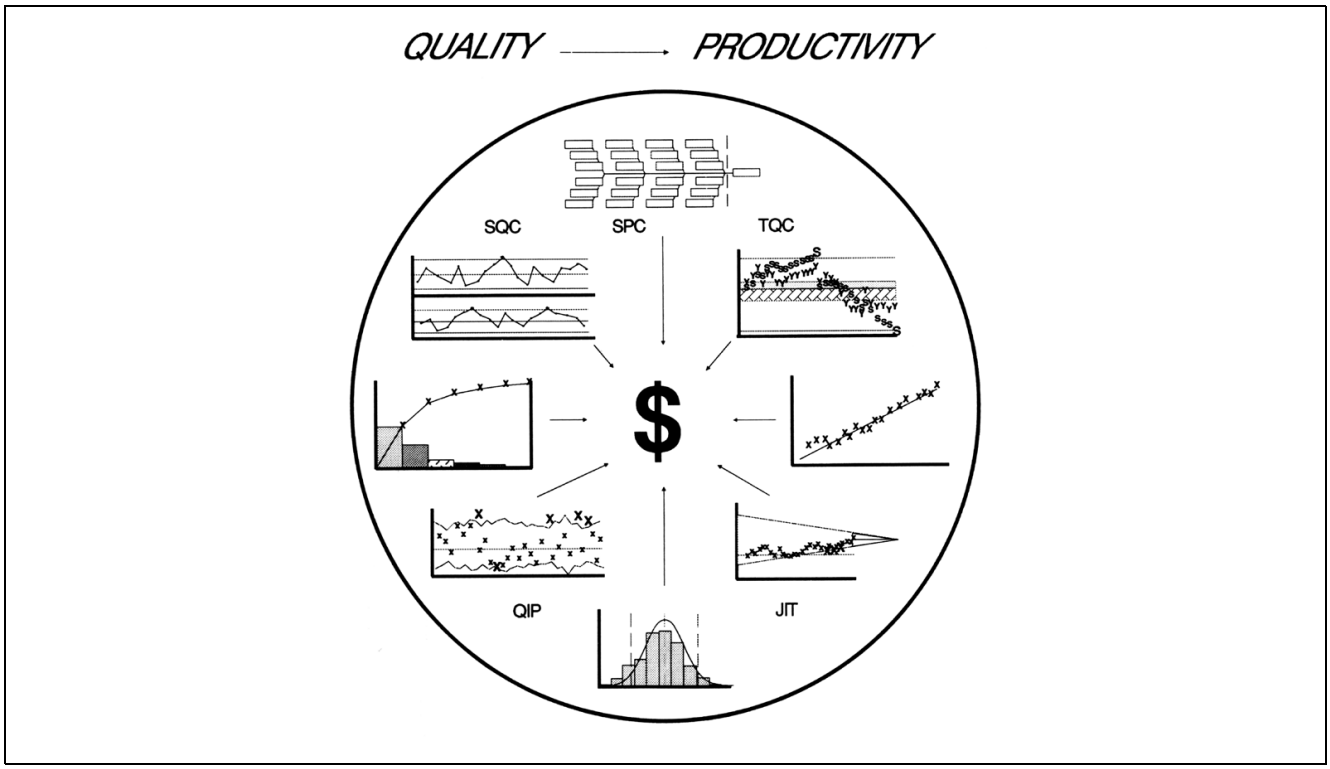
FOXBORO®

PSS 21S-4J1 B3

I/A Series® Software
Statistical Process Control Package (SPCP)



The SPCP is an application software package that provides on-line displays of Statistical Process Control (SPC) charts for analysis of process variables.

INTRODUCTION

The SPCP provides on-line displays of charts and other SPC tools for process variables. You can configure different charts for each variable. You can test some charts against "Rules" to determine the "not in statistical control" state of a variable.

You can configure Cause and Effect Displays with charts and text for operator use or for diagnostic studies. These displays help the operator to identify problems and take corrective action.

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

Consider the spectrum of processes from nondynamic (e.g., automobile manufacturing) to dynamic (e.g., oil refining). 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 SPC provides open-loop advisory capability for the analysis of quality problems in a plant. You decide what action to take, if any.

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

The SPCP supports on-line, on-demand analysis to monitor all process variables that are collected by distributed historians in an I/A Series System. This includes manually entered data and archive or playback (restored) data for all distributed historians.

Figure 2 is a functional overview diagram for the SPCP.

Distributed historians in the I/A Series System collect and store in databases the value, date/time, and status of plant variables, from the current (system) time to some time in the past. These databases are hereafter called real-time databases.

The real-time databases are always tied to the current time. When SPCP charts and other analysis tools are requested, they automatically access data from the current time backward to some time in the past. This allows the operator to take timely corrective action.

When requested for display and analysis, the SPCP 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.

The SPCP uses the following four types of information:

- Quality Variables – Examples are viscosity, composition, density, melt index, brightness, and others. They are used in Xbar and Range, Xbar and Sigma, Individuals, CUSUM, and Cumulative Sum Charts to monitor product quality.

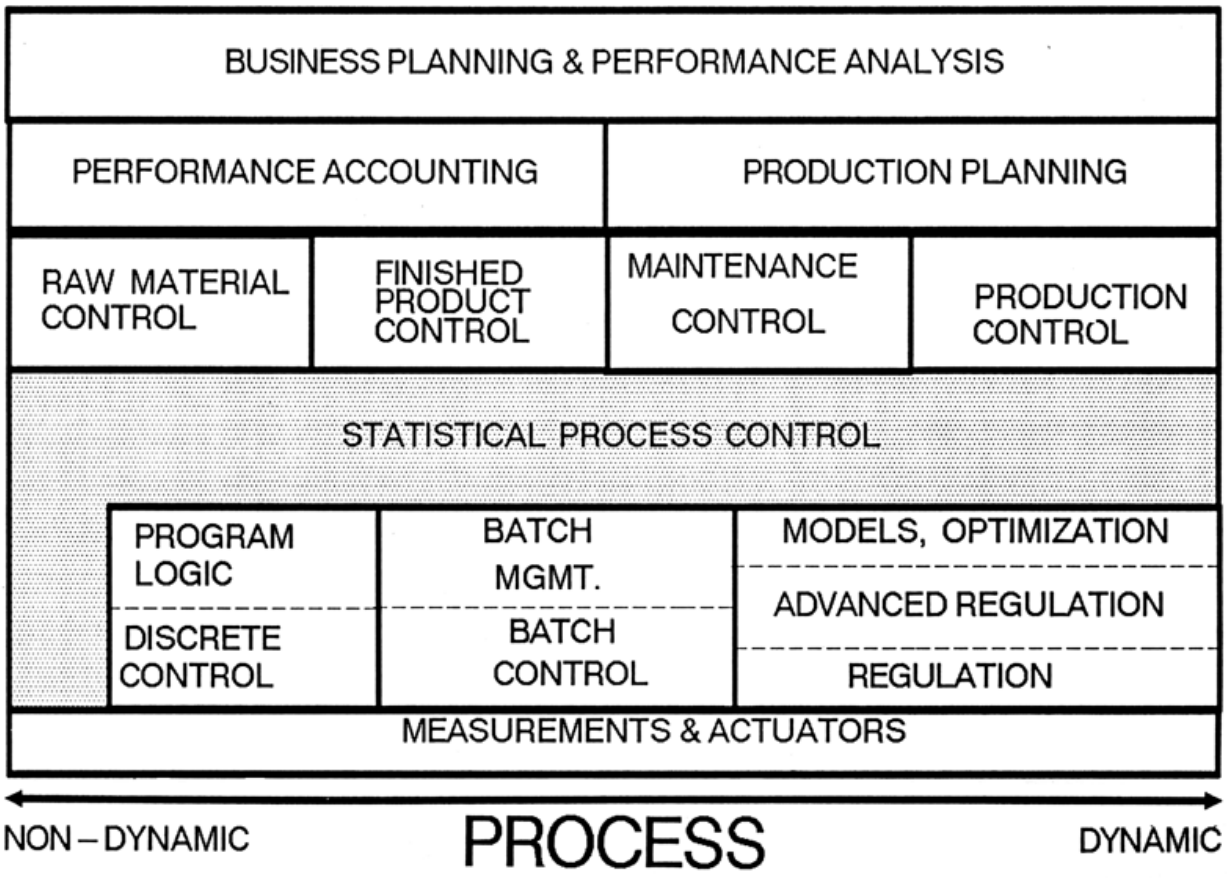


Figure 1. Relationship of SPC to Other Process Operations

- Causal Variables – Examples are flow, temperature, pressure, feed composition, and others. 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 – consists of text information. They are organized and displayed in Cause and Effect Diagrams.

