

# Design-Expert 7.1 Features

## New Features in 7.1

- Upfront power calculation for factorial designs: This mainstreams in the design-builder a 'heads-up' on the percent probability of seeing the desired difference in each response – the signal – based on the underlying variability – the noise.
- “Min-Run Res V” designs are now available for 6 to 50 factors: Resolve two-factor interactions (2FI's) in the least runs possible while maintaining a balance in low versus high levels.
- CCD's are available that are based on the Min-Run Res V fractional-factorial core—now up to 50 factors: Take advantage of a much more efficient design for larger numbers of factors.
- Bookmarks for reports with a toolbox to facilitate selection: This will save you a lot of time scrolling through long statistical outputs such as the design evaluation and analysis of variance.
- Display grid lines on 3D-graph back-planes: This feature provides a better perspective on the varying height of a response surface.
- Simple ratio constraints, such as  $A/B > 1$ , can be entered in directly: This sort of thing is fairly common, for example, A might be air pressure upstream of a check valve and B the pressure after, but it will work only when A exceeds B.
- Save graphs to files in enhanced Windows metafile (EMF), PNG, TIFF, GIF, BNP, JPEG, and encapsulated Postscript (EPS) formats: Many publications do their artwork in one of these file types.
- Fraction of design space (FDS) graph for design evaluation: This enhancement, suggested to us by DOE guru Douglas Montgomery, provides very helpful information on scaled prediction variance (SPV) for comparing alternative test matrices – simple enough that even non-statisticians can see differences at a glance and versatile enough for any type of experiment— mixture, process or combined.
- Design layout can now be modified via a right-click list with added columns for point type and other alternative attributes: Make your "recipe" sheet more informative.
- “Design model” choice added for statistical analysis: This is handy for data from experiments based on a computer-generated D-optimal design.
- More flexibility in handling various file types when opening files: Very helpful default that automatically recognizes any data in the Design-Ease (.de\*) or Design-Expert (.dx\*) format – including ones produced from older versions.
- From the Design node, display mixture constraints coded in actual, real, or pseudo values: An important distinction for understanding the experimental region of formulation.

- Keystroke option (Ctrl+/-) to move through alternate solutions from numerical optimization: This saves mousing around.
- Import and export text files to get responses: Something do-able by all.
- Write transfer functions in format (.vta) readable by VarTran® software (Taylor Enterprises): This sets the stage for statistical tolerancing and sensitivity analysis leading to more robust designs.

## Other great features you will find in Design-Expert 7.1 Software

### A Variety of Design Creation Tools To Meet All Your Experimental Needs

- “Min-Run Res IV” (two-level factorial) designs for 5 to 50 factors: Screen main effects with maximum efficiency in terms of experimental runs.
- Central composite designs (CCD's) are available for up to 30 factors and 8 blocks: This represents a significant expansion in RSM capability.
- Two-level full and fractional factorials for up to 512 runs and 21 factors, along with minimum-aberration blocking choices: Build large designs.
- New “Color By” option: Color-code points on graphs according to the level of another factor—a great way to incorporate another piece of information into a graph.
- Mixture-in-mixture designs: Develop sophisticated experiments for immiscible liquids or multilayer films involving separate formulations that may interact.
- Mixture design builder recognizes inverted simplexes and constrained regions that benefit by being inverted: This provides dramatic advantages in the power for estimating model terms.
- Box-Behnken designs are available for up to 21 factors: This popular RSM design was previously limited to fewer factors, but that is no longer the case.
- General (multilevel) factorial designs (up to 32,766 runs) using factors with mixed levels.
- High-resolution irregular fractions, such as 4 factors in 12 runs.
- Plackett-Burman designs for 11, 19, 23, 27 or 31 factors in up to 64 runs respectively.
- Taguchi orthogonal arrays.
- Response Surface Method (RSM) designs, including central

- composite (small, face-centered, etc.), Box-Behnken (3-level), hybrid and D-optimal.
- Mixture designs, such as simplex-lattice, simplex-centroid screening (for up to 24 components) and D-optimal.
- Combined mixture and process designs: Mix your cake and bake it, too!
- Ability to graph any two columns of data on the XY graph (this is a great way to view a blocked effect).
- Easy-to-use automatic or manual model reduction.
- Ability to easily analyze designs with botched or missing data.
- Design-builder updates resolution of two-level fractional factorials when the number of blocks is changed: Immediately see how segmenting a design might reduce its ability to resolve effects.
- Block names are now entered during the design build: Identify how you will break up your experiment. For example, by specific shift, material lot or the like.
- “Min-Run Res IV plus two” option: Ask for two extra runs to make your experiment more robust to missing data.
- User-defined base factors for design generators: You have more flexibility to customize fractional factorial designs.
- Expanded D-optimal capabilities—impose balance penalty, force categorical balance: This feature helps users equalize the number of treatments.
- CCD's offer new alpha choices of “Practical,” “Orthogonal Quadratic” and “Spherical”: Develop more control over where you put your ‘star’ points.
- Coordinate Exchange capability for D-optimal designs: Avoid the arbitrary nature of designs constructed from candidate point sets.
- In General or Factorial D-optimal designs, categorical factors can be specified as either nominal or ordinal (orthogonal polynomial contrasts): This affects the layout of analysis of variance (ANOVA).
- Specify the same amount for low and high in a mixture design: This is handy for keeping track of fixed component levels—these do not appear in the model.

