

# Package ‘qcr’

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**Type** Package

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**Depends** R (>= 1.8.0), qcc

**Suggests** IQCC

**Description** This package allows to generate Shewhart-type charts and to obtain numerical results of interest to the quality control of a process (involving continuous, attribute or count data).

This package provides basic functionality for univariable and multivariable quality control analysis, including: xbar, xbar-one, S, R, ewna, cusum, mewna, mcusum and T2 charts.

**License** GPL (>= 2)

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## R topics documented:

archery1 . . . . .	2
circuit . . . . .	3
counters . . . . .	4
dowell . . . . .	4

employment . . . . .	5
mqed . . . . .	5
mqs . . . . .	6
mqs.mcusum . . . . .	6
mqs.mewma . . . . .	7
mqs.t2 . . . . .	9
orangejuice . . . . .	10
oxidation . . . . .	11
pcmanufact . . . . .	11
pistonrings . . . . .	12
plates . . . . .	13
plot.mqs . . . . .	13
plot.qcs . . . . .	14
presion . . . . .	16
qcd . . . . .	17
qcr . . . . .	18
qcs . . . . .	18
qcs.add . . . . .	20
qcs.c . . . . .	20
qcs.cusum . . . . .	22
qcs.ewma . . . . .	23
qcs.np . . . . .	24
qcs.one . . . . .	26
qcs.p . . . . .	27
qcs.R . . . . .	29
qcs.S . . . . .	30
qcs.u . . . . .	32
qcs.xbar . . . . .	33
state.control . . . . .	35

<b>Index</b>	<b>37</b>
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archery1	<i>Target archery dataset in the ranking round (used as Phase I)</i>
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### Description

It consists in an stage in which the archer shoots 72 arrows in 12 ends of six arrows. The information is given in x and y coordinates.

### Format

An array of (24 x 2 x 3).

**x-coordinate** x-coordinate

**y-coordinate** y-coordinate

**Examples**

```
data(archery1)
str(archery1) ; plot(archery1)
```

---

circuit

*Circuit boards data*

---

**Description**

Number of nonconformities observed in 26 successive samples of 100 printed circuit boards. Sample 6 and 20 are outside the control limits. Sample 6 was examined by a new inspector and he did not recognize several type of nonconformities that could have been present. Furthermore, the unusually large number of nonconformities in sample 20 resulted from a temperature control problem in the wave soldering machine, which was subsequently repaired. The last 20 samples are further samples collected on inspection units (each formed by 100 boards).

**Format**

A data frame with 46 observations on the following 4 variables:

**x** number of defectives in 100 printed circuit boards (inspection unit)

**sample** sample ID

**size** sample size

**trial** trial sample indicator (TRUE/FALSE)

**References**

Montgomery, D.C. (1991) *Introduction to Statistical Quality Control*, 2nd ed, New York, John Wiley & Sons, pp. 173–175

**Examples**

```
data(circuit)
attach(circuit)
summary(circuit)
boxplot(x ~ trial)
plot(x, type="b")
detach(circuit)
```

---

counters

*The performance of the counters data*

---

### Description

A water company from A Corunia wants to control the performance of the counters installed throughout the city. 60 subsamples are taken each one composed by 3 measurements made by the counters of the same antiquity (10 years) and caliber, in a period of 5 years. Taking into account that there are two brands or providers of counters

### Format

A data frame with 180 observations on the following 3 variables:

**error** the measurement error of the counters (Error: (Real Volume - Measured Volume)/Real Volume)

**sample** sample id

**brand** brands of providers of counters

### Examples

```
data(counters)
attach(counters)
summary(counters)
plot(error, type="b")
detach(counters)
```

---

dowel1

*Dowel pin dataset*

---

### Description

Diameter and length of a manufacturing process of a dowel pin##'

### Format

A data frame with 40 observations on the following 2 variables.

**diameter** a numeric vector

**length** a numeric vector

### Examples

```
data(dowel1)
str(dowel1) ; plot(dowel1)
```

---

employment	<i>Level of employment data</i>
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---

### Description

A Spanish-Argentina hotel company wants to control the level of employment in their establishments. For this it is going to make a continuous control that measures the amount of occupants in terms of percentage. 48 sub samples are taken of six hotels belonging to two countries

### Format

A data frame with 288 observations on the following 3 variables:

**occupantion** the amount of occupants in terms of percentage

**sample** sample id

**hemisphere** Hemisphere

### Examples

```
data(employment)
attach(employment)
summary(employment)
boxplot(occupantion ~ hemisphere)
plot(occupantion, type="b")
detach(employment)
```

---

mqcd	<i>Multivariate Quality Control Data</i>
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---

### Description

Create an object of class 'mqcd' to perform statistical quality control. This object be used to plot Multivariate Control Charts.

### Usage

```
mqcd(data, data.name = NULL)
```

### Arguments

**data** a matrix or data-frame or array where it should contain data.

**data.name** a string that specifies the title displayed on the plots. If not provided is taken from the name of the object data.

**Examples**

```
library(qcr)
data(dowel1)
str(dowel1)
data.mqcd <- mqcd(dowel1)
str(data.mqcd)
```

---

mqcs	<i>Create an object of class 'mqcs' to perform statistical quality control. This function is used to compute statistics required for to plot Multivariate Control Charts</i>
------	--

---

**Description**

Create an object of class 'mqcs' to perform statistical quality control. This function is used to compute statistics required for to plot Multivariate Control Charts

**Usage**

```
mqcs(x, method = "sw", ...)
```

**Arguments**

x	Object mqcd (Multivariate Quality Control Data)
method	Is the method employed to compute the covatiance matrix in individual observation case. Two methods are used "sw" for compute according to (Sullivan,Woodall 1996a) and "hm" by (Holmes,Mergen 1993)
...	arguments passed to or from methods.

---

mqcs.mcusum	<i>Function to plot mcusum chart</i>
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---

**Description**

This function is used to compute statistics required by the mcusum chart.

**Usage**

```
mqcs.mcusum(x, ...)
```

## Default S3 method:

```
mqcs.mcusum(x, data.name = NULL, Xmv = NULL, S = NULL,
  k = 0.5, h = 5.5, method = "sw", plot = FALSE, ...)
```

## S3 method for class 'mqcd'

```
mqcs.mcusum(x, Xmv = NULL, S = NULL, k = 0.5, h = 5.5,
  method = "sw", plot = FALSE, ...)
```

**Arguments**

x	an R object (used to select the method). See details.
...	arguments passed to or from methods.
Xmv	is the mean vector. It is only specified for Phase II or when the parameters of the distribution are known.
S	is the sample covariance matrix. It is only used for Phase II or when the parameters of the distribution are known.
k	is a constant used in MCUSUM chart. Frequently $k = 0.5$
h	is a constant used in MCUSUM chart. Usually $h = 5.5$
method	Is the method employed to compute the covatiance matrix in individual observation case. Two methods are used "sw" for compute according to (Sullivan,Woodall 1996a) and "hm" by (Holmes,Mergen 1993)
plot	a logical value indicating should be plotted.
data.name	a string that specifies the title displayed on the plots. If not provided is taken from the name of the object data.

