



## User Guide Table of Contents

Installing QI Macros	1
QI Macros Overview	3
Creating Charts	4
Data Format & Selection Tips	5
QI Macros Chart Tab	6
QI Macros Wizards	7
Data Mining Wizard	8
Chart Wizard	9
Control Chart Wizard	10
Statistics Wizard	11
PivotTable Wizard	12
Capability and Improvement	13
Pareto Chart	13
Scatter Plot	14
Matrix Plot	14
Box & Whisker	15
Multivari Chart	15
Histogram	16
Control Charts	18
c, np, p, and u Control Charts	18
X and R Control Charts	19
Specialized Control Charts	20
Control Chart Dashboards	21
Control Chart Features	22
Control Chart Stability Rules	22
Create Stair Step Limits	22
QI Macros Chart Menu	23
Excel Charts	25
Fill-in-the-Blank Templates	26
Control Chart Templates	27
Fishbone (Ishikawa) Diagram	28
Value Stream Map	30
Gage R&R	31
Design of Experiments (DOE)	32
Statistical Tools	33
Data Mining Tools	34
Installation Troubleshooting	35
Other Resources	36

# Installing QI Macros

## From Download

- Save the QIMacros230.zip file on your PC or Mac.
- Close Excel.
- Extract files from the zipped folder.
- Launch the installation wizard:
  - PC: Open the QI Macros PC folder and double-click the QI Macros Setup.exe file.
  - Mac: Open the QI Macros Mac folder and double-click the QIMacros.dmg file.

## From CD

- Close Excel.
- Insert the CD to view the contents.
- Launch the installation wizard:
  - PC: Double-click the QI Macros Setup.exe file.
  - Mac: Open the Macintosh Installation Files folder and double-click the QIMacros.dmg file.
- Open Excel and look for the QI Macros tab on the menu.

## Installation Troubleshooting

If the installation wizard ran, but the QI Macros menu did not appear on your Excel toolbar, refer to this web-page for the most common solutions: [qimacros.com/support/qi-macros-tech-support](http://qimacros.com/support/qi-macros-tech-support)

**Tech Support** Monday through Friday 8 a.m. to 5 p.m. MST

Email: [support@qimacros.com](mailto:support@qimacros.com)

Call: 888.468.1537 or 303.756.9144

Live Chat: [www.qimacros.com](http://www.qimacros.com)

## Test Data

Access sample data sets from the QI Macros Help menu for examples of how to set up your data and to practice running charts: [qimacros.com/qi-macros/test-data](http://qimacros.com/qi-macros/test-data)

# Licensing

QI Macros is a single user license; one license per user, per computer: [qimacros.com/pdf/qi-macros-license-agreement.pdf](http://qimacros.com/pdf/qi-macros-license-agreement.pdf).

QI Macros Home/Office is for **one user** with two computers (desktop/laptop, home/office, PC/Mac): [qimacros.com/store/add-w244](http://qimacros.com/store/add-w244).

# Compatibility

QI Macros is compatible with PCs, Macs and tablets running a fully functioning version of Excel (with vba installed):

- Windows 7, 8, and 10, Mac OSX
- Excel 2007, 2010, 2013, 2016 for Windows, 2011/2016 for Mac, and Office 365
- Windows 8 and 10 Tablets that are running a full version of Excel 2013 or Excel 2016

# QI Macros Menu

The QI Macros tab appears on the far right of the Excel menu for Excel 2007–2016. A down arrow to the right of a menu item indicates further options:

# About this User Guide



This booklet covers the use of QI Macros. It does *not* cover Excel, SPC, or Six Sigma. See [qimacros.com/training](http://qimacros.com/training) for other resources addressing these topics.

# Video Tutorials

Watch how-to videos for most of the QI Macros tools:

- ▶ [qimacros.com/qi-macros/video-tour](http://qimacros.com/qi-macros/video-tour)
- ▶ [qimacros.com/training/videos](http://qimacros.com/training/videos)

# QI Macros Overview

## QI Macros menu categories:

### Control Charts:

- Attribute charts: p, np, c, and u
- Variable charts: XbarR, XbarS

### Capability Charts:

- Histograms and process capability (Cp, Cpk and Pp, Ppk)
- Box and whisker, dot, and scatter plots

### Improvement Charts:

- Pareto charts
- Fishbone (Ishikawa) diagrams
- Templates for other chart types such as bullet, funnel, and tornado

### Data Mining Tools:

- Data Mining Wizard: Creates pivot tables and the necessary charts to find the improvement project in your data
- PivotTable Wizard: Creates a pivot table using up to four columns of data
- Word count and restacking tools

### Other Charts:

- Chart Wizard: Creates all chart types appropriate for your data
- Line, run, bar, and other Excel charts

### Statistical Tools:

- ANOVA, t-tests, f-tests, regression analysis
- StatWizard: Automatically selects the right hypothesis test

### Templates for Lean Six Sigma:

- Gage R&R and DOE
- Sample size, DPMO and rolled throughput yield calculators

# Creating Charts

Charts require a certain number of data columns to run properly:

1 Column	1 or More Columns	2 Columns	2 or More Columns
Pareto Pie Run c, np, XmR Levey Jennings Moving Average Dot Plot	XmR Histogram Frequency Histogram EWMA Cusum XmedianR	Scatter u, p Hotelling	Box & Whisker Multi Vari XbarR XbarS Matrix Plot

1. Input your data into an Excel worksheet. The simplest format for your data is one column and one row of labels, and one or more columns of data (e.g., samples). **Select only one column and one row of labels.**

Date/Labels  
↓

	A	B	C	D	E	F
	Sample					
1	Number	Obs 1	Obs 2	Obs 3	Obs 4	Obs 5
2	S1	74.030	74.002	74.019	73.992	74.008
3	S2	73.995	73.992	74.001	74.011	74.004
4	S3	73.988	74.024	74.021	74.005	74.002
5	S4	74.002	73.996	73.993	74.015	74.009

← Defects/Samples

2. Select your data: **Select only the data you want on the chart.**
3. Select a chart from the QI Macros menu. (If you're not sure, the QI Macros Chart Wizard runs all appropriate charts for your data. See page 9 for more information.)
4. Answer the prompts, if applicable.
5. Review and save your workbook.

(Control chart templates are another method for creating control charts. Refer to page 27 for more information.)

▣ [qimacros.com/training/videos/control-chart-video](http://qimacros.com/training/videos/control-chart-video)

# Data Format & Selection Tips

Hold down the control (Ctrl) key to highlight data in non-adjacent columns:

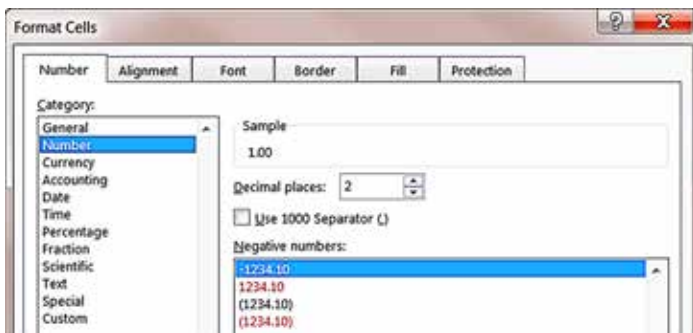
	A	B	C	D
1		Plant 1	Plant 2	Plant 3
2	Jan	15	77	44
3	Feb	23	56	33
4	Mar	56	33	55
5	Apr	33	33	22
6	May	77	23	66
7	Jun	33	15	11
8	Jul	14	14	77

You may also use data in horizontal rows:

	A	B	C	D	E	F	G	H
1		Jan	Feb	Mar	Apr	May	Jun	Jul
2	Plant 1	15	23	56	33	77	33	14
3	Plant 2	77	56	33	33	23	15	14
4	Plant 3	44	33	55	22	66	11	77

Numeric data and decimal precision: Excel formats most numbers as "general," not "number." **If you do not specify a format for your data, Excel will choose one for you.** To achieve the desired precision in your data:

- Highlight your data, right-click, and select Format Cells.
- Select Number from the Category list.
- Specify the preferred number of decimal places.



