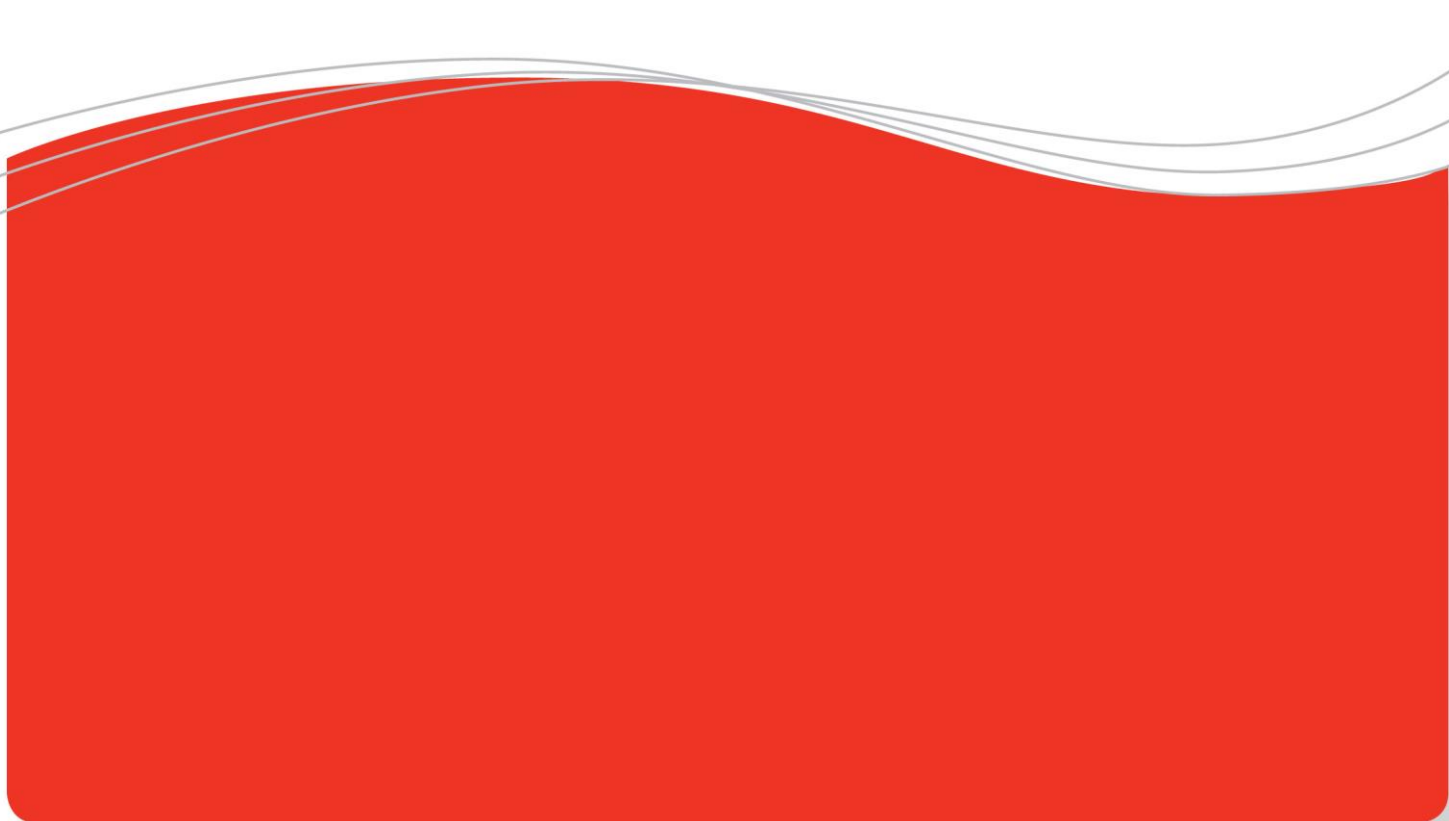




Short run SPC in DataLyzer Qualis 4.0

By Robert Flores





Short run SPC

Introduction

Short-run statistical process control, often referred to as nominals, target or DNOM charting or Z charting, is perceived as the solution for manufactures with a high mix- low volume environment. In this article we will show it should be used in a lot more environments and we also show how this can be easily realized with DataLyzer Qualis 4.0.

If companies start with SPC we often see they simply chart the product measurements which is a missed opportunity. Charting all products on different charts is not helping you to control the process. It is merely an advanced product control tool.

For example if you spray a coating on products and a lot of products have a different target and you use control charts for coating thickness you are not really controlling the process. You will hardly see that variation in the spraying process is increasing because each run will not have more than a few subgroups and there might be a lot of time between runs.

So if you chart the deviation from target you can really monitor the process. Another advantage that you only need 1 chart instead of sometimes hundreds of charts if you do SPC per product.

The introduction of an automated SPC system is exactly the right moment to start these discussions

How does Short Run SPC work

Short run statistical process control allows the user to graph several parts on the same chart instead of creating individual charts for each part.

