

dSPACE Release

# New Features and Migration

Release 4.0.1 – December 2003



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## Software Updates and Patches

dSPACE strongly recommends that you download and install the most recent patches for your current dSPACE installation. Visit <http://www.dSPACE.de/goto?support> for software updates and patches.

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# About This Document

This document provides you with a brief overview of the major new features of dSPACE Release 4.0.1 and the MATLAB R13SP1 (MATLAB® Release 13 with Service Pack 1) Compatibility Update for dSPACE Release 4.0 since dSPACE Release 3.5.

## **About dSPACE Releases**

For information on how dSPACE software products are released, refer to *About dSPACE Releases* on page 7.

## **New features and enhancements**

For a description of the key features, and a summary of the major enhancements made since dSPACE Release 3.5, refer to *Key Features of dSPACE Release 4.0* on page 9.

## **New features of dSPACE Release 4.0.1**

For a description of the new features since dSPACE Release 4.0 and changes introduced with the MATLAB R13SP1 Compatibility Update, refer to *Key Features of dSPACE Release 4.0.1* on page 19.

## **Migration**

In addition, this document provides you with information on the changes you may have to perform when you migrate from previous releases to dSPACE Release 4.0. Refer to *Migrating to dSPACE Release 4.0* on page 25.

### Legend

The following symbols are used in this document.



Warnings provide indispensable information to avoid severe damage to your system and/or your work.



Notes provide important information that should be kept in mind.



Tips show alternative and/or easier work methods.



Examples illustrate work methods and basic concepts, or provide ready-to-use templates.

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# About dSPACE Releases

dSPACE products that form a seamlessly integrated tool chain and require the same set of third-party products are assembled in a dSPACE Release.

## **dSPACE Release number**

A dSPACE Release number consists of two digits to identify major and minor releases (major.minor, for example, dSPACE Release 3.4).

For patches, a patch number is appended to the dSPACE Release number (major.minor patch, for example, dSPACE Release 3.4p1). Patches are free of charge and can be downloaded from the dSPACE Web site.

## **Product Releases**

Product Releases provide new products or new features for the current dSPACE Release.

### **MATLAB Compatibility Updates**

MATLAB Compatibility Updates ensure that a dSPACE Release operates with a new MATLAB version until the availability of the next dSPACE Release (for example, MATLAB R13 Compatibility Update for dSPACE Release 3.4). They generally do not support new features of a new MATLAB version.

MATLAB Compatibility Updates are free of charge and can be downloaded from the dSPACE Web site.

### **Dependencies on third-party products**

A compatibility matrix provided in the `CompList.txt` file (see the root folder of the dSPACE CD) describes the dependencies of a dSPACE Release on the products of other vendors (MATLAB, compilers, Windows, etc.).

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# Key Features of dSPACE Release 4.0

dSPACE Release 4.0 comes with the following key features:

- The software of dSPACE Release 4.0 offers full compatibility with MATLAB from The MathWorks in the following releases:
  - MATLAB Release 13 with Service Pack 1  
(only if the MATLAB R13SP1 Compatibility Update for dSPACE Release 4.0 has been installed, refer to *Key Features of dSPACE Release 4.0.1* on page 19) or
  - MATLAB Release 13.0.1 or
  - MATLAB Release 13 with the additional updates Simulink® 5.0.2 and Real-Time Workshop® 5.0.1 (this requires also updating the MATLAB product itself, see *General Implementation Features, Enhancements and Changes* on page 12).



MATLAB Release 13 with Service Pack 1 replaces MATLAB Release 13.0.1 and MATLAB Release 13 with the additional updates for Simulink and Real-Time Workshop. It is recommended to use the latest MATLAB release.

It does not support MATLAB R12.1 or earlier.

- The software of dSPACE Release 4.0 supports Windows 98, Windows Me, Windows NT 4.0, Windows 2000, and Windows XP.
- Starting with dSPACE Release 4.0, the software support for the following platforms was dropped:
  - DS1102 DSP Controller Boards
  - DS1003 DSP Boards
  - DS1004 Alpha Boards

### **Implementation: key feature summary**

The new key features concerning the implementation software are:

- The new RTI FlexRay Blockset provides access to the FlexRay communications protocol for easy configuration of time-triggered bus communication and task execution.
- MicroAutoBox can be connected to a LIN and a FlexRay bus.
- Real-Time Interface provides new blocks for implementation of time-triggered tasks and timetables.