**Author(s)**

Edgar Santos-Fernandez

**Examples**

```
##
## Continuous data
##
library(qcr)
data(dowel1)
str(dowel1)
data.mqcd <- mqcd(dowel1)
res.mqcs <- mqcs.mcusum(data.mqcd)
summary(res.mqcs)
plot(res.mqcs, title = "MCUSUM Control Chart for dowel1")
```

---

mqcs.mewma

*Function to plot mewma chart*


---

**Description**

This function is used to compute statistics required by the mewma chart.

**Usage**

```
mqcs.mewma(x, ...)

## Default S3 method:
mqcs.mewma(x, data.name = NULL, Xmv = NULL, S = NULL,
  method = "sw", plot = FALSE, ...)

## S3 method for class 'mqcd'
mqcs.mewma(x, Xmv = NULL, S = NULL, lambda = 0.1,
  method = "sw", plot = FALSE, ...)
```

**Arguments**

x	an R object (used to select the method). See details.
...	arguments passed to or from methods.
Xmv	is the mean vector. It is only specified for Phase II or when the parameters of the distribution are known.
S	is the sample covariance matrix. It is only used for Phase II or when the parameters of the distribution are known.
lambda	is the smoothing constant. Only values of 0.1, 0.2,...,0.9 are allowed.
method	Is the method employed to compute the covatiance matrix in individual observation case. Two methods are used "sw" for compute according to (Sullivan,Woodall 1996a) and "hm" by (Holmes,Mergen 1993)
plot	a logical value indicating should be plotted.
data.name	a string that specifies the title displayed on the plots. If not provided is taken from the name of the object data.

**Author(s)**

Edgar Santos-Fernandez

**Examples**

```
##
## Continuous data
##
library(qcr)
data(dowel1)
str(dowel1)
data.mqcd <- mqcd(dowel1)
res.mqcs <- mqcs.mewma(data.mqcd)
summary(res.mqcs)
plot(res.mqcs, title = "MEWMA Control Chart for dowel1")
```



mqcs.t2

*Function to plot t2 Hotelling chart***Description**

This function is used to compute statistics required by the t2 chart.

**Usage**

```
mqcs.t2(x, ...)

## Default S3 method:
mqcs.t2(x, data.name = NULL, Xmv = NULL, S = NULL,
        colm = NULL, alpha = 0.01, phase = 1, method = "sw", plot = FALSE,
        ...)

## S3 method for class 'mqcd'
mqcs.t2(x, Xmv = NULL, S = NULL, colm = NULL,
        alpha = 0.01, phase = 1, method = "sw", plot = FALSE, ...)
```

**Arguments**

x	an R object (used to select the method). See details.
...	arguments passed to or from methods.
Xmv	is the mean vector. It is only specified for Phase II or when the parameters of the distribution are known.
S	is the sample covariance matrix. It is only used for Phase II or when the parameters of the distribution are known.
colm	is the number of samples (m) and it is only used in Hotelling control chart for Phase II
alpha	it is the the significance level (0.01 for default)
phase	Allows to select the type of UCL to use. Only values of phase = 1 or 2 are allowed.
method	Is the method employed to compute the covatiance matrix in individual observation case. Two methods are used "sw" for compute according to (Sullivan,Woodall 1996a) and "hm" by (Holmes,Mergen 1993)
plot	a logical value indicating should be plotted.
data.name	a string that specifies the title displayed on the plots. If not provided is taken from the name of the object data.

**Author(s)**

Edgar Santos-Fernandez

### Examples

```
##  
## Continuous data  
##  
library(qcr)  
data(dowel1)  
str(dowel1)  
data.mqcd <- mqcd(dowel1)  
res.mqcs <- mqcs.t2(data.mqcd)  
summary(res.mqcs)  
plot(res.mqcs, title = "Hotelling Control Chart for dowel1")  
  
data(archery1)  
str(archery1)  
data.mqcd <- mqcd(archery1)  
res.mqcs <- mqcs.t2(data.mqcd)  
summary(res.mqcs)  
plot(res.mqcs, title = "Hotelling Control Chart for archery1")
```

---

orangejuice

*Orange juice data*

---

### Description

Frozen orange juice concentrate is packed in 6-oz cardboard cans. These cans are formed on a machine by spinning them from cardboard stock and attaching a metal bottom panel. A can is then inspected to determine whether, when filled, the liquid could possibly leak either on the side seam or around the bottom joint. If this occurs a can is considered nonconforming. The data were collected as 30 samples of 50 cans each at half-hour intervals over a three-shift period in which the machine was in continuous operation. From sample 15 used a new batch of cardboard stock was put into production. Sample 23 was obtained when an inexperienced operator was temporarily assigned to the machine. After the first 30 samples, a machine adjustment was made. Then further 24 samples were taken from the process.

### Format

A data frame with 54 observations on the following 4 variables:

**sample** sample id

**D** number of defectives

**size** sample sizes

**trial** trial samples (TRUE/FALSE)

### References

Montgomery, D.C. (1991) *Introduction to Statistical Quality Control*, 2nd ed, New York, John Wiley & Sons, pp. 152–155.

**Examples**

```

data(orangejuice)
orangejuice$d <- orangejuice$D/orangejuice$size
attach(orangejuice)
summary(orangejuice)
boxplot(d ~ trial)
mark <- ifelse(trial, 1, 2)
plot(sample, d, type="b", col=mark, pch=mark)

```

oxidation

*Oxidation Onset Temperature***Description**

This database contains information on the level of purity of each batch of Picual varieties. Then we have the types of oils by measuring the Oxidation Onset Temperature. We have 50 subsamples of oils with their temperature to oxide.

**Format**

A data frame with 250 observations on the following 2 variables:

**OOT** That is a quantitative variable that controls the quality of the oil.

**sample** sample id

**Examples**

```

data(oxidation)
attach(oxidation)
summary(oxidation)
plot(OOT, type="b")
detach(oxidation)

```

pcmanufact

*Personal computer manufacturer data***Description**

A personal computer manufacturer counts the number of nonconformities per unit on the final assembly line. He collects data on 20 samples of 5 computers each.

**Format**

A data frame with 10 observations on the following 2 variables.

**x** number of nonconformities (inspection units)

**sample** sample ID

**size** number of computers inspected

## References

Montgomery, D.C. (1991) *Introduction to Statistical Quality Control*, 2nd ed, New York, John Wiley & Sons, pp. 181–182

## Examples

```
data(pmanufact)
summary(pmanufact)
plot(pmanufact$x/pmanufact$size, type="b")
```

---

pistonrings

*Piston rings data*

---

## Description

Piston rings for an automotive engine are produced by a forging process. The inside diameter of the rings manufactured by the process is measured on 25 samples, each of size 5, drawn from a process being considered 'in control'.

