MicroAutoBox II

RTI Reference

For all variants of MicroAutoBox II

Release 2021-A – May 2021

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

How to Contact dSPACE Support

If you encounter a problem when using dSPACE products, contact your local dSPACE representative:

- Local dSPACE companies and distributors: http://www.dspace.com/go/locations
- For countries not listed, contact dSPACE GmbH in Paderborn, Germany.
  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.

Important Notice

Contents

Bit I/O 155

D/A Conversion 223

Timing I/O 237

Single Edge Nibble Transmission (SENT) 397

Serial Peripheral Interface 419

About This Document

Content

This RTI Reference provides a full description of the Real-Time Interface (RTI) software support for all the variants of:

MicroAutoBox II

- 1401/1507
- 1401/1511
- 1401/1511/1514, optionally with DS1552 Multi-I/O Module or DS1554 Engine Control I/O Module
- 1401/1513
- 1401/1513/1514, optionally with DS1552 Multi-I/O Module or DS1554 Engine Control I/O Module

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.

Symbol	Description
	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/go/help.

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 RTI Blockset of MicroAutoBox II

Purpose

Here you get basic information on the RTI Blockset of MicroAutoBox II (RTI1401).

Where to go from here

Information in this section

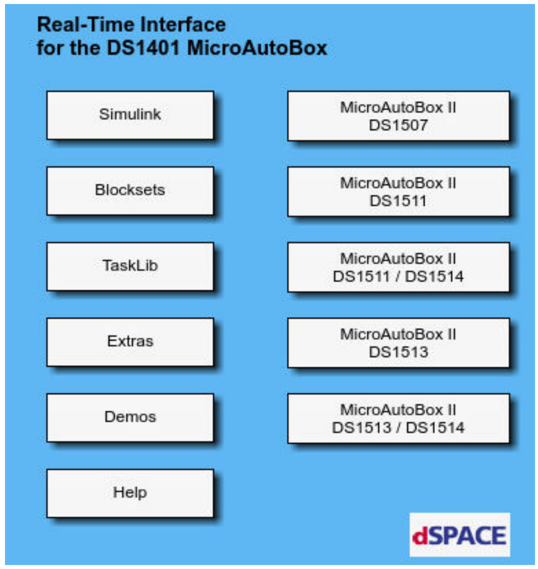
Overview of RTI1401

Introduction

The Real-Time Interface (RTI) board library for MicroAutoBox II – **rtilib1401** – provides the RTI blocks that implement the functionality and I/O capabilities of the DS1401 Base Board and all the available I/O boards in Simulink models. These RTI blocks are designed to specify the hardware setup for real-time applications. Furthermore, rtilib1401 provides additional RTI blocks, demo models and useful information.

RTI blockset

After you enter **`rti1401`** in the MATLAB Command Window, the RTI board library for MicroAutoBox II is displayed.



The following rtilib1401 components are available in the Library: rtilib1401 window:

Simulink Opens the Simulink Library Browser providing the standard Simulink block library.

Blocksets Offers access to the dSPACE blocksets that provide specific functionality for various dSPACE hardware device. Specific license keys are required for some of these blocksets.

For example, the following blocksets are supported by MicroAutoBox II:

- RTI CAN Blockset
- RTI CAN MultiMessage Blockset
- RTI LIN MultiMessage Blockset
- RTI FlexRay Configuration Blockset (RTI FR CONF Blockset)
- RTI Bypass Blockset
- RTI Ethernet (UDP) Blockset (RTI ETH (UDP) Blockset)
- RTI RPCU Blockset
- RTI FPGA Programming Blockset (RTI FPGA Pr. Blockset)
- RTI Watchdog Blockset
- RTI USB Flight Recorder Blockset

TaskLib Offers RTI blocks for modeling interrupts in Simulink. For detailed information, see TaskLib Block Reference (RTI and RTI-MP Implementation Reference 📖).

Extras Offers RTI blocks for special purposes – for example, the service code for dSPACE experiment software. For detailed information, see Extras Block Reference (RTI and RTI-MP Implementation Reference 📖).

Demos Opens the `rti1401demolib` providing various example models.

