

Model-Based Calibration Toolbox Release Notes

Note The Model-Based Calibration Toolbox Version 3.0 is a Web release for Release 14 with Service Pack 3.

The Chapter 1, “Model-Based Calibration Toolbox 3.0 Release Notes” describe the changes introduced in the latest version of the Model-Based Calibration Toolbox. The following topics are discussed in these Release Notes.

- “New Features” on page 1-2
- “Major Bug Fixes” on page 1-4
- “Upgrading from an Earlier Release” on page 1-5
- “Known Software and Documentation Problems” on page 1-6

The Model-Based Calibration Toolbox Release Notes also provide information about recent versions of the product, in case you are upgrading from an earlier version.

- Chapter 2, “Model-Based Calibration Toolbox 2.1.1 Release Notes”
- Chapter 3, “Model-Based Calibration Toolbox 2.1 Release Notes”
- Chapter 4, “Model-Based Calibration Toolbox 2.0 Release Notes”
- Chapter 5, “Model-Based Calibration Toolbox 1.1 Release Notes”

Printing the Release Notes. If you would like to print the Release Notes, you can link to a PDF version.

Model-Based Calibration Toolbox 3.0 Release Notes

1

New Features	1-2
Command-Line Interface to the Model-Based Calibration Toolbox	1-2
Improved CAGE Setup	1-2
Optimization	1-2
Calibration Tool Interface	1-3
Boundary Modeling	1-3
Feature Filling	1-3
Surface Viewer Movie	1-3
Major Bug Fixes	1-4
Upgrading from an Earlier Release	1-5
Compatibility of Version 3.0 Files with Previous Versions	1-5
Optimization Scripts Upgrade	1-5
Known Software and Documentation Problems	1-6

Model-Based Calibration Toolbox 2.1.1 Release Notes

2

Version 2.1.1	2-2
Major Bug Fixes	2-3
Upgrading from an Earlier Release	2-4

Compatibility of Version 2.1.1 Files With Previous Versions	2-4
Known Software and Documentation Problems	2-5
Waitbar Dialogs Have Transparent Backgrounds	2-5

Model-Based Calibration Toolbox 2.1 Release Notes

3

New Features	3-2
CAGE New Features	3-2
Model Browser New Features	3-3
Major Bug Fixes	3-5
Upgrading from an Earlier Release	3-6
You Cannot Load Version 2.1 Files Into Previous Versions	3-6

Model-Based Calibration Toolbox 2.0 Release Notes

4

Introduction to the Model-Based Calibration Toolbox	4-2
New Features for Version 2.0	4-2
Upgrading from an Earlier Release	4-4
You Must Uninstall Previous Versions of the Toolbox.	4-4
You Cannot Load Version 2.0 Files Into Previous Versions	4-4

Model-Based Calibration Toolbox 1.1 Release Notes

5

Introduction to the Model-Based Calibration

Toolbox	5-2
Feature Summary	5-2
New Features for Release 13	5-3

Model-Based Calibration Toolbox 3.0 Release Notes

New Features

This section introduces the new features and enhancements added in Version 3.0 of the Model-Based Calibration Toolbox (Web Release for R14SP3).

Command-Line Interface to the Model-Based Calibration Toolbox

The command-line interface to the Model-Based Calibration Toolbox enables the modeling process to be automated using MATLAB commands. In this way, you can simplify the modeling process for technicians and engineers who might not have extensive background and training in this area. You can also access modeling functionality from test bed automation tools.

Improved CAGE Setup

The CAGE Import Tool allows easier reusability of CAGE sessions. You can use the CAGE Import Tool to import models, data sets, optimizations and features from any Model-Based Calibration Toolbox project file produced in CAGE or the Model Browser (.mat or .cag). This feature can greatly simplify the application of proven feature filling and optimization processes to new engine variants.

Optimization

Optimization in CAGE has had major updates:

- Significant speed improvements
- New optimization parameters that help avoid local minima by specifying multiple start points, and running only from feasible start points
- Automatic scaling of objective and constraint values improves numerical stability of algorithms
- Enhanced table filling from optimization results now allows more flexible filling methods: you can exclude infeasible solutions, choose whether to extrapolate, use selected solutions, and apply custom fill algorithms
- Enhanced API for user-defined optimization scripts

- Improved results visualization for drive-cycle optimizations and multiobjective optimizations
- Improved constraint display for non-model constraints (1-D and 2-D tables, ellipsoid, etc.)

Calibration Tool Interface

New links to standard industry tools allow import and export of calibrations directly from/to ATI Vision (via a live link or .mat files) and ETAS INCA (via .dcm files).

