

Bias

Bias is the difference between the **observed** average of measurements and the **reference** value. The reference value, also known as the accepted reference value or master value, is a value that serves as an agreed-upon reference for the measured values.¹ A reference value can be determined by averaging several measurements with a higher level (e.g., metrology lab or layout equipment) of measuring equipment.

Bias is often referred to as “accuracy.” Because “accuracy” has several meanings in literature, its use as an alternate for “bias” is not recommended.

¹ ASTM D 3980-88.

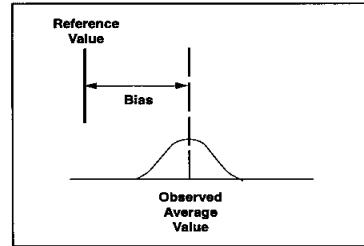


Figure 1. Bias

Linearity

Linearity is the difference in the bias values through the expected **operating range** of the gage.

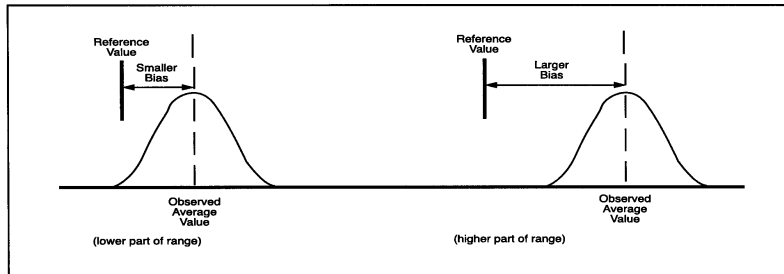


Figure 5a. Linearity

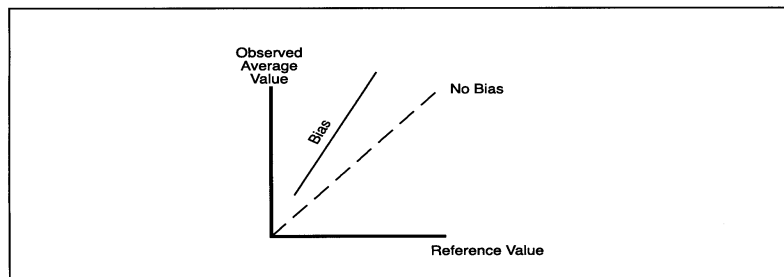


Figure 5b. Linearity (Varying Linear Bias)

Repeatability

Repeatability is the variation in measurements obtained with **one measurement instrument** when used several times by an appraiser while measuring the identical characteristic on the **same part**.

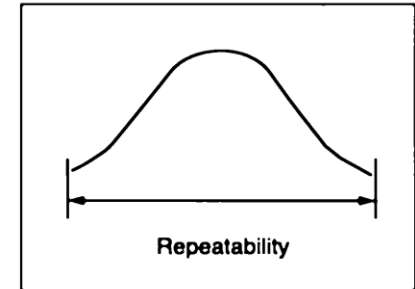


Figure 2. Repeatability

Reproducibility

Reproducibility is the variation in the average of the measurements made by **different** appraisers using the **same measuring instrument** when measuring the identical characteristic on the **same part**.

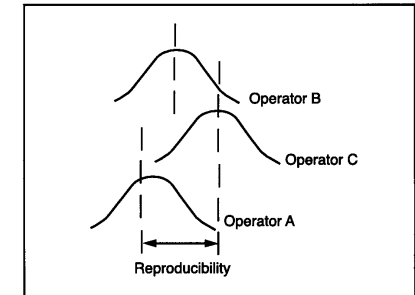


Figure 3. Reproducibility

Stability

Stability (or drift) is the total variation in the measurements obtained with a measurement system on the same master or parts when measuring a single characteristic over an extended time period.

