

SOFTWARE

CHROMATEC ANALYTIC

BUILD 4.0

USER MANUAL

214.00045-51I

SHEWHART CONTROL CHART

Revision 13.11.2023

Table of contents

1 Introduction 4
1.1 Basic concepts 4
1.2 Features of the implementation of charts in Chromatec Analytic 5
2 Method creation 6
3 Compilation of control charts 7

1 INTRODUCTION

The purpose of the Shewhart control chart application is to detect unnatural changes in data from repetitive processes and provide criteria for detecting the lack of statistical controllability. The task of statistical process management is to ensure and maintain processes at an acceptable and stable level, ensuring that products and services meet the established requirements.

1.1 Basic concepts

The text of this section is quoted according to GOST R ISO 7870-2-2015.

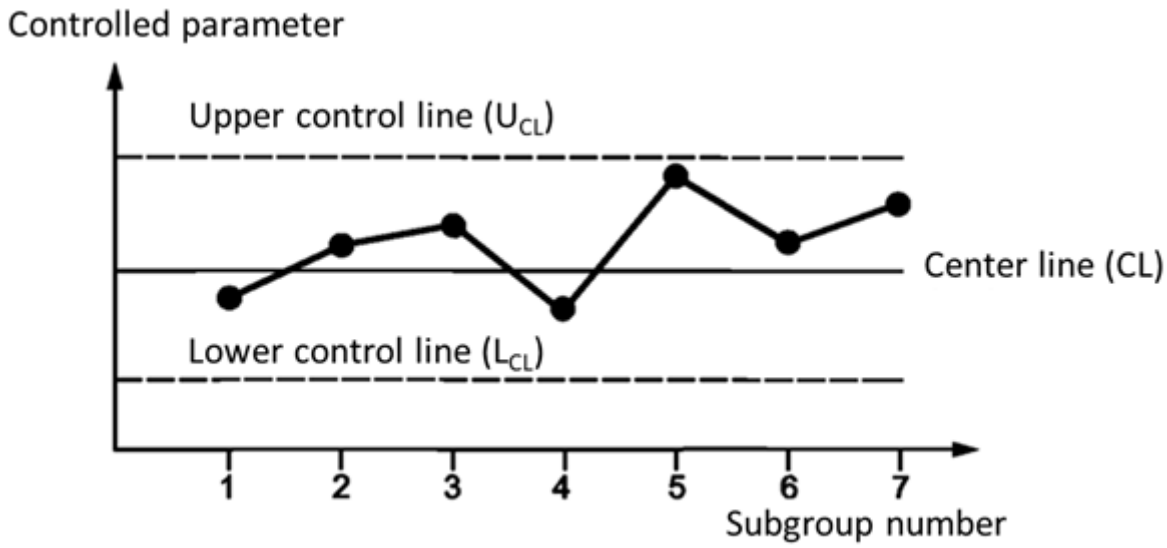
The Shewhart control chart is a graph that is used to represent a statistical measure obtained from quantitative or alternative data.

Shewhart control chart require data obtained selectively from the process at approximately equal intervals. The intervals can be set either by time (for example, every hour) or by the quantity of products (each batch). Usually, the data are samples or subgroups consisting of the same type of units of products or services, with the same controlled indicators and equal volumes of subgroups. For each subgroup, one or more characteristics are determined, such as the arithmetic mean X span R, standard deviation s, or a counting characteristic, such as the proportion of units of a given class.

Shewhart control chart is a graph of the values of a given characteristic of a subgroup in accordance with the number of the subgroup. The map has a center line (CL) corresponding to the reference value of the characteristic. When determining the state of statistical controllability of a process, the arithmetic mean of the statistical indicator used is usually used as a reference value. When controlling a process, the reference value may be the characteristic value set in the technical specifications, a value based on previous information about the process that was in a controlled state, or the intended target value of the product or service characteristic.

Shewhart control chart has two statistically determined control boundaries located on both sides of the center line, which are called the upper control line (U_{CL}) and the lower control line (L_{CL}). The control boundaries on Shewhart control chart are located at a distance of 3σ on both sides of the center line, where σ is the known standard deviation of the population or its estimate. Shewhart decided to use control boundaries at a distance of 3σ from the center line, taking into account economic considerations regarding the balance of costs for finding process problems when such problems do not exist, and non-detection of problems when the functioning of the process does not meet the requirements. The location of borders too close to the center line can lead to the false detection of a large number of problems (not really existing), and the location of borders too far from each other increases the risk of false non-detection of problems (actually occurring). If the statistics follow a normal distribution, the boundaries at a distance of ± 3σ from the center line show that approximately 99.7% of the statistical values will fall within these limits, provided that the process is in a statistically controlled state.

In other words, the probability that a point on the map will be outside the control boundaries when the process is stable is approximately 0.003 (or an average of three per thousand cases). The word "approximately" is used because deviations from assumptions, such as the type of distribution of the source data, affect the probability values. In fact, the choice of k in determining the control boundaries (± kσ) instead of +3σ depends on the ratio of the costs of research and the implementation of the necessary actions and the costs incurred as a result of non-implementation of actions.



1.2 Features of the implementation of charts in Chromatec Analytic

The program allows you to create control charts in accordance with the methods:

GOST R ISO 7870-2-2015. Statistical methods. Controlled cards. Frequency 2. Shewhart control chart. embedded instead of GOST R 50779.42-99.

- Charts of individual values and sliding swings.
- Charts of medians and spans.
- Charts of medium and wide.
- Charts of mean and sample standard deviations.

GOST 30536-2013. Vodka and ethyl alcohol from food raw materials. Gas chromatographic express method for determining the content of toxic trace elements. Interstate standard.

GOST R 51698-2000. Vodka and ethyl alcohol from food raw materials. Gas chromatographic express method for determining the content of toxic trace elements.

GOST 31371.1-2008. Natural gas. Determination of the composition by gas chromatography with uncertainty estimation. Part 1. Guidelines for the analysis.

GOST 31371.7-2008. Natural gas. Determination of the composition by gas chromatography with uncertainty estimation. Part 7. Methodology for measuring the molar fraction of components.

The initial data for building control maps can be obtained from the Chromatec Analytic 3.0 project or entered manually.

Shewhart control charts application is built into Chromatec Navigator and is always available.

2 METHOD CREATION

Working with control charts begins with creating a method. The method here is a set of settings describing the charts.

{video shewhart_method Shewhart control charts method}

The program can be used not only for statistical analysis of chromatographic data. If you want to upload any other data, check the box - "Data is entered manually". In this case, the project is not selected.

- Parameters for rounding numbers in the table.
- Page orientation – portrait or landscape.
- Page margins.
- Font size.
- Font type.
- The date style is just a date (e.g. 2023-05-10) or a date and time (2023-05-10 11:43:12).



If you do not need to create charts for all components, you can delete the extra ones on the Components tab.

3 COMPILATION OF CONTROL CHARTS

{video shewhart_input_data Shewhart control charts input data}

If the "Data is entered manually" option is enabled in the method settings, you can enter data directly in the table.

The report is saved automatically and is available on the Reports page in Chromatec Navigator.