# Common Error Messages

Many charts require more than one column of data. If you highlight only one column of data and then select one of these charts, you will receive this error message:



The u chart (page 18) assumes that your defects column is to the left of your sample size column. If the columns are reversed (larger numbers on the left), QI Macros asks if the left column is the

	A	B	C	D	E	F	G
1	Sample	Data1	Data2				
2	R1	14	10				
3	R2	12	8				
4	R3	20	13				
5	R4	11	10				
6	R5	7	9.5				
7	R6	10	10				
8	R7	21	12				
9	R8	16	10.5				
10	R9	19	12				
11	R10	23	12.5				

sample size:

## QI Macros Chart Tab

The QI Macros Chart tab allows you to revise an existing chart by adding more data, showing a process change, deleting a point, etc.



Click the chart and the QI Macros Chart tab appears on the upper right corner of the Excel menu bar:

► [qimacros.com/control-chart/update-control-chart](http://qimacros.com/control-chart/update-control-chart)

# QI Macros Wizards

QI Macros is the only Six Sigma software with built-in wizards that automatically choose charts based on your data.

QI Macros has several wizards to assist in choosing the right chart or statistic.



## Data Mining Wizard:

Creates a pivot table of data and generates an XmR chart, defect Paretos, and a fishbone diagram

## Control Chart Wizard:

Chooses the right control chart for your data (c, np, p, u, XmR, XbarR, or XbarS)

## Statistics Wizard:

Analyzes your data and chooses the right hypothesis tests

## PivotTable Wizard:

Creates a pivot table when you select up to four columns of data

## Chart Wizard:

Creates all the probable charts (Pareto charts, control charts, histograms, etc.) for your data and runs descriptive statistics

► [qimacros.com/qi-macros/wizards](http://qimacros.com/qi-macros/wizards)



# Data Mining Wizard

The Data Mining Wizard quickly finds the improvement project in large amounts of data.

1. Make sure each column in your data sheet has a heading and that there aren't blank rows or columns separating the data you want in the pivot table.

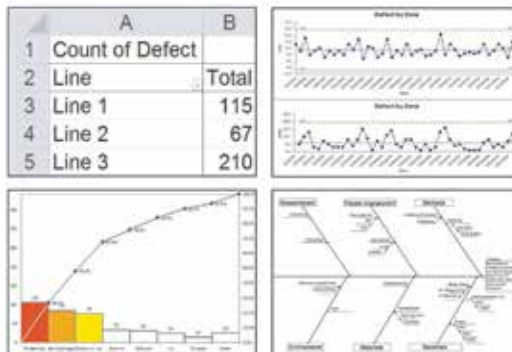
	A	B	C
1	Date	Lost Time (minutes)	Cause
2	01/02/12	45	Generator Failure
3	01/03/12	15	Conveyor Failure
4	01/04/12	10	Training
5	01/05/12	5	Safety
6	01/06/12	9	Flooding

2. Select two column headings, preferably a date and currency, numbers, or text.
3. Select Data Mining Wizard from the QI Macros menu.



The Data Mining Wizard:

- Uses Excel's PivotTable tool to summarize the data
- Draws a control chart using the selected fields
- Draws Pareto charts using the remaining columns
- Creates a fishbone (Ishikawa) diagram from the "big bar" on the Pareto chart



▣ [qimacros.com/data-mining-analysis-excel/data-mining-wizard](http://qimacros.com/data-mining-analysis-excel/data-mining-wizard)

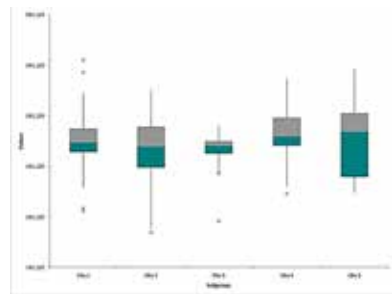
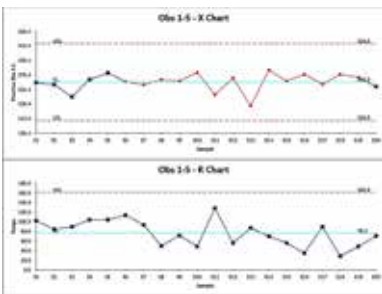
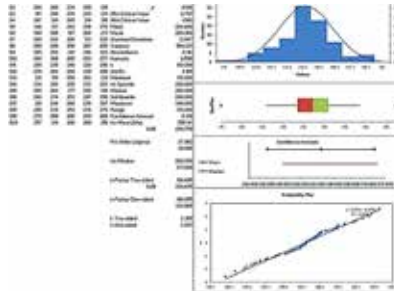
# Chart Wizard

The QI Macros Chart Wizard analyzes your data and chooses the right charts for you.

Highlight your data then select Chart Wizard from the QI Macros menu. QI Macros analyzes your data, runs descriptive statistics and creates the most probable charts.

The Chart Wizard creates the following charts:

- Descriptive statistics, which consist of a normality test, histogram, box plot, confidence intervals, and a normal probability plot
- One of several control charts, and a Pareto, scatter, or box and whisker plot



► [qimacros.com/quality-tools/chart-wizard](http://qimacros.com/quality-tools/chart-wizard)

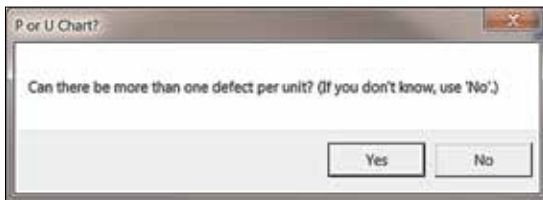
# Control Chart Wizard

Choosing the right control chart depends on your data – attribute (counted) or variable (measured) – and the sample size:

Type of data	Number of Samples		
	1	2 or more	Varies
Fraction Defective		np	p
Number of Defects		c	u
Time, Length, Weight, \$ (Measured)	XmR	XbarR XbarS	XbarR XbarS

The QI Macros Control Chart Wizard analyzes your data and selects the control chart for you.

1. Highlight your data.
2. Select Control Chart Wizard from the QI Macros menu.
3. The wizard analyzes your data and selects the correct chart. If it needs to determine between two possible charts, you may see a prompt:



► [qimacros.com/control-chart/control-chart-wizard](http://qimacros.com/control-chart/control-chart-wizard)

Guidelines for selecting charts:

- [qimacros.com/pdf/spc-free-training.pdf](http://qimacros.com/pdf/spc-free-training.pdf)
- [qimacros.com/free-excel-tips/choosing-control-charts](http://qimacros.com/free-excel-tips/choosing-control-charts)

# Statistics Wizard

Hypothesis testing can seem complex and challenging, but the Stat Wizard analyzes your data and chooses the right hypothesis tests for you. The Stat Wizard tells you if the means and variances of two or more samples are the same or different – no more p values to evaluate.

1. Organize your data into columns. (Access sample data sets from the QI Macros help menu.)
2. Highlight your data, then choose Stat Wizard from the QI Macros menu.
3. The wizard determines the number of columns of data and whether the data is decimals or integers. Based on that information, QI Macros runs the following statistics:

<b>1 Column</b>	Descriptive statistics 1 sample t test for means
<b>2 Columns</b>	f test for variances t test for means Chi-square table for independence (if data is integers) Fisher's test for 2X2 tables Regression
<b>3+ Columns</b>	ANOVA for means Levene's test for variances Chi-square table for independence (if data is integers)

The QI Macros Stat Wizard answers these questions:

- Is your data normal?
- Do you reject or accept the null hypothesis?
- Are the means or variances the same or different?