SPCP TOOLS

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

SPCP Tools for Quality and Causal Variables

Tools to analyze and monitor individual samples are:

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

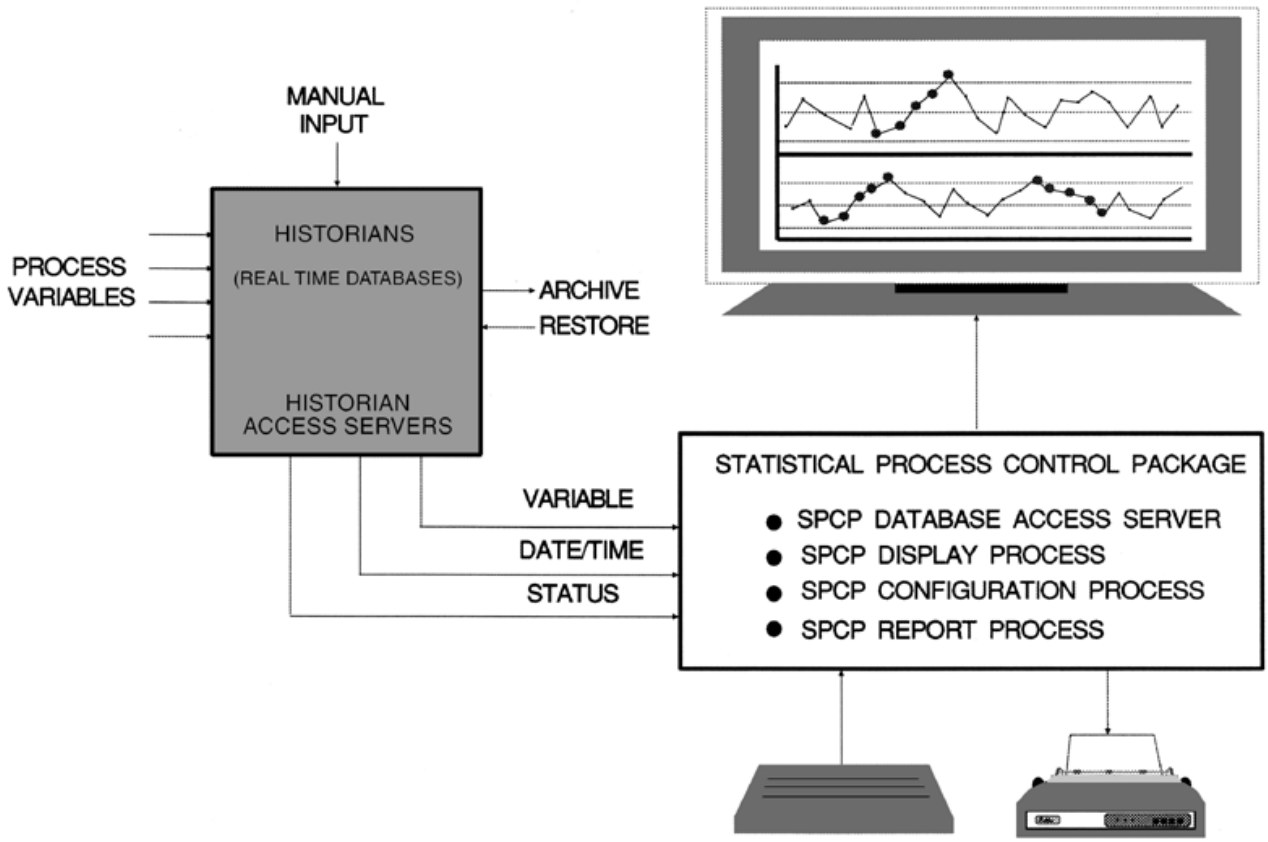


Figure 2. Statistical Process Control Package Functional Overview

Tools to analyze and monitor subgrouped samples are:

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

SPCP Tools for Attribute Variables

Tools to monitor fraction and number defective are:

- P Chart
- NP Chart

Tools to monitor defects and defects per unit are:

- C Chart
- U Chart

SPCP 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 DIAGRAM

Figure 3 shows the Cause and Effect Diagram (CED), which is also called the Fishbone Diagram because of its structure. You use the CED 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.

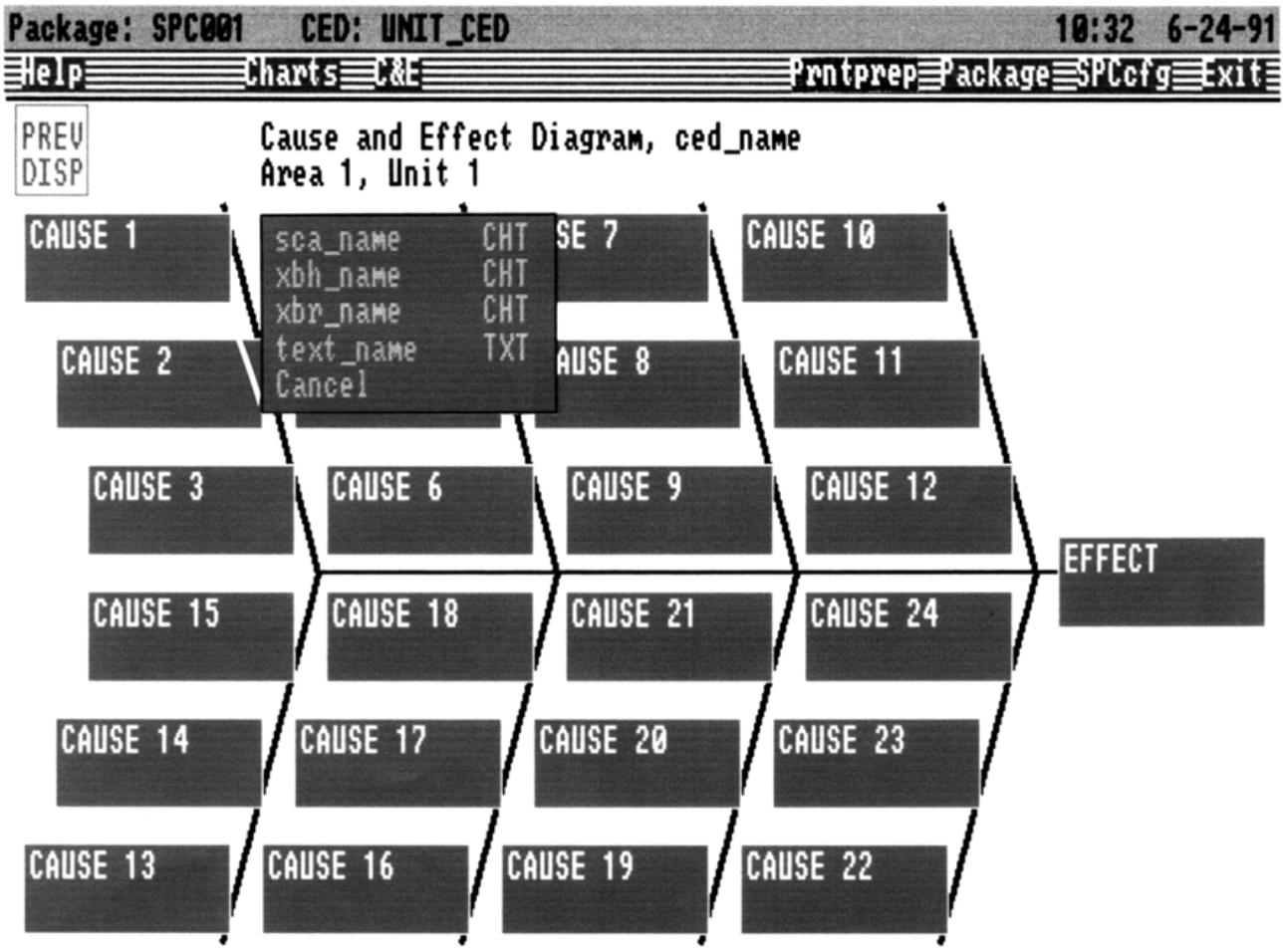


Figure 3. Cause and Effect Diagram

For distributed control and information systems supported by communications networks, the CED not only documents the effect and its related causes, but it also serves as an active information access mechanism in a computer display system. You achieve this by linking charts and/or text files to each cause and effect box. Each cause and effect box is an active screen area for accessing related charts and text. These boxes are selectable by touchscreen, mouse, or trackball.

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

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

Referring to Figure 3, the effect box represents the effect, and cause boxes 1 through 24 represent the causes. Each box has a label for identification purposes.

You can link up to 4 charts and/or text files to the effect box and to each cause box.

If only one chart 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 and text files that you can select for display.

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

OTHER SPCP FEATURES

Other main features of SPCP 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 subgroup of size n.
- Up to 11 statistical control rules per chart to determine “out of statistical control” state in chart displays.
- Chart points that violate one or more rules are plotted as oversized, red-colored symbols. See Figure 4.
- 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. See Figure 4.
- Access to Historian data in basic sample and extended sample files, reduction groups, and user-entered data.
- Move the chart 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 can be used to evaluate the rules and compute the limits.
- Optionally, the target and upper and lower specification limits can be displayed 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. You manually enter the official values, which are usually computed from a data set that has been chosen as the representative operation to judge the future.

You can obtain official values 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, SPCP chart displays perform up to 11 statistical-control-rule checks and inform the operator if the plotted data is “out of statistical control”.

You select and observe the charts for a product quality variable and interpret them. Next, you use the Cause-and-Effect Diagrams to access variables that cause “out of statistical control” states. Then, you observe the charts for those variables and implement the necessary control actions.