The DNOM chart stores the deviation from target. So the chart always has a target of 0.

Before getting started there are a few simple rules that usually must be followed.

1. First, the variation of each product being measured must be similar.
2. The parts must be produced using a similar process – machine, method, and material.
3. The tolerance must be the same



If the variation is not the same or the tolerance is not the same you could in principle still use DNOM charts but you have 2 problems.

If the variation is not the same you need to work with either changing limits or if you fix the limits products with very low variation will not get any alarm signals. Although theoretically not 100% correct this might still be very useful in practice.

If the tolerance is not the same then your Ppk reports will not be correct.

In some cases you can go a step further. Instead of taking the deviation from target you can take the relative deviation from target which is (measurement – target) / target. The result will be a percentage. In literature they even go one step further and instead of dividing by the target they divide by the standard deviation for that product. So the formula is (measurement – target) / stddev. The resulting value should be between -3 and 3.

With the last option (Z-charts) you can even combine multiple characteristics in 1 chart. So 50 subgroups could show the results of 50 different measurements on a product.

The big disadvantage for Z charts is that you start to loose the operator. The operator measures 24.3 inch with a target of 24.1 and the value in the chart is 1.42 indicating the value is 1.42 * normal standard deviation above target.

How is Short Run SPC implemented in DataLyzer Qualis 4.0

This document describes how DataLyzer Qualis 4.0 has been optimized for short-run data collection and analysis.

Using the table below we will construct a short-run chart using DataLyzer Qualis 4.0 data collection module. Each sample represents the actual raw data value. The \bar{X} represents the deviation from target average. X-Target is the value plotted on the X-Bar graph.

Part A : 4.0 +/- .100 Part B: 8.20 +/- .100 Part C: 1.30 +/- .100

	Subgroup 1	Subgroup 2	Subgroup 3	Subgroup 4	Subgroup 5	Subgroup 6	Subgroup 7	Subgroup 8	Subgroup 9	Subgroup 10	Subgroup 11	Subgroup 12
Dimension	A	A	A	B	B	B	B	C	C	C	C	C
Sample 1	3.950	3.960	3.910	8.299	8.199	8.186	8.190	1.350	1.250	1.275	1.210	1.230
Sample 2	3.990	4.040	4.080	8.300	8.298	8.280	8.218	1.360	1.210	1.256	1.254	1.310
Sample 3	4.050	3.980	4.020	8.150	8.180	8.200	8.260	1.355	1.220	1.250	1.355	1.280
\bar{X}	3.997	3.993	4.003	8.250	8.226	8.222	8.223	1.355	1.227	1.260	1.273	1.273
Target	4.000	4.000	4.000	8.200	8.200	8.200	8.200	1.300	1.300	1.300	1.300	1.300
\bar{X} -Target	-0.00333	-0.00667	0.00333	0.04967	0.02567	0.02200	0.02267	0.05500	-0.07333	-0.03967	-0.02700	-0.02667

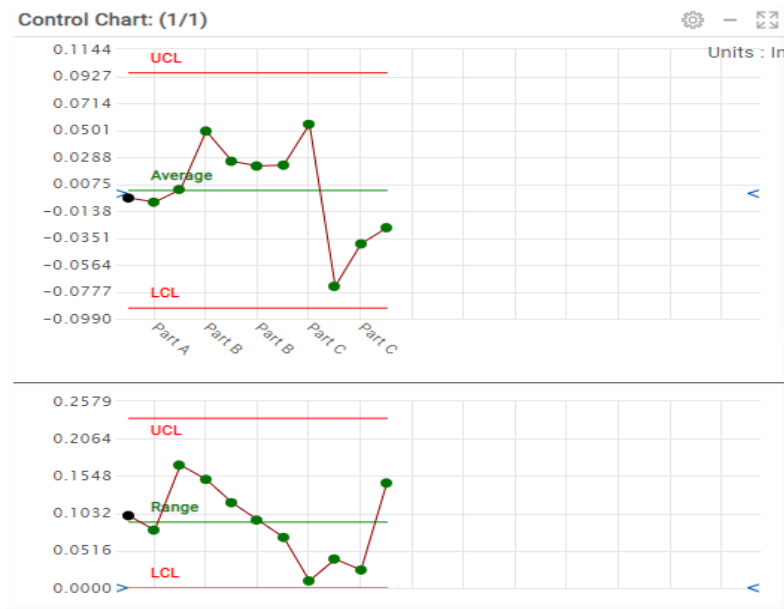


The DataLyzer Qualis 4.0 data collection module contains advanced features specifically developed for this type of application.

The data collection part name will be identified by the process name rather than the part name. Below is an example of how the short-run chart is setup. DataLyzer uses parameters as traceability markers that identify each subgroup by Lot#, Machine, Operator, Part Name, and Target value.