- ▣ [qimacros.com/hypothesis-testing/statistics-wizard-excel](http://qimacros.com/hypothesis-testing/statistics-wizard-excel)
- ▣ [qimacros.com/hypothesis-testing](http://qimacros.com/hypothesis-testing)

# PivotTable Wizard

Pivot tables are a valuable tool for every quality improvement professional, and QI Macros makes creating them easy.

1. Make sure each column in your data sheet has a heading and that there aren't blank rows or columns separating the data you want in the pivot table.
2. Hold the control (Ctrl) key to highlight up to four column headings from your data sheet.

	A	B	C	D	E	F	G	H	I	J	K
1	Region	POST DATE	ENT	ADM DATE	DIS DATE	AS	COS	FC	IN1	PT	DENIED CHARGES
2	North	06/24/13	Hosp1	02/10/13	2/13/13	OL		X	AEH	O	543.07
3	South	12/21/12	Hosp2	07/10/12	7/13/12	OL		X	BCP	E	215.4
4	South	02/22/13	Hosp2	12/03/12	12/6/12			X	CGH	O	157.92
5	South	05/20/13	Hosp3	10/17/12	10/20/12	OL		X	MAH	O	90.73
6	North	07/12/13	Hosp1	05/04/13	5/7/13	AP		X	HEH	O	4103.78

3. Choose the PivotTable Wizard from the Data & Text Mining section of the QI Macros menu.
4. The wizard organizes your data into a pivot table.
5. Hold the control (Ctrl) key to highlight labels and data in the pivot table to draw charts using QI Macros.



	A	B	C	D	E	F	G	H	I
2									
3	Sum of DENIED CHARGES	ENT							
4	ADM DATE	Hosp1	Hosp2	Hosp3	Hosp4	Hosp5	Hosp6	Hosp7	Grand Total
5	03/26/10			387.48					387.48
6	04/23/10			379.62					379.62
7	03/11/11			6908.98					6908.98
8	07/22/11		311.16						311.16
9	07/24/11					2124.86			2124.86
10	08/04/11				3224.83				3224.83
11	08/18/11		193.85	343.51					537.36
12	10/21/11			230.42					230.42
13	11/14/11			2180.16					2180.16
14	11/17/11			2627.84					2627.84

► [qimacros.com/training/videos/cross-tab-pivottable-wizard](http://qimacros.com/training/videos/cross-tab-pivottable-wizard)

# Capability and Improvement

## Pareto Chart

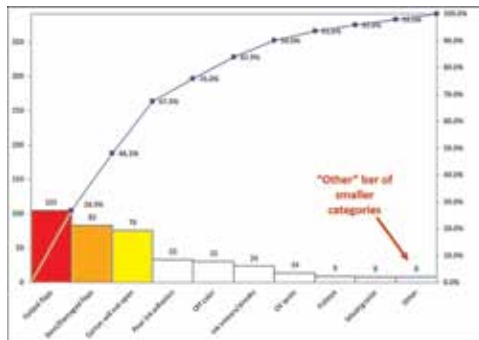
Pareto charts combine a sorted bar graph with a cumulative line graph. Often, two or three "big bars" represent most of the problem. Using the 80-20 rule ([qimacros.com/pareto-chart-excel/80-20-rule](http://qimacros.com/pareto-chart-excel/80-20-rule)), Pareto charts help narrow your focus to simplify problem solving.

1. Put labels in the left-hand column and data in the right-hand column of your data sheet.
2. Highlight your labels and one or more columns of data (QI Macros creates a separate Pareto for each data column).
3. Select Pareto Chart from the QI Macros menu. If you have more than nine data points, QI Macros prompts you for the desired number of bars. The remaining categories are summarized in an "other" bar.

	A	B	C	D	E
		Line 1	Line 2	Line 3	Total Defects
1					83
2	Bent/Damaged Flaps	37	22	24	83
3	Carton will not open	29	18	29	76
4	Damaged Pallet	3			3
5	Fracture	8			8
6	Yielded Flaps	16	6	83	105
7	ink smears/spreads		5	19	24
8	Mislabeled				3
9	Mixing color				6
10	Off color	14	5	12	31
11	Oil spots				14
12	Poor ink adhesion	7	6	16	29
13	Undercure				3



Here's a sample Pareto chart with an "other" bar:



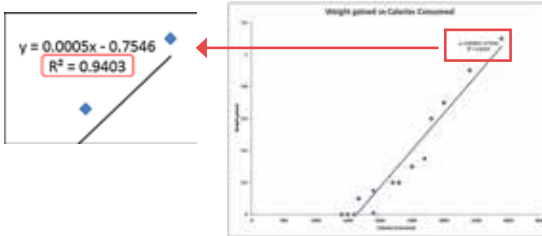
► [qimacros.com/pareto-chart-excel/pareto-chart-video](http://qimacros.com/pareto-chart-excel/pareto-chart-video)

# Scatter Plot

A scatter plot proves or disproves a suspected cause-effect link between two indicators (e.g., calories consumed and weight gain)

- Scatter plots require two columns of data.
- QI Macros creates a scatter plot with y and R<sup>2</sup> metrics.

A	B
Cases (x)	Time (y)
7	16.68
3	11.50
3	12.03
4	14.88
6	13.75
7	18.11



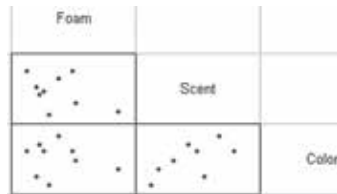
- If  $R^2 > .8$ , there is a strong correlation.
- If the points are tightly clustered along the trend line, then there's a correlation. If it looks more like a shotgun blast, there is no correlation.

▣ [qimacros.com/training/videos/scatter-plot](http://qimacros.com/training/videos/scatter-plot)

# Matrix Plot

When investigating cause-effect links between two or more indicators a matrix plot quickly identifies correlations. If the points are tightly clustered along a line, then there's a strong correlation. If it looks more like a shotgun blast, there is no correlation.

Foam	Scent	Color
6.3	5.3	4.8
4.4	4.9	3.5
3.9	5.3	4.8
5.1	4.2	3.1
5.6	5.1	5.5
4.6	4.7	5.1
4.8	4.8	4.8
6.5	4.5	4.3
8.7	4.3	3.9



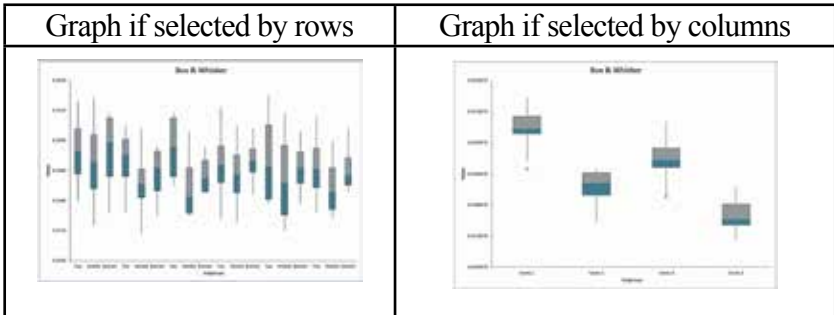
▣ [qimacros.com/training/videos/scatter-plot-matrix](http://qimacros.com/training/videos/scatter-plot-matrix)

# Box & Whisker

Box and whisker plots show the dispersion of data over time. Each bar is like a histogram turned on its side. This chart requires two or more columns of data.

QI Macros asks if your data is grouped in rows or columns. (The example shown here has 18 rows and 4 columns).