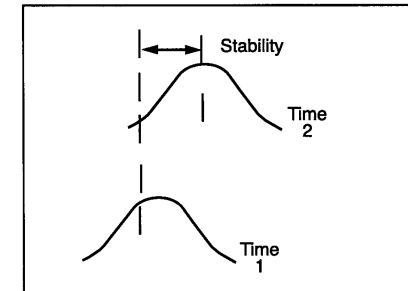
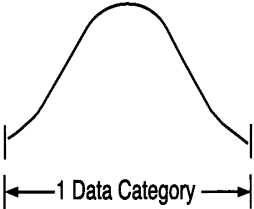
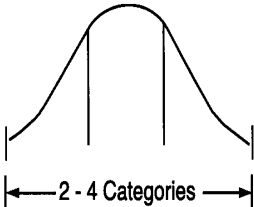
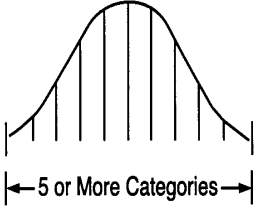
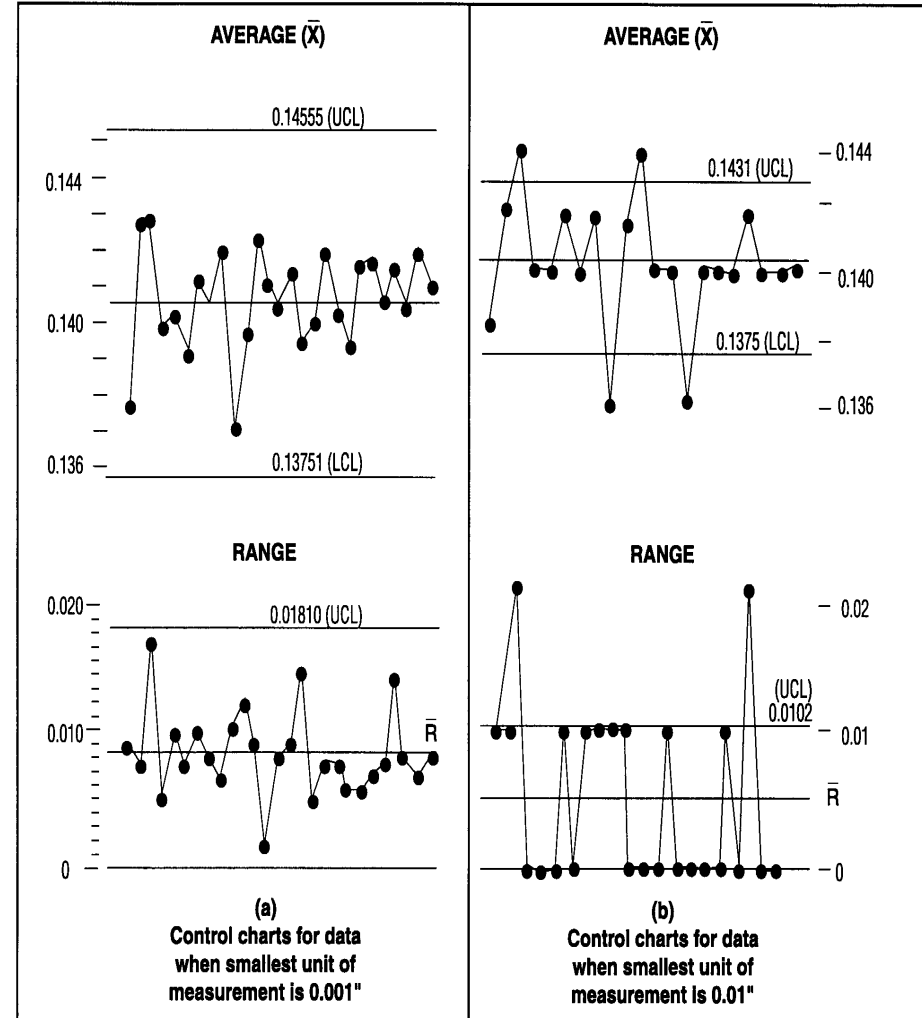


Figure 4. Stability

	Control	Analysis
 <p>← 1 Data Category →</p>	<p>Can be used for control only if</p> <ul style="list-style-type: none"> the process variation is small when compared to the specifications the loss function is flat over the expected process variation the main source(s) of process variation causes a mean shift 	<ul style="list-style-type: none"> Unacceptable for estimating process parameters and indices Only indicates whether the process is producing conforming or nonconforming parts
 <p>← 2 - 4 Categories →</p>	<ul style="list-style-type: none"> Can be used with semi-variable control techniques based on the process distribution Can produce insensitive variables control chart 	<ul style="list-style-type: none"> Generally unacceptable for estimating process parameters and indices Only provides coarse estimates
 <p>← 5 or More Categories →</p>	<ul style="list-style-type: none"> Can be used with variables control charts 	<ul style="list-style-type: none"> Recommended

Impact of Non-overlapping Data Categories of the Process Distribution on Control and Analysis Activities



Process Control Charts