Subgroups #12		Parameter	
Date	2/18/2020	Lot No.	ABC
Time	5:37 pm	Machine	100
#1	-0.070	Part ID	Part C
#2	0.010	Target	1.300
#3	-0.020		

The operator will record each parameter before recording the measurements. In order to avoid errors during the data collection process, the part name parameter will appear on a catalog list. As soon as the operator records the part name a lookup table feature will reference the corresponding target value and perform the calculation subtracting the recorded value from the target automatically or even calculate the Z value in a similar way if required.



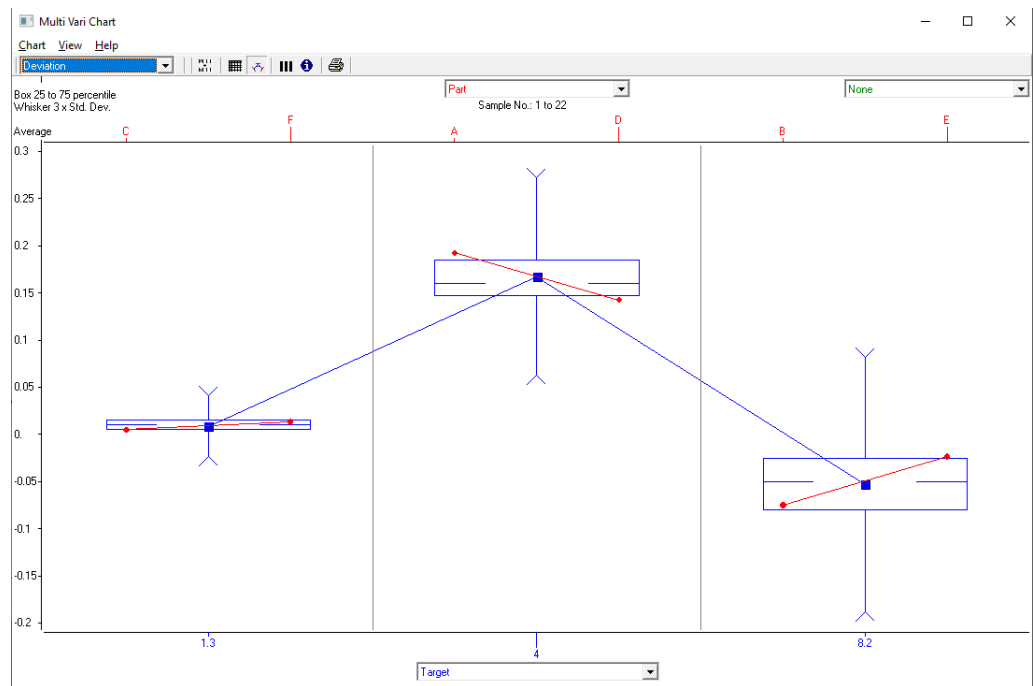


The X-axis on the control can also be configured to display each individual part number.

Reporting and Analysis

DataLyzer Qualis 4.0 analysis supports over 30 statistical charts and reports. For short run analysis the program allows all parts multiple characteristics to be plotted on the same graph along with statistical analysis of each part.

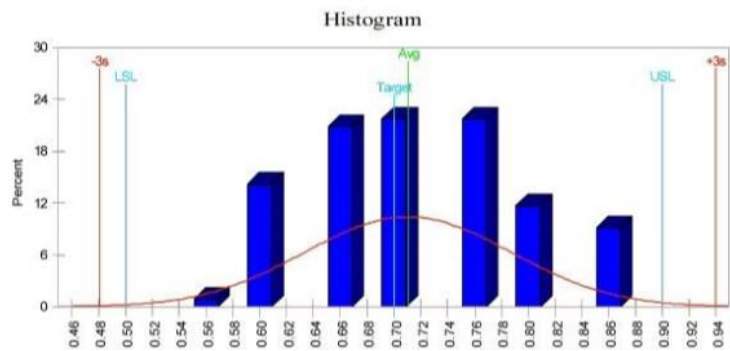
In the multi vari you can show the variation per target and show deviation of individual parts for a specific target. This gives you the opportunity to analyze processes based on technology and products.





DataLyzer filtering capabilities also allow charts to be reported by individually product or any specific selection.

CAPABILITY ANALYSIS			
For part: part 2	Part Number	Operation	Printed: 5/3/05
Plant/Department			
CHARACTERISTIC	ENGINEERING SPECIFICATIONS		
GAP_DIM "A"	50 to 90 mil, Target: 0.70		
Count:	120	Distribution type:	Normal
Average:	0.7104	Process Performance:	PP10= 0.83 PP5= 114.59% PP1= 0.87
Sigma:	0.0754		
Skewness:	0.169	Extreme values:	Lowest= 0.55 Highest= 0.85
Kurtosis:	-0.860	Number of observations off scale:	Below= 0 Above= 0
3 sigma limits:	0.4812 to 0.9396	Observations beyond specification:	Below LSL= 0.00% Above USL= 0.00%
4 sigma limits:	0.4048 to 1.0160	Predicted % out of specification:	Below LSL= 0.20% Above USL= 0.65%
		Z values:	Z-LSL= 2.75 Z-USL= 2.48



For more information: rflores@datalyzer.com