	Cavity 1	Cavity 2	Cavity 3	Cavity 4
Top	0.2522	0.2501	0.2510	0.2489
Middle	0.2523	0.2497	0.2507	0.2481
Bottom	0.2518	0.2501	0.2516	0.2485
Top	0.2514	0.2501	0.2508	0.2485
Middle	0.2513	0.2494	0.2495	0.2478
Bottom	0.2505	0.2495	0.2507	0.2494
Top	0.2518	0.2498	0.2516	0.2494
Middle	0.2512	0.2484	0.2496	0.2485
Bottom	0.2501	0.2492	0.2507	0.2492
Top	0.2520	0.2499	0.2503	0.2483
Middle	0.2514	0.2495	0.2501	0.2482

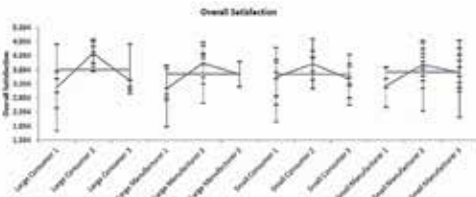


qimacros.com/training/videos/box-whisker-plot

# Multivari Chart

The multivari chart summarizes data based on labels and plots the averages and data points.

	A	B	C	D
1	Size of Customer	Product Type	Customer Type	Overall Satisfaction
2	Small	Consumer	2	3.54
3	Large	Consumer	3	3.16
4	Small	Manufacturer	2	2.42
5	Large	Manufacturer	2	2.7
6	Small	Consumer	3	3.31
7	Large	Consumer	2	4.12
8	Large	Manufacturer	1	3.24
9	Large	Manufacturer	2	4.47
10	Large	Consumer	2	3.83



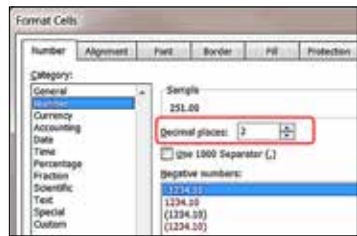
qimacros.com/training/videos/multi-vari-chart



# Histogram

Histograms show the spread, or dispersion, of variable data. The upper specification (USL) and lower specification limits (LSL) determine how well the process delivers on customer requirements. Measurements outside of the specification limits represent data points that don't meet customer requirements.

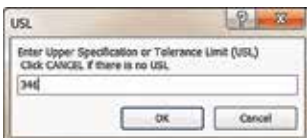
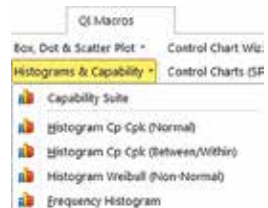
1. Make sure your data is formatted to the correct decimal precision. Highlight your data, right-click and select Format Cells. Select Number from the Category list and specify the number of decimal places.



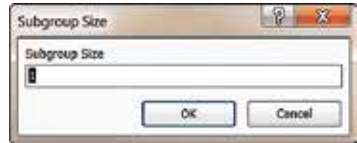
2. Highlight your data (a minimum of 20 data points is recommended). **Do not sort your data before running a histogram.**

	A	B	C	D	E	F
1	Sample	Obs 1	Obs 2	Obs 3	Obs 4	Obs 5
2	S1	265	205	263	307	220
3	S2	268	260	234	299	215
4	S3	197	286	274	243	231
5	S4	267	281	265	214	318

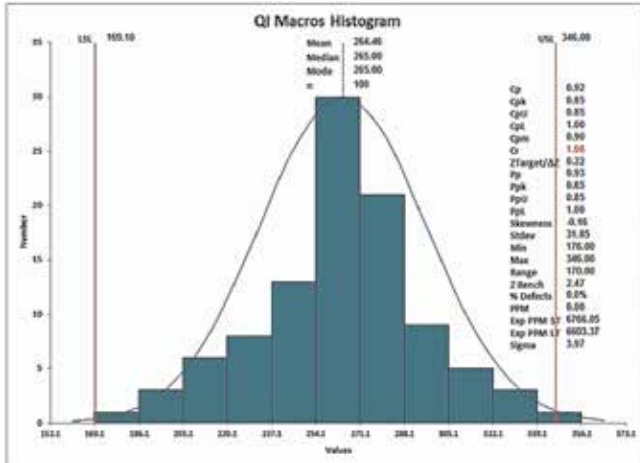
3. Select the type of histogram you want from the Histograms and Capability section of the QI Macros menu.
4. Enter the USL and LSL and the approximate number of bars at the prompts. Click OK to use the defaults or enter your own. For one-sided or unilateral histograms, click Cancel if there is no USL or LSL.



- If you select a single column of data, the histogram prompts you for a subgroup size. Input a subgroup size or use the default of 1 if there are no subgroups.



- QI Macros draws the histogram.



- To revise the process capability analysis, switch to the histogram Data worksheet tab and change the upper and/or lower specification limits. Excel recalculates Cp, Cpk and other metrics and updates the contents of the text boxes on the chart. You can also change the number of bars, class width, and beginning point.

<b>LSL</b>	<b>73.970</b>
<b>USL</b>	<b>74.030</b>
<b>Number of Bars</b>	<b>11.000</b>
<b>Number of Classes</b>	<b>6.000</b>
<b>Class Width</b>	<b>0.010</b>
<b>Beginning Point</b>	<b>73.960</b>

- [qimacros.com/pdf/histogram-manual-calcs.pdf](http://qimacros.com/pdf/histogram-manual-calcs.pdf)
- [qimacros.com/training/videos/histograms](http://qimacros.com/training/videos/histograms)

# Control Charts

## c, np, p, and u Control Charts

Attribute control charts track the number of defects in a sample.

1. Highlight your labels and data (as shown).

### c or np Charts

	A
1	No. Pinholes
2	4
3	5
4	3
5	3
6	5
7	2
8	5
9	3
10	2

### p Charts

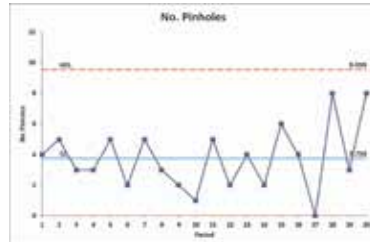
	A	B	C
	Sample Number	Nonconforming Units	Sample Size
1	S1	12	100
2	S2	8	80
3	S3	6	80
4	S4	9	100
5	S5	13	110
6	S6	12	110
7	S7	11	100
8	S8	16	100
9	S9	10	90
10	S10	6	90

### u Charts

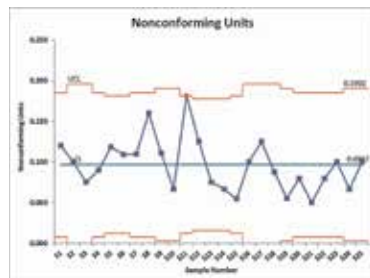
	A	B	C
	Sample Number	Nonconforming Units	Sample Size
1	S1	12	100
2	S2	8	80
3	S3	6	80
4	S4	9	100
5	S5	13	110
6	S6	12	110
7	S7	11	100
8	S8	16	100
9	S9	10	90
10	S10	6	90

2. Select c, np, p, or u chart from the Control Charts (SPC) menu.  
**The np chart prompts for a sample size if you did not include it in your selection.**

c or np charts have flat upper and lower control limit lines.



p and u charts can have wavy upper and lower control limit lines that vary with the sample size.



- ▣ [qimacros.com/control-chart/show-hide-sigma-lines](http://qimacros.com/control-chart/show-hide-sigma-lines)
- ▣ [qimacros.com/control-chart/p-and-u-chart-formats](http://qimacros.com/control-chart/p-and-u-chart-formats)

# X and R Control Charts

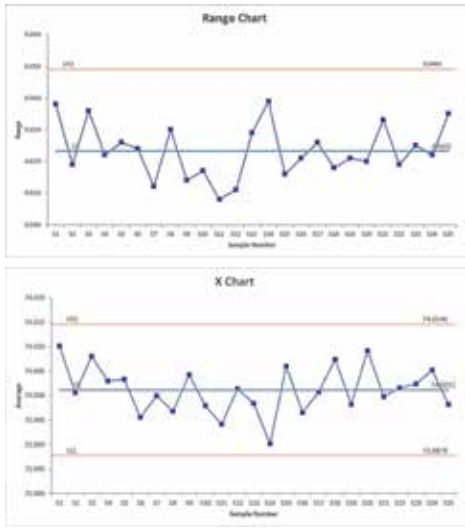
An X chart shows process performance using continuous data (i.e., time, length, weight, money, etc.).

