

# **Model Predictive Control Toolbox Release Notes**

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## Summary by Version

This table provides quick access to what's new in each version. For clarification, see About Release Notes.

<b>Version (Release)</b>	<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>	<b>Related Documentation at Web Site</b>
<b>Latest Version V2.3 (R2007b)</b>	Yes Details	No	No	Printable Release Notes: PDF  Current product documentation
V2.2.4 (R2007a)	No	No	Bug Reports Includes fixes	No
V2.2.3 (R2006b)	No	No	No bug fixes	No
V2.2.2 (R2006a)	Yes Details	No	No bug fixes	No
V2.2.1 (R14SP3)	No	No	No bug fixes	No
V2.2 (R14SP2)	No	No	No bug fixes	No
V2.1 (R14SP1)	No	No	Fixed bugs	No
V2.0 (R14)	Yes Details	No	Known problems	No

### About Release Notes

Use release notes when upgrading to a newer version to learn about new features and changes, and the potential impact on your existing files and practices. Release notes are also beneficial if you use or support multiple versions.

If you are not upgrading from the most recent previous version, review release notes for all interim versions, not just for the version you are installing. For example, when upgrading from V1.0 to V1.2, review the New Features and

**Changes, Version Compatibility Considerations, and Bug Reports for V1.1 and V1.2.**

## New Features and Changes

These include

- New functionality
- Changes to existing functionality
- Changes to system requirements (complete system requirements for the current version are at the MathWorks Web site)
- Any version compatibility considerations associated with each new feature or change

## Version Compatibility Considerations

When a new feature or change introduces a reported incompatibility with the previous version, its description includes a **Compatibility Considerations** subsection that details the impact. For a list of all new features and changes that have reported compatibility impact, see the “Compatibility Summary for Model Predictive Control Toolbox” on page 16.

Compatibility issues that are reported after the product has been released are added to Bug Reports at the MathWorks Web site. Because bug fixes can sometimes result in incompatibilities, also review fixed bugs in Bug Reports for any compatibility impact.

## Fixed Bugs and Known Problems

MathWorks Bug Reports is a user-searchable database of known problems, workarounds, and fixes. The MathWorks updates the Bug Reports database as new problems and resolutions are reported, so check it as needed for the latest information.

Access Bug Reports at the MathWorks Web site using your MathWorks Account. If you are not logged in to your MathWorks Account when you link to Bug Reports, you are prompted to log in or create an account. You then can view bug fixes and known problems for R14SP2 and more recent releases.

The Bug Reports database was introduced for R14SP2 and does not include information for prior releases. You can access a list of bug fixes made in prior versions via the links in the summary table.

## Related Documentation at Web Site

**Printable Release Notes (PDF).** You can print release notes from the PDF version, located at the MathWorks Web site. The PDF version does not support links to other documents or to the Web site, such as to Bug Reports. Use the browser-based version of release notes for access to all information.

**Product Documentation.** At the MathWorks Web site, you can access complete product documentation for the current version and some previous versions, as noted in the summary table.



## Version 2.3 (R2007b) Model Predictive Control Toolbox

This table summarizes what's new in V2.3 (R2007b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	No	No	Printable Release Notes: PDF  Current product documentation

New features and changes introduced in this version are:

- New Option for Specifying Time-Varying Constraints
- Ability to Specify Nondiagonal Q and R Weight Matrices in Cost Function

### New Option for Specifying Time-Varying Constraints

You can now configure the Model Predictive Controller block in Simulink® to accept time-varying constraint signals that are generated by other blocks. To add inports to which you can connect time-varying constraint specifications, select the new **Enable input port for input and output limits** check box in the MPC Controller block. See also the `mpcvarbounds` demo.

In the previous version, you could only specify the constraints during the design phase and these constraints remained constant for the duration of the simulation.

For more information about the new **Enable input port for input and output limits** check box in the Model Predictive Controller block, see the MPC Controller block reference page.

## **Ability to Specify Nondiagonal Q and R Weight Matrices in Cost Function**

You can now specify off-diagonal weights in the cost function. In the previous release, only diagonal Q and R matrices were supported.

To learn more about specifying off-diagonal weights, see the discussion about weights in the MPC Controller block reference pages.

To access a new demo that shows how to use nondiagonal weight matrices, type the following command at the MATLAB prompt:

```
showdemo('mpcweightsdemo')
```

## Version 2.2.4 (R2007a) Model Predictive Control Toolbox

This table summarizes what's new in V2.2.4 (R2007a):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>	<b>Related Documentation at Web Site</b>
No	No	Bug Reports Includes fixes	No

## Version 2.2.3 (R2006b) Model Predictive Control Toolbox

This table summarizes what's new in V2.2.3 (R2006b):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>	<b>Related Documentation at Web Site</b>
No	No	No bug fixes	No

## Version 2.2.2 (R2006a) Model Predictive Control Toolbox

This table summarizes what's new in V2.2.2 (R2006a):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>	<b>Related Documentation at Web Site</b>
Yes Details below	No	No bug fixes	No

New features and changes introduced in this version are described here.