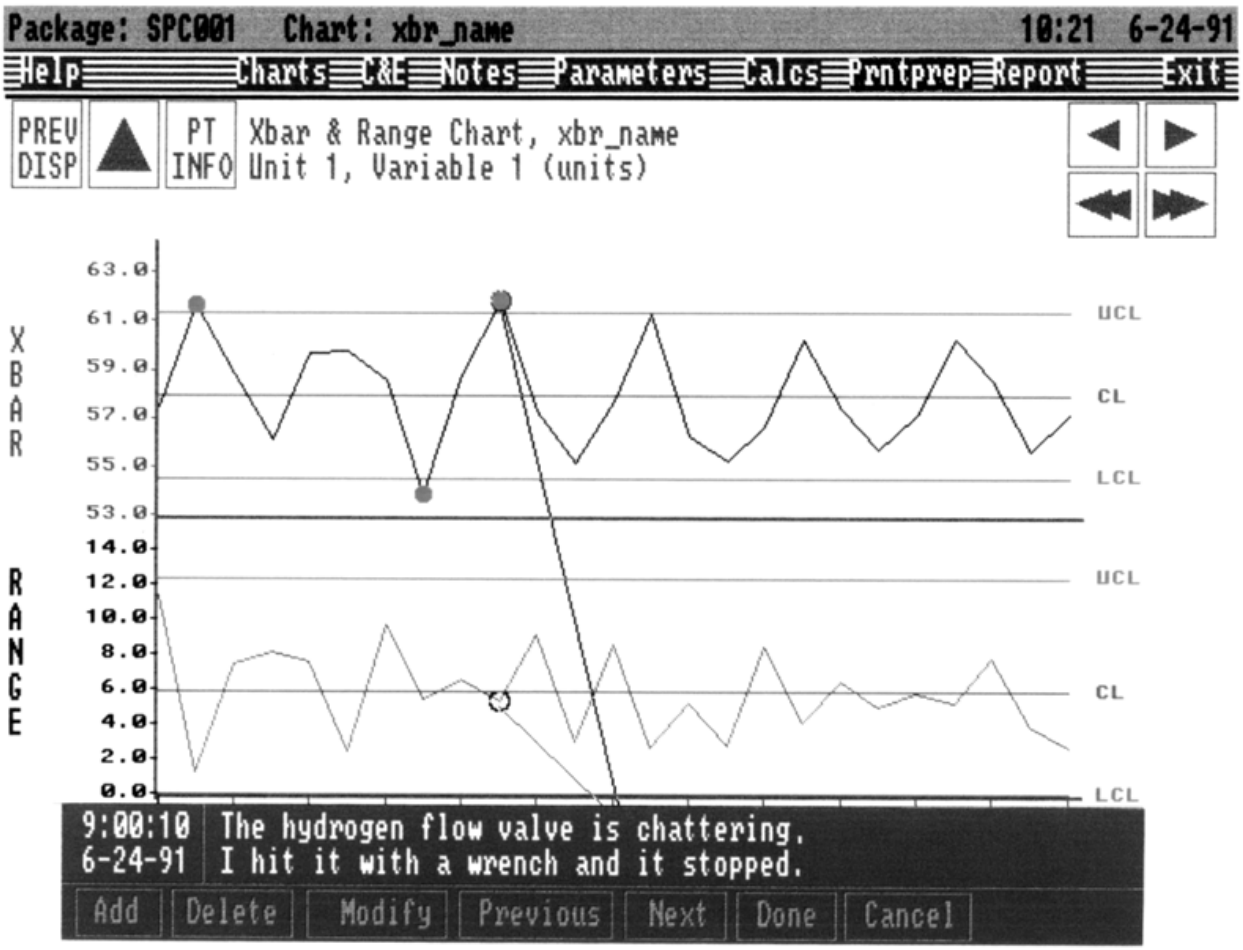


Figure 4. Xbar and Range Chart with Rule Violation and Note

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.

SPCP CHARTS AND TOOLS

The SPCP 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

SPCP charts and tools define all information necessary to:

- Retrieve collected process data, merge or transform it, and subgroup it.
- 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 (rules violated by which subgroups).

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 in the “Functional Specifications” section to the values for this chart, except for merge.

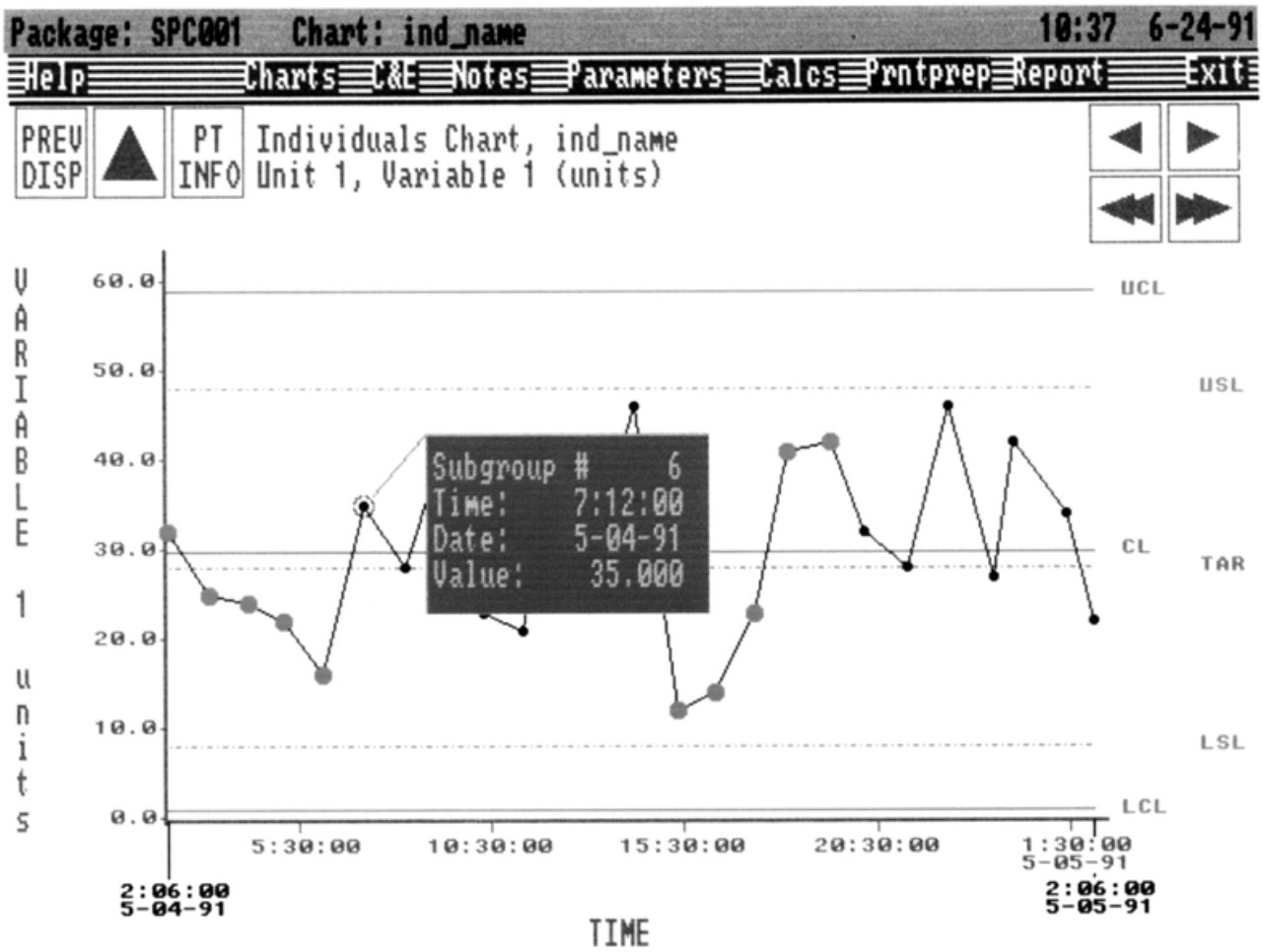


Figure 5. Individuals Chart

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 (rules violated by which subgroups).

You can also display the targets (TARXB, TARR), upper specification limits (USLXB, USLR), and lower specification limits (LSLXB, LSLR) 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 in the “Functional Specifications” section to the values for this chart.

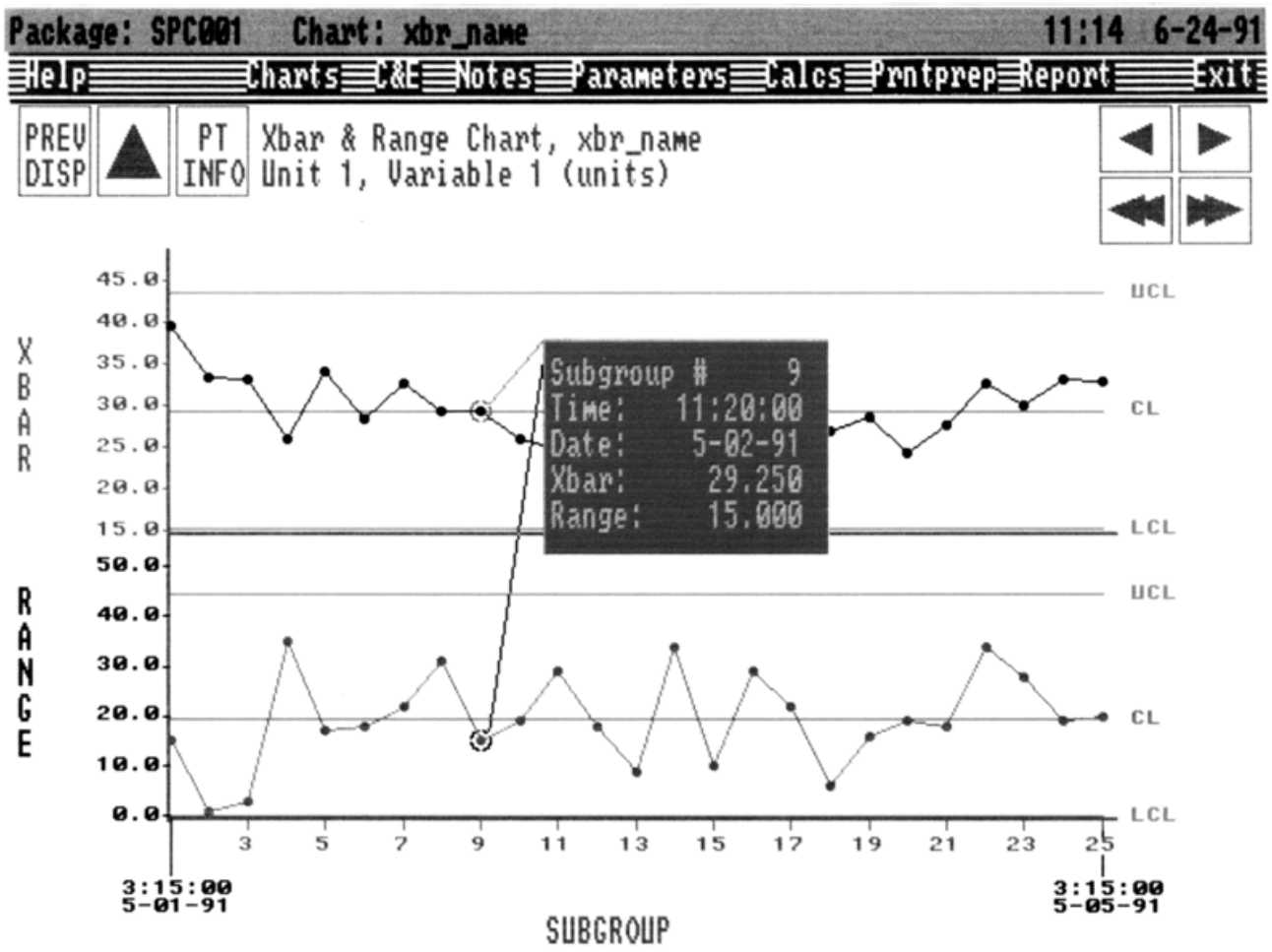


Figure 6. Xbar and Range Chart

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 (rules violated by which subgroups).