1. Highlight your labels and data. You need 20 or more data points to get a good graph.

Your data should look like this:

XmR charts			XbarR and XbarS charts						
	A	B	A	B	C	D	E	F	
	Batch		Sample						
1	Number	Viscosity	1	Number	Obs 1	Obs 2	Obs 3	Obs 4	Obs 5
2	B1	33.75	2	S1	74.030	74.002	74.019	73.992	74.008
3	B2	33.05	3	S2	73.995	73.992	74.001	74.011	74.004
4	B3	34.00	4	S3	73.988	74.024	74.021	74.005	74.002
5	B4	33.81	5	S4	74.002	73.996	73.993	74.015	74.009
6	B5	33.46							

2. Select an X chart from the QI Macros menu (XmR, XmR Median R, XmR Trend, XbarR, XbarS, or Xmedian Chart).
3. Evaluate the range chart first. If the range chart looks unstable, then the process is unstable.
4. Next, evaluate the X chart. If the range Chart looks stable *and* the X chart is stable, then the process is stable.



📌 [qimacros.com/training/videos/individual-moving-range-chart](http://qimacros.com/training/videos/individual-moving-range-chart)

# Specialized Control Charts

QI Macros contains tools for specialized control charts. Refer to the links on this page to learn more:

## Prime Charts:

[qimacros.com/control-chart/p-prime-control-chart](http://qimacros.com/control-chart/p-prime-control-chart)

[qimacros.com/control-chart/u-prime-control-chart](http://qimacros.com/control-chart/u-prime-control-chart)

## g and t Charts:

[qimacros.com/control-chart/g-chart-template](http://qimacros.com/control-chart/g-chart-template)

[qimacros.com/control-chart/t-chart-excel](http://qimacros.com/control-chart/t-chart-excel)

## Moving Average:

[qimacros.com/control-chart/moving-average-chart](http://qimacros.com/control-chart/moving-average-chart)

## Levey Jennings:

[qimacros.com/control-chart/levey-jennings-chart](http://qimacros.com/control-chart/levey-jennings-chart)

## ANOM:

[qimacros.com/control-chart/analysis-of-means-chart](http://qimacros.com/control-chart/analysis-of-means-chart)

## CUSUM:

[qimacros.com/control-chart/cusum-chart](http://qimacros.com/control-chart/cusum-chart)

## EWMA:

[qimacros.com/control-chart/ewma-chart](http://qimacros.com/control-chart/ewma-chart)

## I-MR-R:

[qimacros.com/control-chart/i-mr-r-s-chart](http://qimacros.com/control-chart/i-mr-r-s-chart)

## Hotelling T2:

[qimacros.com/control-chart/hotelling-t2-chart](http://qimacros.com/control-chart/hotelling-t2-chart)

# Control Chart Dashboards

Control chart dashboards simplify the tasks of updating, organizing and presenting control charts.

1. Select a control chart dashboard from the Control Chart Templates menu.



2. Each dashboard workbook contains an instruction sheet, a data input sheet, and a sheet for each available type of chart.

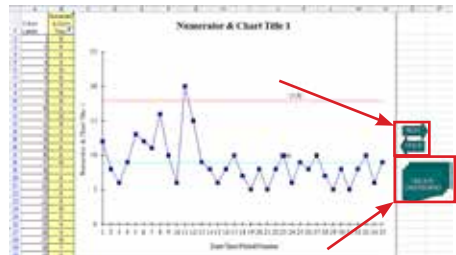


3. Input or paste your data into the columns in the Data Sheet. Each set of labels and data creates a different chart. (The XmR and XbarR dashboards also have cells for USL/LSL.)

	A	B	C	D	E	F	G	H	I	J
1	X Axis Labels	Numerator & Chart Title 1	Denominator	C-Sections	Total Deliveries	Numerator & Chart Title 2	Denominator 2			
2		1	100	65	370					
3		2	80	64	383					
4		3	80	77	446					
5		4	100	59	454					
6		5	131	110	463					

4. Select the chart type from the worksheet tabs. Click the PREV and NEXT arrows to view the charts for each data set.

5. To display the charts for all data sets on one worksheet, click the CREATE DASHBOARD button.



6. Add any new data to the Data Sheet and click on either the Refresh Charts or Refresh w Stability button.



► [qimacros.com/control-chart/control-chart-dashboard](http://qimacros.com/control-chart/control-chart-dashboard)

# Control Chart Features

## Control Chart Stability Rules

QI Macros control charts plot unstable points and trends in red. Unstable points are also diamond shaped (in-control points are square). Control charts show the center line and upper and lower control limits (UCL/LCL) for evaluating stability. QI Macros default stability rules are defined in Montgomery's *Introduction to Statistical Quality Control*.

QI Macro stability rules may be customized by accessing the Control Chart Rules Menu. From this menu you may:

- Select a stability analysis rule set
- Show or hide sigma lines
- Change p and u chart UCL/LCL format (skyline vs. wavy lines)
- Define a custom stability rule set

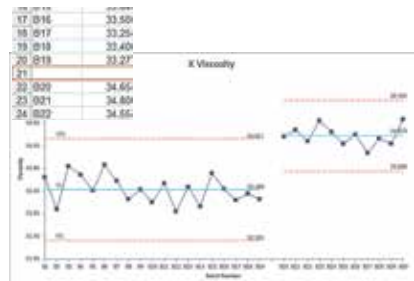


Changes are saved and applied to all new QI Macros charts. To reset the stability rules, select Montgomery (Default) Rules from the Control Chart Rules menu.

- ▣ [qimacros.com/free-excel-tips/control-chart-rules](http://qimacros.com/free-excel-tips/control-chart-rules)
- ▣ [qimacros.com/control-chart/stability-analysis-control-chart-rules](http://qimacros.com/control-chart/stability-analysis-control-chart-rules)

## Create Stair Step Limits

To calculate two or more sets of control limits on charts, leave a blank row in the data where the limits change. QI Macros calculates separate upper and lower control limits (UCL/LCL) for each group of data.



# QI Macros Chart Menu

QI Macros provides additional tools to update and analyze charts. First click the chart, then click the QI Macros Chart tab to access these tools:



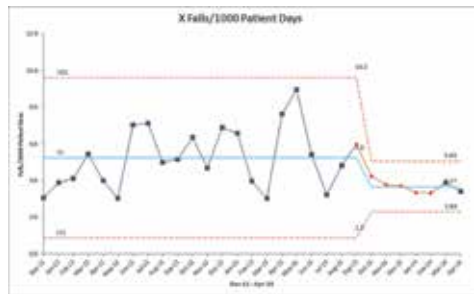
**Add Data:** Add the new data and labels in the rows under your old data. Click the chart and select Add Data from the QI Macros Chart tab. Enter the number of rows to add and click OK.

**Add Target Line to Chart:** Select Add Target Line to Chart and enter a label and value at the prompts.

**Add Text to Point:** Click the point on the chart, and select Add Text to Point from the QI Macros Chart menu. Type your text into the window.

**Show Process Change:** Click the point on the chart where the process change occurred, then select show process change from the QI Macros Chart menu.

The macros calculates a new set of control limits starting at the point selected. The UCL, CL and LCL values update to show the new limits. This feature can be used multiple times on the same chart.



**Fix Control Limits:** Use historical control limits or your limits instead of the calculated control limits.

**Ghost or Delete Point:** Ghosting removes a point from the calculations, but leaves it on the chart. Deleting a point removes it from the calculations *and* from the chart.