## Format

A data frame with 200 observations on the following 3 variables.

**diameter** a numeric vector

**sample** sample ID

**trial** trial sample indicator (TRUE/FALSE)

## References

Montgomery, D.C. (1991) *Introduction to Statistical Quality Control*, 2nd ed, New York, John Wiley & Sons, pp. 206–213

## Examples

```
data(pistonrings)
attach(pistonrings)
summary(pistonrings)
boxplot(diameter ~ sample)
plot(sample, diameter, cex=0.7)
lines(tapply(diameter, sample, mean))
detach(pistonrings)
```

---

plates

*Vickers hardness data*

---

### Description

A known chemical company is developing a patent for a new variant of artificial stone composed mostly of quartz (93wt) and polyester resin. This company is launching a pilot plant where it begins to produce plates of this material to industry scale. In order to measure the degree of product homogeneity, 50 samples were taken, performed 5 measurements per plate corresponding to different areas of artificial stone Vickers hardness

### Format

A data frame with 250 observations on the following 2 variables:

**hardness** Vickers hardness corresponding to different areas of artificial stone

**sample** sample id

### Examples

```
data(plates)
attach(plates)
summary(plates)
plot(hardness, type="b")
detach(plates)
```

---

plot.mqcs

*Plot method for 'mqcs' objects*

---

### Description

Generic function for plotting Multivariate charts of object of class 'mqcs' to perform statistical quality control.

### Usage

```
## S3 method for class 'mqcs'
plot(x, title, subtitle, xlab, ylab, ylim, ...)

## S3 method for class 'mqcs.t2'
plot(x, title = NULL, subtitle = NULL, xlab = NULL,
     ylab = NULL, ylim = NULL, ...)

## S3 method for class 'mqcs.mcusum'
plot(x, title = NULL, subtitle = NULL, xlab = NULL,
     ylab = NULL, ylim = NULL, ...)
```

```
## S3 method for class 'mqcs.mewma'
plot(x, title = NULL, subtitle = NULL, xlab = NULL,
     ylab = NULL, ylim = NULL, ...)
```

### Arguments

x	Object mqcs (Multivariate Quality Control Statistical)
title	an overall title for the plot
subtitle	a sub title for the plot
xlab	a title for the x axis
ylab	a title for the y axis
ylim	the y limits of the plot
...	arguments to be passed to or from methods.

---

plot.qcs	<i>function to create a plotting 'qcs' object</i>
----------	---

---

### Description

Generic function for plotting Shewhart charts of object of class 'qcs' to perform statistical quality control.

### Usage

```
## S3 method for class 'qcs'
plot(x, title, subtitle, xlab, ylab, ylim,
     center.nominal = NULL, limits.specification = NULL, limits.alert = NULL,
     label.index = NULL, type.data = c("continuous", "atributte",
     "dependence"), ...)
```

```
## S3 method for class 'qcs.xbar'
plot(x, title = NULL, subtitle = NULL, xlab = NULL,
     ylab = NULL, ylim = NULL, conf.nsigma.alert = NULL,
     center.nominal = NULL, limits.specification = NULL, label.index = NULL,
     ...)
```

```
## S3 method for class 'qcs.S'
plot(x, title = NULL, subtitle = NULL, xlab = NULL,
     ylab = NULL, ylim = NULL, conf.nsigma.alert = NULL,
     center.nominal = NULL, limits.specification = NULL, label.index = NULL,
     ...)
```

```
## S3 method for class 'qcs.R'
plot(x, title = NULL, subtitle = NULL, xlab = NULL,
```

```
ylab = NULL, ylim = NULL, conf.nsigma.alert = NULL,
center.nominal = NULL, limits.specification = NULL, label.index = NULL,
...)
```

```
## S3 method for class 'qcs.one'
plot(x, title = NULL, subtitle = NULL, xlab = NULL,
     ylab = NULL, ylim = NULL, conf.nsigma.alert = NULL,
     center.nominal = NULL, limits.specification = NULL, label.index = NULL,
     ...)
```

```
## S3 method for class 'qcs.p'
plot(x, title = NULL, subtitle = NULL, xlab = NULL,
     ylab = NULL, ylim = NULL, conf.nsigma.alert = NULL,
     center.nominal = NULL, limits.specification = NULL, label.index = NULL,
     ...)
```

```
## S3 method for class 'qcs.np'
plot(x, title = NULL, subtitle = NULL, xlab = NULL,
     ylab = NULL, ylim = NULL, conf.nsigma.alert = NULL,
     center.nominal = NULL, limits.specification = NULL, label.index = NULL,
     ...)
```

```
## S3 method for class 'qcs.c'
plot(x, title = NULL, subtitle = NULL, xlab = NULL,
     ylab = NULL, ylim = NULL, conf.nsigma.alert = NULL,
     center.nominal = NULL, limits.specification = NULL, label.index = NULL,
     ...)
```

```
## S3 method for class 'qcs.u'
plot(x, title = NULL, subtitle = NULL, xlab = NULL,
     ylab = NULL, ylim = NULL, conf.nsigma.alert = NULL,
     center.nominal = NULL, limits.specification = NULL, label.index = NULL,
     ...)
```

```
## S3 method for class 'qcs.ewma'
plot(x, title = NULL, subtitle = NULL, xlab = NULL,
     ylab = NULL, ylim = NULL, label.index = NULL, ...)
```

```
## S3 method for class 'qcs.cusum'
plot(x, title = NULL, subtitle = NULL, xlab = NULL,
     ylab = NULL, ylim = NULL, label.index = NULL, ...)
```

## Arguments

x	Object qcs (Quality Control Statical)
title	an overall title for the plot
subtitle	a sub title for the plot
xlab	a title for the x axis

<code>ylab</code>	a title for the y axis
<code>ylim</code>	the y limits of the plot
<code>center.nominal</code>	a value specifying the center of group statistics or the "target" value of the process
<code>limits.specification</code>	a two-values vector specifying control limits.
<code>limits.alert</code>	a two-values vector specifying control alert limits.
<code>label.index</code>	logical. If TRUE label index is plotted
<code>type.data</code>	a string specifying el type de data.
<code>conf.nsigma</code>	a numeric value used to compute control limits, specifying the number of standard deviations (if <code>conf.nsigma &gt; 1</code> ) or the confidence level (if <code>0 &lt; conf.nsigma &lt; 1</code> ).
<code>conf.nsigma.alert</code>	a numeric value used to compute control limits, specifying the number of standard deviations (if <code>conf.nsigma &gt; 1</code> ) or the confidence level (if <code>0 &lt; conf.nsigma &lt; 1</code> ).
<code>...</code>	arguments to be passed to or from methods.

