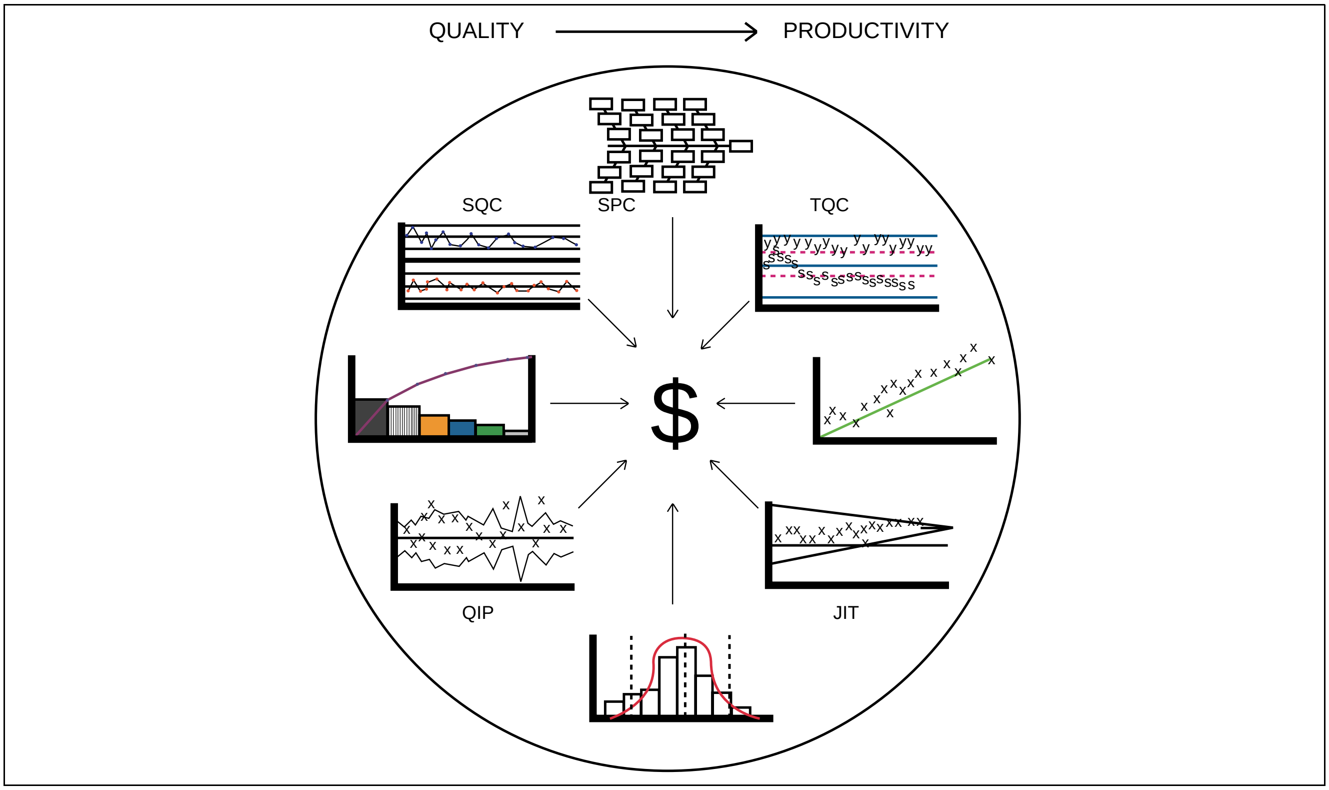
PSS 21S-6C3 B3

I/A Series Information Suite
AIM*SPC Statistical Process Control



INTRODUCTION

AIM*SPC provides on-line displays of charts and other Statistical Process Control (SPC) tools for process variables. With AIM*SPC, you can configure different charts for each variable and test some charts against Statistical Control Rules to determine the not in statistical control state of a variable.

You can filter data for specific batch or product types, or filter out bad data. Cause and Effect Diagrams (CEDs) can be configured with charts and text for operator use or for diagnostic studies. These displays can also be linked to each other. Thus, you can create a multilevel hierarchy by drilling down to lower levels of detail, isolating problem causes and taking the appropriate corrective action.

Where AIM*SPC Fits in Your Plant Operation

Figure 1 shows where AIM*SPC fits in relation to other process plant operations or facility management functions, such as production planning, performance accounting, and statistical process control.

Consider the spectrum of processes from nondynamic processes such as automobile manufacturing to dynamic processes like oil refining. AIM*SPC applies directly to the measurements and actuators of the nondynamic processes, while for dynamic processes, it applies at the point where the variables have been made essentially steady state by traditional process control. In general, AIM*SPC provides open loop advisory capability for the analysis of quality problems in a plant.

AIM*SPC is applicable at steady state, where the variations in process and quality variables are predominantly random.

AIM*SPC supports an on-line, on-demand analysis capability for data on all process variables that are collected by local historians. It also supports analysis of manually entered data.

