DS2003 High-Speed A/D Board

RTI Reference

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dSPACE

How to Contact dSPACE

Mail:	dSPACE GmbH
	Rathenaustraße 26
	33102 Paderborn
	Germany
Tel.:	+49 5251 1638-0
Fax:	+49 5251 16198-0
E-mail:	info@dspace.de
Web:	http://www.dspace.com

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  Tel.: +49 5251 1638-941 or e-mail: support@dspace.de

You can also use the support request form: http://www.dspace.com/go/supportrequest. If you are logged on to mydSPACE, you are automatically identified and do not need to add your contact details manually.

If possible, always provide the relevant dSPACE License ID or the serial number of the CmContainer in your support request.

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.com/go/patches for software updates and patches.

Contents

About This Reference

Content

This RTI Reference provides a full description of the Real-Time Interface (RTI) software support for the DS2003 High-Speed A/D Board, which can be controlled by the DS1006 Processor Board and the DS1007 PPC Processor Board.

Symbols

dSPACE user documentation uses the following symbols:

Symbol	Description
⚠ DANGER	Indicates a hazardous situation that, if not avoided, will result in death or serious injury.
⚠ WARNING	Indicates a hazardous situation that, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates a hazard that, if not avoided, could result in property damage.
Note	Indicates important information that you should take into account to avoid malfunctions.
Tip	Indicates tips that can make your work easier.
?	Indicates a link that refers to a definition in the glossary, which you can find at the end of the document unless stated otherwise.
📖	Precedes the document title in a link that refers to another document.

Naming conventions

dSPACE user documentation uses the following naming conventions:

%name%   Names enclosed in percent signs refer to environment variables for file and path names.

< > Angle brackets contain wildcard characters or placeholders for variable file and path names, etc.

Examples:

- Where you find terms such as `rti<XXXX>` replace them by the RTI platform support you are using, for example, `rti1007`.
- Where you find terms such as `<model>` or `<submodel>` in this document, replace them by the actual name of your model or submodel. For example, if the name of your Simulink model is `smd_1007_sl.slx` and you are asked to edit the `<model>_usr.c` file, you actually have to edit the `smd_1007_sl_usr.c` file.

RTI block name conventions   All I/O blocks have default names based on dSPACE's board naming conventions:

- Most RTI block names start with the board name.
- A short description of functionality is added.
- Most RTI block names also have a suffix.

Suffix	Meaning
B	Board number (for PHS-bus-based systems)
M	Module number (for MicroAutoBox II)
C	Channel number
G	Group number
CON	Converter number
BL	Block number
P	Port number
I	Interrupt number

A suffix is followed by the appropriate number. For example, DS2201IN_B2_C14 represents a digital input block located on a DS2201 board. The suffix indicates board number 2 and channel number 14 of the block. For more general block naming, the numbers are replaced by variables (for example, DS2201IN_Bx_Cy).

Special folders

Some software products use the following special folders:

Common Program Data folder   A standard folder for application-specific configuration data that is used by all users.

`%PROGRAMDATA%\dSPACE\<InstallationGUID>\<ProductName>`

or

`%PROGRAMDATA%\dSPACE\<ProductName>\<VersionNumber>`

Documents folder   A standard folder for user-specific documents.

`%USERPROFILE%\Documents\dSPACE\<ProductName>\`
`<VersionNumber>`

Local Program Data folder   A standard folder for application-specific configuration data that is used by the current, non-roaming user.

`%USERPROFILE%\AppData\Local\dSPACE\<InstallationGUID>\`
`<ProductName>`

Accessing dSPACE Help and PDF Files

After you install and decrypt dSPACE software, the documentation for the installed products is available in dSPACE Help and as PDF files.

dSPACE Help (local)   You can open your local installation of dSPACE Help:

- On its home page via Windows Start Menu
- On specific content using context-sensitive help via **F1**

dSPACE Help (Web)   You can access the Web version of dSPACE Help at www.dspace.com.