Boundary Modeling

You can model boundaries using convex hulls. You can create boundary models for subsets of inputs, which simplifies the boundary identification process for complex engines. Improved visualization tools in the Boundary Editor help you construct accurate constraints. Boundary constraints can now be imported into the Design Editor and exported to Simulink.

Feature Filling

The Feature Fill Wizard uses new algorithms to fill and optimize table values with reference to a model. You can fill multiple tables simultaneously using the wizard, extending the range of calibration problems that CAGE can solve. You can impose gradient and smoothing penalties, and fill tables on a region-by-region basis.

Surface Viewer Movie

The Surface Viewer now has a movie mode that is faster and easier to use, with an interactive progress bar.

Major Bug Fixes

To view major bug fixes made in R14SP3 for the Model-Based Calibration Toolbox Version 3.0, use the Bug Reports interface on the MathWorks Web site.

Note If you are not already logged in to Access Login, when you link to the Bug Reports interface (see below), you will be prompted to log in or create an Access Login account.

After you are logged in, use this [Bug Reports](#) link. You will see the bug report for the Model-Based Calibration Toolbox. The report is sorted with fixed bugs listed first, and then open bugs.

If you are viewing these release notes in PDF form on the MathWorks Web site, you can refer to the [HTML](#) form of the release notes on the MathWorks Web site and use the link provided.

If you are upgrading from a version earlier than Version 2.1.2 (R14SP3), you should also see Version 2.1.1 “Major Bug Fixes” on page 2-3.

Upgrading from an Earlier Release

This section describes the upgrade issues involved in moving from the Model-Based Calibration Toolbox 2.1.2 to Version 3.0.

Compatibility of Version 3.0 Files with Previous Versions

Files from earlier versions of the toolbox are fully supported in Version 3.0. However, files saved with this new version will not load into versions older than 3.0.

Optimization Scripts Upgrade

Some existing user-defined optimization scripts may require a call to the function `setRunInterfaceVersion` to fix incompatibilities. You can also do this in the CAGE Browser GUI in the Optimization Parameters dialog.

If you want to use the new `foptcon` optimization parameters (multiple start points and run only from feasible start points) with existing optimizations, you must use the menu item **Optimization > Reset Parameters**.

Known Software and Documentation Problems

To view important open bugs in R14SP3 for the Model-Based Calibration Toolbox Version 3.0, use the Bug Reports interface on the MathWorks Web site.

Note If you are not already logged in to Access Login, when you link to the Bug Reports interface (see below), you will be prompted to log in or create an Access Login account.

After you are logged in, use this [Bug Reports link](#). You will see the bug report for the Model-Based Calibration Toolbox. The report is sorted with fixed bugs listed first, and then open bugs. You can select the Status column to list the open bugs first.

If you are viewing these release notes in PDF form on the MathWorks Web site, you can refer to the [HTML form of the release notes on the MathWorks Web site](#) and use the link provided.

Model-Based Calibration Toolbox 2.1.1 Release Notes

Version 2.1.1

The Model-Based Calibration Toolbox 2.1.1 is a Web release for MathWorks Release 14. Version 2.1 of the toolbox was part of the Release 14 CD. Version 2.1.1 contains some important bug fixes.

If you are upgrading from Version 2.0 you should also see the for the new features and bug fixes in Version 2.1.

If you are upgrading from a release earlier than Release 13 with Service Pack 1, then you should also see the .

Major Bug Fixes

The Model-Based Calibration Toolbox 2.1.1 includes several bug fixes made since Version 2.1. This section describes the particularly important Version 2.1.1 bug fixes.

If you are viewing these Release Notes in PDF form, please refer to the HTML form of the Release Notes, using either the Help browser or the MathWorks Web site and use the link provided.

Upgrading from an Earlier Release

This section describes the upgrade issues involved in moving from the Model-Based Calibration Toolbox 2.1 to Version 2.1.1

Compatibility of Version 2.1.1 Files With Previous Versions

Files from earlier versions of the toolbox are fully supported in Version 2.1.1

Files saved with this new version will also load into Version 2.1.

However, files saved with this new version will not load into versions older than 2.1.

Known Software and Documentation Problems

This section describes known software and documentation problems in Version 2.1.1.

Waitbar Dialogs Have Transparent Backgrounds

The waitbar dialogs that are displayed to inform you of the progress of lengthy operations in MBC often display with transparent backgrounds. Instead of the normal window grey, they pick up their background from whatever is on the screen when they are displayed. This bug is purely cosmetic and will not cause any data loss.