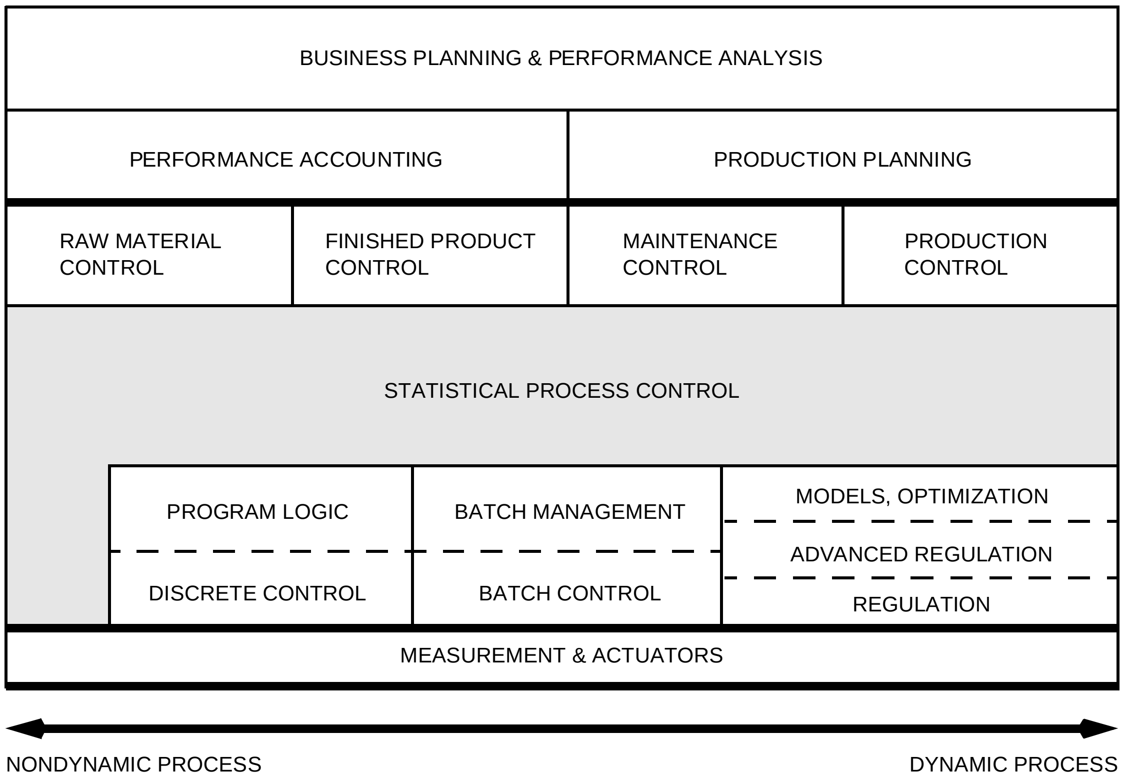


Figure 1. Relationship to Other Process Operations

Figure 2 gives an overview of AIM*SPC functions. Local historians collect and store in databases the value, date/time, and status of plant variables. These real-time databases are always tied to the current time. When AIM*SPC charts and other analysis tools are requested, they automatically access data from the current time backward to some time in the past. Real-time data processing allows you to respond quickly when necessary.

When requested for display and analysis, the AIM*SPC charts and other tools access variables from the current time as far back as required by the subgroup size, type, and number (count). Once a chart is displayed, you can move both forward or backward in time by one subgroup or half of the chart and then redisplay the chart. You can also change the starting time of data access, either temporarily or permanently via on-line reconfiguration. Thus, you can readily move on-line through the whole history of a charted variable.

AIM*SPC uses the following four types of information:

- Quality Variables – Examples are viscosity, composition, density, melt index, and brightness. They are used in Xbar and Range, Xbar and Sigma, Individuals, CUSUM, and Cumulative Sum charts to monitor product quality.
- Causal Variables – Examples are flow, temperature, pressure, and feed composition. They are used in Xbar and Range, Xbar and Sigma, Individuals, CUSUM, and Cumulative Sum charts to monitor and determine the cause of poor product quality.
- Attributes – Examples are sample size and fraction and number of defective items, and unit size and number of defects and defects per unit. They are used in P, NP, C, and U charts to monitor end (final) product and overall process performance.
- Causal Relationships – These consist of text information. They are organized and displayed in CEDs.

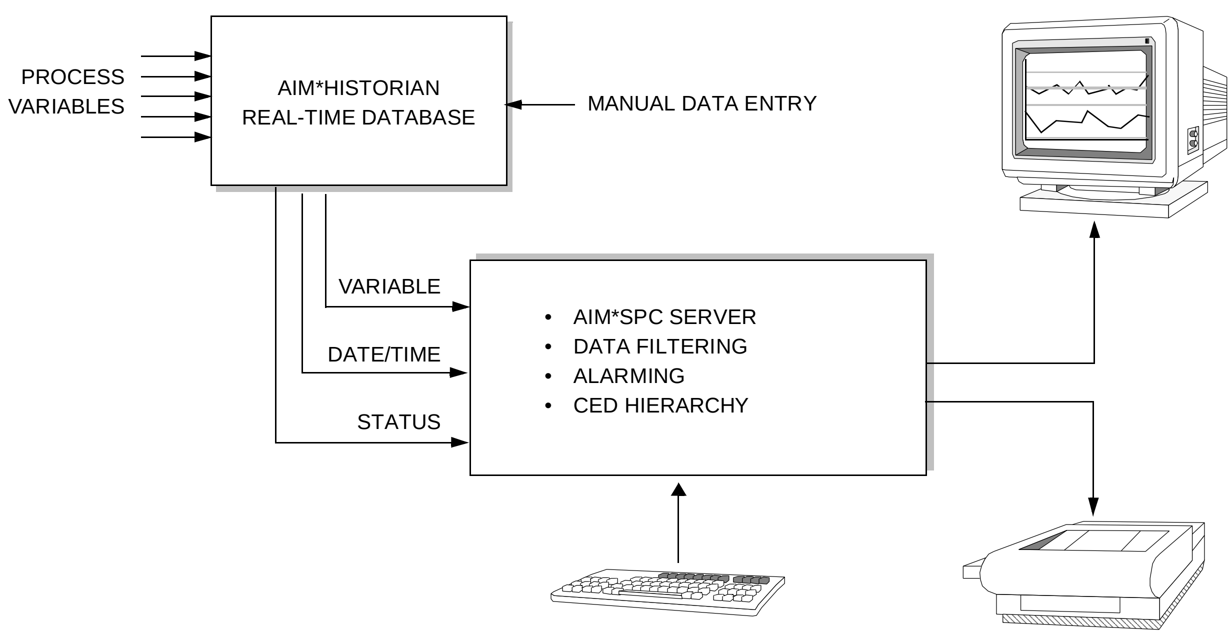


Figure 2. AIM*SPC Functional Overview

AIM*SPC TOOLS

AIM*SPC charts and other analysis tools access data from real-time databases that consist of quality and causal variables, attribute variables, and causal relationships. Therefore, AIM*SPC tools can be classified according to variable and analysis types as follows:

AIM*SPC Tools for Quality and Causal Variables

Tools to analyze and monitor individual samples are:

- Individuals Histogram
- Individuals Chart
- Scatter Diagram for Auto-Correlation.

Tools to analyze and monitor subgrouped samples are:

- Xbar Histogram
- Xbar and Range Chart
- Xbar and Sigma Chart
- CUSUM Chart
- Cumulative Sum Chart.

AIM*SPC Tools for Attribute Variables

Tools to monitor fraction and number defects are:

- P Chart
- NP Chart.

Tools to monitor defects and defects per unit are:

- C Chart
- U Chart.

AIM*SPC Data Filtering

AIM*SPC data filtering ignores bad or unwanted variable data in SPC calculations.

- Data filtering is controlled by up to four separate variables.
- SPC data can be filtered by product, batch or lot ID.
- Ignored data can be charted as yellow triangles or removed completely.

AIM*SPC Tools for Cause and Effect Analysis

These tools are:

- Scatter Diagram for Cross-Correlation
- Pareto Diagram
- Cause and Effect Diagram.

