

p-Charts

- ▶ In statistical quality control, the p-chart is a type of control chart used to monitor the proportion of nonconforming units in a sample, where the sample proportion nonconforming is defined as the ratio of the number of nonconforming units to the sample size, n .

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- ▶ The p-chart only accommodates "*pass*" / "*fail*"-type inspection as determined by one or more go-no go gauges or tests, effectively applying the specifications to the data before they are plotted on the chart.
- ▶ Other types of control charts display the magnitude of the quality characteristic under study, making troubleshooting possible directly from those charts.

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Assumptions The binomial distribution is the basis for the p-chart and requires the following assumptions:

- ▶ The probability of nonconformity p is the same for each unit; Each unit is independent of its predecessors or successors;
- ▶ The inspection procedure is same for each sample and is carried out consistently from sample to sample

Calculation and plotting

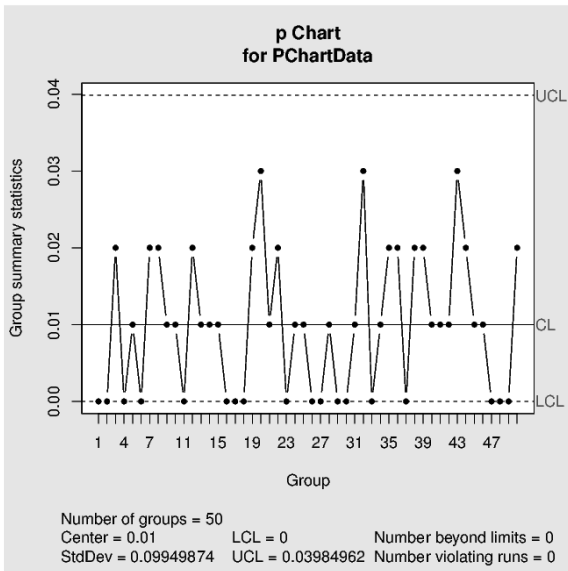
- ▶ The control limits for this chart type are

$$\bar{p} \pm 3\sqrt{\frac{\bar{p}(1 - \bar{p})}{n}}$$

where \bar{p} is the estimate of the long-term process mean established during control-chart setup.

- ▶ Naturally, if the lower control limit is less than or equal to zero, process observations only need be plotted against the upper control limit.

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Note that observations of proportion nonconforming below a positive lower control limit are cause for concern as they are more frequently evidence of improperly calibrated test and inspection equipment or inadequately trained inspectors than of sustained quality improvement.

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- ▶ Some organizations may elect to provide a standard value for p , effectively making it a target value for the proportion nonconforming.
- ▶ This may be useful when simple process adjustments can consistently move the process mean, but in general, this makes it more challenging to judge whether a process is fully out of control or merely off-target (but otherwise in control).

Potential pitfalls

There are two circumstances that merit special attention:

- ▶ Ensuring enough observations are taken for each sample
- ▶ Accounting for differences in the number of observations from sample to sample