### Enjoy Incredible Flexibility with Design Modification & Augmentation Tools

- Add blocks D-optimally: This feature is especially useful for mixture designs.
- “Semifold”: In only half the runs needed by a normal foldover, augment Res IV designs to resolve specified 2FI's aliased in the original block of runs.

- Add center points, blocks and replicates without rebuilding the design: This is a real time-saver.
- Impose linear multifactor constraints on RSM or mixture designs.
- Add categorical factors to RSM, mixture or combined designs.
- Create a factorial candidate set for RSM designs when only specific factor levels are available.
- Ignore or highlight a row of data or a single response while preserving the numbers.

### Build Confidence with Statistical Analysis of Data

- From Alias List, Pareto Chart or Effects Plots views, right-click on effects to show aliases: Never lose sight of what really is being measured in fractional-factorial designs.
- Select alternative aliased effects: Choose what you think makes most sense based on your subject-matter knowledge.
- Backward stepwise regression is applicable to factorial designs: This is useful for quickly analyzing general (categorical) factorials.
- Means and standard deviations for all experimental inputs (factors) and outputs (responses) are added to the Design Summary screen: This provides a handy assessment of your system.
- The user can define their preference for sums of squares calculations for both numeric and categorical factors to be sequential, classical, or partial: These distinctions are important for statisticians who want to do ANOVA in specific ways.
- Cox model option for mixtures: May be more informative for formulators with a standard (reference) blend to which they'd like to compare more optimal recipes.
- Select optional annotated views for assistance interpreting the ANOVA.
- If your model is aliased, a warning will pop up prior to viewing the ANOVA for two-level fractional factorials, allowing you to make substitutions for aliased effects.
- Inspect F-test values on individual model terms and confidence intervals on coefficients.
- Take advantage of user preferences, ex: make a global change in the significance threshold (0.05 by default vs. 0.01 and 0.1).

### Make Use of Powerful Tools for Response Modeling

- Change models from RSM to factorial and back, and from Scheffe (mixture) to slack (during design building and at model selection).
- Add integer power terms to the model, for example, quartic.

- Select terms for model, error, or to be ignored (allows analysis of split-plot and nested designs).

### Spot Problematic or Influential Data with Diagnostics Tools

- Rows in the design layout are highlighted when points are selected on the diagnostics: The highlighting feature makes identification of problematic data much easier.
- Box-Cox transformation parameters added to the diagnostics report: Includes stats that may not appear on the plot.
- DFFITS: Spot influential runs via this deletion diagnostic that measures difference in fits when any given response is removed from the dataset.
- DFBETAS: See from this deletion diagnostic how model terms change due to an influential run.

### Simplify Interpretation with Terrific Graphics

- Full-color contour and 3D surface plots: Graduated or banded colorization adds life to reports and presentations.
- 3D surface plots for categorical factors: See colored bars towering above others where effects are greatest.
- Pareto chart of t-values of effects: Quickly see the vital few effects relative to the trivial many from two-level factorial experiments.
- Magnification feature: An incredible tool for expanding a mixture graph that is originally a small sliver and difficult to interpret.
- Points on 3D graphs: See "lollipops" protruding from surfaces where actual responses were collected.
- Crosshairs window: Predict your response at any place in the response surface plot.
- Grid lines on contour plots: See more readily what the coordinates are at any given point.
- Select the details printed on flags planted on contour plots.
- Confidence bands on one-factor plots: Get a good feel for the uncertainty in a predicted response as a function of the factor level.
- Color-codes for positive versus negative effects: Assess plus or minus impacts on half-normal and Pareto plots.
- Smart tic marks: Get more-reasonably rounded settings straight off.
- A quick summary of the design type as well as factor, response and model information is available by clicking on the design status node.
- Discover significant effects at a glance with half-normal or normal probability plots, made easier by including points representing estimates of pure error (if available from your design).