You can also display the targets (TARXB, TARSIG), upper specification limits (USLXB, USLSIG), and lower specification limits (LSLXB, LSLSIG) 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 in the “Functional Specifications” section to the values for this chart.

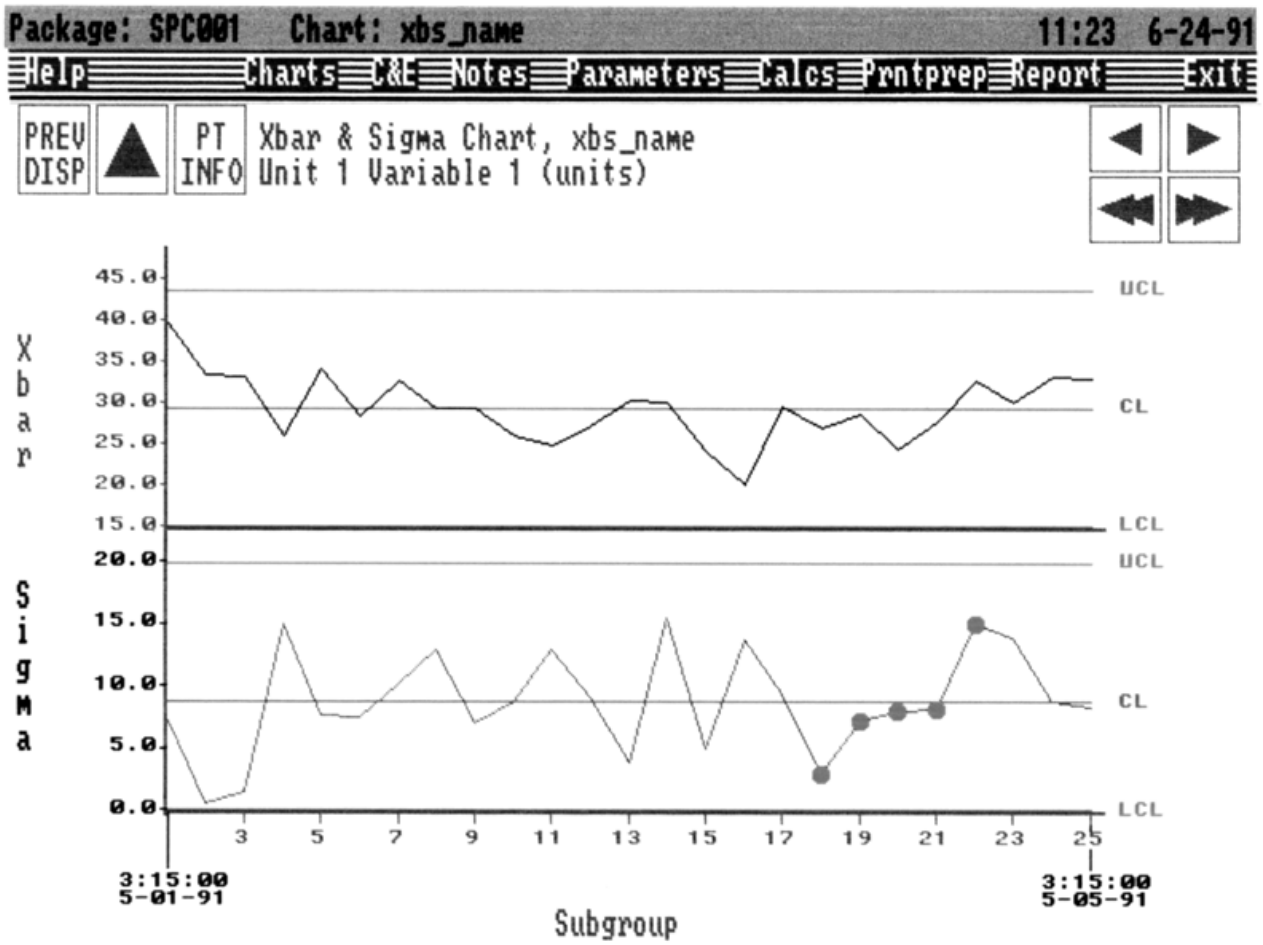


Figure 7. Xbar and Sigma Chart

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 two-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 in the “Functional Specifications” section to the values for this chart.

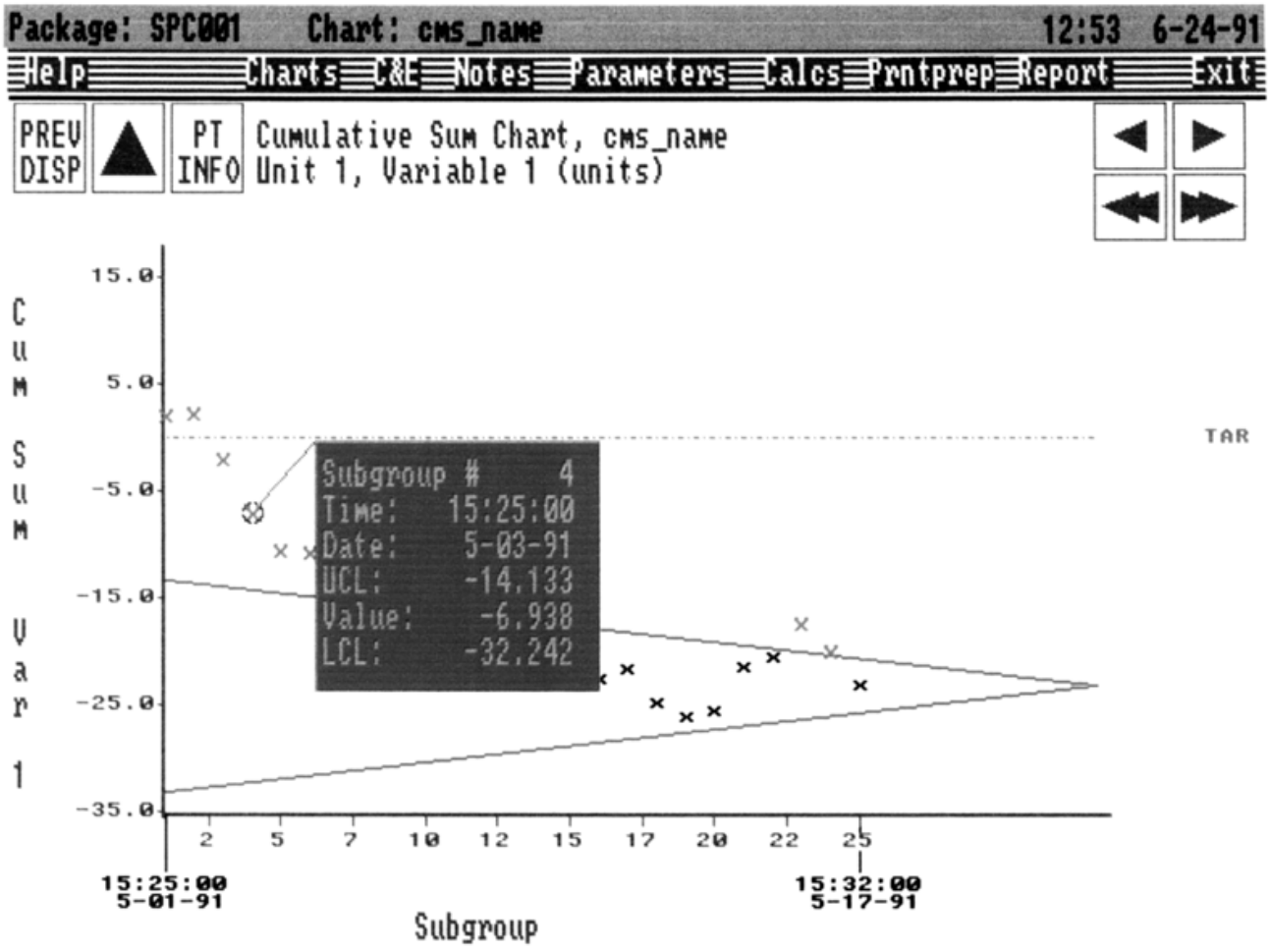


Figure 8. Cumulative Sum Chart

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.

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 in the “Functional Specifications” section to the values for this chart.

