Chapter 31
PROC SHEWHART and General Statements

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Overview

The PROC SHEWHART statement starts the SHEWHART procedure and it optionally identifies various data sets.

To create a Shewhart chart, you specify a chart statement (after the PROC SHEWHART statement) that specifies the type of Shewhart chart you want to create and the variables in the input data set that you want to analyze. For example, the following statements request $\bar{X}$ and R charts:

```
proc shewhart data=values;
   xrchart weight*lot;
run;
```

Here, the DATA= option specifies an input data set (VALUES) with the *process* measurement variable (WEIGHT) and the *subgroup-variable* (LOT). *

You can use options in the PROC SHEWHART statement to

- specify input data sets containing variables to be analyzed, control limit information, or annotation information

- specify a graphics catalog for saving graphical output

- specify whether charts are to be produced on graphics devices or line printers

- define characters used for features on charts produced on line printers

Note: If you are learning to use the SHEWHART procedure, you should read both this chapter and the "Getting Started" section in the chapter for the chart statement that corresponds to the chart you want to create.

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*In Release 6.12 and previous releases of SAS/QC software, the keyword GRAPHICS was required in the PROC SHEWHART statement to specify that the chart be created with a graphics device. In Version 7, you can specify the LINEPRINTER option to request line printer plots.

Syntax Overview for the SHEWHART Procedure

The following are the primary statements that control the SHEWHART procedure:

PROC SHEWHART $<$ *options* $>$;

BOXCHART (*processes***)****subgroup-variable* $<$**(***block-variables* **)** $>$
$<$ $=$*symbol-variable* $|$ $=$*'character'* $>$ $<$ **/** *options* $>$;

CCHART (*processes***)****subgroup-variable* $<$**(***block-variables* **)** $>$
$<$ $=$*symbol-variable* $|$ $=$*'character'* $>$ $<$ **/** *options* $>$;

IRCHART (*processes***)****subgroup-variable* $<$**(***block-variables* **)** $>$
$<$ $=$*symbol-variable* $|$ $=$*'character'* $>$ $<$ **/** *options* $>$;

MCHART (*processes***)****subgroup-variable* $<$**(***block-variables* **)** $>$
$<$ $=$*symbol-variable* $|$ $=$*'character'* $>$ $<$ **/** *options* $>$;

MRCHART (*processes***)****subgroup-variable* $<$**(***block-variables* **)** $>$
$<$ $=$*symbol-variable* $|$ $=$*'character'* $>$ $<$ **/** *options* $>$;

NPCHART (*processes***)****subgroup-variable* $<$**(***block-variables* **)** $>$
$<$ $=$*symbol-variable* $|$ $=$*'character'* $>$ $<$ **/** *options* $>$;

PCHART (*processes***)****subgroup-variable* $<$**(***block-variables* **)** $>$
$<$ $=$*symbol-variable* $|$ $=$*'character'* $>$ $<$ **/** *options* $>$;

RCHART (*processes***)****subgroup-variable* $<$**(***block-variables* **)** $>$
$<$ $=$*symbol-variable* $|$ $=$*'character'* $>$ $<$ **/** *options* $>$;

SCHART (*processes***)****subgroup-variable* $<$**(***block-variables* **)** $>$
$<$ $=$*symbol-variable* $|$ $=$*'character'* $>$ $<$ **/** *options* $>$;

UCHART (*processes***)****subgroup-variable* $<$**(***block-variables* **)** $>$
$<$ $=$*symbol-variable* $|$ $=$*'character'* $>$ $<$ **/** *options* $>$;

XCHART (*processes***)****subgroup-variable* $<$**(***block-variables* **)** $>$
$<$ $=$*symbol-variable* $|$ $=$*'character'* $>$ $<$ **/** *options* $>$;

XRCHART (*processes***)****subgroup-variable* $<$**(***block-variables* **)** $>$
$<$ $=$*symbol-variable* $|$ $=$*'character'* $>$ $<$ **/** *options* $>$;

XSCHART (*processes***)****subgroup-variable* $<$**(***block-variables* **)** $>$
$<$ $=$*symbol-variable* $|$ $=$*'character'* $>$ $<$ **/** *options* $>$;

INSET *keyword-list* $<$ **/** *options* $>$;

INSET2 *keyword-list* $<$ **/** *options* $>$;

The PROC SHEWHART statement invokes the procedure and specifies the input data set. The chart statements create different types of control charts. You can specify one or more of each of the chart statements. For details, read the chapter on the chart statement that corresponds to the type of control chart you want to produce.