Model-Based Calibration Toolbox 2.1 Release Notes

New Features

This section summarizes the new features and enhancements introduced in the Model-Based Calibration Toolbox 2.1 for MathWorks Release 14.

If you are upgrading from a release earlier than Release 13 with Service Pack 1, then you should also see the .

Here are the enhancements for Version 2.1.

CAGE New Features

There is new functionality in CAGE tradeoff views, model views, tables, data sets and features.

Tradeoff Enhancements

- There is improved zooming on graphs
- You can now remove tables
- There is much more information in the table display
- Enhanced multimodel import interface
- You can set inputs to table values

Optimization Enhancements

- New streamlined filling of calibration tables using optimization results
- You can now perform mixed point and sum optimizations

Tables Functionality

- Simplified table creation – you can select size, initial value and inputs all at once, and normalizers are automatically initialized across variables; so there is no longer any need to go to the Calibration Manager or initialize normalizers (except in features)
- You can convert tables directly to models

- New table arithmetic tool allows you to perform operations on whole tables or selected cells
- New extrapolation mask creation options in tables (from boundary models and Prediction Error)
- The Tables view is now one of the Data Objects and no longer a Process (this used to be called Manual Calibration)

Models Enhancements

- You can now import models from multiple files simultaneously
- Boundary models are enabled in the Surface Viewer and Models View
- You can use the new Model Properties dialog to view information such as the model type, definition, inputs, availability of Prediction Error Variance and constraints, creation date, user name, and toolbox version
- There is improved zooming on the model connections graph

Data Sets and Features Enhancements

- Data sets are significantly faster for larger datasets
- You can now copy feature strategies to the clipboard

Model Browser New Features

There is new functionality in the Data and Design Editors and modeling interfaces.

Data Editor Enhancements

- You can now select and remove outliers in the Data Editor plots
- You can apply test notes to help you identify and sort problem data for analysis in the Data Editor
- You can select noted tests to view them in other plots and tables
- There is a new improved interface for importing data from the Workspace

Design Editor Enhancements

- You can display the number of overlapping design points in the projection graphs
- You can round columns of the design

Modeling Enhancements

- Now you can export models directly to CAGE
- You can clip using boundary models in the Prediction Error Variance viewer
- It is now easier to build exported Simulink models in Real-Time Workshop – to build your exported models, you no longer need to copy all .c and .h files from `mbc/mbcsimulink` to the directory where you are building the Simulink models.

Major Bug Fixes

The Model-Based Calibration Toolbox 2.1 includes several bug fixes made since Version 2.0. This section describes the particularly important Version 2.1 bug fixes.

If you are viewing these Release Notes in PDF form, please refer to the HTML form of the Release Notes, using either the Help browser or the MathWorks Web site and use the link provided.

Upgrading from an Earlier Release

This section describes the upgrade issues involved in moving from the Model-Based Calibration Toolbox 2.0 to Version 2.1.

You Cannot Load Version 2.1 Files Into Previous Versions

Files from earlier versions of the toolbox are fully supported in Version 2.1.

However, files saved with this new version will not load into previous versions.

Model-Based Calibration Toolbox 2.0 Release Notes

Introduction to the Model-Based Calibration Toolbox

Note The Model-Based Calibration Toolbox Version 2.0 is a Web release for MathWorks Release 13+ (13.0.1). Version 1.1 was the first release of this toolbox as part of a MathWorks release CD. The Model-Based Calibration Toolbox 1.0 was initially released in Web-downloadable form between Release 12.1 and 13. These notes describe changes introduced after Version 1.1 (see “New Features for Version 2.0” on page 4-2).

For a feature summary see “Introduction to the Model-Based Calibration Toolbox” on page 5-2 in the version 1.1 release notes .

New Features for Version 2.0

Here are the enhancements for Version 2.0.

- Optimization capability for base map calibration in CAGE. For example you could maximize fuel economy at a single point or over a drive cycle within emissions requirements, using Fuel and NoX models. You can perform multi-objective optimizations, such as minimizing fuel consumption while maximizing torque within emissions constraints. You can also incorporate your own algorithms in provided templates.
- Automatic fill of Tradeoff, using the optimization scripts.
- Boundary modelling for understanding complex operating envelopes using nonparametric surfaces.
- Stepwise improvements in terms of speed and large data set handling. Automatic stepwise is available for RBF models and prune as a stepwise option for all linear models.
- More efficient (size ~ 1000 to 10000 points) fitting and handling of large data sets is more efficient.
- New and improved Data Editor with increased functionality. There are new viewing options similar to the Design Editor so you can view your data in many ways simultaneously. You can now access the Data Editor to view and export your modeling data from all nodes in the model tree. For example, this allows you to extract the value of MBT from all your

local models and export them to the workspace. The Data Editor retains a memory of view settings.

