used. Telemetry transmitters are usually designed to interface with a particular class of sensor. Changing amplifier gains or balancing bridges can be done in rotor telemetry applications, but it is typically more difficult than with "bench top" instruments. As a result, careful planning and coordination will pay off handsomely.

Accumetrics' application engineers can guide users through the considerations and then propose a rotor telemetry solution that is best tailored to solve their rotor measurement needs.

Contact us: Telemetry@Accumetrix.com
www.Accumetrix.com
Phone:518-393-2200 Fax: 518-393-3622
409 Front Street, Schenectady NY 12305