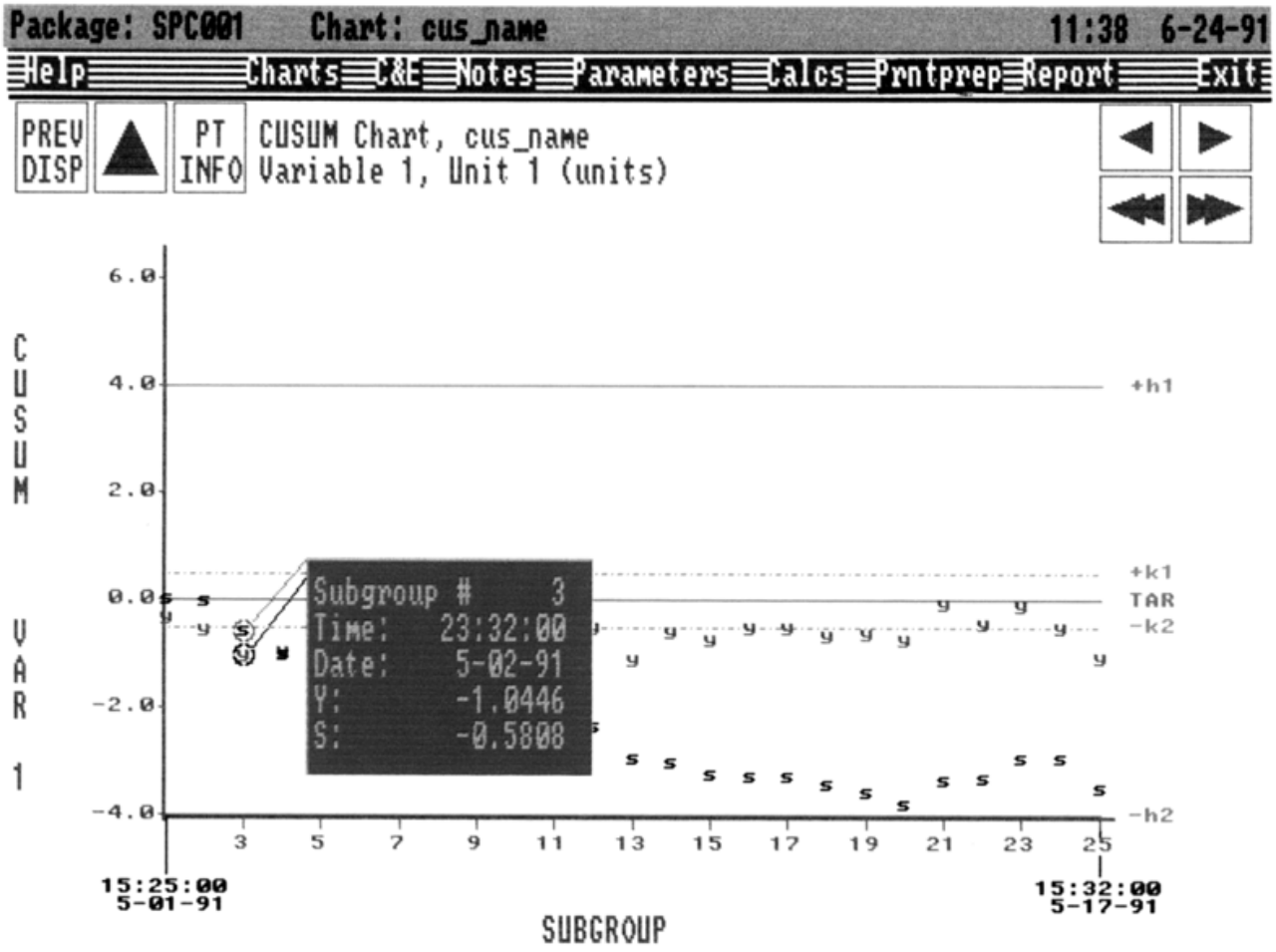


Figure 9. CUSUM Chart

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 in the “Functional Specifications” section to the values for this chart, except for merge.

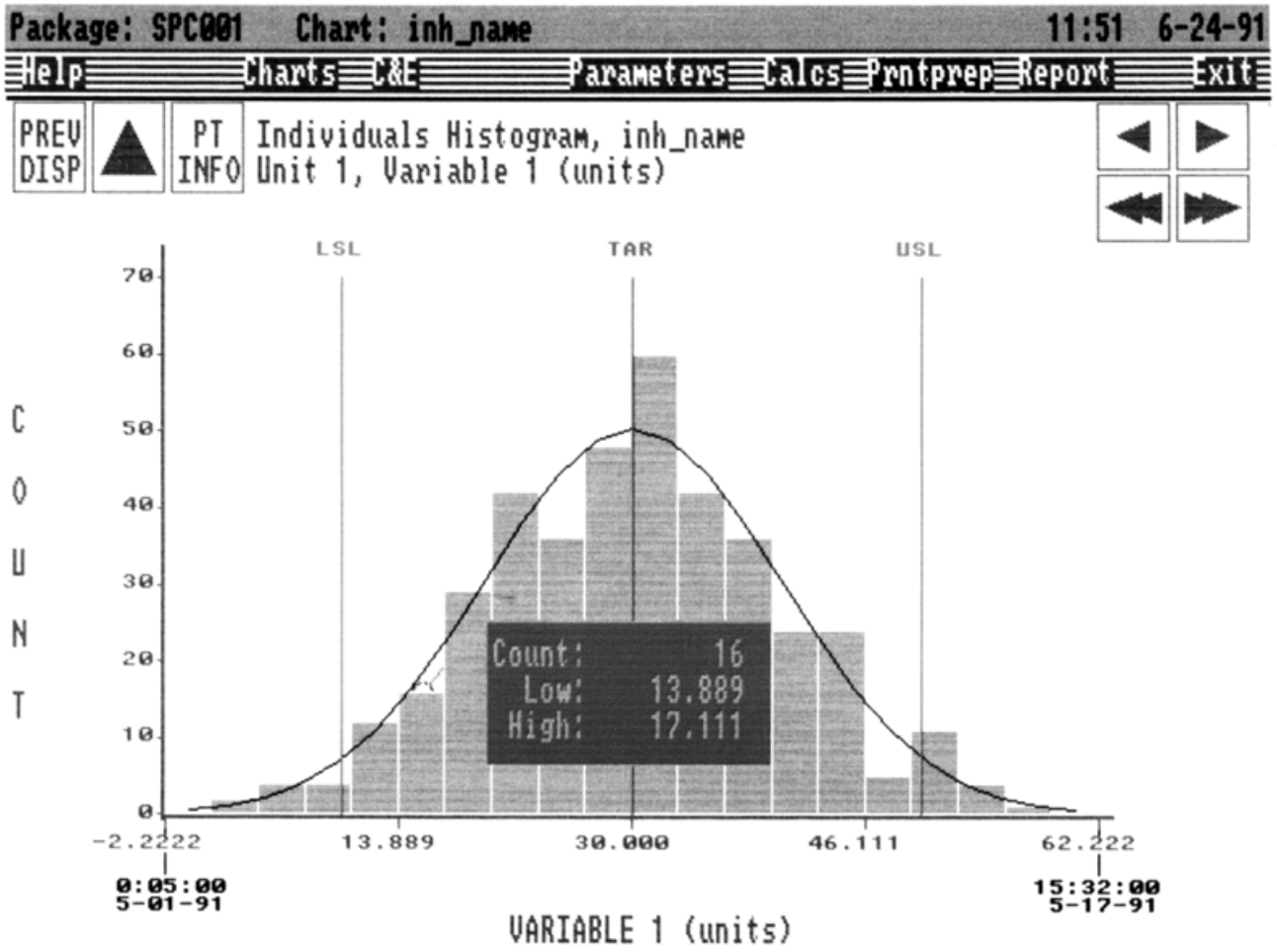


Figure 10. Individuals Histogram

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 value 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 in the “Functional Specifications” section to the values for this chart.

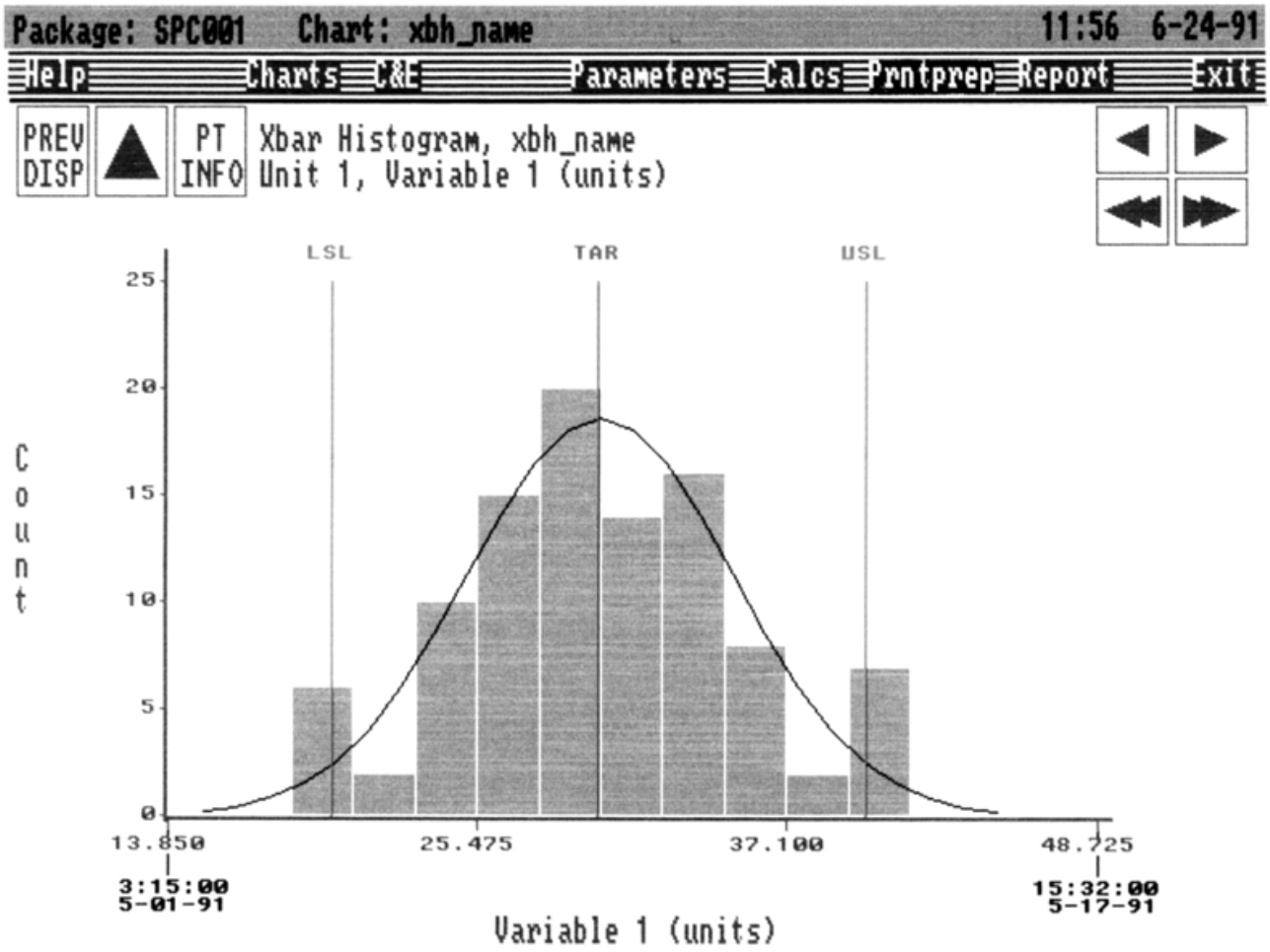


Figure 11. Xbar Histogram

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 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 (rules violated by which subgroups).