BY and ID Statements

In addition, you can optionally specify one of each of the following statements:

BY *variables***;**
ID *variables***;**

The BY statement specifies variables in the input data set that are used for BY processing. A separate control chart is created for each group of observations defined by the levels of the BY variables. The input data set must be sorted in order of the BY variables.

The ID statement specifies variables used to identify observations. The ID variables must be variables in the DATA= or HISTORY= input data sets.

The ID variables are used in the following ways:

- If you create an OUTHISTORY= or OUTTABLE= data set, the ID variables are included. If the input data set is a DATA= data set, only the values of the ID variables from the first observation in each subgroup are passed to the output data set.

- If you specify the TABLEID or TABLEALL options in a chart statement, the table produced is augmented by a column for each of the ID variables. Only the values of the ID variables from the first observation in each subgroup are tabulated. See the entry for the TABLEID option (page 1663) in Chapter 46, "Dictionary of Options."

- If you specify the BOXSTYLE=SCHEMATICID option or the BOXSTYLE= SCHEMATICIDFAR option in the BOXCHART statement, the value of the first variable listed in the ID statement is used to label each extreme observation. See Output 32.2.3 on page 1091 and Output 32.2.4 on page 1092.

Graphical Enhancement Statements

You can use TITLE, FOOTNOTE, and NOTE statements to enhance graphical and printed output. If you are creating charts with a graphics device, you can also use AXIS, LEGEND, and SYMBOL statements to enhance your charts. For details, refer to *SAS/GRAPH Software: Reference* and see the chapter for the control chart statement that you are using.

Syntax for the PROC SHEWHART Statement

The syntax for the PROC SHEWHART statement is as follows:

PROC SHEWHART $<$ *options* $>$ **;**

The PROC SHEWHART statement starts the SHEWHART procedure, and it option-
ally identifies various data sets and requests graphics output. The following section
lists all *options*. See "Dictionary of Options" below for detailed information.

Summary of Options

The following tables list the PROC SHEWHART *options* by function:

Table 31.1. Input Data Sets Options

ANNOTATE=*SAS-data-set*	specifies input data set containing annotation infor-mation for primary chart
ANNOTATE2=*SAS-data-set*	specifies input data set containing annotation infor-mation for secondary chart
DATA=*SAS-data-set*	specifies input data set containing raw data
HISTORY=*SAS-data-set*	specifies input data set containing summary statistics
LIMITS=*SAS-data-set*	specifies input data set containing control limits
TABLE=*SAS-data-set*	specifies input data set containing summary statistics and control limits

Table 31.2. Plotting and Graphics Options

FORMCHAR(*index*)='*string*'	defines characters used for features on charts
GOUT=*graphics-catalog*	specifies catalog for saving graphical output
LINEPRINTER	requests line printer charts be produced

Dictionary of Options

The following entries provide detailed descriptions of options in the PROC SHE-
WHART statement. The marginal notes *Graphics* and *Line Printer* identify options
that apply to graphics devices and line printers, respectively.

ANNOTATE=*SAS-data-set*
ANNO=*SAS-data-set*

Graphics

specifies an input data set containing Annotate variables as described in *SAS/GRAPH
Software: Reference*. You can use this data set to add features to primary charts
produced on graphics devices; use this data set only when the chart is created using a
graphics device; it is ignored when then LINEPRINTER option is specified. Features
provided in this data set are displayed on every chart produced in the current run of
PROC SHEWHART.