Help Opens dSPACE Help and displays an overview of the available user documentation for implementing real-time applications with MicroAutoBox II.

Hardware-specific sublibraries For each MicroAutoBox II variant, there is a specific sublibrary that provides only the applicable RTI blocks. For further information, refer to Hardware-Specific Sublibraries on page 21.

Tip

You can open rtilib1401 components by double-clicking the appropriate button in the `Library: rtilib1401` window.

Related topics

References

Extras Block Reference (RTI and RTI-MP Implementation Reference 📖)
TaskLib Block Reference (RTI and RTI-MP Implementation Reference 📖)

Hardware-Specific Sublibraries

Introduction

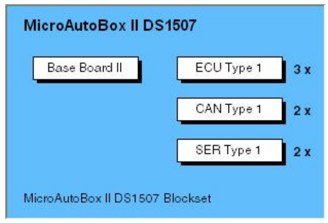
RTI1401 contains sublibraries that provide a hardware-specific selection of all the available RTI blocks for MicroAutoBox II. To avoid incompatibilities with the implemented functionality and the hardware used, you should use only the sublibrary that corresponds to your MicroAutoBox II variant.

The display of the I/O sublibraries contains numbers showing how many times the I/O units are available on the MicroAutoBox II variant used.

Sublibraries for MicroAutoBox II

You can use one of the following sublibraries.

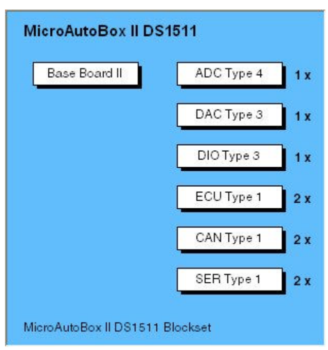
MicroAutoBox II DS1507 Blockset



The MicroAutoBox II DS1507 Blockset provides the following sublibraries:

- Base Board II (refer to Base Board II Blockset on page 27) including RTI blocks for hardware interrupt handling, power down handling, RAM access, flash memory access, and optionally for USB Flight Recorder and communication via the I/O Ethernet interface.
- ECU Type 1 (refer to ECU Type 1 Blockset on page 36) including RTI blocks for accessing the ECU interface.
- CAN Type 1 (refer to CAN Type 1 Blockset on page 36) including RTI blocks for implementing CAN bus communication.
- SER Type 1 (refer to SER Type 1 Blockset on page 37) including RTI blocks for implementing communication on the serial interface.

MicroAutoBox II DS1511 Blockset

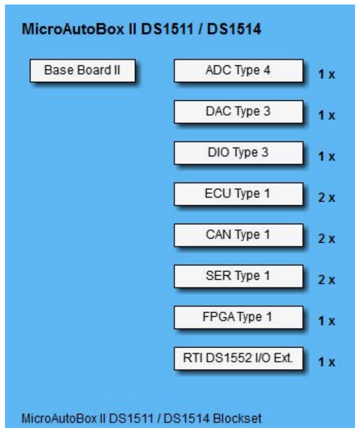


The MicroAutoBox II DS1511 Blockset provides the following sublibraries:

- Base Board II (refer to Base Board II Blockset on page 27) including RTI blocks for hardware interrupt handling, power down handling, RAM access, flash memory access, and optionally for USB Flight Recorder and communication via the I/O Ethernet interface.
- ADC Type 4 (refer to ADC Type 4 Blockset on page 30) including RTI blocks for A/D conversion.
- DAC Type 3 (refer to DAC Type 3 Blockset on page 30) including RTI blocks for D/A conversion.
- DIO Type 3 (refer to DIO Type 3 Blockset on page 32) including RTI blocks for Bit I/O and Timing I/O.
- ECU Type 1 (refer to ECU Type 1 Blockset on page 36) including RTI blocks for accessing the ECU interface.

- CAN Type 1 (refer to CAN Type 1 Blockset on page 36) including RTI blocks for implementing CAN bus communication.
- SER Type 1 (refer to SER Type 1 Blockset on page 37) including RTI blocks for implementing communication on the serial interface.

