KOSO AMERICA
4 Manley Street
W. Bridgewater, MA 02379
Tel: 508.584.1199
Fax: 508.584.2525

Positioning and Resolution

POSITIONING CAPABILITY

GENERAL

All the parameters referred to in this technical memo relate directly to the REXA X-PAC actuator and not the finial control element. Various professional societies (ISA, ANSI, IEEE, etc.) provide rigorous technical definitions for control element performance criteria. It is not the purpose of this memo to define or justify these terms, but to use them as they pertain to REXA actuators. Please refer to these standards for a detailed development of terms and equations.

Movement and control of an actuator does not insure a change in the controlled process variable. Factors such as stiffness of the connecting shaft, the static and dynamic loads on the driven device play an important role in determining whether an actual change occurs. For Example, an actuator that exhibits 20,000 step changes for 90° rotation on a control valve may exist, but that does not result in 20,000 different repeatable flow rates. Many actuator step changes will only increase tension in the connecting shaft, until the torque in the shaft exceeds the static load on the valve plug, there will be no motion. When the shaft finally does move, the load (dynamic) will reduce resulting in an indeterminate rotation. A direction reversal only exacerbates this action.

Typically, a rotary ball or plug valve presents the worse case of this phenomenon. Torsional stiffness of the shaft is low, required torque is high and there can be a large difference between dynamic and static friction. For fine control, a linear valve presents the stiffest mechanical connection.

LINEARITY

A graph between control signal input versus actuator position should result in a straight line. Any deviation from this straight line is a measure of nonlinearity of the actuator. This value is defined by REXA to be the actuators linearity value.

The feedback components are the greatest contributor of nonlinearities in the REXA X-pac actuator. These components consist of the resistive film potentiometer, the resistance-to-current feedback board and the analog input section of the CPU. A Best Straight Line measurement will produce an unmodified linearity of approximately 1%.

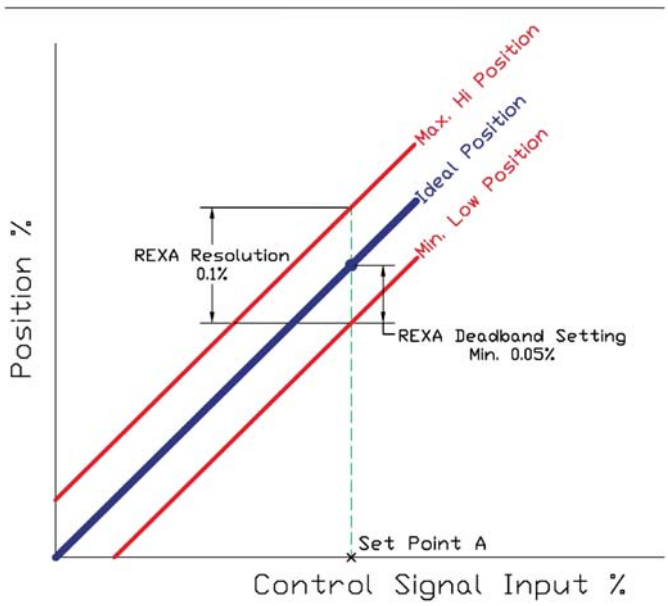
This value can be improved by implementing REXA's electronic flow characterization feature (see PM18). When this feature is turned off it forces both the 0% and 100% positions of stroke to have zero error. To enhance linearity, the flow characterization can be configured to allow an additional nine positions of zero error; these nine additional positions are user settable. A corrected actuator linearity of 0.05% is achievable with this feature. Conversely, the actuator could also be tuned for specific applications to have a non-linear output as may be required for a specific control scheme.

RESOLUTION

Positioning resolution is defined by REXA as the smallest position change an actuator can respond to. A typical REXA Xpac actuators has a resolution of <0.1% of it's full electrical travel*. Resolution of the Rexa actuator is adjustable and can be set to match the actuator's process application. This adjustment can be done by changing the dead band setting in the control parameter's menu of the CPU. The actuator moves only when the difference between the actual actuator position and the input set point is greater then the set dead band value. The worst case resolution would be two times the dead band as shown in the figure below.

For instance, on a typical 4-20 mA control range, a 12.00 mA signal and a deadband setting of 0.1% would position the actuator between 49.9% and 50.1%. If the actuator was at 50.05% of its stroke it would require a signal increase of 0.03 mA or 0.15% before repositioning. Conversely, a decrease in signal of only 0.01 mA or 0.05% would be needed before repositioning.

The 16 Bit REXA CPU allows the controller to do extensive digital averaging to insure the actuator is not reacting to noise induced on the feedback cable from any outside equipment. The trade off for improved resolution, lower dead band setting, is the potential for reading noise from the cylinder position transducer. For a 0.05% dead band setting, additional electrical shielding may be required on the transducer/cylinder feedback cable to prevent the actuator from reacting to noise.



**Full electrical travel is defined as the total travel length of the potentiometer installed in the actuator.*

REPEATABILITY

Repeatability defined by REXA is the maximum amount of deviation for any given control signal set point. Repeatability is <0.1% for a REXA X-Pac actuator. The amount below .1% will vary on multiple set up parameters like load, speed and acceleration. If the actuator ever falls outside this value it will automatically correct its position.