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.

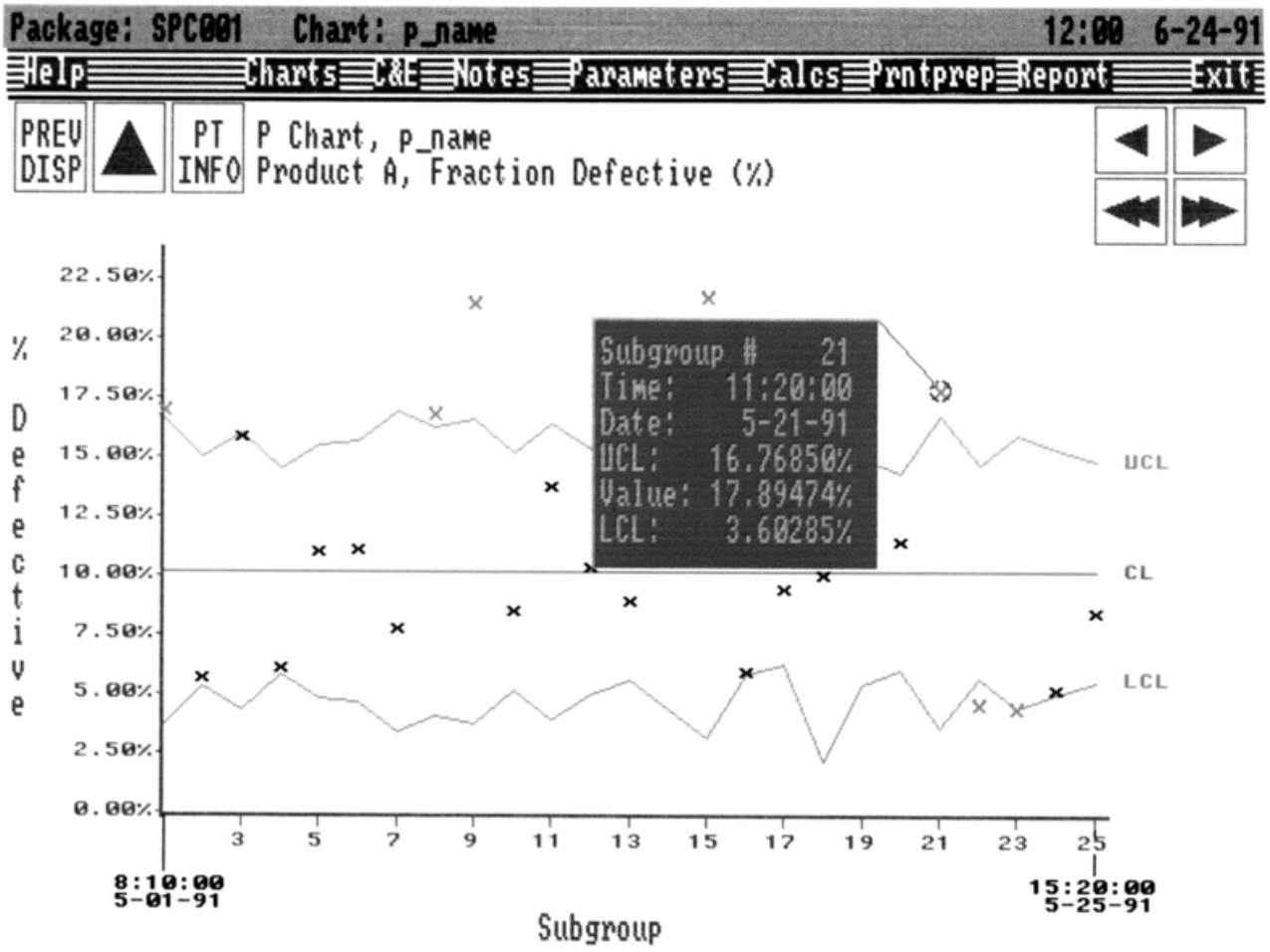


Figure 12. P Chart

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 (rules violated by which subgroups).

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.

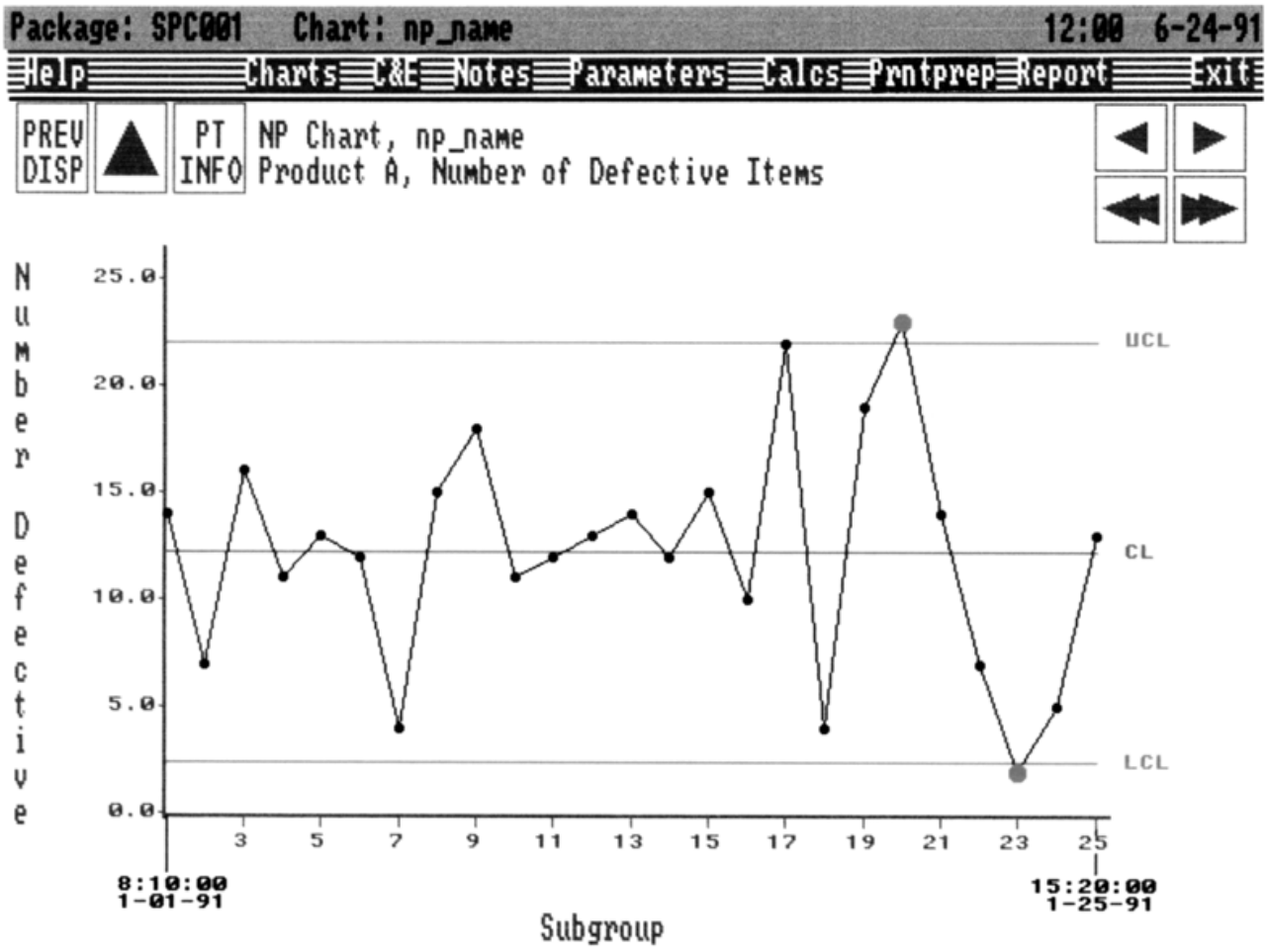


Figure 13. NP Chart

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.

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 (rules violated by which subgroups).

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.