To access the Web version, you must have a *mydSPACE* account.

PDF files   You can access PDF files via the 🅿 icon in dSPACE Help. The PDF opens on the first page.

General Information on the DS2003 Blockset

## Overview of the DS2003 Blockset

About this board
The DS2003 High-Speed A/D Board provides 32 A/D channels of 2 independent A/D converters. You can choose between various channel numbers, resolutions and speeds.

RTI blockset
The Real-Time Interface (RTI) board library for the DS2003 Multi-Channel A/D Converter Board provides the RTI blocks that implement the functionality and I/O capabilities of the DS2003 board in Simulink models.

After you double-click the corresponding board library icon in the library **rtilibm** the **Library: rtilibm/DS2003** opens:
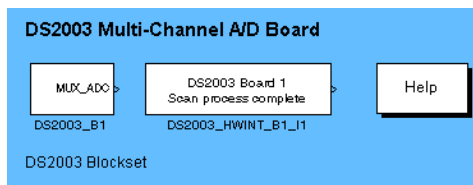
The following I/O units can be accessed by the RTI blockset for the DS2003:

- ADC Unit on page 11
- Interrupts on page 17

Demo model
For Simulink models, that shows how to use the RTI blocks of the DS2003 board, refer to the RTI demo library of your processor board. You can find the model files also at `<RCP_HIL_InstallationPath>\Demos\<ProcessorBoard>\RTI`.

Related topics

References

ADC Unit

Objective

The **Library: rtilibm/DS2003** provides access to the ADC unit of the DS2003.

Demo model

For a demo model using the ADC unit, refer to
`<RCP_HIL_InstallationPath>\Demos\<ProcessorBoard>\RTI\demom_ds2003_1.slx`. This is the **DS2003, DS2102** model, which you can find in the processor board's RTI demo library.

DS2003_Bx

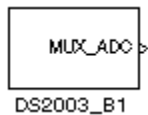**Where to go from here**   Information in this section

Block Description (DS2003_Bx)

Block

Purpose

To get access to up to 32 multiplexed channels of an A/D converter.

> **Note**
>
> Because the A/D conversion works in polling mode, do not specify an interrupt using the HWINT block. Otherwise the processor will be blocked. For further information, refer to Limitations (DS2003 Features 📖).

I/O mapping

For details on the I/O mapping, refer to ADC Unit (DS2003 Features 📖).

I/O characteristics

- The scaling between the analog input voltage and the output of the block is:

Input Voltage Range	Simulink Output
±5 V DC	±1.0
±10 V DC	±1.0

- The width of the block output vector matches the number of selected channels.
- The DS2003 board uses two parallel A/D converters. The channels used are distributed automatically to the 2 converters in a way that achieves maximum performance with respect to the overall conversion time.

> **Note**
>
> When started, data conversion takes place for all selected channels. A second conversion must not be started until the first one has finished completely and all sampled data is read out. For this reason all channels must be sampled in a single task, and thus only one DS2003 block should be used in a Simulink model.

Dialog pages

The dialog settings can be specified on the following pages:

- Unit Page (DS2003_Bx) on page 13
- Range Page (DS2003_Bx) on page 14
- Resolution Page (DS2003_Bx) on page 14

Related RTLib functions

ds2003_board_init (DS2003 RTLib Reference 📖), ds2003_init_scantbl (DS2003 RTLib Reference 📖), ds2003_set_range (DS2003 RTLib Reference 📖), ds2003_set_trigger (DS2003 RTLib Reference 📖), ds2003_set_wordlen (DS2003 RTLib Reference 📖), ds2003_start (DS2003 RTLib Reference 📖), ds2003_in (DS2003 RTLib Reference 📖)

Unit Page (DS2003_Bx)

Purpose

To specify the board number, and to select a set of channels.