---

presion	<i>Level of presion data</i>
---------	------------------------------

---

### Description

A shipyard of recreational boats manufacturing, intended to optimize and control the mechanical properties hull yacht models. This has made a study in which the modulus of elasticity tensile strength of the epoxy resin (polymer) used, after applying different curing pressures measured: 0.1 y 10 MPa. 60 subsamples composed of three measurements taken on the same day are taken.

### Format

A data frame with 180 observations on the following 3 variables:

**presion** presion level

**sample** sample id

**measur** pressures measured: 0.1 y 10 MPa

### Examples

```
data(presion)
attach(presion)
summary(presion)
plot(presion$presion, type="b")
detach(presion)
```



---

qcd *Quality Control Data*

---

### Description

Create an object of class 'qcd' to perform statistical quality control. This object may then be used to plot Shewhart charts, Multivariate Control Charts, and more.

### Usage

```
qcd(data, var.index = 1, sample.index = 2, covar.index = NULL,
     covar.names = NULL, data.name = NULL, type.data = c("continuous",
     "attributte", "dependence"), sizes = NULL)
```

### Arguments

data	a matrix or data-frame where it should contain data, index sample and, optionally, covariate(s).
var.index	a scalar with the column number corresponding the observed data for the variable (the variable quality). Alternatively can be a string with the name of the quality variable.
sample.index	a scalar with the column number corresponding the index each group (sample).
covar.index	optional. A scalar or numeric vector with the column number(s) corresponding to the covariate(s). Alternatively can be a character vector with the names of the covariates.
covar.names	optional. A string or vector of strings with names for the covariate columns. Only valid if there is more than one column of data. By default, takes the names from the original object.
data.name	a string specifying the name of the variable which appears on the plots. If not provided is taken from the object given as data.
type.data	a string specifying el type de data.
sizes	optional. A value or a vector of values specifying the sample sizes associated with each group. For continuous data the sample sizes are obtained counting the non-NA elements of the sample.index vector. For attribute variable the argument sizes is required.

---

qcr

*Quality Control and Reability*


---

**Description**

Quality control and reliability

**Details**

This package allows to generate Shewhart-type charts and to obtain numerical results of interest to the quality control of a process (involving continuous, attribute or count data). This package provides basic functionality for univariable and multivariable quality control analysis, including: `xbar`, `xbar-one`, `S`, `R`, `n`, `np`, `c`, `g`, `ewna`, `cusum`, `mewna`, `mcusum` and `T2` charts.

---

qcs

*Quality Control Statistics*


---

**Description**

Create an object of class 'qcs' to perform statistical quality control. This object may then be used to plot Shewhart charts, Multivariate Control Charts, and more.

**Usage**

```
qcs(x, sample.index, sizes = NULL, type = c("xbar", "R", "S", "one", "p",
      "np", "c", "u", "ewma", "cusum"), center = NULL, std.dev, conf.nsigma = 3,
      limits = NULL, type.data = c("continuous", "atributte", "dependence"),
      lambda = 0.2, decision.interval = 5, se.shift = 1)
```

```
qcs.continuous(x, sample.index, sizes = NULL, type = c("xbar", "R", "S",
      "one"), center = NULL, std.dev, conf.nsigma = 3, limits = NULL)
```

```
qcs.atributte(x, sample.index = NULL, sizes = NULL, type = c("p", "np",
      "c", "u"), center = NULL, conf.nsigma = 3, limits = NULL)
```

```
qcs.dependence(x, sample.index = NULL, sizes = NULL, type = c("ewma",
      "cusum"), center = NULL, std.dev, nsigma = 3, lambda = 0.2,
      decision.interval = 5, se.shift = 1)
```

**Arguments**

`x` a vector containing observed data  
`sample.index` a scalar with the column number corresponding the index each group (sample).

sizes	a value or a vector of values specifying the sample sizes associated with each group. For continuous data the sample sizes are obtained counting the non-NA elements of the sample.index vector. For "p", "np" and "u" charts the argument sizes is required.	
type	a character string specifying the group statistics to compute:	
	Statistic charted	Chart description
"xbar"	mean	means of a continuous process variable
"R"	range	ranges of a continuous process variable
"S"	standard deviation	standard deviations of a continuous variable
"one"	mean	one-at-time data of a continuous process variable
"p"	proportion	proportion of nonconforming units
"np"	count	number of nonconforming units
"c"	count	nonconformities per unit
"u"	count	average nonconformities per unit
"g"	count	number of non-events between events
center	a value specifying the center of group statistics or the "target" value of the process.	
std.dev	a value or an available method specifying the within-group standard deviation(s) of the process. Several methods are available for estimating the standard deviation in case of a continuous process variable.	
conf.nsigma	a numeric value used to compute control limits, specifying the number of standard deviations (if conf.nsigma > 1) or the confidence level (if 0 < conf.nsigma < 1).	
limits	a two-values vector specifying control limits.	
type.data	a string specifying el type de data.	
lambda	the smoothing parameter $0 \leq \lambda \leq 1$	
nsigma	a numeric value used to compute control limits, specifying the number of standard deviations.	
decision.interval	A numeric value specifying the number of standard errors of the summary statistics at which the cumulative sum is out of control.	
se.shift	The amount of shift to detect in the process, measured in standard errors of the summary statistics.	

### Value

Returns an object of class 'qcs'.

### References

- Montgomery, D.C. (2000) *Introduction to Statistical Quality Control*, 4th ed. New York: John Wiley & Sons.
- Wetherill, G.B. and Brown, D.W. (1991) *Statistical Process Control*. New York: Chapman & Hall.

---

qcs.add	<i>qcs.add</i> Add a data.frame object with a qcs object
---------	--

---

### Description

This function is used to join two objects of type data.frame and qcs.

### Usage

```
qcs.add(x, ...)
```

## Default S3 method:

```
qcs.add(x, value, var.index = NULL, sample.index = NULL,
        covar.index = NULL, ...)
```

### Arguments

x	Object type qcs
value	Object type data.frame
var.index	a scalar with the column number corresponding the observed data for the variable (the variable quality). Alternatively can be a string with the name of the quality variable.
sample.index	a scalar with the column number corresponding the index each group (sample).
covar.index	optional. A scalar or numeric vector with the column number(s) corresponding to the covariate(s). Alternatively can be a character vector with the names of the covariates.
...	arguments to be passed to or from methods.

---

qcs.c	<i>Function to plot Shewhart c chart</i>
-------	--

---

### Description

This function is used to compute statistics required by the c chart.