PLANT ORGANIZATION USING CAUSE AND EFFECT DIAGRAMS

Figure 3 shows a Cause and Effect Diagram, which is also called a fishbone diagram because of its structure. The CED is used to document and classify the relationships between effects and their causes. The head of the fish indicates a specific effect whereas the labels on the bones indicate the causes.

For distributed control and information systems supported by communication networks, the CED not only documents the effect and its related causes, but also serves as a dynamic information access mechanism. You achieve this by linking charts, text files, or other CEDs to each cause and effect box.

The ability to link cause and effect diagrams to other cause and effect diagrams lets you build up a hierarchy of cause and effect relationships that mirror the complexity of plant organizations. Each cause and effect box is an active screen area for accessing related charts and text. Click a cause box to view the information linked to it.

Multilevel CEDs

Hierarchical CEDs give the operator a diagnostic tool that mirrors the hierarchical organization of a complex, multiprocess plant. The lowest level of CEDs might reflect the individual components of one process or machine. The next level might cover all the production processes for a single line or product. The top level might encompass the entire building or plant. When a problem arises – for example, a quality variable for a product is out of control – the operator can “drill down” to successively more detailed levels of CEDs until the cause is determined.

The text files provide information for the operator about a cause variable and its effect, as well as guidance for corrective action.

You can attach any of the AIM*SPC charts and analysis tools that use the real-time databases to the cause and effect boxes.

In Figure 3, the effect box represents the effect, and cause boxes 1 through 24 represent the causes. Each box is labelled so it can be identified.

You can link as many as four charts, other CEDs and/or text files to the effect box and to each cause box.

If only one chart, CED, or text file is linked to a box, selecting the box displays the linked object. If more than one object is linked to a box, selecting the box displays a menu which lists the names of the linked charts, CEDs and text files that you can select for display.

You can also divide a typical plant or process into areas and units. Therefore, you can configure the CEDs for the plant, areas, and units.

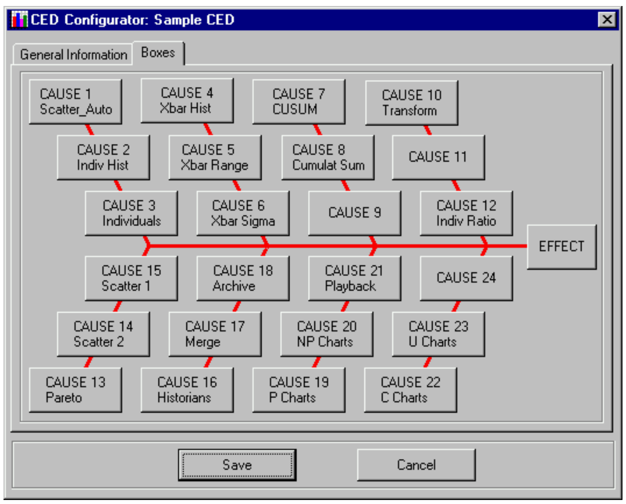


Figure 3. Cause and Effect Diagram

OTHER AIM*SPC FEATURES

Other main features of AIM*SPC are:

- Three ways of forming subgroups for chart calculations:
  - Size – Divide a group of values into consecutive subgroups of size n
  - Size n, Skip m – Choose n consecutive values for the subgroup, then skip m consecutive values
  - Moving Subgroups of Size n
- Up to 11 statistical control rules per chart to determine out of statistical control states in chart displays
- Chart points that violate one or more rules are displayed as oversized, red-colored symbols
- Chart overlay that displays rule violations, chart calculations, and other parameters
- User-entered notes for a specific chart and time are available from chart displays and reports, as shown in Figure 4.

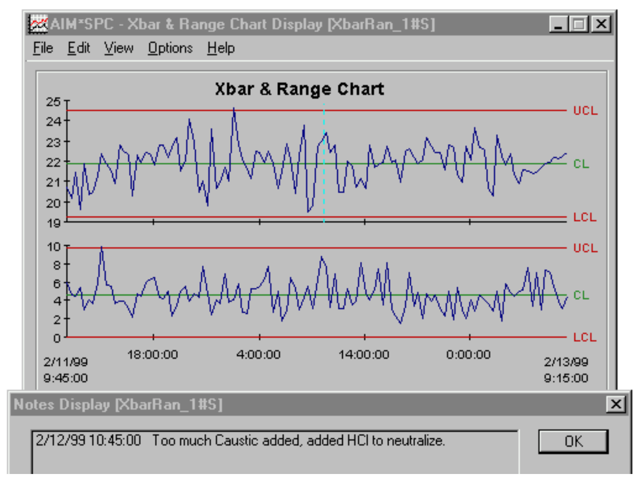


Figure 4.
Xbar and Range Chart with Rule Violation and Note

- Access to Historian sample, reduction, and user-entered data
- PC clients
- Data filtering
- Chart movement backward or forward in time throughout the database
- On-line reconfiguration of certain chart parameters on the chart display, either temporarily or permanently
- Mathematical transformations on collected variable samples
- Option to build charts for the ratio of two variables or for data sets formed by merging samples from several variables
- Official and/or calculated values for the mean and standard deviation to evaluate rules and compute limits
- Optional display of the target, upper, and lower specification limits on the chart
- Generation of screen images and reports containing charts, raw values, calculated values, and notes
- Configuration of charts and CED displays, with on-line configuration editing and reporting
- Individuals Histogram for determination of normality and calculation of process capability indices for individual samples
- Xbar Histogram for determination of normality and calculation of process capability indices for subgroup mean values
- Scatter diagram for cross-correlation of variables with optional time shift
- Scatter diagram for auto-correlation of a variable with selected time shift
- Pareto diagram that plots the number of occurrences of rejection and the percent contribution for up to 16 causes of rejection for a product

To evaluate the rules and compute the control limits,. you can use official or calculated values for the mean and/or standard deviation.

Official values are obtained for a variable by moving in time through the database, selecting a set of samples as the standard set to judge the future, and computing the required official values.

Mathematical transformations are useful when the variable itself is not normally distributed, but a function of the variable is normally distributed. For example, a log-normal distribution is transformed to normal via the natural log function.

As an aid to the operator, AIM*SPC chart displays perform up to 11 statistical control rule checks and inform the operator if the plotted data is out of statistical control.

First, you select and observe the charts for a product quality variable and interpret them. Next, you use the CEDs to access variables that cause out of statistical control states. Then, you observe the charts for those variables and implement the necessary control actions.

Typical control actions consist of:

- Changing appropriate variable set points and/or targets
- Retuning the controllers, and modifying associated control functions
- Improving control of upstream units to minimize the introduction of systematic variation into the downstream process.