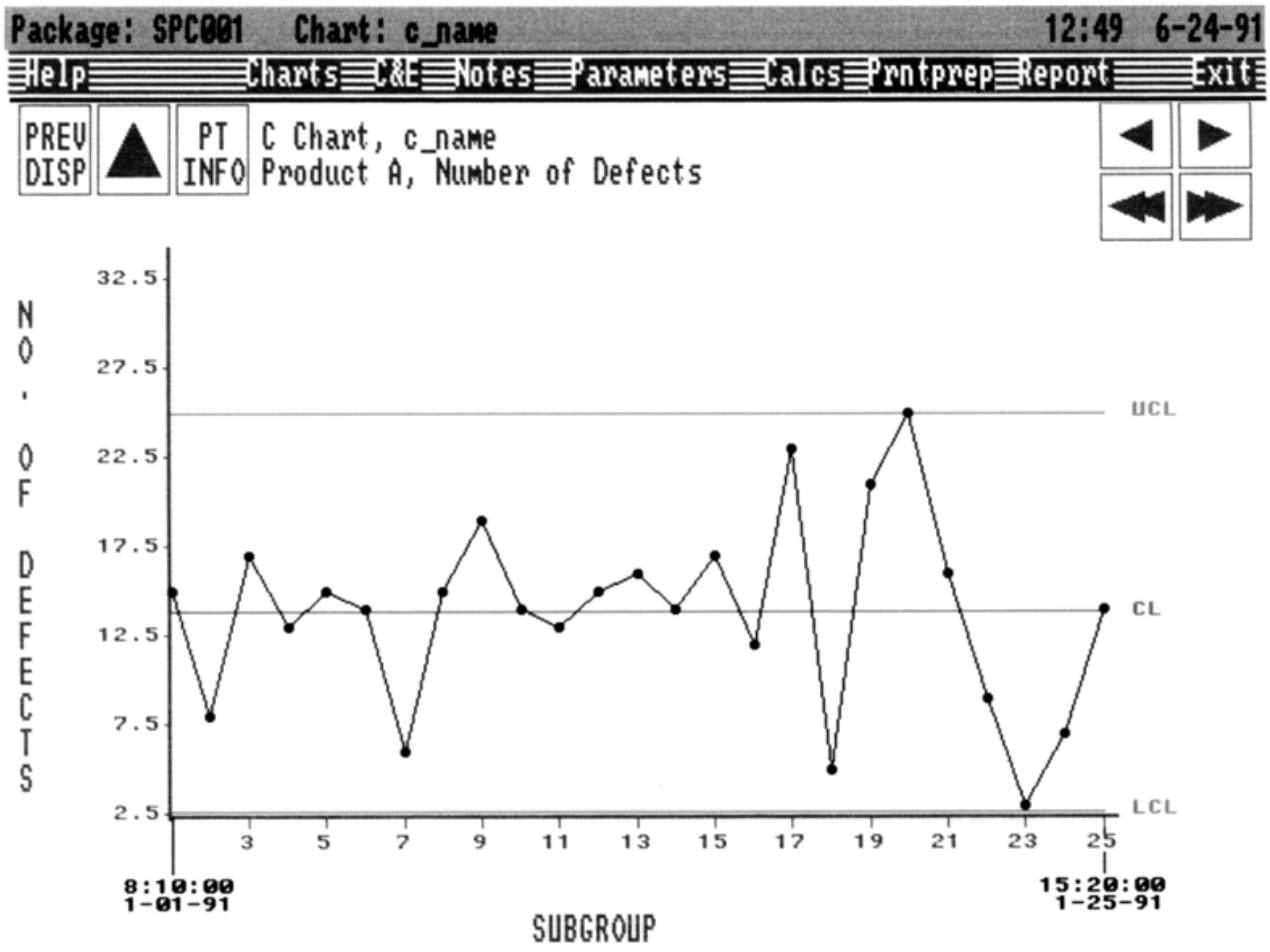


Figure 14. C Chart

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, etc. When the unit size is constant, the C Chart 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 (rules violated by which subgroups).

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.

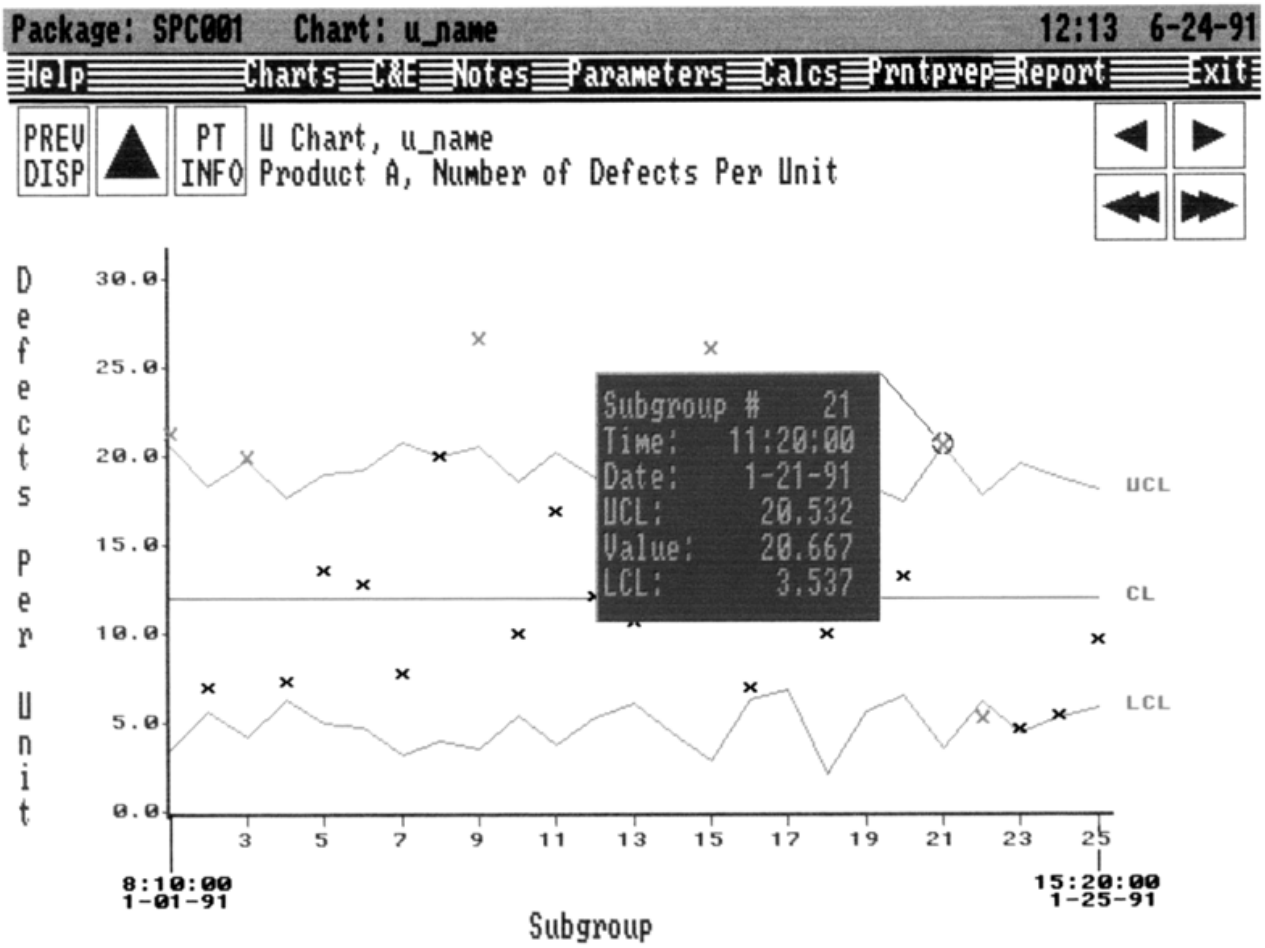


Figure 15. U Chart

Scatter Diagram

Figure 16 shows the Scatter Diagram. It is a plot of one variable against another or itself, with a computed linear regression line superimposed on the plot. This diagram displays, both graphically and by 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, both graphically and by computed value, its auto-correlation. You can configure the diagram for different time delays to display the computed auto-correlation of the variable.

You can apply any one of the variable transformations listed in the "Functional Specifications" section to the values for this chart, except for merge. 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.

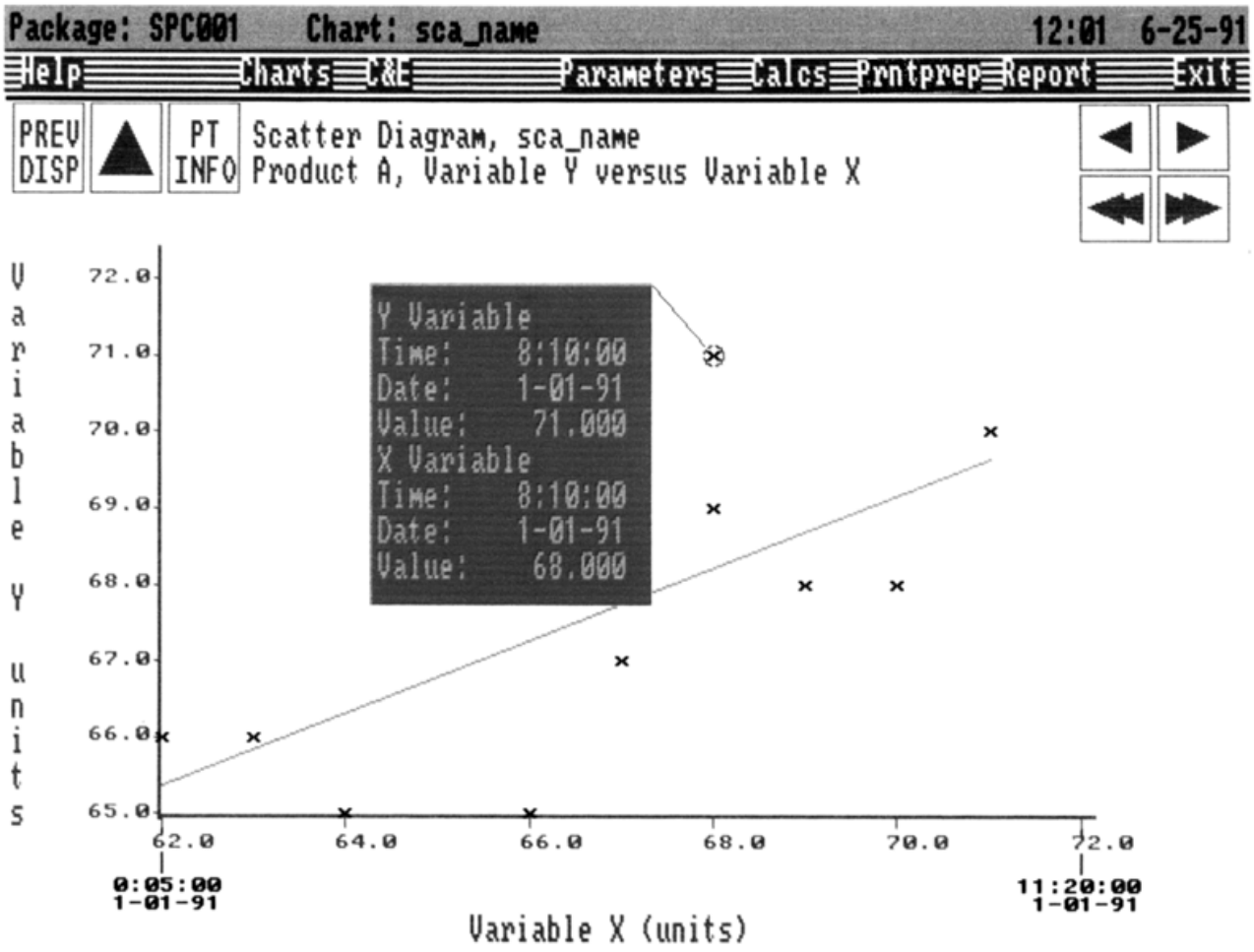


Figure 16. Scatter Diagram

Pareto Diagram

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

The software can also plot the sum of occurrences for a given period of time (e.g., 30 days) on the 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 “X” 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.