For details on the key features and a list of more new features of dSPACE Release 4.0, refer to *New Implementation Features* on page 12.

### **Experiment and test: key feature summary**

The new key features of the experiment and test software are:

- AutomationDesk is a new tool that facilitates automated, model-based testing in every development phase. Its major features include the graphical Sequence Builder for describing tests and the Project Manager for managing large test projects. AutomationDesk also provides a function library, which you can easily extend and adapt to your requirements.



AutomationDesk replaces ControlDesk Test Automation. Existing test automation scripts can continue to be used. To facilitate script maintenance, the ControlDesk Test Automation documents are installed with the AutomationDesk installation. For further information, refer to *How to Migrate from dSPACE Release 3.5* on page 26.

- ControlDesk has a graphical user interface to control the Failure Insertion Units in hardware-in-the-loop simulators.
- ControlDesk supports sound generation. The new SoundController instrument can generate various sounds, for example, engine sound or screeching tires. The MultiStateLED instrument can output sounds when displayed LEDs change their state.
- MotionDesk can generate high-quality video files from its motion data to replay an animation on PCs without MotionDesk.
- MotionDesk can simulate different visual fog and light situations in 3-D visualization, for example, sunny, foggy, sunset.

For details on the key features and a list of more new features of the experiment and test software, refer to *New Experiment and Test Features* on page 16.

# New Implementation Features

dSPACE Release 4.0 comes with several new implementation features, enhancements and changes that apply to all dSPACE boards, see below.

In addition, there are changes that apply to specific dSPACE boards and blocksets:

- *New Implementation Features for MicroAutoBox* on page 13
- *New Implementation Features for Modular Hardware* on page 14
- *New Implementation Features for the RTI LIN Blockset* on page 14
- *New Implementation Features for the RTI CAN Blockset* on page 14
- *New RTI FlexRay Blockset* on page 15

## General Implementation Features, Enhancements and Changes

RTLib, RTI and RTI-MP of dSPACE Release 4.0 provide the following hardware-independent new features and enhancements. Unless stated otherwise, these features can be implemented on all dSPACE systems.

### Compatibility with MATLAB

- The software of dSPACE Release 4.0 offers full compatibility with MATLAB from The MathWorks in the following releases:
  - MATLAB® Release 13 with Service Pack 1 (only if the MATLAB R13SP1 Compatibility Update for dSPACE Release 4.0 has been installed, refer to *Key Features of dSPACE Release 4.0.1* on page 19) or
  - MATLAB Release 13.0.1 or
  - MATLAB Release 13 with the additional updates Simulink® 5.0.2 and Real-Time Workshop® 5.0.1.



MATLAB Release 13 with Service Pack 1 replaces MATLAB Release 13.0.1 and MATLAB Release 13 with the additional updates for Simulink and Real-Time Workshop. It is recommended to use the latest MATLAB release.

It does not support MATLAB R12.1 or earlier.



If you update an existing MATLAB Release 13 installation with the Simulink 5.0.2 and Real-Time Workshop 5.0.1 updates (Web download), take care to also update the MATLAB product itself. Otherwise your installation will run MATLAB, Simulink and Real-Time Workshop as a mix of Release 13 and Release 13.0.1 products, which is known to lead to various problems. It is important that MATLAB, Simulink and Real-Time Workshop all come from the same release. You can verify this by inspecting the (Rxx) version numbers output by the MATLAB `ver` command.

### Time-triggered tasks and timetables

RTI now supports time-triggered tasks and timetables. These allow you to implement tasks and groups of tasks with variable or predefined delay times in relation to an associated trigger event. This makes task handling in your model very flexible. One possible application is to sample combustion engine sensor signal inputs with a computed time shift after ignition. Refer to *Basics of Time-Triggered Tasks and Timetables* in the *RTI and RTI-MP Implementation Guide*.

### Subsystem read/write permissions support

The new **Apply subsystem read/write permissions** option lets you apply Simulink's ReadOnly and NoReadOrWrite permissions for subsystems to the TRC file. As a result, all the block parameters of ReadOnly subsystems are read-only in ControlDesk, and the content of NoReadOrWrite subsystems is hidden in ControlDesk. Refer to *How to Apply Subsystem Permissions to the TRC File* in the *RTI and RTI-MP Implementation Guide*.