AIM*SPC CHARTS AND TOOLS

AIM*SPC provides 13 types of charts and tools:

- Individuals Chart
- Xbar and Range Chart
- Xbar and Sigma Chart
- Cumulative Sum Chart
- CUSUM Chart
- Individuals Histogram
- Xbar Histogram
- P Chart
- NP Chart
- C Chart
- U Chart
- Scatter Diagram
- Pareto Diagram.

AIM*SPC charts and tools define all information necessary to:

- Retrieve collected process data for ratioing, merging, transformation, and subgrouping
- Perform the statistical calculations appropriate to the chart type
- Plot and display the results
- Apply statistical control rules to the data to determine when the variable is out of statistical control.

The chart display presents the chart, as configured, and allows the operator or analyst to:

- Display chart help text
- Display chart parameters
- Change chart parameters, either temporarily or permanently
- Display the results of internal chart calculations
- Change screen background color to white for printing
- Print a standard chart report.

Optionally, you can display the target and upper and lower specification limits on the chart.

In the charts, the central line (mean) is labelled CL, when calculated from the data. When based on the official mean, it is labelled OCL.

In the charts, the upper and lower control limits are labelled UCL and LCL, when based on the calculated sigma. When based on the official sigma, they are labelled OUCL and OLCL.

Individuals Chart

Figure 5 shows the Individuals chart. It is a plot of a group of individual measurement values versus time or subgroup, together with their mean and the upper and lower control limits. The subgroup size is always **1** for this chart.

The software can calculate the mean and control limits from the actual data, or it can base them on official values of the mean and standard deviation (sigma).

When the chart is displayed, the software checks up to 11 preconfigured rules for violations and displays the results.

You can also display the target (TAR), upper specification limit (USL), and lower specification limit (LSL) on the chart, along with the calculated or official central line (mean) and calculated or official control limits.

You can apply any one of the variable transformations listed on page 17 to the values for this chart, except for merge.

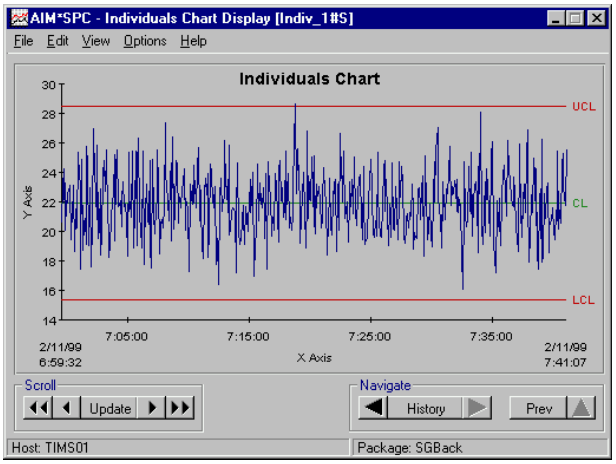


Figure 5. Individuals Chart

Xbar and Range Chart

Figure 6 shows the Xbar and Range chart, which is a double chart. The upper chart is a plot of subgroup mean values versus time or subgroup, together with their mean value (the grand mean), and the upper and lower control limits.

The lower chart is a plot of subgroup range values versus time or subgroup, together with the range mean and the range upper and lower control limits.

The software can calculate the mean and control limits from the actual data, or base them on official values of the Xbar mean and range mean.

When the chart is displayed, the software checks up to 11 preconfigured rules for violations and displays the results.

You can also display the targets, upper specification limits, and lower specification limits on the chart, along with the calculated or official central lines (means) and calculated or official control limits.

You can apply any one of the variable transformations listed on page 17 to the values for this chart.

Xbar and Sigma Chart

Figure 7 shows the Xbar and Sigma chart, which is a double chart. The upper chart is a plot of subgroup mean values versus time or subgroup, together with their mean value (the grand mean), and the upper and lower control limits.

The lower chart is a plot of subgroup sigma values versus time or subgroup, together with the sigma mean and the sigma upper and lower control limits.

The software can calculate the mean and control limits from the actual data, or base them on official values of the mean and sigma.

When the chart is displayed, the software checks up to 11 preconfigured rules for violations and displays the results.

You can also display the targets, upper specification limits, and lower specification limits on the chart, along with the calculated or official central lines (means) and calculated or official control limits.

You can apply any one of the variable transformations listed on page 17 to the values for this chart.

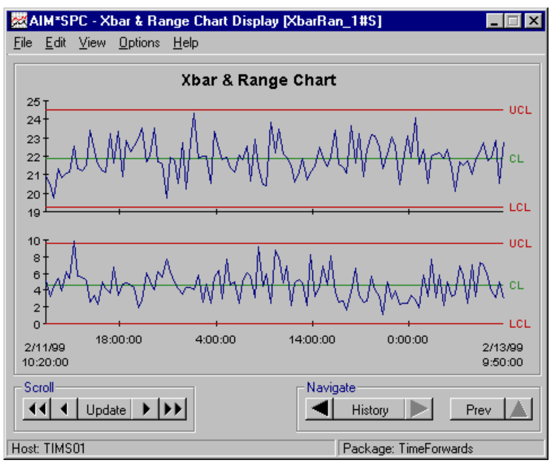


Figure 6. Xbar and Range Chart

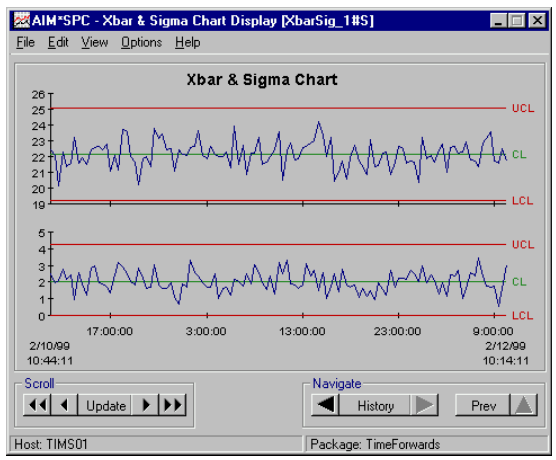


Figure 7. Xbar and Sigma Chart

Cumulative Sum Chart

Figure 8 shows the Cumulative Sum Chart, which displays the cumulative deviation of the subgroup mean from the target value.

The chart control limits are in the form of a V-mask that provides a 2-sided decision criteria similar to the 3-sigma limits of the Xbar chart.

The software can calculate the standard deviation of the mean values from the actual data, or base them on official values of the mean and sigma.

You can apply any one of the variable transformations listed on page 17 to the values for this chart.

