

ACCURACY

In closed loop process control, the accuracy of a control element has no impact on setpoint. The error of the controlled variable provides the impetus for correction. The detection of the error, the magnitude of the correction and the responsiveness of the loop are the critical factors in determining the size of the error. For most installations, the actuator is the limiting component in error correction (resolution, see **TM22**) and loop response (frequency response, see **TM11**). The **Xpac** was developed to eliminate these deficiencies in actuation and bring instrument level performance to the final control element.

Some control schemes, such as feedforward, or preestablished start-up settings may require an accurate actuator. Open loop positioning occurring often in the automation industry also needs high accuracy. The **Xpac** offers features to enhance its accuracy and positioning capability.

Various professional societies (ISA, ANSI, IEEE, etc.) provide rigorous technical definitions for accuracy and other characteristics used to determine accuracy. 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.

Accuracy rating includes the effects of linearity, hysteresis, dead band and repeatability errors. Hysteresis and dead band are usually measured together and reported as the dead band. These factors are then combined utilizing the root sum of the squares (RSS) to calculate a meaningful value for accuracy.

$$\text{Accuracy} = \sqrt{(\text{linearity})^2 + (\text{dead band})^2 + (\text{repeatability})^2}$$

With the **Xpac** actuator, the linearity of the feedback components is the greatest contributor to accuracy. These components consist of the resistive film potentiometer, the resistance-to-current feedback board and the analog input section of the digital microprocessor (PCP). A Best Straight Line measurement will produce an unmodified linearity of approximately 1%. This value can be improved by implementing REXA's electronic stroke characterization feature (see **TM18**). Standard software forces both the 0% and 100% positions of stroke to have zero error. To enhance linearity, the stroke characterization can be configured to allow an additional nine positions of zero error; one at every 10% of control signal. A corrected linearity as low as 0.05% is achievable.

The standard dead band is a user set value from 0.1% to 5%. The impact of dead band on accuracy can range from negligible to dominant. Although a minimum setting for dead band may seem logical, a number of additional factors involving process stability, signal noise and actuator maintenance must be considered.

For the majority of applications, the **Xpac** produces remarkable setpoint control. The accuracy may be modest, but low dead band is the more important operational criteria. Electronic correction of the linearity and a lower dead band (0.05%, see **TM18**) can improve the accuracy to better than 0.15%.