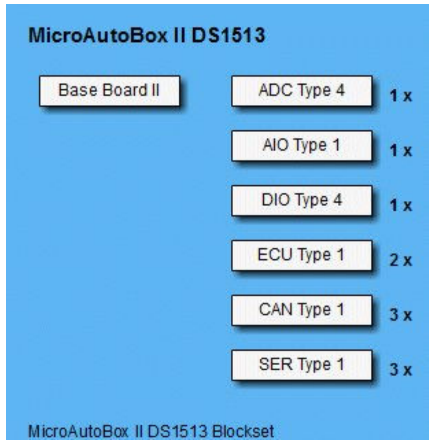
MicroAutoBox II DS1511/1514 Blockset



The MicroAutoBox II DS1511/1514 Blockset provides the following sublibraries:

- Base Board II (refer to Base Board II Blockset on page 27) including RTI blocks for hardware interrupt handling, power down handling, RAM access, flash memory access, and optionally for USB Flight Recorder and communication via the I/O Ethernet interface.
- ADC Type 4 (refer to ADC Type 4 Blockset on page 30) including RTI blocks for A/D conversion.
- DAC Type 3 (refer to DAC Type 3 Blockset on page 30) including RTI blocks for D/A conversion.
- DIO Type 3 (refer to DIO Type 3 Blockset on page 32) including RTI blocks for Bit I/O and Timing I/O.
- ECU Type 1 (refer to ECU Type 1 Blockset on page 36) including RTI blocks for accessing the ECU interface.
- CAN Type 1 (refer to CAN Type 1 Blockset on page 36) including RTI blocks for implementing CAN bus communication.
- SER Type 1 (refer to SER Type 1 Blockset on page 37) including RTI blocks for implementing communication on the serial interface.
- FPGA Type 1 (refer to RTI FPGA Type 1 Blockset on page 41) opens the RTI FPGA Programming Blockset.
- RTI DS1552 I/O Ext. (refer to RTI DS1552 I/O Extension Blockset on page 41) opens the RTI DS1552 I/O Extension Blockset, if the required license is available.

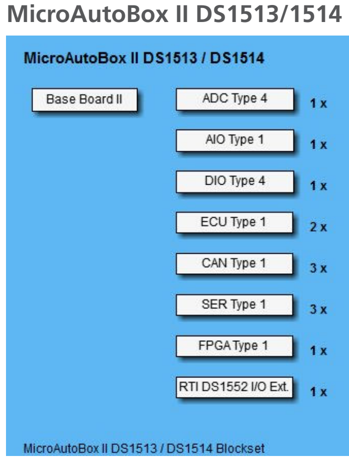
MicroAutoBox II DS1513 Blockset



The MicroAutoBox II DS1513 Blockset provides the following sublibraries:

- Base Board II (refer to Base Board II Blockset on page 27) including RTI blocks for hardware interrupt handling, power down handling, RAM access, flash memory access, and optionally for USB Flight Recorder and communication via the I/O Ethernet interface.
- ADC Type 4 (refer to ADC Type 4 Blockset on page 30) including RTI blocks for A/D conversion.
- AIO Type 1 (refer to AIO Type 1 Blockset on page 31) including RTI blocks for A/D conversion and D/A conversion.
- DIO Type 4 (refer to DIO Type 4 Blockset on page 34) including RTI blocks for Bit I/O and Timing I/O.
- ECU Type 1 (refer to ECU Type 1 Blockset on page 36) including RTI blocks for accessing the ECU interface.
- CAN Type 1 (refer to CAN Type 1 Blockset on page 36) including RTI blocks for implementing CAN bus communication.
- SER Type 1 (refer to SER Type 1 Blockset on page 37) including RTI blocks for implementing communication on the serial interface.

