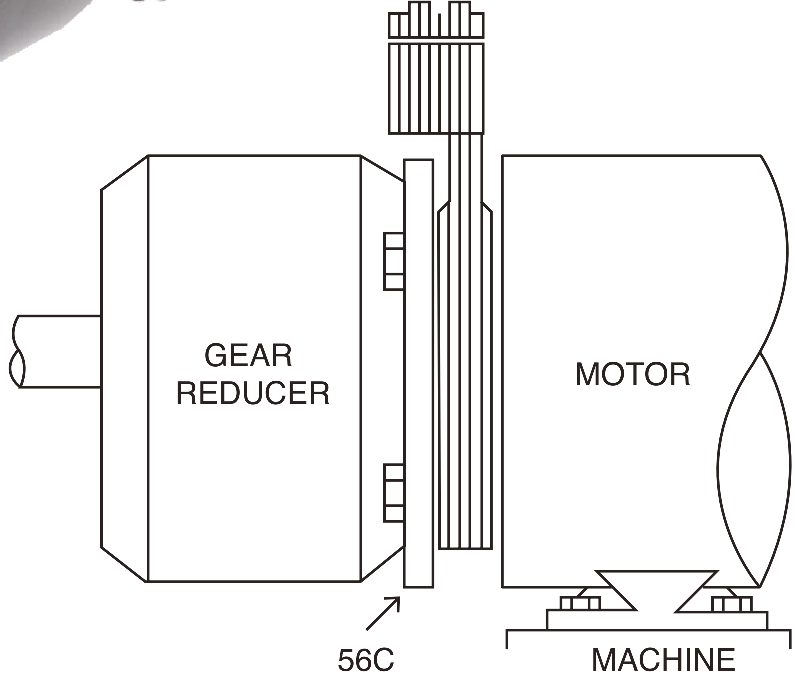
DYNAPAR™

Encoder Mounting:
Optimize the Life and Performance of Rotary Encoders through Correct Mounting



Optimize the Life and Performance of Rotary Encoders Through Correct Mounting

Consider spatial, environmental and mechanical factors when choosing the encoder mounting configuration that will best fit your application.

Encoders are a physically small component of a complex closed-loop feedback system that allow manufacturers to make quality parts or move objects from point A to point B in a swift smooth motion. If you break down this system into its major physical components, it most often includes a motor, a drive or amplifier, a brake, and an encoder. When it comes to mounting, the encoder requires the most thought. This paper explains the different encoder mounting methods available, and how they can benefit your application.

Encoder Mounting Styles

Encoders are the component in motion control systems that provide feedback to drives for accurate speed and position control. Selecting the appropriate encoder involves considering environmental, electrical and mechanical factors, and will largely depend on your application requirements.

Encoders are available in numerous mounting styles, and these different styles dictate how encoders integrate or "mount" into motion control systems. Encoder mounting styles are typically classified as shafted, hollow-shaft, hub-shaft and bearingless. The appropriate mounting selection can optimize both the life and performance of the encoder.

Coupling or Belt-Driven Mounting

A shafted encoder, such as Dynapar's incremental **HC25** or absolute **AI25**, requires two special interfaces to be properly mounted, an encoder mount and a flexible coupling (see figure 1).

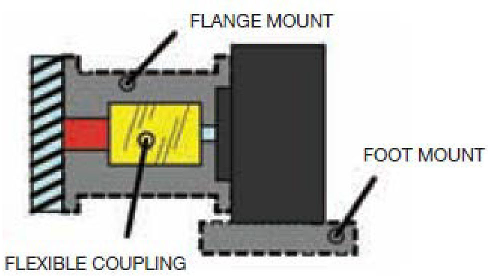


Figure 1: A shafted encoder is mounted using an encoder mount and a flexible coupling

The encoder mount is typically either a mounting flange or a foot mount (see figure 2) that is used to mount the encoder to a fixed surface, typically a bracket or adapter. The flexible coupling is used to connect the encoder shaft directly to the motor or driven shaft using set screws, and provides isolation from shock, vibration and movement in the motor shaft.

Figure 2: An encoder mount can be either a mounting flange (left) or a foot mount (right).

This mounting configuration is typically used when a hollow- or hub-shafted encoder is not available, when an encoder is matched to an older non-standard motor, or when the shaft movement is too strenuous for a standard encoder to handle.

A shafted encoder can also be interfaced to a driven shaft by a belt (see figure 3). This configuration is used when the driven shaft is too large for coupling, or the application is space-constrained and the encoder can't be mounted in line with the driven shaft.

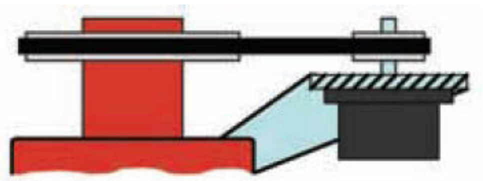


Figure 3: A shafted encoder can also be mounted to a driven shaft using a belt and gears

Mounting an encoder through a flexible coupling has several advantages. Using this method of mounting typically provides electrical isolation from the motor. When electrical isolation does not exist, the encoder is susceptible to noise induced by the high currents supplied to and generated by the motor. If there is electrical noise, the the encoder output may have missing pulses, added pulses, or the encoder could get damaged.

Mechanical isolation is also a benefit. Flexible couplings can absorb shaft movement and compensate for shaft misalignments, which can allow for installations on older motors or motors that are used in high shock and vibration applications.