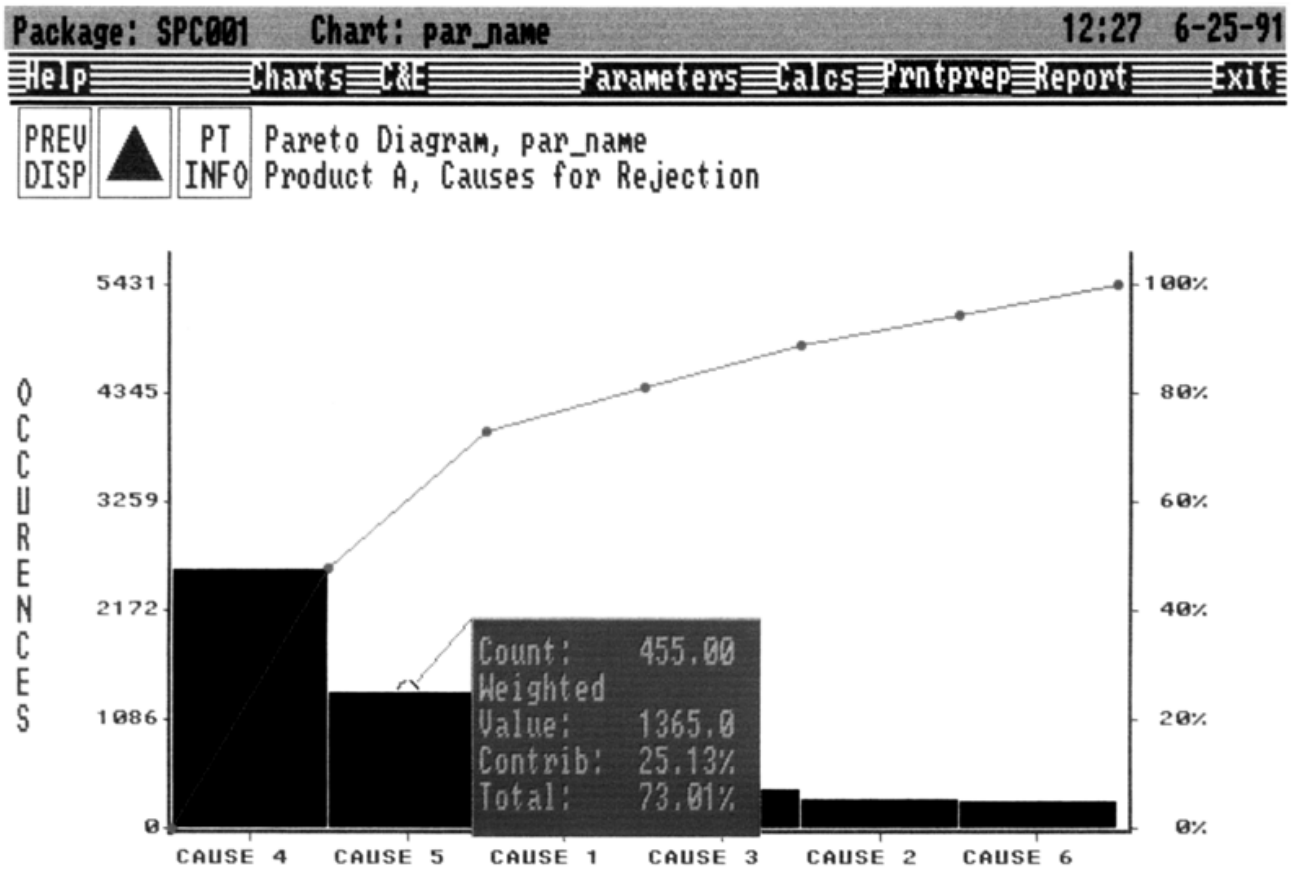


Figure 17. Pareto Diagram

DATA COLLECTION AND ACCESS

The Historian performs the data collection. The SPCP accesses the following Historian data:

- Basic and extended sample data.
- Reduction group data.
- Manual entry group data.
- Archive or playback (restored) files for any of the above.

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

Because reduction group data are collected periodically, the SPCP treats them as periodic data in the charts.

User-entered data are treated as nonperiodic values.

The SPCP 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 Subgroup of Size n -- Given the group of values $X_{1}...X_{N}$, the j^{TH} subgroup of size n is formed with the values X_{J+I-1}, i = 1...n.

CONFIGURATION

You configure the SPCP from a workstation using the SPCP Configurator which interacts with the user via workstation displays and updates the SPCP definition files via an Access Server.

The SPCP configuration top-level display provides the following selectable options:

- Display configuration help text.
- Display list of charts that have been configured.
- Display list of CED's that have been configured.
- Generate Foxboro defined configuration reports.
- Repack SPCP configuration files.
- Display list of available SPCPs in the system.
- Go to SPCP operation.
- Exit SPCP 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.
- 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 have to configure Historian variables in the Historian prior to SPCP chart configuration.

Cause and Effect Diagram Configuration

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

OPERATION

The SPCP operation top-level display provides the following selectable options:

- Display operational help text.
- Display list of configured charts that can be displayed.
- Display list of configured CEDs that can be displayed.
- Display list of available SPC packages in the system.
- Go to SPCP configuration.
- Exit SPCP operation.

Cause and Effect Diagram Displays

CED displays provide the following selectable options:

- Display CED help text.
- Display chart selected from list of configured charts.
- Display CED selected from list of configured CEDs.
- Change screen background color to white for printing.
- Display list of available SPC packages in the system.
- Go to SPCP configuration.
- Exit SPCP operation.
- Return to previous CED or chart display.

Chart Displays

Chart displays provide the following selectable options:

- Display chart help text.
- Display chart selected from list of configured charts.
- Display CED selected from 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 SPCP operation.
- Return to previous chart or CED display.
- Return to SPCP operation top-level display.
- Display list of available SPC packages in the system.

The SPCP performs the following operations to generate the chart display:

1. Retrieves variable samples for the chart:
   – When the chart is configured for a desired number of variable samples, the SPCP 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, the SPCP retrieves all sample values collected within this time span and forms subgroups for these.
2. Performs the configured variable transformation (if any) on the samples.
3. Forms subgroups according to the configured subgrouping method.
4. Performs the appropriate statistical calculations.
5. Plots the results, using the configured plot line type.
6. Performs any configured statistical control rule checks and plots the points in violation as oversized, red-colored symbols.

REPORT GENERATION

The SPCP provides a set of predefined configuration reports that are requested via the "Reports" field in the top menu bar of SPCP configuration displays.

The SPCP also provides operational reports that are requested via the “Reports” field in the top menu bar of chart displays.

For example, you can call up a chart for display, change its parameters, and generate a report consisting of tables of raw and calculated values, and notes for the selected time period. You can also obtain hard copy of the plotted chart by using the “Prntprep” field in the top menu bar of the chart display in conjunction with the I/A Series print screen function.

SPCP COMPONENTS

SPCP comprises four major software components, all implemented as VENIX processes. They are:

- SPCP Database Access Server Process – reads and writes SPCP configuration files for the Display and Configurator processes.
- SPCP Display Process – provides all SPCP operational displays.
- SPCP Configuration Process – provides all SPCP configuration displays.
- SPCP Report Process – generates all SPCP configuration and operational reports.

SYSTEM CONFIGURATION

The SPCP software executes on the following:

- Application Processor (excepting an AP10) in conjunction with a Workstation Processor (excepting a WP10).
- Application Workstation (AW) which can host WPs.
- Personal Workstation (PW)

SPCP residing on an AP can service all WPs hosted by the AP. SPCP configuration and displays are performed locally within the AP/WP cluster. Process data is accessed from any Historian database in the I/A Series network.

SPCP_INTEL is the SPCP software that executes in Intel-based APs and PWs in the I/A Series network. A single SPCP_INTEL package is accessible to all Intel-based WPs hosted by the Intel-based AP that has the SPCP_INTEL software package.

SPCP_SUN is the SPCP software that executes in Sun-based APs and AWs in the I/A Series network. A single SPCP_SUN package is accessible to all Sun-based WPs and AW's in the I/A Series network. It is also accessible to all Intel-based WPs hosted by the Sun-based AP or AW that has the SPCP_SUN software package.

Both versions of the SPCP software, SPCP_INTEL and SPCP_SUN, can access data from the local Historian (database) and all remote Historians (databases) in the I/A Series network.

SPCP functionality is distributed as follows:

- The SPCP Display and Configuration functions execute in the AP and use the Access Server in the AP for configuration file access and updating.
- The SPCP Report function executes in the AP and accesses the local configuration files directly.

FUNCTIONAL SPECIFICATIONS

SPCP Tools

- Individuals Chart
- Xbar and Range Chart
- Xbar and Sigma Chart
- Cumulative Sum Chart
- CUSUM Chart
- Individuals Histogram
- Xbar HistogramP 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	$y = c_1x$
TYPE 2	$y = c_1(\log_e x)$
TYPE 3	$y = c_1x + c_2$
TYPE 4	$y = c_1(e^{C_2X})$
TYPE 5	$y = c_1\sqrt{x}$
TYPE 6	$y = x^{C_1}$
RATIO	$y = c_1(x/z)$
MERGE	Merge up to 8 variables so that each subgroup contains one sample from each variable.

(1) In transformation equations, x and z are variable values.

Input Historian Data

- Basic and extended samples
- Reduction group data
- Manual entry data
- Archive or playback data

Installation

One SPCP per AP (excepting an AP10), AW, or PW

Printer Requirements

CONFIGURATION REPORTS
Dot-Matrix or Color Ink-Jet (PaintJet) Printer
PRINT SCREEN FUNCTION
Color Ink-Jet (PaintJet) Printer

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