### Usage

```
qcs.c(x, ...)
```

## Default S3 method:

```
qcs.c(x, var.index = 1, sample.index = 2,
        covar.index = NULL, covar.names = NULL, data.name = NULL,
        sizes = NULL, center = NULL, conf.nsigma = 3, limits = NULL,
        plot = FALSE, ...)
```

```
## S3 method for class 'qcd'
qcs.c(x, center = NULL, conf.nsigma = 3, limits = NULL,
      plot = FALSE, ...)
```

### Arguments

<code>x</code>	an R object (used to select the method). See details.
<code>...</code>	arguments passed to or from methods.
<code>center</code>	a value specifying the center of group statistics or the "target" value of the process.
<code>conf.nsigma</code>	a numeric value used to compute control limits, specifying the number of standard deviations (if <code>conf.nsigma &gt; 1</code> ) or the confidence level (if $0 < \text{conf.nsigma} < 1$ ).
<code>limits</code>	a two-values vector specifying control limits.
<code>plot</code>	a logical value indicating should be plotted.
<code>var.index</code>	a scalar with the column number corresponding the observed data for the variable (the variable quality). Alternatively can be a string with the name of the quality variable.
<code>sample.index</code>	a scalar with the column number corresponding the index each group (sample).
<code>covar.index</code>	optional. A scalar or numeric vector with the column number(s) corresponding to the covariate(s). Alternatively can be a character vector with the names of the covariates.
<code>covar.names</code>	optional. A string or vector of strings with names for the covariate columns. Only valid if there is more than one column of data. By default, takes the names from the original object.
<code>data.name</code>	a string specifying the name of the variable which appears on the plots. If not provided is taken from the object given as data.
<code>sizes</code>	optional. A value or a vector of values specifying the sample sizes associated with each group. For continuous data the sample sizes are obtained counting the non-NA elements of the <code>sample.index</code> vector. For attribute variable the argument <code>sizes</code> is required.

### Examples

```
library(qcr)
data(circuit)
attach(circuit)
str(circuit)
datos <- circuit
datos$sample <- 1:length(datos$x)
str(datos)
sizes <- datos[,2]

datos.qcd <- qcd(data = datos, var.index = 1, sample.index = 2,
                sizes = size, type.data = "atributte")
res.qcs <- qcs.c(datos.qcd)
```

```
summary(res.qcs)
plot(res.qcs)
```

---

qcs.cusum

*Function to plot cusum chart*


---

## Description

This function is used to compute statistics required by the cusum chart.

## Usage

```
qcs.cusum(x, ...)

## Default S3 method:
qcs.cusum(x, var.index = 1, sample.index = 2,
  covar.index = NULL, covar.names = NULL, data.name = NULL,
  sizes = NULL, center = NULL, std.dev = NULL, decision.interval = 5,
  se.shift = 1, plot = FALSE, ...)

## S3 method for class 'qcd'
qcs.cusum(x, center = NULL, std.dev = NULL,
  decision.interval = 5, se.shift = 1, plot = FALSE, ...)
```

## Arguments

x	an R object (used to select the method). See details.
...	arguments passed to or from methods.
sizes	a value or a vector of values specifying the sample sizes associated with each group.
center	a value specifying the center of group statistics or the "target" value of the process.
std.dev	a value or an available method specifying the within-group standard deviation(s) of the process. Several methods are available for estimating the standard deviation.
decision.interval	A numeric value specifying the number of standard errors of the summary statistics at which the cumulative sum is out of control.
se.shift	The amount of shift to detect in the process, measured in standard errors of the summary statistics.
plot	a logical value indicating should be plotted.
var.index	a scalar with the column number corresponding the observed data for the variable (the variable quality). Alternatively can be a string with the name of the quality variable.
sample.index	a scalar with the column number corresponding the index each group (sample).

covar.index	optional. A scalar or numeric vector with the column number(s) corresponding to the covariate(s). Alternatively can be a character vector with the names of the covariates.
covar.names	optional. A string or vector of strings with names for the covariate columns. Only valid if there is more than one column of data. By default, takes the names from the original object.
data.name	a string specifying the name of the variable which appears on the plots. If not provided is taken from the object given as data.

### Examples

```
library(qcr)
data(pistonrings)
attach(pistonrings)
res.qcd <- qcd(pistonrings, type.data = "dependence")
res.qcs <- qcs.cusum(res.qcd, type = "cusum")
summary(res.qcs)
plot(res.qcs)
```

---

qcs.ewma

*Function to plot ewma chart*


---

### Description

This function is used to compute statistics required by the ewma chart.

This function is used to compute statistics required by the ewma chart.

### Usage

```
qcs.ewma(x, ...)
```

## Default S3 method:

```
qcs.ewma(x, var.index = 1, sample.index = 2,
  covar.index = NULL, covar.names = NULL, data.name = NULL,
  sizes = NULL, center = NULL, std.dev = NULL, nsigma = 3,
  lambda = 0.2, plot = FALSE, ...)
```

## S3 method for class 'qcd'

```
qcs.ewma(x, center = NULL, std.dev = NULL, nsigma = 3,
  lambda = 0.2, plot = FALSE, ...)
```

### Arguments

x	an R object (used to select the method). See details.
...	arguments passed to or from methods.
center	a value specifying the center of group statistics or the "target" value of the process.

std.dev	a value or an available method specifying the within-group standard deviation(s) of the process. Several methods are available for estimating the standard deviation in case of a continuous process variable.
nsigma	a numeric value used to compute control limits, specifying the number of standard deviations.
lambda	the smoothing parameter $0 \leq \lambda \leq 1$
plot	a logical value indicating should be plotted.
var.index	a scalar with the column number corresponding the observed data for the variable (the variable quality). Alternatively can be a string with the name of the quality variable.
sample.index	a scalar with the column number corresponding the index each group (sample).
covar.index	optional. A scalar or numeric vector with the column number(s) corresponding to the covariate(s). Alternatively can be a character vector with the names of the covariates.
covar.names	optional. A string or vector of strings with names for the covariate columns. Only valid if there is more than one column of data. By default, takes the names from the original object.
data.name	a string specifying the name of the variable which appears on the plots. If not provided is taken from the object given as data.
sizes	optional. A value or a vector of values specifying the sample sizes associated with each group. For continuous data the sample sizes are obtained counting the non-NA elements of the sample.index vector. For attribute variable the argument sizes is required.

---

qcs.np

*Function to plot Shewhart np chart*


---

## Description

This function is used to compute statistics required by the np chart.

## Usage

```
qcs.np(x, ...)

## Default S3 method:
qcs.np(x, var.index = 1, sample.index = 2,
       covar.index = NULL, covar.names = NULL, data.name = NULL,
       sizes = NULL, center = NULL, conf.nsigma = 3, limits = NULL,
       plot = FALSE, ...)

## S3 method for class 'qcd'
qcs.np(x, center = NULL, conf.nsigma = 3, limits = NULL,
       plot = FALSE, ...)
```



**Arguments**

<code>x</code>	an R object (used to select the method). See details.
<code>...</code>	arguments passed to or from methods.
<code>center</code>	a value specifying the center of group statistics or the "target" value of the process.
<code>conf.nsigma</code>	a numeric value used to compute control limits, specifying the number of standard deviations (if <code>conf.nsigma &gt; 1</code> ) or the confidence level (if $0 < \text{conf.nsigma} < 1$ ).
<code>limits</code>	a two-values vector specifying control limits.
<code>plot</code>	a logical value indicating should be plotted.
<code>var.index</code>	a scalar with the column number corresponding the observed data for the variable (the variable quality). Alternatively can be a string with the name of the quality variable.
<code>sample.index</code>	a scalar with the column number corresponding the index each group (sample).
<code>covar.index</code>	optional. A scalar or numeric vector with the column number(s) corresponding to the covariate(s). Alternatively can be a character vector with the names of the covariates.
<code>covar.names</code>	optional. A string or vector of strings with names for the covariate columns. Only valid if there is more than one column of data. By default, takes the names from the original object.
<code>data.name</code>	a string specifying the name of the variable which appears on the plots. If not provided is taken from the object given as data.
<code>sizes</code>	optional. A value or a vector of values specifying the sample sizes associated with each group. For continuous data the sample sizes are obtained counting the non-NA elements of the <code>sample.index</code> vector. For attribute variable the argument <code>sizes</code> is required.