Dialog settings

Board number   Lets you select the board number in the range 1 … 16. If your system contains several boards of the same type, RTI uses the board number to distinguish between them.

Channel selection   Lets you select a set of up to 32 channels. To select all or none of the 32 channels, push the **All** or the **None** button, respectively.

Related topics

References

Range Page (DS2003_Bx)

Purpose   To specify the input voltage range.

Dialog settings   **Configure channels**   Lets you switch between channel sets (1 … 8, 9 … 16, …), for which you want to specify the input voltage range.

Range   Lets you select the input voltage ranges of ±5 V or ±10 V for each channel of the specified channel set. To assign one input voltage range to all of the channels displayed, specify the desired value before pushing the Set all button.

> **Note**
>
> The range setting is only possible for the channels, that were specified on the Unit page.

Related topics   References

Resolution Page (DS2003_Bx)

Purpose   To specify the bit resolution.

Dialog settings   **Configure channels**   Lets you switch between channel sets (1 … 8, 9 … 16, …), for which you want to specify the bit resolution.

Resolution   Lets you select the bit resolution of 4, 8, 10, 12, 13, 14, 15 or 16 bits for each channel of the specified channel set. To assign one bit resolution to all of the channels displayed, specify the desired value before pushing the Set all button.

Tip

You can achieve faster conversion times if you lower the resolution of the converters. For detailed information, refer to Faster A/D Conversion via Short-Cycling (DS2003 Features 📖).

Related topics

References

Interrupts

Objective

The **Library: rtilibm/DS2003** provides access to the hardware interrupts of the DS2003.
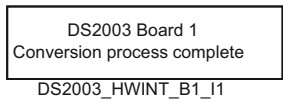
DS2003_HWINT_Bx_Iy

Where to go from here

Information in this section

Block Description (DS2003_HWINT_Bx_Iy)

Block

```
┌─────────────────────────────┐
│      DS2003 Board 1         │ ▷
│ Conversion process complete │
└─────────────────────────────┘
      DS2003_HWINT_B1_I1
```

Purpose

To make the hardware interrupts of the DS2003 board available as trigger sources in a block diagram.

> **Note**
>
> Because the A/D conversion works in polling mode, do not specify an interrupt using the HWINT block. Otherwise the processor will be blocked. For further information, refer to Limitations (DS2003 Features 📖).

Dialog pages

The dialog settings can be specified on the Unit Page (refer to Unit Page (DS2003_HWINT_Bx_Iy) on page 18).

Unit Page (DS2003_HWINT_Bx_Iy)

Purpose

To specify the board number and the interrupt source.

Dialog settings

Board number   Lets you select the board number in the range 1 … 16. If your system contains several boards of the same type, RTI uses the board number to distinguish between them.

Interrupt   Lets you specify the type of the interrupt source.

Four interrupts of the DS2003 board provide access to the state of the conversion process:

Interrupt No.	Interrupt Type
1	Conversion process complete
2	ADC data buffer not empty
3	ADC data buffer half full
4	ADC data buffer full

- The ADC data buffer is used to obtain the results of a conversion process. The buffer consists of 512 x 32 bits first-in-first-out (FIFO) memory. It can be read randomly even while a conversion process is in progress. The 32-bit word of the buffer is shared by the 2 converters.

Data Buffer Event	State	Function
Buffer not empty	true	At least one data pair is available.
	false	The data buffer is empty. Reading it results in erroneous data.
Buffer half full	true	At least 256 data pairs available.
	false	255 or fewer ADC data pairs available.
Buffer full	true	512 ADC data pairs available. Further data values will be lost.
	false	Less than 512 data pairs available.

- The events *ADC data buffer half full* and *ADC data buffer full* will never occur with code generated from the DS2003 block.

> **Tip**
>
> For detailed information on the conversion process and the ADC buffer, refer to ADC Unit (DS2003 Features 📖).

Related topics

References