MicroAutoBox II DS1513/1514 Blockset



The MicroAutoBox II DS1513/1514 Blockset provides the following sublibraries:

- Base Board II (refer to Base Board II Blockset on page 27) including RTI blocks for hardware interrupt handling, power down handling, RAM access, flash memory access, and optionally for USB Flight Recorder and communication via the I/O Ethernet interface.
- ADC Type 4 (refer to ADC Type 4 Blockset on page 30) including RTI blocks for A/D conversion.
- AIO Type 1 (refer to AIO Type 1 Blockset on page 31) including RTI blocks for A/D conversion and D/A conversion.
- DIO Type 4 (refer to DIO Type 4 Blockset on page 34) including RTI blocks for Bit I/O and Timing I/O.
- ECU Type 1 (refer to ECU Type 1 Blockset on page 36) including RTI blocks for accessing the ECU interface.
- CAN Type 1 (refer to CAN Type 1 Blockset on page 36) including RTI blocks for implementing CAN bus communication.
- SER Type 1 (refer to SER Type 1 Blockset on page 37) including RTI blocks for implementing communication on the serial interface.
- FPGA Type 1 (refer to RTI FPGA Type 1 Blockset on page 41) opens the RTI FPGA Programming Blockset.
- RTI DS1552 I/O Ext. (refer to RTI DS1552 I/O Extension Blockset on page 41) opens the RTI DS1552 I/O Extension Blockset, if the required license is available.

Related topics

Basics

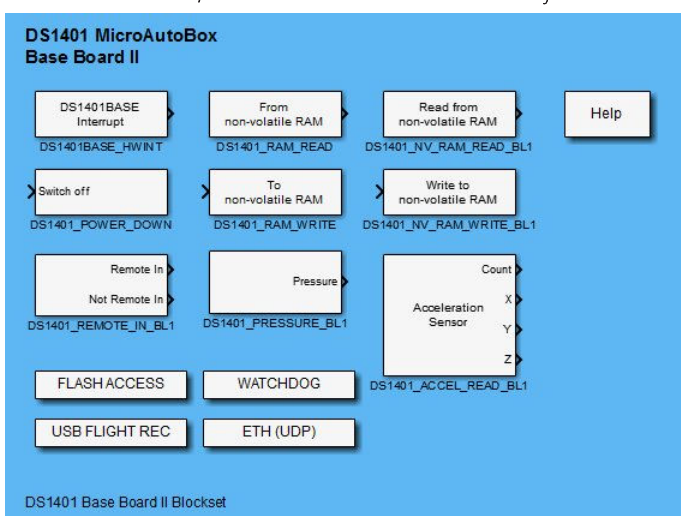
Hardware Requirements..45

Overview of the Base Board Library

Base Board II Blockset

Introduction

After you click the **Base Board II** button in one of the hardware-specific libraries of MicroAutoBox II, the **DS1401 Base Board II** library window is displayed.



The **DS1401 Base Board II** blockset provides the following RTI blocks:

- Interrupt handling: DS1401BASE_HWINT on page 50
- Power down handling:
  - DS1401_POWER_DOWN on page 112
  - DS1401_REMOTE_IN_BLx on page 114
- Nonvolatile data handling:
  - DS1401_RAM_READ on page 87
  - DS1401_RAM_WRITE on page 84
  - DS1401_NV_RAM_READ_BLx on page 94
  - DS1401_NV_RAM_WRITE_BLx on page 91

- Accessing the onboard sensors:
  - DS1401_ACCEL_READ_BLx on page 118
  - DS1401_PRESSURE_BLx on page 122

Additionally you have access to the following blocksets:

- Flash handling and flash memory-based Flight Recorder: Flash Memory Access on page 98
- USB Flight Recorder (separate license required): RTI USB Flight Recorder Blockset Reference 📖
- Watchdog (separate license required): RTI Watchdog Blockset Reference 📖
- I/O Ethernet interface (separate license required): RTI Ethernet (UDP) Blockset Reference 📖

For basic information on the base board features, refer to MicroAutoBox II Basic Features (MicroAutoBox II Features 📖).

Overview of the I/O Libraries

Introduction

When you open one of the hardware-specific sublibraries, one base board blockset and several I/O blocksets are displayed.

The RTI blocks of the I/O blocksets are required to implement the I/O capabilities of the MicroAutoBox II's I/O boards in your Simulink model. For information on the I/O features available on each of the boards, refer to the Hardware-Specific Sublibraries on page 21.