- See the Box-Cox plot for advice on the best response transformation.
- View a complete array of diagnostic graphs to check statistical assumptions and detect possible outliers (bonus feature: predicted vs. actual graphs with a rotatable best-fit line).
- See the effects plot in the original scale after transforming the response.
- Observe variation in predictions by viewing the least significant difference (LSD) bars on the model graphs.
- Poorly predicted regions on contour maps are shaded to give you confidence in your predictions.
- Slice your contour plots using a simple slide bar: See actual design points when they're on a slice!
- Drag 2-D contours using your mouse.
- Rotate 3-D graphics and see projected 2-D contours.
- Set flags to reveal the predicted response at any location.
- Edit colors, text and more to produce professional reports.
- See all effects on one graph with trace and perturbation plots.
- Plot the standard error of your design on any graph type (contour, 3D, etc.).

### Locate Your Sweet Spot with Multiple Response Optimization

- Maximize, minimize or target specific levels for both responses and factors.
- Set weight and importance levels to prioritize responses for desirability.
- Choose 2-D contour, 3-D surface, histogram or ramp desirability graphs.
- Include categorical factors.
- Set factors at constant levels.
- Add equation-only responses, such as cost, to the optimization process.
- Look at the overlay plot to view constraints on your process or formulation.
- Predict responses at any set of conditions (including confidence levels).
- Discover optimal process conditions or formulations.

### Achieve Six-Sigma Goals

- Explore propagation of error (POE) for mixtures, combined designs

and transformed responses, as well as RSM.

- For purposes of POE, enter your own response standard deviation or set it at zero.

### Save Time with Design-Expert's Intuitive User Interface

- Right-click on any response cell and "ignore" it: This feature allows you to ignore a response data point without having to ignore the entire row.
- On plots of effects simply draw a box around the ones you want selected for your model: This is much easier than clicking each one with your mouse.
- Set row status to normal, ignore or highlight: This allows users control over their design matrix.
- Sort by row status – normal, ignored or highlighted: Most real-life experiments do not go as planned so it's good to easily assess the damage.
- Numerical optimization solutions are now carried over to graphical optimization and point prediction: Explore the results of the numerical optimization on other screens.
- Cut and paste graphics to your word processor or presentation, or numbers to and from a spreadsheet.
- Easily maneuver through the program: down trees, through wizards, and across progressive toolbars.
- Tab flow through all fields on the screen: Quicker for data entry than having to click your mouse in a new location.
- Quickly select the next step with incredibly easy-to-use push buttons.
- Open reports and graphs for automatic updating.
- View numerical outputs spreadsheet style.
- Export any spreadsheet view as ASCII text, for example, design layouts or ANOVA reports.
- View several graphs simultaneously using the handy pop-out option.
- 32-bit architecture provides maximum performance on Windows 98SE, 2000, XP and beyond.
- Access graphic and spreadsheet options instantly with a simple right click.
- Choose significant terms to plot from the pull-down list on the Factors Tool.

### Handy Tools Customize Design Evaluation

- Annotation option on reports: This will be a boon to those who may be unfamiliar with all the esoteric statistics needed for design evaluation.
- Customizable design evaluation content and power levels: Use the OPTIONS button to select which statistics to display, specific power

levels to report, and whether to display the standard error or variance on the graph (with the option to scale by N—the number of runs in the design).

- Specify model terms to ignore (during evaluation) so they don't display in the alias list: For example, don't bother showing interactions of four or more factors.
- Evaluation can be done on either a design or a particular response: Shows the effect when data is missing from a specific response, but not all responses.

### Find Answers to Your Questions in Help

- "Screen tips": Press the tips button for enlightenment on the current screen—this is especially helpful for novice users.
- Tutorial movies: See Flash demo's of features via Screen Tips—a very effective way to show how to navigate through the software.
- Internet links: These are helpful connections to further information.
- Better guidance helps you choose the best model.
- A bonus help section provides "quick start" advice.

### Import/Export Tools Increase Flexibility

- XML (eXtensible Markup Language) capability: Export design files or reports in a viewable format that can be manipulated for further processing. (The XML tool also allows import of designs created externally.)
- Scripting capability: Run Design-Expert software in batch mode so it can be tied into more comprehensive lab ware or used to cycle through massive quantities of data—for example computer-based simulations.

### System Requirements

- Pentium IV 1 GHz or greater recommended (minimum Pentium Pro 266)
- Windows 98SE, ME, 2000, XP or Vista
- CD-rom drive
- 40 MB hard-disk space or greater
- Memory: 128 MB minimum, 512 MB recommended
- Annual Network licenses available

### Extras!

- Free technical support
- Limited free statistical support
- Helpful tutorials illustrate the most powerful features
- 30-day money-back guarantee