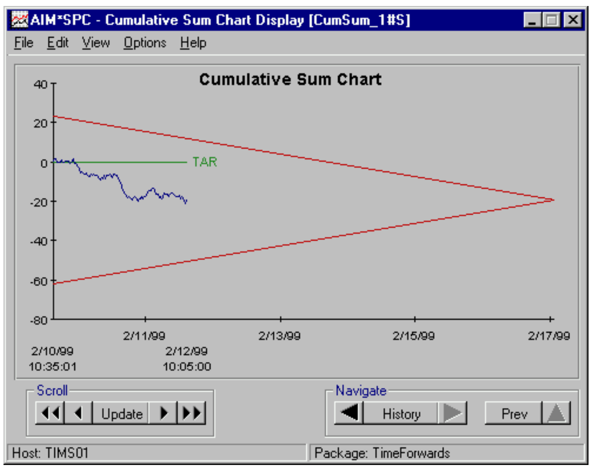


Figure 8. Cumulative Sum Chart

CUSUM Chart

Figure 9 shows the CUSUM Chart, which displays the cumulative deviation of the subgroup mean from the target value, divided by the sample standard deviation of the subgroup.

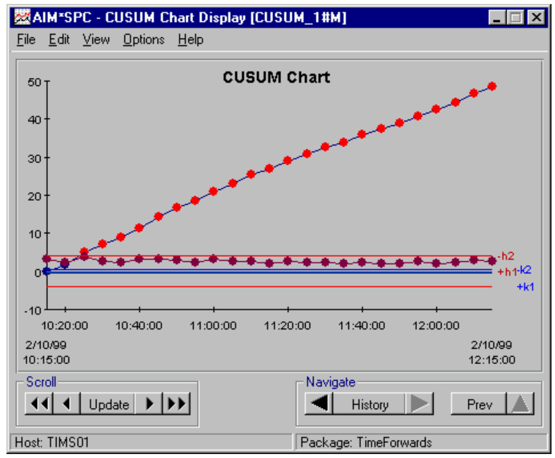


Figure 9. CUSUM Chart

This chart is a plot of *S* and *Y* versus time or subgroup where:

S = cumulative deviation value

Y = [(subgroup mean) – target] + standard deviation.

The chart also shows the target value (TAR), decision intervals (h1 and h2), and slack values (k1 and k2).

You can apply any one of the variable transformations listed on page 17 to the values for this chart.

Individuals Histogram

Figure 10 shows an Individuals Histogram with the normal curve superimposed. This chart is a frequency distribution of a set of data. It is a plot of the count of points as a function of value.

The software calculates the standard deviation of the data and uses this value and the mean to plot the superimposed normal curve.

This chart also shows the target (TAR), upper specification limit (USL), and lower specification limit (LSL). You enter these values.

You can use the Individuals Histogram for process capability analysis and determination of the normality of data. The software calculates the standard capability indices, as well as mean, standard deviation, skewness, kurtosis and percent out of specification.

You can apply any one of the variable transformations listed on page 17 to the values for this chart, except for merge.

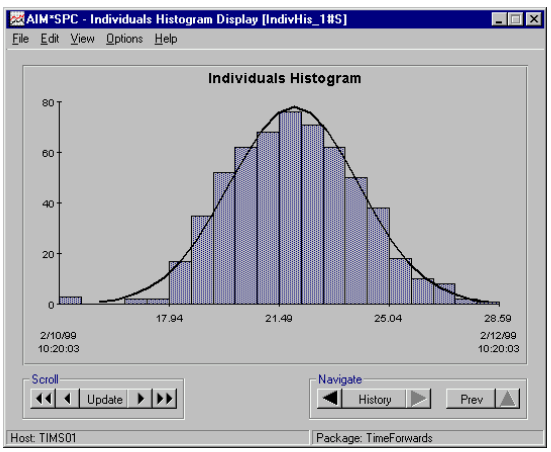


Figure 10. Individuals Histogram

Xbar Histogram

Figure 11 shows an Xbar Histogram with the normal curve superimposed. This chart is a frequency distribution of a set of subgroup means. It is a plot of the count of means as a function of value.

The software calculates the standard deviation of the data and uses this value and the mean to plot the superimposed normal curve.

This chart also shows the target (TAR), upper specification limit (USL), and lower specification limit (LSL). You enter these values.

You can use the Xbar Histogram for process capability analysis and determination of the normality of data. The software calculates the standard capability indices, as well as mean, standard deviation, skewness, kurtosis and percent out of specification.

You can apply any one of the variable transformations listed on page 17 to the values for this chart.

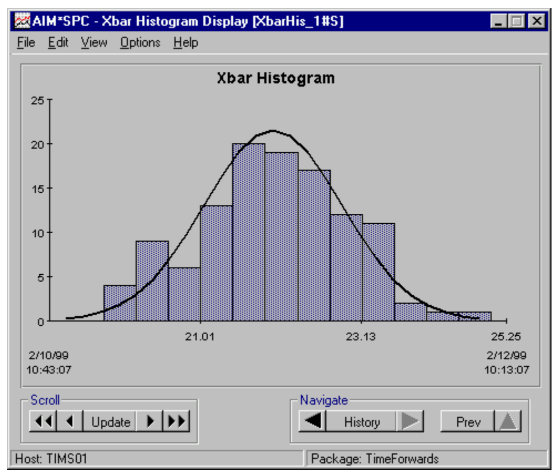


Figure 11. Xbar Histogram

P Chart

Figure 12 shows the P Chart. It is a plot of the fraction of defective items versus time or subgroup, together with the mean value and upper and lower control limits.

The P chart is useful when the number of tested items varies from sample to sample, that is, subgroup to subgroup. When the number of tested items per subgroup is constant, the NP chart shown in Figure 13 is used instead of the P chart.

Optionally, you can plot percent defective instead of fraction defective.

The software can calculate the mean and control limits from the actual data, or it can base them on official values of the mean and sigma.

When the chart is displayed, the software checks up to 11 preconfigured rules for violations and displays the results.

You can also display the target (TAR), upper specification limit (USL), and lower specification limit (LSL) on the chart, along with the calculated or official central line (mean) and calculated or official control limits.

This chart does not use any variable transformations.

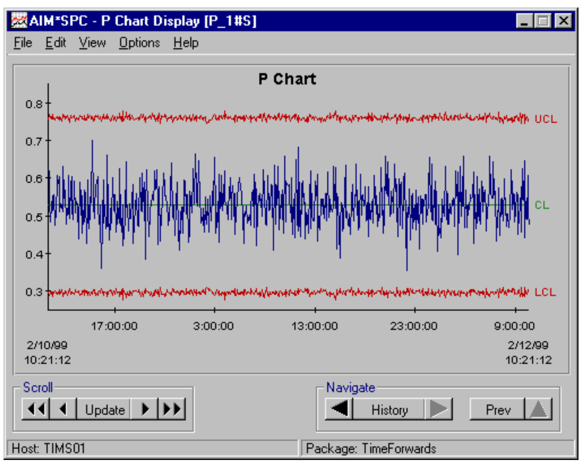


Figure 12. P Chart

NP Chart

Figure 13 shows the NP Chart. It is a plot of the number of defective items versus time or subgroup, together with the mean value and the upper and lower control limits.