### **Bumpless Transfer Added to MPC Block**

Bumpless transfer between manual and automatic operation or from one controller to another has been added to the Model Predictive Controller block in Simulink®. This block now allows feedback of the true manipulated variable signals, which allows the controller to maintain an accurate state estimate during periods when its calculated adjustments are not being sent to the plant. For example, the controller's output might be ignored during a startup period or during temporary intervention by a (simulated) plant operator. If the controller assumes that its adjustments are being implemented (the default behavior), its state estimate will be incorrect, leading to a "bump" when the controller is reconnected to the plant. A tutorial example has been added to the documentation.

### **Bumpless Transfer Demo Added**

A new demo illustrating bumpless transfer has been added to the toolbox.

## Version 2.2.1 (R14SP3) Model Predictive Control Toolbox

This table summarizes what's new in V2.2.1 (R14SP3):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>	<b>Related Documentation at Web Site</b>
No	No	No bug fixes	No

## Version 2.2 (R14SP2) Model Predictive Control Toolbox

This table summarizes what's new in V2.2 (R14SP2):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>	<b>Related Documentation at Web Site</b>
No	No	No bug fixes	No

## Version 2.1 (R14SP1) Model Predictive Control Toolbox

This table summarizes what's new in V2.1 (R14SP1):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>	<b>Related Documentation at Web Site</b>
No	No	Fixed bugs	No



## Version 2.0 (R14) Model Predictive Control Toolbox

This table summarizes what's new in V2.0 (R14):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	No	Fixed bugs	No

New features and changes introduced in this version are

- Object-Oriented Command Syntax Revised
- MPC Block for Simulink Revised
- MPC Tools Designer Added
- Integration with Other MATLAB Toolboxes
- Demos
- Documentation

### Object-Oriented Command Syntax Revised

The command syntax has been completely revised, and is similar to that used in Control System Toolbox. You create an “LTI object” to represent the plant to be controlled, using it and other specifications to create an MPC object, which represents the controller. You can then analyze controller properties, run simulations, modify the controller design, etc. The following list summarizes the major command features:

- Create and modify an MPC object.
- Extract a linear representation of the unconstrained controller as an LTI object (transfer function, state space, or zero-pole-gain).
- Calculate closed-loop steady-state gains for the unconstrained controller.
- Determine closed-loop steady-state conditions for given inputs and/or outputs.
- Calculate the constrained control action at a specified condition (can be used repeatedly as time evolves in a simulation or experiment).

- Simulate closed-loop constrained response for a linear plant and arbitrary changes in the reference signals (setpoints), disturbances, and noise.
- Specify disturbance characteristics to improve regulation while maintaining good response to reference signal changes (2-DOF design).

## **MPC Block for Simulink Revised**

The completely revised MPC block lets you insert your MPC controller object into a Simulink block diagram. You can use multiple MPC blocks within a single Simulink model if you want. In any case, the MPC block makes it easy to evaluate controller performance with a nonlinear plant.

## **MPC Tools Designer Added**

MPC Tools is a new graphical environment that lets you design and test an MPC controller object without learning the command syntax. It is tightly integrated with the MPC block for Simulink, making it easy to run either a linear or nonlinear simulation.

## **Integration with Other MATLAB Toolboxes**

Model Predictive Control Toolbox uses the same LTI model representation found in Control System Toolbox, System Identification Toolbox, etc. Examples of ways in which you can exploit toolbox compatibility include the following:

- Import raw dynamic response data to System Identification Toolbox, determine an appropriate LTI plant model, and export it to Model Predictive Control Toolbox for controller design.
- Extract an LTI representation of a model predictive controller for analysis in Control Systems Toolbox or Robust Control Toolbox.

## **Integration with Control and Estimation Tools Manager**

The Model Predictive Control Graphical Design Tool is integrated with other control and estimation projects within the Control and Estimation Tools Manager environment. In general, this lets you group control-related applications associated with the same Simulink model and share infrastructure. Specifically, the ability to combine the functionality of Model Predictive Control and Simulink Control Design Toolbox allows in-situ model predictive control design in Simulink by linearizing a Simulink model as it is

connected to an MPC block, with automatic use of the resulting linear model to define the internal MPC plant model.

## **Demos**

Model Predictive Control Toolbox includes new demos that highlight all the added features.

## **Documentation**

The documentation has been revised completely.

# Compatibility Summary for Model Predictive Control Toolbox

This table summarizes new features and changes that might cause incompatibilities when you upgrade from an earlier version, or when you use files on multiple versions. Details are provided with the description of the new feature or change.

<b>Version (Release)</b>	<b>New Features and Changes with Version Compatibility Impact</b>
<b>Latest Version V2.3 (R2007b)</b>	None
V2.2.4 (R2007a)	None
V2.2.3 (R2006b)	None
V2.2.2 (R2006a)	None
V2.2.1 (R14SP3)	None
V2.2 (R14SP2)	None
V2.1 (R14SP1)	None
V2.0 (R14)	None