

Using the MSA EMP Manufacturing Instructions Add-In

Introduction:

The MSA EMP Manufacturing Instructions add-in is based on the book [EMP III, Evaluating the Measurement Process & Using Imperfect Data, Dr. Donald J. Wheeler](#). The statistical approach to adjusting specification limits used by the add-in is described in Section 14.4. Wheeler describes these adjusted limits as Manufacturing Instructions which are adjustments to specification limits that account for measurement system noise. These adjustments are made based on an expectation of the probability of correctly identifying a conforming product. The benefit to the practitioner when using Wheeler's method comes from applying measurement systems analysis results when deploying or implementing the gauge. Doing so supports quality (correctly identify conforming product) and business objectives (trade-off between probability of identifying a conforming product and costs associated with adjusting specification limits). The idea of adjusting/narrowing specification limits for greater quality assurance, commonly termed guard-banding, is used in a variety of high-tech industries such as semiconductor. Wheeler's approach is statistically based versus common arbitrary approaches such as narrowing by a percentage. It is also broadly applicable due to objective nature of the method.

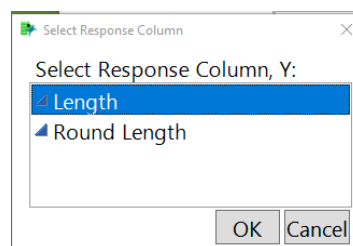
Preparing to use the add-in:

1. Set objectives for the MSA study.
2. Identify variables that influence measurement noise
3. Design the EMP experiment study (DOE > Special Purpose > MSA Design)
 - a. Add spec limits column property to response measurement column (select column > Cols > Column Info... > Column Properties > Spec Limits)
 - b. Or, enter them in the EMP Manufacturing Instructions report.
4. Execute the design using the data table generated in step 3 to collect measurement data.
5. Check that the data are consistent with the experimental assumptions (Analyze > Distribution and/or Graph > Graph builder).
6. Start add-in analysis procedure.

Adapted from [NIST Engineering Statistics Handbook 5.1.3](#)

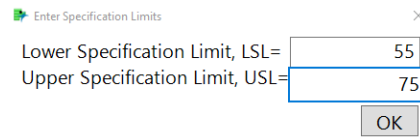
Add-In Procedure:

1. Open a measurement systems analysis data table.
2. Run the add-in from the add-in menu (Add-Ins > EMP Manufacturing Instructions).
3. Select Response column.



Add-In Procedure:

4. Enter specification limits if they are not already assigned as a column property



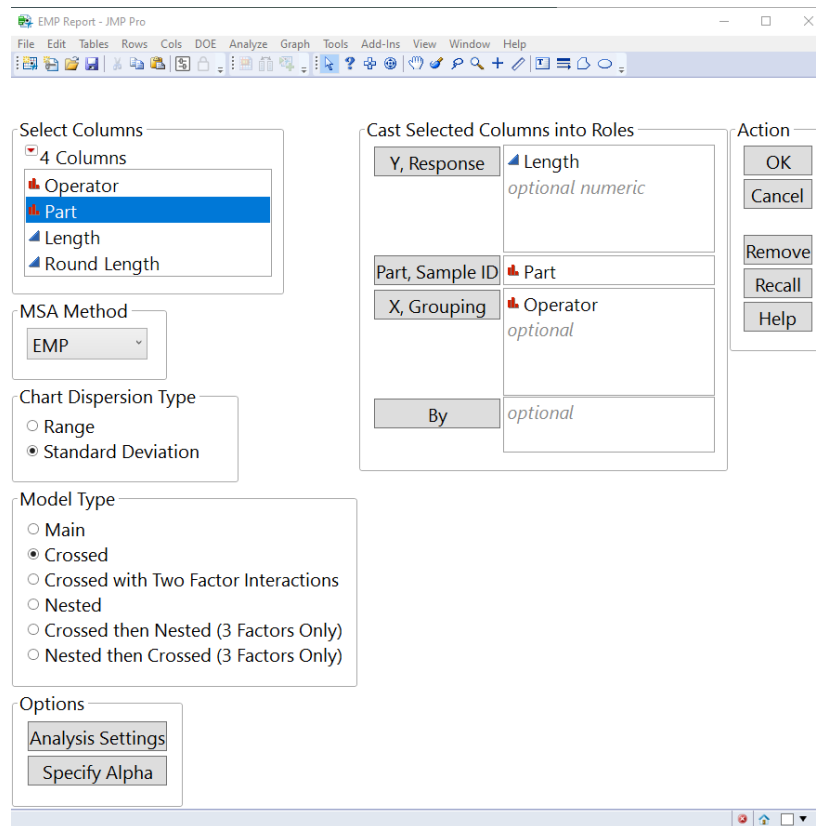
Enter Specification Limits

Lower Specification Limit, LSL= 55

Upper Specification Limit, USL= 75

OK

5. Complete EMP platform launch
 - a. Cast Part into Part, Sample ID role.
 - b. Cast other variables like Operator into X, Grouping role.
 - c. Select appropriate Chart Dispersion Type.
 - d. Select appropriate Model Type.
 - e. Click OK.



EMP Report - JMP Pro

File Edit Tables Rows Cols DOE Analyze Graph Tools Add-Ins View Window Help

Select Columns

4 Columns

- Operator
- Part
- Length
- Round Length

MSA Method

EMP

Chart Dispersion Type

☐ Range

☒ Standard Deviation

Model Type

☐ Main

☒ Crossed

☐ Crossed with Two Factor Interactions

☐ Nested

☐ Crossed then Nested (3 Factors Only)

☐ Nested then Crossed (3 Factors Only)

Options

Analysis Settings

Specify Alpha

Cast Selected Columns into Roles

Y, Response

Length
optional numeric

Part, Sample ID

Part

X, Grouping

Operator
optional

By

optional

Action

OK

Cancel

Remove

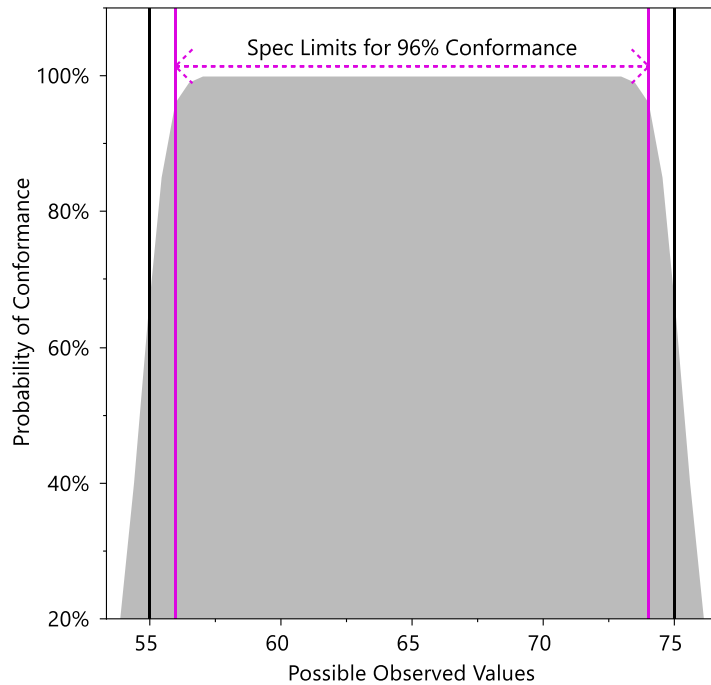
Recall

Help

6. Scroll to the bottom of the EMP Measurement Systems Analysis report .
7. Enter specification limits if not applied as column property prior.
8. Select % Conformance from list -Note: Percent conformance options are based on multiples of probable error (see EMP III p193).
9. Set number of decimal places for adjusted specification limits.
10. Click Compute.

EMP Manufacturing Instructions

EMP Gauge Performance Plot



Select % Product Conformance Expectation

% Conformance= 96

Set Precision for Limits

Number of Decimal Places= 3

Compute

Manufacturing Instructions

Lower Limit= Upper Limit=

55.992 74.008

Make MI Table

11. Review EMP report with all stakeholders.
12. Adjust % Conformance based on balancing customer expectations with business goals.
13. Click 'Make MI Table' to create a new data table with a table script to create a gauge performance.
 - a. Use step 13 to explore options for manufacturing instructions outside the EMP report.
14. Take actions based on analysis results -deploy, improve, or replace the gauge.
15. If deployed, monitor measurements over time with control charts and watch for special cause variation.