**Examples**

```
library(qcr)
data(orangejuice)
str(orangejuice)
attach(orangejuice)

datos.qcd <- qcd(data = orangejuice, var.index = 1, sample.index = 2,
                sizes = size, type.data = "atributte")

res.qcs <- qcs.np(datos.qcd)
summary(res.qcs)
plot(res.qcs)

datos.qcs <- qcs.np(orangejuice[trial,c(1,2)], sizes = orangejuice[trial,3])
plot(datos.qcs)
```

qcs.one

*Function to plot Shewhart xbar.one chart***Description**

This function is used to compute statistics required by the xbar.one chart.

**Usage**

```
qcs.one(x, ...)

## Default S3 method:
qcs.one(x, var.index = 1, sample.index = 2,
        covar.index = NULL, covar.names = NULL, data.name = NULL,
        sizes = NULL, center = NULL, std.dev = c("MR", "SD"), k = 2,
        conf.nsigma = 3, limits = NULL, plot = FALSE, ...)

## S3 method for class 'qcd'
qcs.one(x, center = NULL, std.dev = c("MR", "SD"), k = 2,
        conf.nsigma = 3, limits = NULL, plot = FALSE, ...)
```

**Arguments**

x	an R object (used to select the method). See details.
...	arguments passed to or from methods.
sizes	optional. A value or a vector of values specifying the sample sizes associated with each group. For continuous data the sample sizes are obtained counting the non-NA elements of the sample.index vector. For attribute variable the argument sizes is required.
center	a value specifying the center of group statistics or the "target" value of the process.
std.dev	a value or an available method specifying the within-group standard deviation(s) of the process. Several methods are available for estimating the standard deviation in case of a continuous process variable.
k	number of successive pairs of observations for computing the standard deviation based on moving ranges of k points.
conf.nsigma	a numeric value used to compute control limits, specifying the number of standard deviations (if <code>conf.nsigma &gt; 1</code> ) or the confidence level (if <code>0 &lt; conf.nsigma &lt; 1</code> ).
limits	a two-values vector specifying control limits.
plot	a logical value indicating should be plotted.
var.index	a scalar with the column number corresponding the observed data for the variable (the variable quality). Alternatively can be a string with the name of the quality variable.

sample.index	a scalar with the column number corresponding the index each group (sample).
covar.index	optional. A scalar or numeric vector with the column number(s) corresponding to the covariate(s). Alternatively can be a character vector with the names of the covariates.
covar.names	optional. A string or vector of strings with names for the covariate columns. Only valid if there is more than one column of data. By default, takes the names from the original object.
data.name	a string specifying the name of the variable which appears on the plots. If not provided is taken from the object given as data.

### Details

In the default method `qcs.one.default` parameter `x` is a matrix or data-frame where it should contain data, index sample and, optionally, covariate(s).

### Examples

```
##
## Continuous data
##
library(qcr)
x <- c(33.75, 33.05, 34, 33.81, 33.46, 34.02, 33.68, 33.27, 33.49, 33.20,
      33.62, 33.00, 33.54, 33.12, 33.84)

sample <- 1:length(x)
datos <- data.frame(x,sample)
datos.qcd <- qcd(datos)

res.qcs <- qcs.one(datos.qcd)
class(res.qcs)
summary(res.qcs)
plot(res.qcs, title = "Control Chart Xbar.one for pistonrings")
```

---

qcs.p

*Function to plot Shewhart xbar chart*

---

### Description

This function is used to compute statistics required by the p chart.

### Usage

```
qcs.p(x, ...)
```

## Default S3 method:

```
qcs.p(x, var.index = 1, sample.index = 2,
      covar.index = NULL, covar.names = NULL, data.name = NULL,
      sizes = NULL, center = NULL, conf.nsigma = 3, limits = NULL,
```

```

    plot = FALSE, ...)

## S3 method for class 'qcd'
qcs.p(x, center = NULL, conf.nsigma = 3, limits = NULL,
      plot = FALSE, ...)

```

### Arguments

<code>x</code>	an R object (used to select the method). See details.
<code>...</code>	arguments passed to or from methods.
<code>center</code>	a value specifying the center of group statistics or the "target" value of the process.
<code>conf.nsigma</code>	a numeric value used to compute control limits, specifying the number of standard deviations (if <code>conf.nsigma &gt; 1</code> ) or the confidence level (if $0 < \text{conf.nsigma} < 1$ ).
<code>limits</code>	a two-values vector specifying control limits.
<code>plot</code>	a logical value indicating should be plotted.
<code>var.index</code>	a scalar with the column number corresponding the observed data for the variable (the variable quality). Alternatively can be a string with the name of the quality variable.
<code>sample.index</code>	a scalar with the column number corresponding the index each group (sample).
<code>covar.index</code>	optional. A scalar or numeric vector with the column number(s) corresponding to the covariate(s). Alternatively can be a character vector with the names of the covariates.
<code>covar.names</code>	optional. A string or vector of strings with names for the covariate columns. Only valid if there is more than one column of data. By default, takes the names from the original object.
<code>data.name</code>	a string specifying the name of the variable which appears on the plots. If not provided is taken from the object given as data.
<code>sizes</code>	optional. A value or a vector of values specifying the sample sizes associated with each group. For continuous data the sample sizes are obtained counting the non-NA elements of the <code>sample.index</code> vector. For attribute variable the argument <code>sizes</code> is required.

### Examples

```

library(qcr)
data(orangejuice)
str(orangejuice)
attach(orangejuice)

datos.qcd <- qcd(data = orangejuice, var.index = 1, sample.index = 2,
                sizes = size, type.data = "atributte")

res.qcs <- qcs.p(datos.qcd)
summary(res.qcs)

```

```

plot(res.qcs)

datos.qcs <- qcs.p(orangejuice[trial,c(1,2)], sizes = orangejuice[trial,3])
plot(datos.qcs)

```

---

qcs.R

*Function to plot Shewhart R chart*


---

## Description

This function is used to compute statistics required by the R chart.