## New Implementation Features for MicroAutoBox

dSPACE Release 4.0 provides the following new implementation features and enhancements for the new MicroAutoBox variants:

### LIN support

All new MicroAutoBox variants (with DS1501-09 or DS1504-03 I/O-board version) can be connected to a LIN bus using the RTI LIN Blockset. Refer to *New Implementation Features for the RTI LIN Blockset* on page 14.

**FlexRay support** MicroAutoBox 1401/1505/1506 can be connected to a FlexRay bus using the RTI FlexRay Blockset. Refer to *New RTI FlexRay Blockset* on page 15.

**IP module support** MicroAutoBox 1401/1505/1506 allows connection of standard IP modules. Access is granted via RTLib functions.

**CAN support** All MicroAutoBox variants are supported which are equipped with a new CAN microcontroller supporting two clockrates, 24 and 36 MHz. Refer to *New Implementation Features for the RTI CAN Blockset* on page 14.

**SPI support** The RTLib for MicroAutoBox supports connecting devices via a serial peripheral interface.

### **New Implementation Features for Modular Hardware**

dSPACE Release 4.0 provides the following new implementation features and enhancements for modular hardware:

**FlexRay support** A modular system can be connected to a FlexRay bus. Refer to *New RTI FlexRay Blockset* on page 15.

### **New Implementation Features for the RTI LIN Blockset**

dSPACE Release 4.0 provides the following new implementation features and enhancements for the RTI LIN Blockset:

**MicroAutoBox support** The RTI LIN blockset supports the connection of MicroAutoBox to a LIN bus in master or slave mode.

### **New Implementation Features for the RTI CAN Blockset**

dSPACE Release 4.0 provides the following new implementation features and enhancements for the RTI CAN Blockset:

**MicroAutoBox support**

The RTI CAN Blockset of MicroAutoBox supports MicroAutoBox revisions equipped with the new CAN microcontroller with two selectable clockrates (24 and 36 MHz) and previous MicroAutoBox revisions. Refer to *Selecting the Slave MC Frequency* in the *MicroAutoBox Features*.

**New RTI FlexRay Blockset**

dSPACE Release 4.0 provides the RTI FlexRay Blockset with the following implementation features:

- Access to a FlexRay communication system for Rapid Control Prototyping
- Interaction with DECOMSYS communication planning tools for access to network configuration and message scheduling data
- Simulink blocks for specification of time-triggered tasks and mapping of tasks to RCP nodes
- Code generation of application tasks for FlexRay systems
- Integration of code generated by DECOMSYS tools for communication tasks and controller configuration
- Time-triggered execution of tasks following basic principles of the OSEKtime standard
- Synchronization of the local time base of the RCP node with the global time of the FlexRay communication system
- Support for several dSPACE RCP nodes within one FlexRay network with internode synchronization for task execution
- Support for different simulation and task execution scenarios

**Supported hardware**

The RTI FlexRay Blockset supports the following dSPACE hardware:

- DS1005 Processor Board with a DS4501 containing a FlexRay IP module
- MicroAutoBox 1401/1505/1506

# New Experiment and Test Features

On dSPACE Release 4.0, many new features and enhancements have been implemented for dSPACE's experiment and test software. See:

- *New Product AutomationDesk* on page 16
- *New Features for ControlDesk* on page 17
- *New Features for MotionDesk* on page 17

## New Product AutomationDesk

The new product AutomationDesk on dSPACE Release 4.0 comes with the following features:

- Project management to keep automation sequences, data and results clearly arranged
- Graphical development of automation sequences using standard automation blocks or custom automation blocks
- AutomationDesk library containing automation elements for typical, reusable automation tasks:
  - Main Library  
including elements for control flows, standard automation functions and data objects
  - Platform Access  
including elements for accessing dSPACE simulation platforms
  - ControlDesk Access  
including elements for accessing ControlDesk
  - Failure Simulation Access  
including elements for accessing Failure Insertion Units
  - RS232  
including elements for connection to the serial interface of the host PC
  - Remote Calibration  
including elements for accessing measurement and calibration systems based on the ASAP3 standard

- DTS6  
including elements for accessing the diagnosis line of an ECU
- Custom library, which you can easily extend and adapt to your requirements
- Seamless integration into the dSPACE tool chain

### New Features for ControlDesk

ControlDesk on dSPACE Release 4.0 comes with the following new features and enhancements:

- The Failure Simulation Component to control failure insertion units in a dSPACE Simulator. Refer to *Failure Simulation* in the *ControlDesk Experiment Guide*.
- The SoundController instrument can generate various sounds (for example, engine sound) in relation to measured signals to make your experiment more realistic. Your host PC must be equipped with a sound card which supports sound fonts.
- The MultiStateLED instrument with sound related to the displayed LED state via a standard sound card of the host PC.
- The Template instrument has been renamed PlotterArray instrument. The functionality remains the same.