The NP chart is useful when the number of tested items per subgroup is constant, as specified by the subgroup size parameter. When the number of tested items per subgroup varies, the P chart is used instead of the NP chart.

The software can calculate the mean and control limits from the actual data, or it can base them on official values of the mean and sigma.

When the chart is displayed, the software checks up to 11 preconfigured rules for violations and displays the results.

You can also display the target (TAR), upper specification limit (USL), and lower specification limit (LSL) on the chart, along with the calculated or official central line (mean) and calculated or official control limits.

This chart does not use any variable transformations.

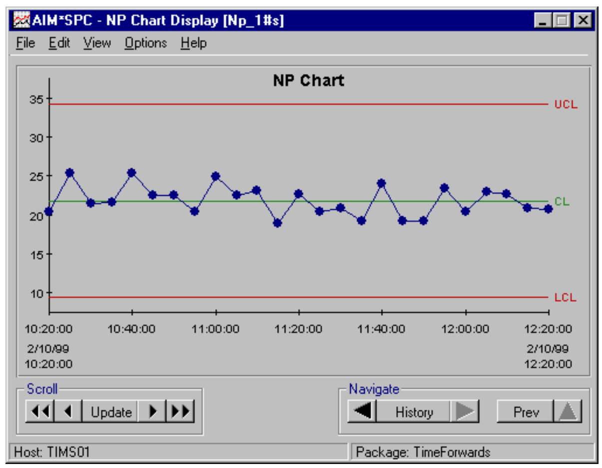


Figure 13. NP Chart

C Chart

Figure 14 shows the C Chart. It is a plot of the number of defects versus time or subgroup, together with the mean value and the upper and lower control limits.

The C chart is useful when the unit size is constant. An example is the number of defects in a yard of cloth, where the unit size is a yard of cloth every time. When the unit size varies, the U chart is used instead of the C chart. See Figure 15.

The software can calculate the mean and control limits from the actual data, or it can base them on *official values* of the mean and sigma.

When the chart is displayed, the software checks up to 11 preconfigured rules for violations and displays the results.

You can also display the target (TAR), upper specification limit (USL), and lower specification limit (LSL) on the chart, along with the calculated or official central line (mean) and calculated or official control limits.

This chart does not use any variable transformations.

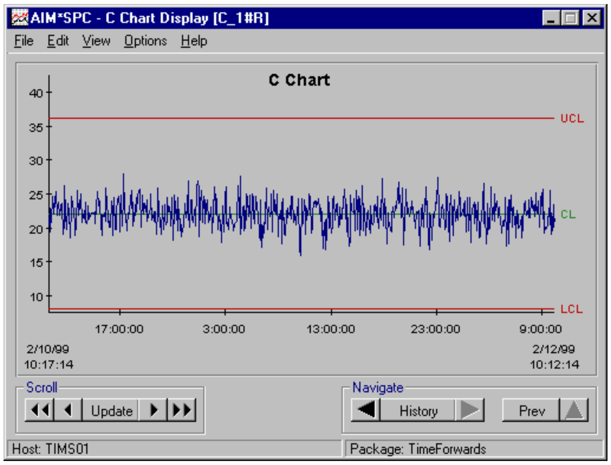


Figure 14. C Chart

U Chart

Figure 15 shows the U Chart which is a plot of the number of defects per unit versus time or subgroup, together with the mean value and the upper and lower control limits.

The U chart is useful when the unit size varies. An example is the number of defects per yard of cloth where the unit size is 1 yard of cloth for the first subgroup, 1.35 yards of cloth for the second subgroup, and so on. When the unit size is constant, the C chart shown in Figure 14 is used instead of the U chart.

The software can calculate the mean and control limits from the actual data, or it can base them on official values of the mean and sigma.

When the chart is displayed, the software checks up to 11 preconfigured rules for violations and displays the results.

You can also display the target (TAR), upper specification limit (USL), and lower specification limit (LSL) on the chart, along with the calculated or official central line (mean) and calculated or official control limits.

This chart does not use any variable transformations.

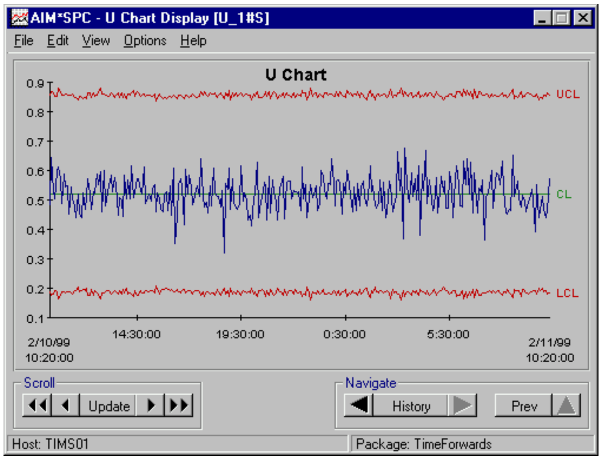


Figure 15. U Chart

Scatter Diagram

Figure 16 shows the Scatter Diagram. This diagram is a plot of one variable against another or itself, with a computed linear regression line superimposed on the plot. This diagram displays, graphically and with a computed value, the cross-correlation between two variables or a variable's auto-correlation. An optional time shift compensates for the time delay between these variables.

The Scatter Diagram provides a visual display of the correlation between the two variables. The software computes and displays the value of the cross-correlation coefficient to provide a quantitative measure of the correlation between the variables. The software also computes and plots a linear regression line on the diagram.

The software can also plot a variable against itself on the Scatter Diagram, thus showing, graphically and with a computed value, its auto-correlation. You can configure the diagram for different time delays to display the computed auto-correlation of the variable.

With the exception of merge, you can apply any one of the variable transformations listed on page 17 to the values for this chart. The ratio transformation allows you to plot one variable against the ratio of two other variables or the ratio of two variables against the ratio of two other variables.