## QI Macros Chart Menu (Continued)

**Analyze Stability:** Runs stability analysis after you add new data, delete a point, or show a process change on a control chart.

**Analyze Stability Green Up/Green Down:** Shows "good" rule violations in green depending on whether "up" (higher) is better or "down" (lower) is better.

**Clear Stability Analysis:** Clears stability analysis from the chart and resets all data points and lines to blue.

**Show/Hide Rule Numbers:** Displays the number of the stability analysis rule that unstable points violate.

**Show/Hide 1-2 Sigma Lines:** Displays or hides sigma lines.

**Recalculate UCL/LCL:** Recalculates control limits using all of the data points after adding new data to a chart.

**Convert Skyline to Wave/Wave to Skyline:** Changes the way upper and lower control limits are displayed on p, u, XbarR, and XbarS charts.

**Remember Format, Apply Format, Apply to All:** Customizes the chart fonts, colors, styles, etc.

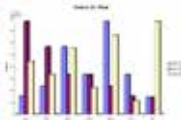
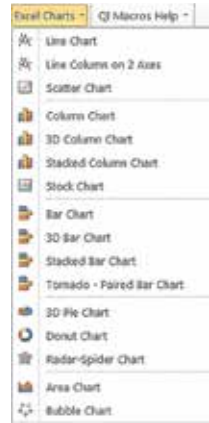
**Change Titles:** Quickly revises chart and axis titles.

**Move Charts, Move All Charts, Copy to PPT, Copy to Word:** Exports a chart or charts to a separate worksheet, PowerPoint, or Word document.

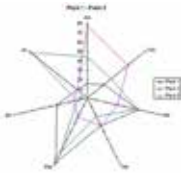
■ [qimacros.com/control-chart/update-control-chart](http://qimacros.com/control-chart/update-control-chart)

# Excel Charts

Excel creates basic charts, but the multistep process takes a long time. You can create Excel charts more quickly from the QI Macros menu.



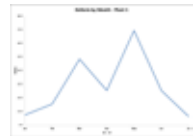
Column/bar charts compare discrete results and highlight the differences between groups or categories.



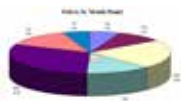
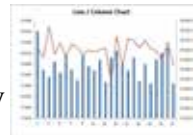
Radar or spider charts compare discrete results and highlight the differences in multivariate data. Each spoke represents one observation of one or more (multivariate)

data points.

Line charts give you a quick impression of performance over time, but they don't tell you whether the process is stable and predictable. Use control charts to maximize your understanding of the process and its performance.



Line-column charts show performance over time and a comparison of categories, with one or more data series from a different chart type on a secondary vertical (value) axis. Consider using a control chart for better insights over time and a Pareto chart for a more robust comparison of data categories.



Pie charts show the relative size of contribution of various components of defects, time, or cost, and illustrate how various parts relate to the whole. The pie chart is like the Pareto, but it doesn't show you the biggest contributor first unless you sort your data.

■ [qimacros.com/excel-charts-qimacros](http://qimacros.com/excel-charts-qimacros)

# Fill-in-the-Blank Templates

There are over 100 templates in QI Macros. Templates are grouped with their corresponding category. Lean Six Sigma templates are grouped into their own category and sub-categorized:



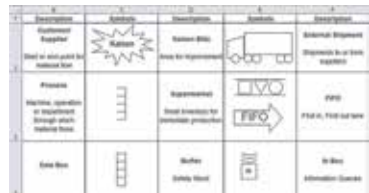
QI Macros templates simplify Lean Six Sigma project documentation (value stream maps, flowcharts, and fishbone diagrams), monthly chart and dashboard updating, and advanced analysis like Gage R&R and DOE.

Each template contains instructions and a worksheet tab for each tool included in that template:



To use templates like the calculators, DOE, Gage R&R, etc., type or paste data into the yellow shaded input areas.

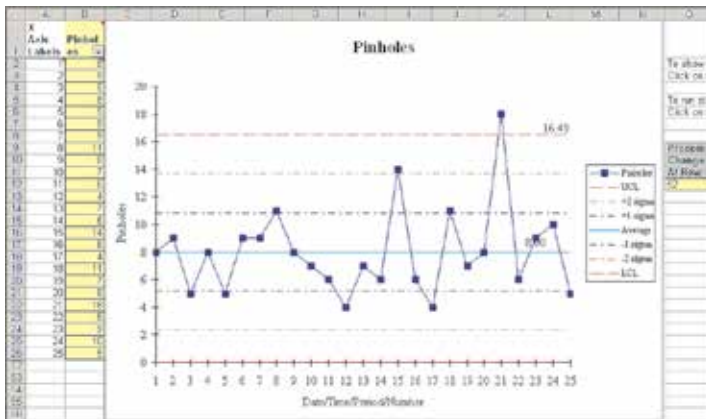
Use Excel's drawing toolbar to update the template and to insert boxes, arrows and other symbols for templates like the value stream map.



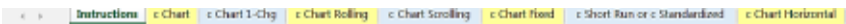
► [qimacros.com/lean-six-sigma/lean-six-sigma-tools](http://qimacros.com/lean-six-sigma/lean-six-sigma-tools)

# Control Chart Templates

The control chart templates contain a data input area and the chart on one worksheet. Input data in the yellow area and the points are plotted on the chart as you enter them. You can also paste data into the yellow area or link the cells to another spreadsheet.



Each template is made up of several worksheets (average, median, rolling, fixed, short run, etc.).



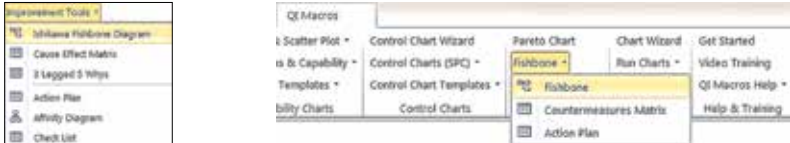
Once populated, click on the chart and use the QI Macros chart menu to analyze stability, show process changes, etc. (For more information about the QI Macros Chart menu and its functions, see page 22.)

▣ [qimacros.com/control-chart/control-chart-template](http://qimacros.com/control-chart/control-chart-template)

# Fishbone (Ishikawa) Diagram

Fishbone (Ishikawa) diagrams identify the special root causes of delay, waste, rework or cost.

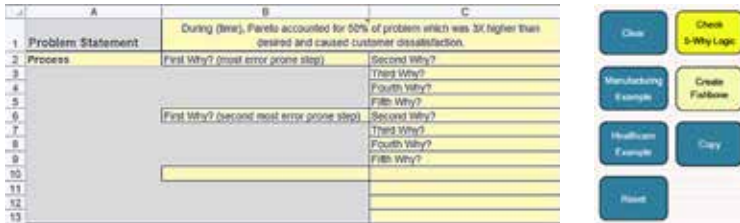
1. Access the fishbone diagram from either the Improvement Tools or the Improve Charts section of the QI Macros menu:



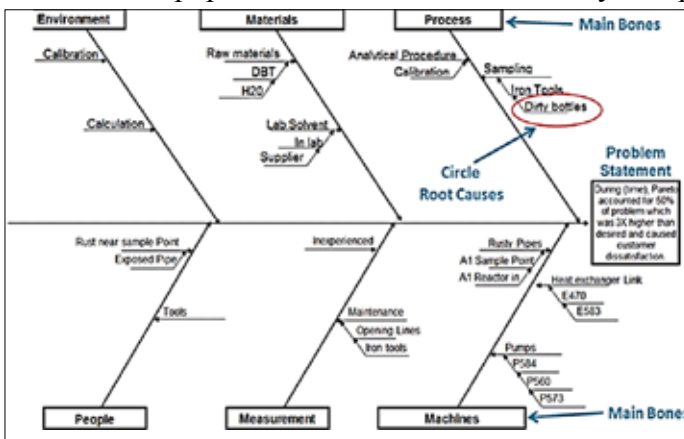
2. Select the fishbone style you prefer (healthcare, manufacturing, marketing, process, or service):