### New Features for MotionDesk

MotionDesk on dSPACE Release 4.0 comes with the following new features and enhancements:

#### AVI file generation

To present an animation on a PC without MotionDesk, you can generate high-quality video files from MotionDesk's motion data. The video files are created offline with high resolution and smooth animation. Refer to *Generating a Video of an Animation* in the *MotionDesk 3-D Visualization Guide*.

#### Atmospherics settings

To get a more realistic view, atmospherics can be set in MotionDesk. You can select a predefined atmospheric setting, for example, sunset, sunny or foggy, or you can define your own atmospheric settings. Refer to *Atmospheric Settings* in the *MotionDesk 3-D Visualization Guide*.

## Key Features of dSPACE Release 4.0

### **Ethernet connection to real-time system**

Now the MotionDesk PC can be connected to a real-time system in an expansion box via an Ethernet connection.

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# Key Features of dSPACE Release 4.0.1

dSPACE Release 4.0.1 contains add-ons to dSPACE Release 4.0, and the MATLAB R13SP1 Compatibility Update. It comes with the following new key features:

- The software of dSPACE Release 4.0.1 supports the new **DS2211 HIL I/O Board**. The DS2211 is the successor of the DS2210 HIL I/O Board. Many features are improved, for example, the signal conditioning works now with voltages up to 60 V or the APU resolution is 16 bit. For details, refer to *DS2211 Versus DS2210* or *Feature Summary* in the *DS2211 Features* document.
- The **RTI FlexRay Blockset 2.0** is a further development of the RTI FlexRay Blockset 1.1, which was shipped with dSPACE Release 4.0. Now the blockset supports the FlexRay protocol 6.2 and DECOMSYS baseline 2. For details, refer to the *FlexRay Features* document.

- The **MATLAB R13SP1 Compatibility Update** enables you to use dSPACE Release 4.0 together with MATLAB Release 13 with Service Pack 1. For details, see below.

### MATLAB R13SP1 Compatibility Update

The MATLAB R13SP1 Compatibility Update enables you to use dSPACE Release 4.0 together with MATLAB Release 13 with Service Pack 1:

- If you are a new dSPACE user you can start working with MATLAB R13SP1 and dSPACE Release 4.0.
- If you have used MATLAB R13 or R13.0.1 and dSPACE Release 4.0 before, you can update to MATLAB R13SP1. Models that you have created do not need to be modified.



- If you are installing MATLAB R13SP1 on a computer that already has an earlier version of MATLAB installed on it, you must install MATLAB R13SP1 in a new installation folder.
- After the MATLAB R13SP1 Compatibility Update has been installed, the interaction between MATLAB and dSPACE software is configured for MATLAB R13SP1 only. You can uninstall the older MATLAB release.

#### Migration

There is no need to modify models created with MATLAB R13, MATLAB R13 with updates, and MATLAB R13.0.1.

#### New Characteristics of MATLAB R13SP1

If you are working with MATLAB R13SP1 you should be aware of the following two characteristics.

#### New Trigger block parameters

The new Trigger block parameters of R13SP1 do not apply for subsystems driven by RTI interrupt blocks.

With MATLAB R13SP1 Simulink introduces some enhancements to function-call subsystems. These enhancements are reflected in new parameters of the Trigger block (see the MATLAB R13SP1 release notes and the Trigger block's documentation for additional information):

- **States when enabling** parameter

- **Sample time type** and **Sample time** parameters

These Trigger block parameters are related to new features that have been introduced for function-call initiators (Bind Actions in Stateflow, and `ssEnableSystemWithTid` and `ssDisableSystemWithTid` for S-functions). However, they are available and valid only for function-call initiators that realize *synchronous* function-calls.