## Usage

```

qcs.R(x, ...)

## Default S3 method:
qcs.R(x, var.index = 1, sample.index = 2,
      covar.index = NULL, covar.names = NULL, data.name = NULL,
      sizes = NULL, center = NULL, std.dev = c("UWAVE-R", "MVLUE-R"),
      conf.nsigma = 3, limits = NULL, plot = FALSE, ...)

## S3 method for class 'qcd'
qcs.R(x, center = NULL, std.dev = c("UWAVE-R", "MVLUE-R"),
      conf.nsigma = 3, limits = NULL, plot = FALSE, ...)

```

## Arguments

x	an R object (used to select the method). See details.
...	arguments passed to or from methods.
center	a value specifying the center of group statistics or the "target" value of the process.
std.dev	a value or an available method specifying the within-group standard deviation(s) of the process. Several methods are available for estimating the standard deviation in case of a continuous process variable.
conf.nsigma	a numeric value used to compute control limits, specifying the number of standard deviations (if <code>conf.nsigma &gt; 1</code> ) or the confidence level (if <code>0 &lt; conf.nsigma &lt; 1</code> ).
limits	a two-values vector specifying control limits.
plot	a logical value indicating should be plotted.
var.index	a scalar with the column number corresponding the observed data for the variable (the variable quality). Alternatively can be a string with the name of the quality variable.
sample.index	a scalar with the column number corresponding the index each group (sample).

<code>covar.index</code>	optional. A scalar or numeric vector with the column number(s) corresponding to the covariate(s). Alternatively can be a character vector with the names of the covariates.
<code>covar.names</code>	optional. A string or vector of strings with names for the covariate columns. Only valid if there is more than one column of data. By default, takes the names from the original object.
<code>data.name</code>	a string specifying the name of the variable which appears on the plots. If not provided is taken from the object given as data.
<code>sizes</code>	optional. A value or a vector of values specifying the sample sizes associated with each group. For continuous data the sample sizes are obtained counting the non-NA elements of the <code>sample.index</code> vector. For attribute variable the argument <code>sizes</code> is required.

### Examples

```
##
## Continuous data
##
library(qcr)
data(pistonrings)
str(pistonrings)
pistonrings.qcd<-qcd(pistonrings)

class(pistonrings.qcd)

res.qcs <- qcs.R(pistonrings.qcd)
class(res.qcs)
plot(res.qcs,title="Control Chart R for pistonrings")
summary(res.qcs)
```

---

qcs.S

*Function to plot Shewhart S chart*

---

### Description

This function is used to compute statistics required by the S chart.

### Usage

```
qcs.S(x, ...)
```

## Default S3 method:

```
qcs.S(x, var.index = 1, sample.index = 2,
      covar.index = NULL, covar.names = NULL, data.name = NULL,
      sizes = NULL, center = NULL, std.dev = c("UWAVE-SD", "MVLUE-SD",
        "RMSDF"), conf.nsigma = 3, limits = NULL, plot = FALSE, ...)
```

```
## S3 method for class 'qcd'
qcs.S(x, center = NULL, std.dev = c("UWAVE-SD", "MVLUE-SD",
  "RMSDF"), conf.nsigma = 3, limits = NULL, plot = FALSE, ...)
```

### Arguments

x	an R object (used to select the method). See details.
...	arguments passed to or from methods.
center	a value specifying the center of group statistics or the "target" value of the process.
std.dev	a value or an available method specifying the within-group standard deviation(s) of the process. Several methods are available for estimating the standard deviation in case of a continuous process variable.
conf.nsigma	a numeric value used to compute control limits, specifying the number of standard deviations (if <code>conf.nsigma &gt; 1</code> ) or the confidence level (if <code>0 &lt; conf.nsigma &lt; 1</code> ).
limits	a two-values vector specifying control limits.
plot	a logical value indicating should be plotted.
var.index	a scalar with the column number corresponding the observed data for the variable (the variable quality). Alternatively can be a string with the name of the quality variable.
sample.index	a scalar with the column number corresponding the index each group (sample).
covar.index	optional. A scalar or numeric vector with the column number(s) corresponding to the covariate(s). Alternatively can be a character vector with the names of the covariates.
covar.names	optional. A string or vector of strings with names for the covariate columns. Only valid if there is more than one column of data. By default, takes the names from the original object.
data.name	a string specifying the name of the variable which appears on the plots. If not provided is taken from the object given as data.
sizes	optional. A value or a vector of values specifying the sample sizes associated with each group. For continuous data the sample sizes are obtained counting the non-NA elements of the <code>sample.index</code> vector. For attribute variable the argument sizes is required.

### Details

In the default method `qcs.S.default` parameter `x` is a matrix or data-frame where it should contain data, index sample and, optionally, covariate(s).

### See Also

[qcs](#), [qcd](#)

**Examples**

```
##
## Continuous data
##
library(qcr)
data(pistonrings)
str(pistonrings)
pistonrings.qcd<-qcd(pistonrings)

class(pistonrings.qcd)

res.qcs <- qcs.S(pistonrings.qcd)
class(res.qcs)
plot(res.qcs,title="Control Chart S for pistonrings")
summary(res.qcs)
```

---

qcs.u

*Function to plot Shewhart u chart*


---

**Description**

This function is used to compute statistics required by the u chart.

**Usage**

```
qcs.u(x, ...)
```

## Default S3 method:

```
qcs.u(x, var.index = 1, sample.index = 2,
      covar.index = NULL, covar.names = NULL, data.name = NULL,
      sizes = NULL, center = NULL, conf.nsigma = 3, limits = NULL,
      plot = FALSE, ...)
```

## S3 method for class 'qcd'

```
qcs.u(x, center = NULL, conf.nsigma = 3, limits = NULL,
      plot = FALSE, ...)
```

**Arguments**

x	an R object (used to select the method). See details.
...	arguments passed to or from methods.
center	a value specifying the center of group statistics or the "target" value of the process.
conf.nsigma	a numeric value used to compute control limits, specifying the number of standard deviations (if <code>conf.nsigma &gt; 1</code> ) or the confidence level (if <code>0 &lt; conf.nsigma &lt; 1</code> ).
limits	a two-values vector specifying control limits.



<code>plot</code>	a logical value indicating should be plotted.
<code>var.index</code>	a scalar with the column number corresponding the observed data for the variable (the variable quality). Alternatively can be a string with the name of the quality variable.
<code>sample.index</code>	a scalar with the column number corresponding the index each group (sample).
<code>covar.index</code>	optional. A scalar or numeric vector with the column number(s) corresponding to the covariate(s). Alternatively can be a character vector with the names of the covariates.
<code>covar.names</code>	optional. A string or vector of strings with names for the covariate columns. Only valid if there is more than one column of data. By default, takes the names from the original object.
<code>data.name</code>	a string specifying the name of the variable which appears on the plots. If not provided is taken from the object given as data.
<code>sizes</code>	optional. A value or a vector of values specifying the sample sizes associated with each group. For continuous data the sample sizes are obtained counting the non-NA elements of the <code>sample.index</code> vector. For attribute variable the argument <code>sizes</code> is required.

