BALLUFF

Linear measurement terminology explained

RESOLUTION, ACCURACY, REPEATABILITY, AND PRECISION

Many linear measurement system specifications seem similar. What do they really mean?

Resolution

The output resolution of your sensing device determines the smallest possible physical change your device is able to detect. One has to distinguish here between theoretical and practical resolution. In theory, a given linear motion sensor might give you 4nm resolution, but practically, your motion system will never be able to make 4nm steps due to mechanical compliance , friction and mechanical backlash.

Low Resolution

High Resolution

Accuracy

Accuracy describes for a specific point the difference between the actual position of your drive system and the position as measured by the measurement device. The actual achievable system accuracy depends on all components of the system including mechanical tolerances and backlash, and load weight, as well as programming algorithms.

Low Accuracy – Low Repeatability

Repeatability

Repeatability (sometimes called “repeat accuracy”) is defined as the range of actual positions the system takes while being repeatedly commanded to the same location under identical conditions. Some linear measurement systems differentiate between unidirectional and bidirectional repeatability, which defines if the target has been approached from only one direction or from both.

Low Accuracy – High Repeatability

Precision

Precision is a synonym for the concept of repeatability described above.
The most difficult part in the specification of a motion or measurement feedback system is finding the right balance between all components involved to achieve the desired system performance at the best cost level. A highly accurate and repeatable measurement device alone cannot compensate for low mechanical system compliance or ineffective program logic and vice versa.

High Accuracy – High Repeatability