RTI's hardware, software, and timer interrupt blocks always create *asynchronous* function-calls and therefore these new parameters have no meaning for function-call subsystems that are driven by RTI interrupt blocks. In detail this means:

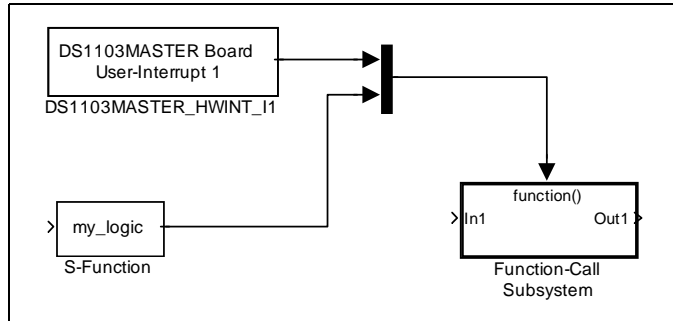
- The Trigger block **States when enabling** parameter has no effect. Independently of its setting (*inherit*, *held*, or *reset*) the states of a function-call subsystem triggered by an RTI interrupt block will never be reset when an interrupt occurs. This corresponds to the *held* behavior and is the same as in previous releases.
- The Trigger block **Sample time type** parameter must always be set to *triggered* (the **Sample time** parameter then is disabled). Otherwise, you get the following error message from Simulink:
 

```
Block 'test/Function-Call Subsystem1/function' has a discrete sample time. Only constant blocks or blocks with an inherited (-1) sample time are allowed in triggered subsystems.
```

### Combined triggering of subsystems

The combination of asynchronous and synchronous triggering of subsystems is not supported.

In the following example model the function-call subsystem is triggered by both an RTI hardware interrupt block and an S-function `my_logic`.



The RTI interrupt block realizes an asynchronous trigger event for the function-call subsystem. The S-function `my_logic` realizes a synchronous function-call trigger (that is, unlike the RTI interrupt block, it has not set the `SS_OPTION_ASYNCHRONOUS` flag in its implementation).

This model has two problems:

- 1 The combined asynchronous/synchronous triggering of subsystems is not recommended and should not be used. You will get the following message from Simulink:

```
Warning: Only one function-call initiator should execute function-call subsystem 'test/Function-Call Subsystem' because it is asynchronously triggered. This can cause corrupted data in a multitasking real-time system. This diagnostic will be enforced as an error in future releases.
```



Instead of the S-function block, the synchronous function-caller could be a standard Function-Call Generator block or a Stateflow chart with a function-call output.

- 2 If the `my_logic` S-function makes use of the new macros `ssEnableSystemWithTid` and `ssDisableSystemWithTid` to enable and disable the function-call subsystem, this will have no effect for the hardware interrupt. When an interrupt occurs, the subsystem will always be triggered even if `my_logic` has called `ssDisableSystemWithTid` before.



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# Migrating to dSPACE Release 4.0

After you install dSPACE Release 4.0, it may be necessary to carry out additional steps.

## **Migrating from dSPACE Release 3.5**

To migrate from dSPACE Release 3.5 to dSPACE Release 4.0, see *How to Migrate from dSPACE Release 3.5* on page 26.

## **Migrating from dSPACE Release 3.4 or Earlier**

To migrate from dSPACE Release 3.4 or earlier to dSPACE Release 4.0, see *How to Migrate from dSPACE Release 3.4 or Earlier* on page 27.

## How to Migrate from dSPACE Release 3.5

Note the following points when migrating from dSPACE Release 3.5 to dSPACE Release 4.0:

### **Migrating Test Automation**

If you want to use your Python scripts developed for Test Automation, you have to install AutomationDesk. The test automation scripts run with the built-in ControlDesk interpreter and also with external Python interpreters.

## How to Migrate from dSPACE Release 3.4 or Earlier

To migrate from dSPACE Release 3.4 or earlier to dSPACE Release 4.0, you have to migrate step by step via the intervening dSPACE Releases.



For example, if you want to migrate from dSPACE Release 3.3 to dSPACE Release 4.0, you have to follow the migration steps given in

1. New Features and Migration of dSPACE Release 3.4
2. New Features and Migration of dSPACE Release 3.5
3. Finally, the migration steps given in *How to Migrate from dSPACE Release 3.5* on page 26.



You can find the PDF files of the New Features and Migration documents for previous releases in the \Doc\Print folder on the dSPACE CD or download them from <http://www.dspace.de/goto?migration>.

The PDF files are named `NewFeaturesAndMigrationxx.pdf`, where `xx` stands for the version or release number.