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ANNOTATE2=*SAS-data-set*
ANNO2=*SAS-data-set*

specifies an input data set that contains annotate variables. You can use this data set | *Graphics* |
to add features to the secondary chart in statements that produce two charts (the IR-
CHART, MRCHART, XRCHART, and XSCHART statements and, when you specify
the TRENDVAR= option, the BOXCHART, MCHART, and XCHART statements).
The restrictions and features are the same as those for the ANNOTATE= option.

DATA=*SAS-data-set*

names an input data set that contains raw data as observations. Note that the DATA=
data set may need sorting. If the values of the *subgroup-variable* are numeric, you
must sort the data set so that these values are in increasing order (within BY groups).
Use PROC SORT if the data are not already sorted.

The DATA= data set may contain more than one observation for each value of the
subgroup-variable. This happens, for example, when you produce a control chart for
means and ranges with the XRCHART statement.

You cannot use a DATA= data set together with a HISTORY= or a TABLE= data set.
If you do not specify one of these three input data sets, PROC SHEWHART uses the
most recently created data set as a DATA= data set. For more information, see the
"DATA= Data Set" section in the chapter for the chart statement you are using.

FORMCHAR(*index***)='***string***'**

defines characters used for features on charts produced on a line printer, where *index* | *Line Printer* |
is a list of numbers ranging from 1 to 17, and *string* is a character or hexadecimal
string. The *index* identifies which features are controlled with the *string* characters,
as discussed in the following table. If you specify the FORMCHAR= option and omit
the *index*, the *string* controls all 17 features.

Value of *index*	Description of Character	Chart Feature
1	vertical bar	frame
2	horizontal bar	frame, central line
3	box character (upper left)	frame
4	box character (upper middle)	serifs, tick (horizontal axis)
5	box character (upper right)	frame
6	box character (middle left)	not used
7	box character (middle middle)	serifs
8	box character (middle right)	tick (vertical axis)
9	box character (lower left)	frame
10	box character (lower middle)	serifs
11	box character (lower right)	frame
12	vertical bar	control limits
13	horizontal bar	control limits
14	box character (upper right)	control limits
15	box character (lower left)	control limits
16	box character (lower right)	control limits
17	box character (upper left)	control limits

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Not all printers can produce all the characters in the preceding list. By default, the form character list specified with the SAS system FORMCHAR= option is used; otherwise, the default is FORMCHAR='|—-|+|—|====='. If you print to a PC screen or if your device supports the ASCII symbol set (1 or 2), the following is recommended:

```
formchar='B3,C4,DA,C2,BF,C3,C5,B4,C0,C1,D9,BA,CD,BB,C8,BC,D9'X
```

Note that the FORMCHAR= option in the PROC SHEWHART statement allows you to override temporarily the values of the SAS system option of the same name. The values of the SAS system option are not altered by using the FORMCHAR= option in the PROC SHEWHART statement.

GOUT=*graphics-catalog*

Graphics

specifies the graphics catalog for graphics output from PROC SHEWHART. This is useful if you want to save the output. The GOUT= option is used only when the chart is created using a graphics device; it is ignored when the LINEPRINTER option is specified.

HISTORY=*SAS-data-set*
HIST=*SAS-data-set*

names an input data set that contains subgroup summary statistics. For example, you can read sample sizes, means, and ranges for the subgroups to create $\bar{X}$ and R charts. Typically, this data set is created as an OUTHISTORY= data set in a previous run of PROC SHEWHART, but it can also be created using a SAS summarization procedure such as PROC MEANS.

Note that the HISTORY= data sets may need sorting. If the values of the *subgroup-variable* are numeric, you need to sort the data set so that these values are in increasing order (within BY groups). Use PROC SORT if the data are not already sorted. The HISTORY= data set can contain only one observation for each value for the *subgroup-variable*.

You cannot use a HISTORY= data set with a DATA= or a TABLE= data set. If you do not specify one of these three input data sets, PROC SHEWHART uses the most recently created data set as a DATA= data set. For more information, see the "HISTORY= Data Set" section in the chapter for the chart statement you are using.

LIMITS=*SAS-data-set*

names an input data set that contains preestablished control limits or the parameters from which control limits can be computed. Each observation in a LIMITS= data set provides control limit information for a *process*. Typically, this data set is created as an OUTLIMITS= data set in a previous run of PROC SHEWHART.