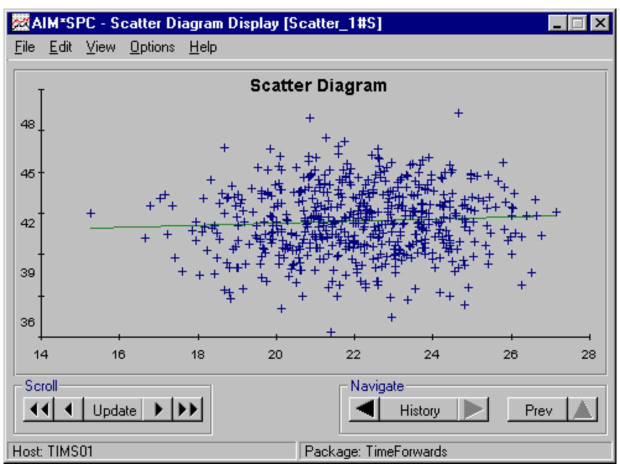


Figure 16. Scatter Diagram

Pareto Diagram

Figure 17 shows the Pareto Diagram which graphically displays, in order of priority, up to 16 causes of rejection for a product. This diagram plots the number of occurrences of rejection and percent contribution, both charted versus cause of rejection.

The software can also plot the sum of occurrences for any given period of time, for example 30 days, using a Pareto Diagram. It provides weighting coefficients to convert the number of occurrences to whatever is desirable, including dollars.

The Pareto Diagram is most commonly used for attribute variables. It has two y-axes.

The y-axis on the left is for the number of occurrences of product rejection versus causes for rejection, in order of priority. It is associated with the bar graph.

The y-axis on the right represents cumulative percent contribution for the same causes of rejection, and it is associated with the curve with the ● symbol.

You enter the number of causes for rejection and the name for each cause during chart configuration.

This chart does not use any variable transformations.

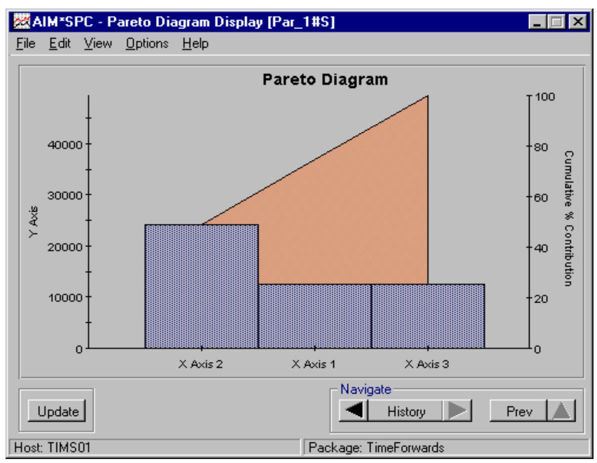


Figure 17. Pareto Diagram

DATA COLLECTION AND ACCESS

The AIM*Historian performs the data collection. AIM*SPC accesses the following Historian data:

- Sample data
- Reduction data
- Manually entered data.

For sample data, which is collected on a change-driven basis, AIM*SPC builds charts with the collected data, converted to periodic values, based on the sample period for the chart.

Because reduction group data is collected periodically, AIM*SPC treats it as periodic data in the charts.

User-entered values are treated as nonperiodic values.

AIM*SPC accesses collected samples in four ways:

- From start time/date, number of subgroups backward in time
- From start time/date, number of subgroups forward in time
- From start time/date, a time span backward in time
- From start time/date, a time span forward in time.

The start time/date defaults to the current system time/date.

For charts that require them, there are three ways of forming subgroups for chart calculations:

- Size n – Divide a group of values into consecutive subgroups of size n
- Size n, Skip m – Choose n consecutive values for the subgroup, and then, skip m consecutive values
- Moving Subgroups of Size n – Given the group of values $X_1...X_N$, the j^{th} subgroup of size n where j = 1...N is formed with the values X_{j+i-1}, and i = 1...n.

CONFIGURATION

AIM*SPC is configured from a workstation using the AIM*SPC Configurator, which interacts with the user via workstation displays and updates the AIM*SPC definition files via an access server.

The AIM*SPC configuration environment provides the following selectable options:

- Display configuration help text
- Display list of charts that have been configured
- Display list of CEDs that have been configured
- Repack AIM*SPC configuration files
- Display list of available AIM*SPC packages in the system
- Exit AIM*SPC configuration

Chart Configuration

You configure each chart as a separate, named instance of one of the supported chart types. You can add, modify, copy, delete, and report chart definitions.

Chart definitions provide all information necessary to:

- Retrieve collected process data
- Ratio, merge, or transform the data
- Subgroup the data
- Filter the data
- Perform calculations appropriate to the chart type
- Plot and display results of these operations
- Check rules for *out of statistical control* state

You do not need to configure Historian variables in the Historian prior to AIM*SPC chart configuration.

Cause and Effect Diagram Configuration

You configure each CED as a separate, named definition. The definition specifies the number, position, and title of boxes in the CED, as well as the charts, CEDs, and text files linked to the boxes. You can add, modify, copy, delete, and report CED definitions.

When using the AIM*SPC Windows display, you can export data to spreadsheets, word processors and other Windows applications. Exportable data includes all the plotted values, and calculation results for any displayed chart.

DISPLAY CLIENT

Use the AIM*SPC display client to view charts, CEDs, parameter settings and other information available from the application. When using the AIM*SPC display client, you can export data to spreadsheets, word processors, and other Windows applications. Exportable data includes all the plotted values and calculation results for any displayed chart.

Cause and Effect Diagram Displays

CED displays provide the following selectable options:

- Display CED help text
- Display chart selected from a list of configured charts
- Display CED selected from a list of configured CEDs
- Change screen background color to white for printing
- Display list of available Statistical Process Control packages in the system
- Go to AIM*SPC configuration
- Exit the AIM*SPC display client
- Return to previous CED or chart display

Chart Displays

Chart displays provide the following selectable options:

- Display chart help text
- Display chart selected from a list of configured charts
- Display CED selected from a list of configured CEDs
- Display chart point information
- Display/enter chart notes (not in Scatter, Pareto, or Histogram charts)
- Display calculated values for chart parameters
- Display/change chart configuration parameters, either temporarily or permanently
- Move chart data backward or forward in time by one subgroup or half of the chart
- Change screen background color to white for printing
- Print selected operation report from list of standard chart reports
- Exit the AIM*SPC display client
- Return to previous chart or CED display.

AIM*SPC performs the following operations to generate the chart display:

- Retrieves variable samples for the chart:
  - When the chart is configured for a desired number of variable samples, AIM*SPC computes the number of variable samples, based on the configured subgroup size, number of subgroups, and subgrouping method.
  - When the chart is configured for all available samples for a specific time span, AIM*SPC retrieves all sample values collected within this time span and forms subgroups for these.
- Performs the configured variable transformation (if any) on the samples.
- Forms subgroups according to the configured subgrouping method.
- Filters the data, if requested.
- Performs the appropriate statistical calculations.
- Plots the results using the configured plot line type.
- Performs any configured statistical control rule checks, and then plots the points in violation as oversized, red dots.