- Improved multi-model tradeoff (one model for all sites, greatly reducing file size).
- Significantly faster CAGE evaluation.
- User-defined and transient models available as one-stage models.
- New Tree Regression methods for fitting RBF's.
- Local Multi-Models for site specific models. You can fit a variety of different models to each test and choose criteria to automatically select the best fit for each.
- Ability to fit the same model to all tests using Local Average Fit. This allows you to fit global models to your data while also being able to view the fit to each test individually.
- Support for more blocks in CAGE strategy parsing – all standard Simulink lookup tables and the relational operator block.
- Much improved data selection and matching to designs.
- New enhancements to design augmentation. You can easily use the data matching functions to add all your data to a design as fixed points, in order to augment the design and collect more data.
- Flexible summary statistics for models and you can use these criteria to automatically select best models, in addition to using them as diagnostic statistics when comparing models.
- Considerable usability improvements in the new Surface Viewer in CAGE.
- Memory of settings for a test plan retained by response surface, cross-section view, and validation data.
- Ability to display boundary models in Model Browser response surface viewer and cross-section viewer.
- Use of boundary models in CAGE (in the response surface viewer and optimization views).

Upgrading from an Earlier Release

This section describes the upgrade issues involved in moving from the Model-Based Calibration Toolbox 1.1 to Version 2.0.

You Must Uninstall Previous Versions of the Toolbox.

Important: you must uninstall any previous versions of the toolbox before installing version 2.0. If you have not done this incompatibilities will cause errors. If you have already installed the latest version without removing a previous version, simply uninstall version 2.0 and then reinstall.

You Cannot Load Version 2.0 Files Into Previous Versions

Files from earlier versions of the toolbox are fully supported in Version 2.0.

However, files saved with this new version will not load into previous versions.

Model-Based Calibration Toolbox 1.1 Release Notes

Introduction to the Model-Based Calibration Toolbox

Note The Model-Based Calibration Toolbox 1.1 is the first release of this toolbox as part of a MathWorks release CD. The Model-Based Calibration Toolbox 1.0 was initially released in Web-downloadable form after Release 12.1, but before Release 13. These notes describe any changes introduced after Version 1.0 (see “New Features for Release 13” on page 5-3).

Feature Summary

The Model-Based Calibration Toolbox contains tools for design of experiments, statistical modeling, and calibration of complex systems. You can use these tools to systematically find optimal calibrations for increasingly complex powertrain systems. The toolbox can significantly reduce dynamometer testing time, increase engineering productivity, save calibration time, and improve performance and reliability.

There are two main user interfaces:

- Model Browser for design of experimental and statistical modeling
- CAGE Browser for analytical calibration

Model Browser

The Model Browser is a flexible, powerful, intuitive graphical interface for building and evaluating experimental designs and statistical models. The Model Browser enables you to:

- Design experiment tools that can drastically reduce expensive data collection time
- Create and evaluate optimal, space filling, and classical designs, and constraints can be designed or imported
- Use hierarchical statistical models to capture the variability inherent in engine data, accounting for variation both within and between tests
- Build, compare, and evaluate statistical models and experimental designs.
- Build user-defined models using an extensive library of prebuilt model types

- Export models to MATLAB, Simulink, or CAGE.

CAGE Browser

CAGE (CALibration GEneration) is an easy-to-use graphical interface for calibrating lookup tables for your Electronic Control Unit (ECU).

As engines get more complicated, and models of engine behavior more intricate, it is increasingly difficult to rely on intuition alone to calibrate lookup tables. CAGE provides analytical methods for calibrating lookup tables.

CAGE uses models of the engine control subsystems to calibrate lookup tables. With CAGE you fill and optimize lookup tables in existing ECU software using Model Browser models. From these models, CAGE builds steady-state ECU calibrations.

CAGE also compares lookup tables directly to experimental data for validation.

New Features for Release 13

The Model-Based Calibration Toolbox Version 1.0 was released in Web-downloadable form after Release 12.1 was released, but before Release 13.

Here are the enhancements for Version 1.1.

- You can now create two new classical design styles in the Design Editor - Plackett-Burman and Regular Simplex designs.
- You can now save detailed user information to help you trace the history of project files in the Model Browser.
- You can use a new context menu to copy, delete, and rename models.
- There is a new zoom facility on data plots, in addition to the existing zoom on all model plots.
- Many processes have been made significantly faster.