If you omit the LIMITS= option, then control limits are computed from the data in the DATA= or HISTORY= input data sets. For details about the variables needed in a LIMITS= data set, see the "LIMITS= Data Set" section in the chapter for the chart statement you are using.

LINEPRINTER

requests that line printer charts be produced. By default, the procedure creates charts for a graphics device.

TABLE=*SAS-data-set*

　　names an input data set that contains subgroup summary statistics and control limits. Each observation in a TABLE= data set provides information for a particular subgroup and *process*. Typically, this data set is created as an OUTTABLE= data set in a previous run of PROC SHEWHART.

　　You cannot use a TABLE= data set with a DATA= or a HISTORY= data set. If you do not specify one of these three input data sets, PROC SHEWHART uses the most recently created data set as a DATA= data set. For more information, see the "TABLE= Data Set" section in the chapter for the chart statement that you are using.

Input and Output Data Sets

Figure 31.1 summarizes the input and output data sets used with the SHEWHART procedure.
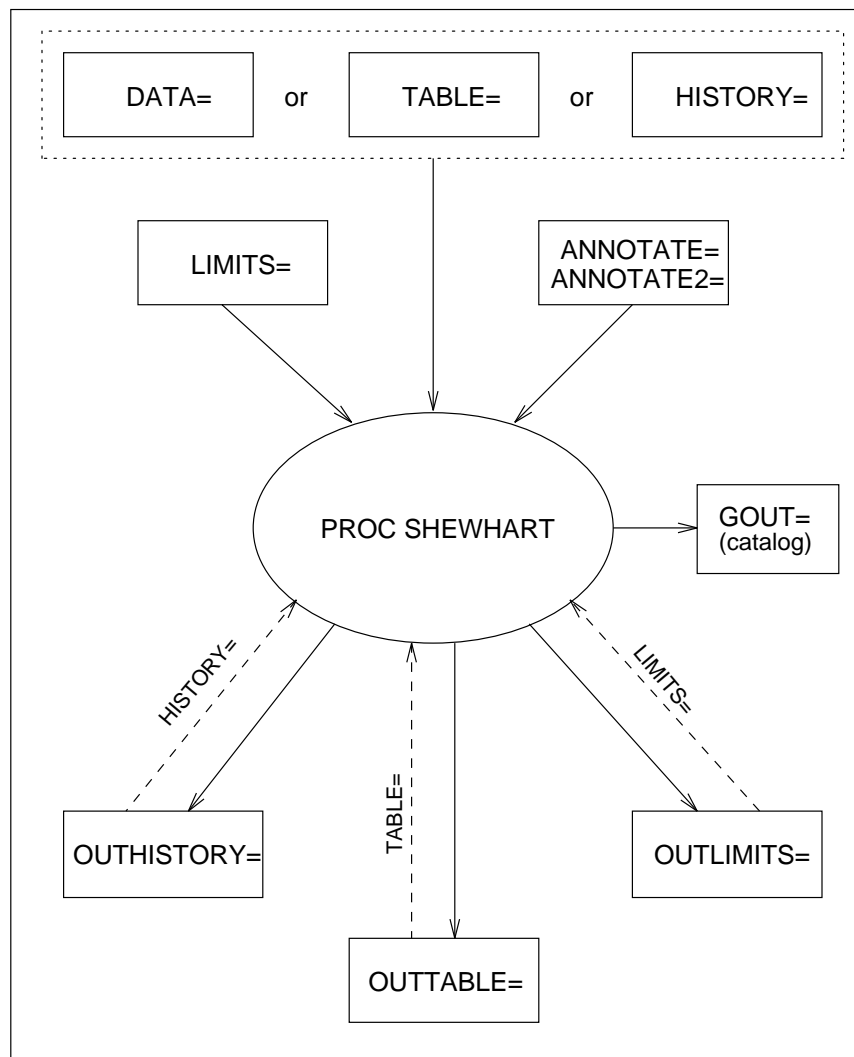
Figure 31.1.　Input and Output Data Sets in the SHEWHART Procedure

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