3. Input text in the yellow shaded cells, then click the Create Fishbone button:

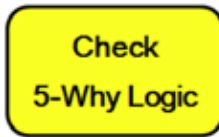


4. QI Macros will populate a fishbone with the text you input:

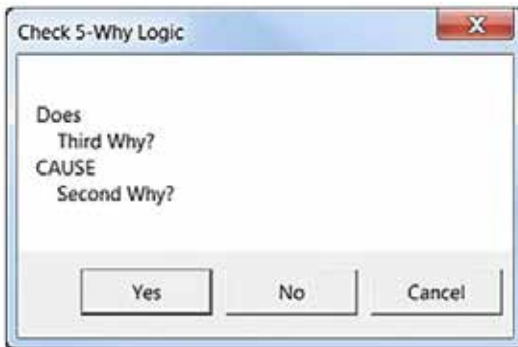


## Fishbone (Ishikawa) Diagram (Continued)

- To revise the fishbone, go back into the input tab and update your text then click the Create Fishbone button again.
- To copy the fishbone to Powerpoint or Word click on the Copy button, then paste the fishbone diagram as either a picture or drawing object. (Pictures are static, drawing objects can be revised.)
- To check the logic in your fishbone, click on the Check Logic button:



- The check logic tool will walk you through the logic of your fishbone. Does X cause Y? Rework or revisit your five whys, as needed.



▣ [qimacros.com/fishbone-diagram-template](http://qimacros.com/fishbone-diagram-template)

# Value Stream Map

A value stream map analyzes value-added and non-value added activities and delays. The QI Macros value stream template contains an automated value stream map (VSM Text), a worksheet of symbols, three different examples to help you get started, and a spaghetti diagram.

The VSM Text worksheet tab in QI Macros value stream template is pre-populated with values to give you an idea of what to input in each cell. Use the Clear button to delete the contents of each cell and the Reset button to re-populate the sample text.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Z
1	Step	Process	Inventory	VA/NVA	CT/VA	CT/NVA	Crew	CO	Uptime	Waste	Available Sec				
2	1	Process 1		VA	CT sec		1	10 min	100%	5%	27000				
3		WIP1	100	NVA		1 Day									
4	2	Process 2		VA	30 sec		1	10 min	100%	5%	27000				
5		WIP2	100	NVA		1 Day									
6	3	Process 3		VA	25										
7		WIP3	100	NVA		1 Day									
8	4	Process 4		VA	30										
9		WIP4	100	NVA		1 Day									
10	5	Process 5		VA	30										
11		WIP5	100	NVA		1 Day									
12	6	Process 6		VA	40										

Clear

Reset

Create  
VSM

Each step in a value stream map represents an operation that is performed on the product. The operation is generally performed in one location with a clear beginning and ending point. Value stream maps are broad in scope and are not meant to describe individual tasks like a flowchart.

**Process:** Briefly describe the Process or Work in Process step.

**Inventory:** Estimate the amount of inventory on hand.

**VA/NVA:** Indicate if the step is value-added or non-value added.

**CT/VA and CT/NVA:** Input the cycle time for value-added and non-value added steps.

**Crew:** Input the number of people it takes to perform the process.

**CO:** Input time from completion of step for one product to beginning of step for the next product.

**Uptime:** Input % of Uptime.

**Waste:** Input % of waste or scrap.

**Available Sec:** Input available time.

Once all fields are populated, click the Create VSM button to create a value stream map.

■ [qimacros.com/training/videos/value-stream-map](http://qimacros.com/training/videos/value-stream-map)

# Gage R&R

1. Select Gage R&R from the DOE, GageR&R, FMEA section of the QI Macros menu.
2. From the File menu, select Save As to store the template.

A		B	C	D	E	F	G	H	I	J	K	L	M	N	O
1 Gage R&R															
2 Average & Range Method		1	2	3	4	5	6	7	8	9	10	Sum			
3	Appraiser 1	Trials	0.29	-0.56	1.34	0.47	-0.01	0.02	0.59	-0.31	2.26	-1.36	5.710		
4	Enter your data here→	Trials	0.41	-0.68	1.17	0.5	-0.92	-0.11	0.75	-0.2	1.99	-1.25			
5		Trials	0.64	-0.58	1.27	0.64	-0.84	-0.21	0.66	-0.17	2.01	-1.31	2.116		
6		Trials												Xbar1	Reference
7		Trials													0.091
8		Total	1.34	-1.82	3.78	1.61	-2.56	-0.3	2	-0.66	6.52	-3.92		0.18333	0.091
9		Average	0.4467	-0.607	1.26	0.5367	-0.853	-0.11	0.6667	-0.227	2.0067	-1.307		Xbar1	0.091
10		Range	0.35	0.12	0.17	0.17	0.13	0.23	0.16	0.14	0.27	0.11	0.184		0.184
11	Appraiser 2	Trials	0.08	-0.47	1.19	0.01	-0.56	-0.2	0.47	-0.63	1.6	-1.68	2.050		
12	Enter your data here→	Trials	0.25	-1.22	0.84	1.03	-1.2	0.22	0.55	0.88	2.12	-1.62			
13		Trials	0.07	-0.68	1.34	0.2	-1.28	0.05	0.83	-0.34	2.15	-1.5	0.990		
14		Trials												Xbar2	Reference
15		Trials													0.001
16		Total	0.4	-2.37	3.47	1.24	-3.04	0.08	1.65	-0.89	6.11	-4.3		0.00433	0.001
17		Average	0.13333	-0.79	1.1567	0.4133	-1.013	0.0267	0.5167	-0.297	2.0367	-1.4		Xbar2	0.002
18		Range	0.18	0.25	0.4	1.02	0.72	0.42	0.36	0.71	0.39	0.18	0.513		0.513
19	Appraiser	Trials	0.04	-1.38	0.88	0.14	-1.48	-0.29	0.02	-0.46	1.72	-1.48	-7.630		
20	Enter your data here→	Trials	-0.11	-1.13	1.09	0.2	-1.07	-0.67	0.01	-0.56	1.46	-1.77			
21		Trials	-0.15	-0.96	0.67	0.11	-1.45	-0.45	0.21	-0.49	1.87	-2.14	-2.840		
22		Trials												Xbar3	Reference
23		Trials													-0.25433
24		Total	-0.22	-3.47	2.64	0.46	-3.98	-1.45	0.24	-1.51	5.09	-5.42			0.001
25		Average	-0.0733	-1.157	0.88	0.15	-1.327	-0.483	0.08	-0.503	1.6967	-1.807		Xbar3	0.296
26		Range	0.19	0.42	0.42	0.09	0.39	0.39	0.2	0.1	0.42	0.47	0.323		0.323

3. To conduct a study, you'll need five-to-ten samples of a part from one batch or lot (these must span the range or tolerance you are trying to measure), at least two appraisers, and a minimum of two measurement trials on each part by each appraiser. If you have references or specification tolerances, enter them.
4. Evaluate Gage R&R graphs and data to identify where to improve your measurement system.

Gage R&R system acceptability:

- % R&R<10% - Gage system is okay (most variation caused by parts, not people or equipment)
- % R&R<30% - may be acceptable based on importance of application and cost of gage or repair
- % R&R>30% - Gage system needs improvement (people and equipment cause over 1/3 of variation)

📌 [qimacros.com/gage-r-and-r-study/aiaq-msa-gage-r-and-r](http://qimacros.com/gage-r-and-r-study/aiaq-msa-gage-r-and-r)



# Design of Experiments (DOE)

DOE shortens the time and effort required to discover the optimal conditions to produce Six Sigma quality in your product or service.