### Examples

```

data(pcmanufact)
attach(pcmanufact)
str(pcmanufact)
datos <- pcmanufact
datos$sample <- 1:length(datos$x)
str(datos)
sizes <- datos[,2]

datos.qcd <- qcd(data = datos, var.index = 1, sample.index = 2,
               sizes = sizes, type.data = "atributte")

res.qcs <- qcs.u(datos.qcd)
summary(res.qcs)
plot(res.qcs)

```

---

qcs.xbar

*Function to plot Shewhart xbar chart*

---

### Description

This function is used to compute statistics required by the xbar chart.

**Usage**

```

qcs.xbar(x, ...)

## Default S3 method:
qcs.xbar(x, var.index = 1, sample.index = 2,
  covar.index = NULL, covar.names = NULL, data.name = NULL,
  sizes = NULL, center = NULL, std.dev = c("UWAVE-R", "UWAVE-SD",
  "MVLUE-R", "MVLUE-SD", "RMSDF"), conf.nsigma = 3, limits = NULL,
  plot = FALSE, ...)

## S3 method for class 'qcd'
qcs.xbar(x, center = NULL, std.dev = c("UWAVE-R", "UWAVE-SD",
  "MVLUE-R", "MVLUE-SD", "RMSDF"), conf.nsigma = 3, limits = NULL,
  plot = FALSE, ...)

```

**Arguments**

<code>x</code>	an R object (used to select the method). See details.
<code>...</code>	arguments passed to or from methods.
<code>center</code>	a value specifying the center of group statistics or the "target" value of the process.
<code>std.dev</code>	a value or an available method specifying the within-group standard deviation(s) of the process. Several methods are available for estimating the standard deviation in case of a continuous process variable.
<code>conf.nsigma</code>	a numeric value used to compute control limits, specifying the number of standard deviations (if <code>conf.nsigma &gt; 1</code> ) or the confidence level (if <code>0 &lt; conf.nsigma &lt; 1</code> ).
<code>limits</code>	a two-values vector specifying control limits.
<code>plot</code>	a logical value indicating should be plotted.
<code>var.index</code>	a scalar with the column number corresponding the observed data for the variable (the variable quality). Alternatively can be a string with the name of the quality variable.
<code>sample.index</code>	a scalar with the column number corresponding the index each group (sample).
<code>covar.index</code>	optional. A scalar or numeric vector with the column number(s) corresponding to the covariate(s). Alternatively can be a character vector with the names of the covariates.
<code>covar.names</code>	optional. A string or vector of strings with names for the covariate columns. Only valid if there is more than one column of data. By default, takes the names from the original object.
<code>data.name</code>	a string specifying the name of the variable which appears on the plots. If not provided is taken from the object given as data.
<code>sizes</code>	optional. A value or a vector of values specifying the sample sizes associated with each group. For continuous data the sample sizes are obtained counting the non-NA elements of the <code>sample.index</code> vector. For attribute variable the argument <code>sizes</code> is required.

## References

Montgomery, D.C. (2000)

## Examples

```
##
## Continuous data
##
library(qcr)
data(pistonrings)
str(pistonrings)
pistonrings.qcd<-qcd(pistonrings)

class(pistonrings.qcd)

res.qcs <- qcs.xbar(pistonrings.qcd)
plot(res.qcs,title="Control Chart Xbar for pistonrings I")
summary(res.qcs)

res.qcd <- state.control(res.qcs)
res.qcs <- qcs.xbar(res.qcd)
plot(res.qcs,title="Control Chart Xbar for pistonrings II")
summary(res.qcs)

res.qcd <- state.control(res.qcs)
res.qcs <- qcs.xbar(res.qcd)
plot(res.qcs,title="Control Chart Xbar for pistonrings III")
summary(res.qcs)

x <- droplevels(pistonrings[1:125,])
y <- droplevels(pistonrings[126:200,])

res.qcs <- qcs.xbar(x, data.name="Control Chart Xbar for pistonrings")
plot(res.qcs)

res.qcs <- qcs.add(x = res.qcs, value = y[,c(1,2)])
plot(res.qcs)
summary(res.qcs)

res.qcs <- qcs.xbar(pistonrings.qcd, std.dev="UWAVE-SD")
class(res.qcs)
plot(res.qcs,title="Control Chart Xbar for pistonrings (UWAVE-SD)")
summary(res.qcs)
```

---

state.control

*This function is used for the state of the process is under control. Were removed from the sample observations that violate the rules of a process under control*

---

**Description**

This function is used for the state of the process is under control. Were removed from the sample observations that violate the rules of a process under control

**Usage**

```
state.control(x)
```

**Arguments**

x                    Object qcs (Quality Control Statistical)

**Examples**

```
##  
## Continuous data  
##  
library(qcr)  
data(pistonrings)  
str(pistonrings)  
pistonrings.qcd<-qcd(pistonrings)  
  
class(pistonrings.qcd)  
  
res.qcs <- qcs.xbar(pistonrings.qcd)  
plot(res.qcs,title="Control Chart Xbar for pistonrings I")  
summary(res.qcs)  
  
res.qcd <- state.control(res.qcs)  
res.qcs <- qcs.xbar(res.qcd)  
plot(res.qcs,title="Control Chart Xbar for pistonrings II")  
summary(res.qcs)  
  
res.qcd <- state.control(res.qcs)  
res.qcs <- qcs.xbar(res.qcd)  
plot(res.qcs,title="Control Chart Xbar for pistonrings III")  
summary(res.qcs)
```

# Index

## \*Topic **datasets**

- archery1, 2
- circuit, 3
- counters, 4
- dowel1, 4
- employment, 5
- orangejuice, 10
- oxidation, 11
- pcmanufact, 11
- pistonrings, 12
- plates, 13
- presion, 16

archery1, 2

circuit, 3  
counters, 4

dowel1, 4

employment, 5

mqcd, 5  
mqcs, 6  
mqcs.mcusum, 6  
mqcs.mewma, 7  
mqcs.t2, 9

orangejuice, 10  
oxidation, 11

pcmanufact, 11  
pistonrings, 12  
plates, 13  
plot.mqcs, 13  
plot.qcs, 14  
presion, 16  
print.mqcs (mqcs), 6  
print.qcs (qcs), 18

qcd, 17, 31

qcr, 18  
qcr-package (qcr), 18  
qcs, 18, 31  
qcs.add, 20  
qcs.c, 20  
qcs.cusum, 22  
qcs.ewma, 23  
qcs.np, 24  
qcs.one, 26  
qcs.p, 27  
qcs.R, 29  
qcs.S, 30  
qcs.u, 32  
qcs.xbar, 33

state.control, 35  
summary.mqcs (mqcs), 6  
summary.qcs (qcs), 18