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Electric actuation:

A comparison between incremental and absolute encoders

Intelligent electric actuators are widely used in valve automation and these require sensors and electronic devices in order to get the position of the valve at any time. For this purpose, there are two main types of encoders: incremental and absolute. The question is which one is the optimum choice? This article reviews and assesses both technologies, and reveals the answer.

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Intelligent electric actuators are widely used in valve automation. Apart from their user-friendliness and potential to gather more information, their main advantages are preventative maintenance and non-intrusive settings. Such benefits are of high importance especially for complex or critical processes, which cannot suffer long downtime or in special environments such as an explosive atmosphere. In order to allow non-intrusive settings, intelligent actuators feature position and torque encoders instead of micro switches for standard electric actuators.

Intelligent electric actuators require sensors and electronic devices in order to get the position of the valve at any time. There are two main types of encoders made for this purpose: incremental and absolute.

Incremental encoders

Incremental encoders can be used as position sensors. The working principle of such a device is based on a Hall effect sensor coupled with magnets located at the surface of the actuator output shaft. The actuator electronics then increments or decrements a counter each time a magnet is detected by the sensor while the shaft is turning in one direction and onto the next. The count is stored in memory but if ever power supply is lost, the counting stops, which means that if the manual override is used during power shutdown, the operation will not be recorded. Therefore, the position measured when power comes back is inaccurate and the actuator on valve setting must be activated to realign the actual valve position and position reported by the actuator.

Bernard Controls optical absolute position encoder.

A solution to overcome this issue is to include a battery back-up to ensure good functioning of sensors in case of power failure. However, this brings additional need for maintenance as the operator must check and/or replace this battery regularly. This is especially true when lack of power conditions can last for days (site start-up, process shutdown for maintenance, etc.); battery is then used extensively to power the sensor and the associated electronics thus increasing the risk of discharging it.

Absolute encoders

Absolute encoders may be a solution for end users who do not want to support maintenance of the battery back-up system. Indeed, this type of encoders includes a non-contacting position sensor which reports the exact position of the valve shaft.

Compared to incremental encoders that measure change in position, absolute encoders report the absolute position of the valve. One example of absolute position sensor is Bernard Controls' optical encoder. It works with a binary code: each valve position thus corresponds to a unique code, which is given by the encoder slotted disc's mechanical position using light emitting diodes and receivers. With such technology, there is no need for battery back-up in case of loss of power; in such case, even if the manual override is used, the encoder disks, mechanically linked to the output shaft will turn.

A potential issue with absolute encoder systems is the possibility of detecting sensor failure. Since each position corresponds to one single code, it is possible to immediately detect and report to the control room any coder fault due to the monitoring of these codes with an intelligent actuator.

As a conclusion, both incremental and absolute sensors are suitable to measure the motorized valve position but the absolute sensor brings the additional benefit of being maintenance-free.