However, there are also disadvantages in using flexible couplings to mount encoders. The primary disadvantage is the additional space required to mount the encoder in line with the shaft. Coupling an encoder can add up to seven inches in line with the motor shaft when you consider the bracket, the shaft gap within the coupling, and the encoder housing. Coupling an encoder also makes installation more complex and requires careful alignment of encoder and driven shafts to avoid the coupling material from tearing or breaking.

Similarly, the additional mechanical hardware required to mount anencoder using a belt and gears adds cost and complexity to the system.

Direct Mounting

Hollow-shaft encoders, such as Dynapar's incremental **HS35R**, can be directly mounted on the shaft of the motor and affixed using a concentric clamp. In this mounting configuration, a flexible tether or torque arm attaches to the motor face or any fixed object to prevent the encoder body from rotating with the shaft (see figure 4).

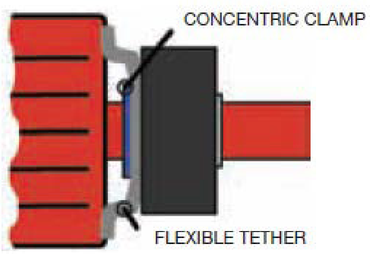


Figure 4: A hollow-shaft encoder can be directly mounted on the motor or driven shaft

Direct mounting is also achieved with hub-shaft encoders such as Dynapar's **HSD25**, except that the motor shaft does not extend through the encoder (see figure 5).

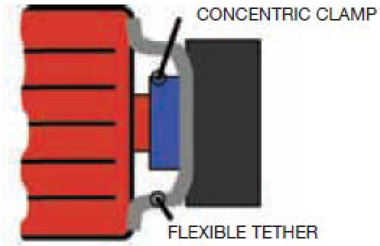


Figure 5: A hub-shaft encoder can also be directly mounted on the motor or driven shaft

In this mounting configuration, it is important to protect the encoder from motor shaft current. This is accomplished by isolating the shaft of hollow- or hub-shaft encoders through the use of a plastic sleeve or insert between the motor and encoder shafts. If an insert is not available, the encoder will have to rely on the motor for a shaft current solution or on another shaft grounding kit accessory.

There are several advantages of using a direct mounting configuration. It is usually easier to select the appropriate encoder for the motor by matching the shaft size of the motor to the hollow- or hub-shaft encoder bore (or shaft) size. Installation is also simpler as direct mounting eliminates the need for a coupling, requires no motor shaft alignment with respect to the encoder, and allows for mounting at various radii from the center of the motor shaft through the use of slotted tethers. Encoder inserts and spring tethers also help make direct mounting more robust than coupling mounting as they isolate encoders from motor shaft current and help absorb sudden shaft movements, both design elements that can extend the life of the encoder bearings A hub-shaft encoder with require a more precise shaft length to properly locate the encoder for tethering, but provides improved sealing, as there is no opening on the back of the encoder.

Direct mounting does require improved sealing as there is a larger area of the encoder in contact with the driven shaft, increasing the exposure of the encoder electronics.

Ring or C-Face Mounting

Ring or C-Face mounting is available when using bearingless encoders such as Dynapar's incremental **RIM Tach 8500 Nex Gen.** A bearingless encoder has a modular design and is comprised of three main pieces: encoder housing, one or multiple sensor modules, and a magnetic wheel. The housing of the encoder mounts to the motor face, on the drive or accessory end of the motor, using pilot dimensions that comply with NEMA or IEC standards. The wheel is inserted onto the motor shaft, aligned to the sensor embedded within the housing, and fastened into place (see figure 6).

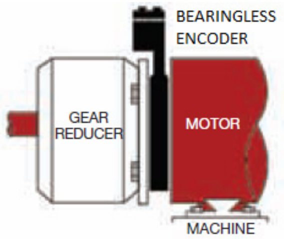


Figure 6: A bearingless encoder is a modular feedback device with different components that mount to the motor face and to the motor shaft

This mounting configuration results in a more robust design for applications that require maximum reliability. The absence of any mechanical connection between the wheel and the sensor eliminates potential failure points and allows sensors to have potted electronics. This is an improvement over direct mount encoders that rely on the integrity of a series of connector and shaft gaskets.

Another benefit of ring mounting is that it allows the motor to perform the function of the encoder bearing, removing a critical failure point from the system.

Finally, bearingless encoders also take up less space along the shaft of the motor. They mount directly to the face of the motor.

A key consideration in the ring mounting configuration is the alignment of the wheel with respect to the sensor. This is not a factor in coupled or direct mounted encoders since the sensor is aligned by the factory. The quality of the signal is entirely dependent on the installer's ability to properly align the wheel of the encoder. Dynapar's new magnetic technology found in the RIM Tach and SLIM Tach product families now offers up to 0.250" axial play, significantly improving ease of installation.

In Summary

When it comes to encoder mounting configuration, there is no one perfect solution, of course, only the best solution for a given project or application. Coupling, Direct, and Ring mounting are the primary mounting options available for closed-loop feedback applications. They will all have their place according to the environment they are installed in, the age of the motor it will be installed on, and the mounting provisions that exist in the application.

Related articles

- *TIncremental and absolute encoders: What's the best solution for your application?*
- *Optical vs. Magnetic: How to Pick the Right Encoder Engine*
- *Encoder Wiring Made Simple*
- *Understanding encoder IP ratings*