1. Select Design of Experiments from the DOE, Gage R&R, FMEA list on the QI Macros menu.
2. Input your factors and the low/high settings for each factor. In a two-factor test it might be time (30 minutes and 45 minutes) and temperature (325 degrees and 375 degrees).

Design of Experiments					
Factor	Factor Name	Level 1 (Low)	Level 2 (High)		
2 <sup>2</sup>	A	Time	30	45	Two Factor Experiment
	B	Temp	325	375	
2 <sup>3</sup>	AB	Time X Temperature			Three Factor Experiment
	C	c	Here		
	AC	Time X c			
2 <sup>4</sup>	BC	Temperature X c			Four Factor Experiment
	ABC	Time X Temperature X c			
	D	d			
	AD	Time X d			
	BD	Temperature X d			
	CD	c X d			
ABD	Time X Temperature X d				
ACD	Time X c X d				
BCD	Temperature X c X d				
ABCD	Time X Temperature X c X d				

3. Use the +/- values in the orthogonal array to guide your test of every combination. In a two-factor test it would be high ++ (45 minutes and 375 degrees), low -- (30 minutes and 325 degrees), in between +- (45 minutes and 325 degrees) and -+ (30 minutes and 375 degrees).

Design	Trial	Factors						
		A	B	AB	C	AC	BC	ABC
2 <sup>2</sup>	1	-	-	+	-	+	+	-
	2	+	-	-	-	-	+	+
	3	-	+	-	-	+	-	+
	4	+	+	+	-	-	-	-
2 <sup>3</sup>	5	-	-	+	+	-	-	+
	6	+	-	-	+	+	-	-
	7	-	+	-	+	-	+	-
	8	+	+	+	+	+	+	+

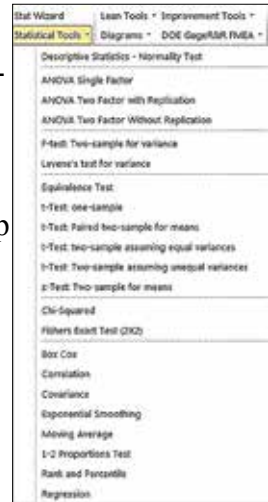
4. Input results into the yellow input area and observe the interactions.

■ [qimacros.com/lean-six-sigma-articles/design-of-experiments](http://qimacros.com/lean-six-sigma-articles/design-of-experiments)

# Statistical Tools

QI Macros statistical tools are easier to use than the Excel Data Analysis Toolpak. Additionally, they mistake-proof data entry and interpret the results of statistical tests.

1. Select data for analysis. Some tools – like ANOVA – can take multiple columns. Others – like regression – use two columns. A few use only one column. Data must be in columns for these tools to work. (Open QI Macros Test Data from the QI Macros Help menu to see examples of how your data should be organized.)
2. Select the statistical analysis tool from the Statistical Tools section of the QI Macros menu. If you aren't sure, choose the Stat Wizard and answer the prompts (defaults are provided.)
3. QI Macros interprets the results, tells you to reject or accept the null hypothesis and whether the means or variances are the same or different.



Group	Count	Sum	Average	Variance
Data1	7	8005%	856%	25.8099
Data2	7	8815%	1259%	41.1728
Data3	7	10215%	1459%	43.227
Data4	7	12720%	1817%	88.6057

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	329.602	3	109.867	2.52857	0.0813	3.00878
Within Groups	1042.89	24	43.4538			
Total	1372.49	27				

ANOVA: Cannot Reject Null Hypothesis because  $p > 0.05$  (Means are the same)

Colorful cells have significant mean differences

Levenes - ANOVA Res.

Data is Normal

Variances are the same

Means are the same

OK

- ▶ [qimacros.com/hypothesis-testing/statistics-wizard-excel](http://qimacros.com/hypothesis-testing/statistics-wizard-excel)
- ▶ [qimacros.com/hypothesis-testing/hypothesis-testing-excel](http://qimacros.com/hypothesis-testing/hypothesis-testing-excel)

# Data Mining Tools

QI Macros data mining tools quickly analyze your data and reorganize it into a usable format. Refer to the links on this page to learn more.

**Data Mining Wizard:** Draws pivot tables and all of the charts required to find the improvement project in your data. (see page 8).

■ [qimacros.com/data-mining-analysis-excel/data-mining-wizard](http://qimacros.com/data-mining-analysis-excel/data-mining-wizard)

**PivotTable Wizard:** Creates pivot tables using up to four column headings. (see page 12)

■ [qimacros.com/quality-tools/pivot-table-cross-tab](http://qimacros.com/quality-tools/pivot-table-cross-tab)

**Word Count:** Counts the number of times a word or two-word phrase appears in your data.

■ [qimacros.com/quality-tools/word-count](http://qimacros.com/quality-tools/word-count)

**Stack/Restack/Restacking:** Restacks one column of data into multiple columns or restacks multiple columns of data into one column. Converts two columns to three, four columns to two, etc.

■ [qimacros.com/quality-tools/restack](http://qimacros.com/quality-tools/restack)

**Paste Link/Paste Link Transpose:** Paste-links and paste-transposes in one step. Links your data to a chart template to create dashboards. Updates your data sheet to automatically update the template and chart.

■ [qimacros.com/quality-tools/pastelink](http://qimacros.com/quality-tools/pastelink)

**Box Cox Transformation:** Transforms non-normal data into data that is closer to normal.

■ [qimacros.com/quality-tools/boxcox](http://qimacros.com/quality-tools/boxcox)

# Installation Troubleshooting

If the installation wizard ran, but the QI Macros tab did not appear on your Excel menu, or the message "qimacros.xla could not be found" appears, check to see if Excel disabled the QI Macros:

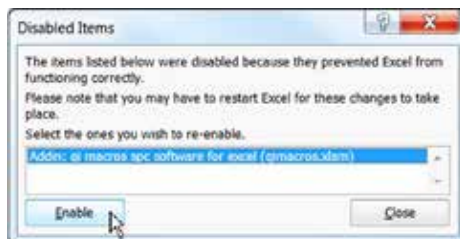
Excel 2010, 2013, and 2016:

1. Go to File / Options.
2. Select Add-Ins from menu pane on the left.
3. Click the arrow next to Manage and select Disabled Items from the drop-down list.
4. Click Go to see the disabled items.



5. If QI Macros is listed in the disabled items window, highlight it and click Close. Then close and re-open Excel to restore the QI Macros menu to the Excel toolbar.

■ [qimacros.com/support/qi-macros-tech-support](http://qimacros.com/support/qi-macros-tech-support)



# Other Resources

## Free Webinars and Training

Resources: [qimacros.com/free-resources/qimacros-training](http://qimacros.com/free-resources/qimacros-training)

QI Macros overview: [qimacros.com/webinar](http://qimacros.com/webinar)

Email tips: [qimacros.com/free-resources/newsletter](http://qimacros.com/free-resources/newsletter)

Yellow Belt training: [lssyb.com](http://lssyb.com)

Excel tips: [qimacros.com/free-resources/excel-tips](http://qimacros.com/free-resources/excel-tips)

QI Macros Video Tour: [qimacros.com/qi-macros/video-tour](http://qimacros.com/qi-macros/video-tour)

## Other Products and Services

Books and Videos: [qimacros.com/store](http://qimacros.com/store)

Product Brochure: [qimacros.com/pdf/qiflyer.pdf](http://qimacros.com/pdf/qiflyer.pdf)

On-Site Training: [qimacros.com/training/lean-six-sigma-training](http://qimacros.com/training/lean-six-sigma-training)

## Order Options

Online: [qimacros.com/store](http://qimacros.com/store)

Email: [orders@qimacros.com](mailto:orders@qimacros.com)

Fax: 888-468-1536 or 303-756-3107

Call: 888-468-1537 or 303-756-9144

Monday through Friday 8 a.m. to 5 p.m. MST

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