STANDARD DEVIATION

The standard deviation is a measure of dispersion of a set of data to the mean. The more spread apart the data, the higher the deviation. Standard deviation is calculated as the square root of the variance. Reaction Plan Manager uses the following equation to calculate the standard deviation

$$\sigma = \sqrt{\frac{\sum\limits_{i=1}^{n}(X_i - \overline{X})^2}{n-1}}$$

σ = population standard deviation
X_i = value of sample (i)
$\overline{X}$ = mean of sample values
n = number of samples

Based on the statistical assumption the data is normally distributed (bell shaped curve) and the appropriate number of samples taken (typically 30) you can use the standard deviation to estimate process capability. By comparing the mean +/- 3 standard deviations to the nominal and tolerances you can determine if the process is capable or in other words 99.7% of the population falls within this area (see figure 1).
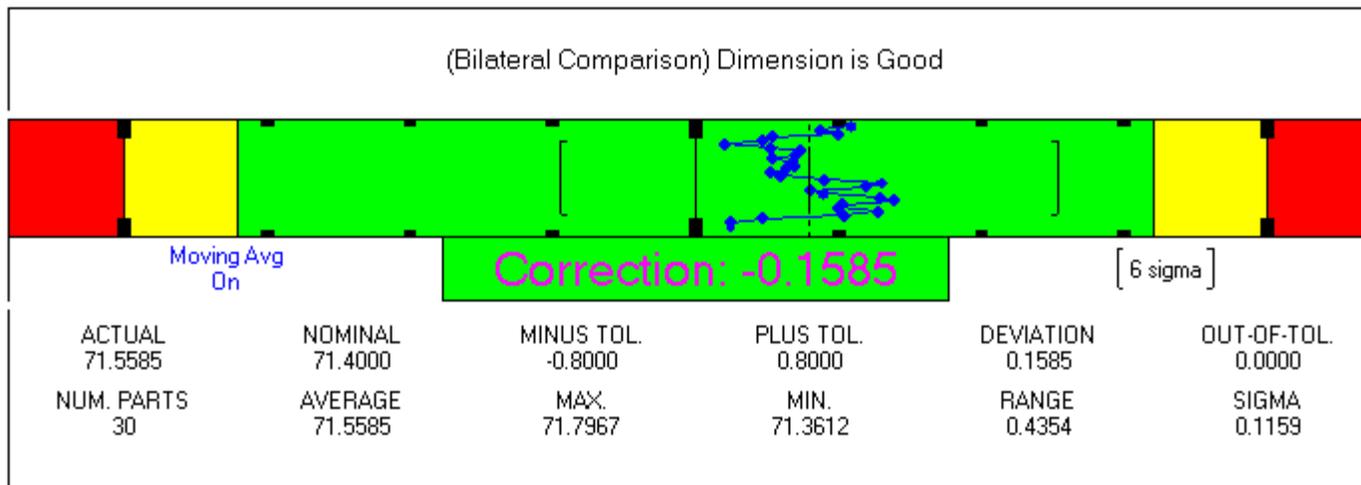

(Bilateral Comparison) Dimension is Good

Moving Avg On

Correction: -0.1585

[6 sigma]

ACTUAL	NOMINAL	MINUS TOL.	PLUS TOL.	DEVIATION	OUT-OF-TOL.
71.5585	71.4000	-0.8000	0.8000	0.1585	0.0000

NUM. PARTS	AVERAGE	MAX.	MIN.	RANGE	SIGMA
30	71.5585	71.7967	71.3612	0.4354	0.1159

Figure 1

The chart resembles a typical stats information chart. You will notice brackets "[]" centered about the mean located in the green area. The brackets represent the mean +/- 3 sigma or 6 sigma. You will also see "[6 sigma]" on the right side. This indicates that process capability monitoring is turned on. If a standard deviation bracket falls inside the percent of tolerance or out of tolerance zones the appropriate message (reaction) will be triggered. Evaluating this chart we see the mean falls on the positive side of the nominal (about 20% of the plus tolerance). The -3 sigma falls on the negative side about 25% of the minus tolerance. The +3 sigma falls about 63% of the plus tolerance. Based on their location to the nominal

and tolerances we can conclude no adjustments are required. The process is capable of running within the tolerance limits.

Triggering a Reaction – Process Capability Monitoring

The message (reaction) that is triggered is based on the standard deviation bracket that is the furthest from the nominal. For example using the chart above, if the mean was .317 (about 40% of the plus tolerance) the standard deviation bracket on the right would be in the percent of tolerance zone (yellow area) causing the percent of tolerance reaction to occur. The "RpmVar.StndDevMultiplier" is used to turn on and set the number of standard deviations to use to monitor process capability. The value is multiplied by the standard deviation. In the example above the variable was set to 3. Setting the variable to 0 turns the process capability monitor off.