AIM*SPC PRODUCT STRUCTURE

AIM*SPC uses client-server architecture, as shown in Figure 18. The product is structured to be cost effective and to accommodate the needs of most applications. The product structure requires one SPC server and can accommodate any combination of Windows clients. When you order at least one SPC server, you should specify the desired number of clients.

SYSTEM CONFIGURATION

The Foxboro Company can, as an option, provide a fully loaded and tested AIM*SPC server, including the hardware. The Foxboro Company can also supply on-site engineering services to install a basic AIM*SPC software package and provide AIM*SPC user training.

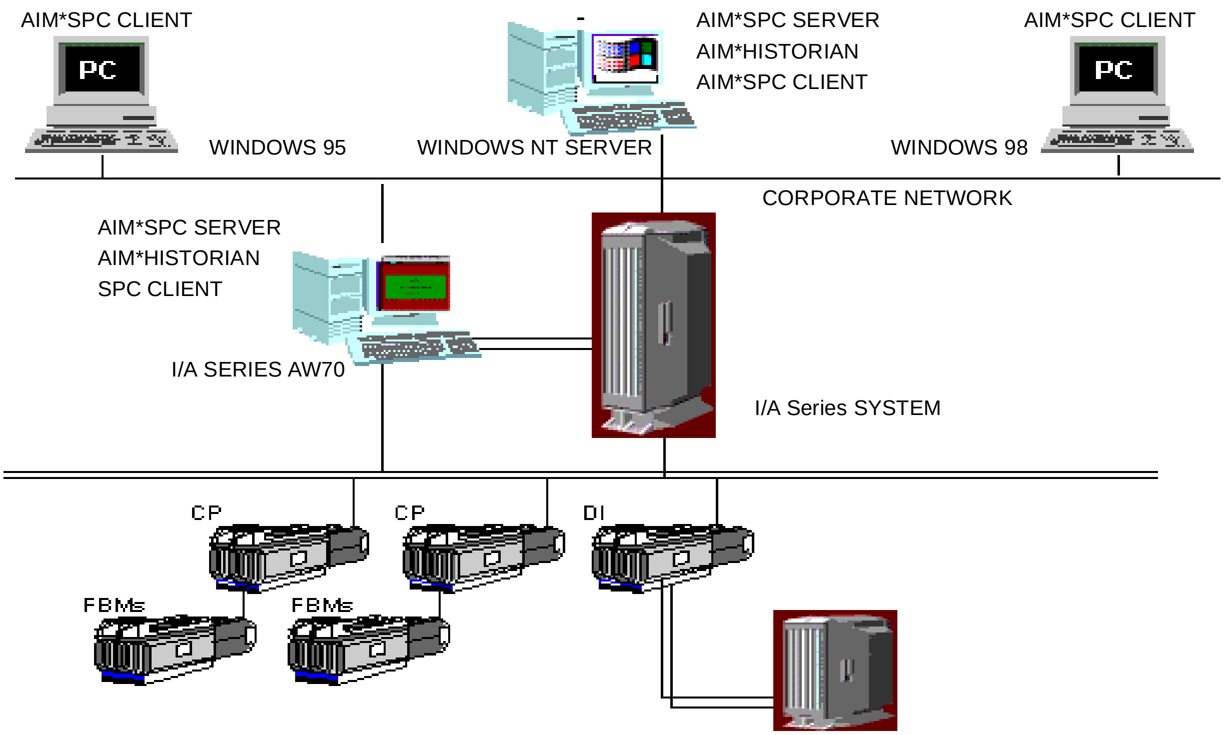


Figure 18. Real-Time AIM*SPC System Architecture

SYSTEM REQUIREMENTS

AIM*SPC is available on the following platforms:

AIM*SPC Servers

- Windows NT operating system
- 32 MB RAM, minimum. Additional clients will require more memory
- 30 MB of hard drive, minimum

Clients - Personal Computers

- Pentium or 486 class PC
- Windows 95, Windows 98, or Windows NT 4.0
- 16 MB RAM, minimum
- Network interface card and Win-Socket compliant TCP/IP software

FUNCTIONAL SPECIFICATIONS

AIM*SPC Tools

- Individuals Chart
- Xbar and Range Chart
- Xbar and Sigma Chart
- Cumulative Sum Chart
- CUSUM Chart
- Individuals Histogram
- Xbar Histogram
- P Chart
- NP Chart
- C Chart
- U Chart
- Scatter Diagram
- Pareto Diagram
- Cause and Effect Diagram

Statistical Control Rules for Charts

UP TO 11 RULES PER CHART

Rule 1	1 point outside ±3 sigma of the central line.
Rule 2	3 consecutive points jumping ±3 sigma or more.
Rule 3	2 of 3 consecutive points above +2 sigma or below –2 sigma from the central line.
Rule 4	4 of 5 consecutive points above +1 sigma or below –1 sigma from the central line.
Rule 5	8 consecutive points above the central line.
Rule 6	8 consecutive points below the central line.
Rule 7	5 consecutive points increasing in value.
Rule 8	5 consecutive points decreasing in value.
Rule 9	15 consecutive points within ±1 sigma of the central line.
Rule 10	8 consecutive points outside ±1 sigma of the central line.
Rule 11	After a jump of ±3 sigma, 3 consecutive points within ±0.75 sigma of the jump point

Variable Transformation Options(1)

TYPE 0	None
TYPE 1	$y = c_1 x$
TYPE 2	$y = c_1 (\log_E x)$
TYPE 3	$y = c_1 x + c_2$
TYPE 4	$y = c_1 \exp (c_2 x)$
TYPE 5	$y = c_1 \sqrt{x}$
TYPE 6	$y = x^{c1}$
RATIO	$y = c_1 (x/z)$
MERGE	Merge up to 8 variables so that each subgroup contains one sample from each variable.

Input Historian Data

- Sample data
- Reduction data
- Manually entered data

(1) In transformation equations, x and z are variable values. C_1 and C_2 are user defined constants.

The Foxboro Company
33 Commercial Street
Foxboro, Massachusetts 02035-2099
United States of America
http://www.foxboro.com
Inside U.S.: 1-508-543-8750 or 1-888-FOXBORO (1-888-369-2676)
Outside U.S.: Contact your local Foxboro Representative.

MB 021 Printed in U.S.A. 0999

An Invensys company