Where to go from here

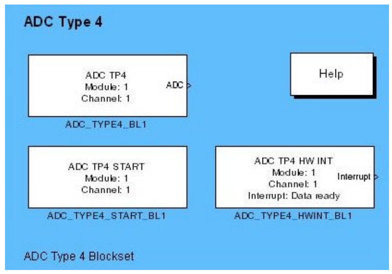
Information in this section

Information in other sections

ADC Type 4 Blockset

Introduction

After you click the **ADC Type 4** button in one of the hardware-specific libraries, the **ADC Type 4** library window is displayed.



The ADC Type 4 blockset provides the following RTI blocks:

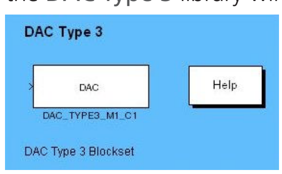
- ADC_TYPE4_BLx on page 127
- ADC_TYPE4_START_BLx on page 136
- ADC_TYPE4_HWINT_BLx on page 55

For basic information on the ADC Type 4 features, refer to ADC Unit Type 4 (MicroAutoBox II Features 📖).

DAC Type 3 Blockset

Introduction

After you click the **DAC Type 3** button in one of the hardware-specific libraries, the **DAC Type 3** library window is displayed.



The DAC Type 3 blockset provides this RTI block:

- DAC_TYPE3_Mx_Cy on page 229

For basic information on the DAC Type 3 features, refer to DAC Unit Type 3 (MicroAutoBox II Features 📖).

Related topics

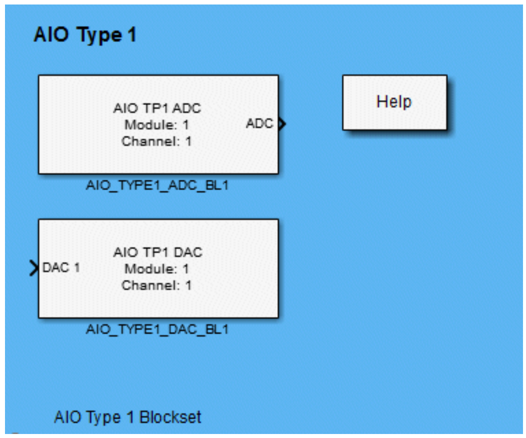
References

AIO Type 1 Blockset... 31

AIO Type 1 Blockset

Introduction

After you click the AIO Type 1 button in one of the hardware-specific libraries, the AIO Type 1 library window is displayed.



The AIO Type 1 blockset provides these RTI blocks:

- AIO_TYPE1_ADC_BLx on page 151
- AIO_TYPE1_DAC_BLx on page 224

For basic information on the AIO Type 1 features, refer to AIO Unit Type 1 (ADC) (MicroAutoBox II Features 🕮) and AIO Unit Type 1 (DAC) (MicroAutoBox II Features 🕮).

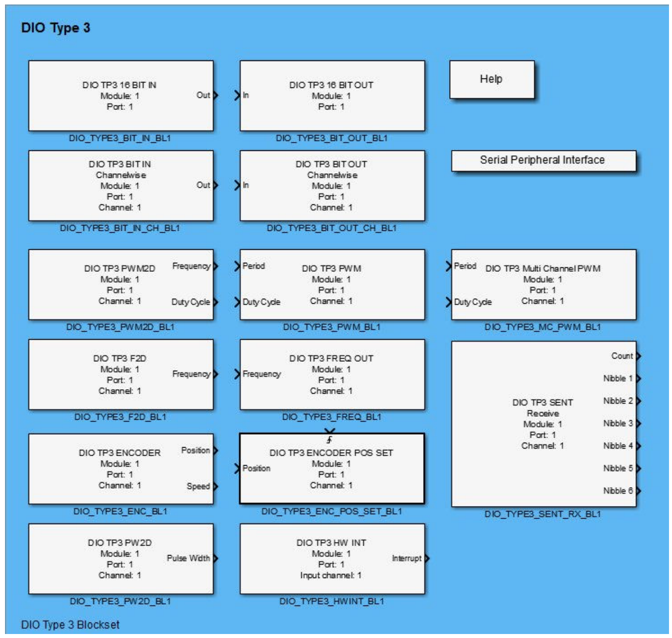
Related topics

References

DIO Type 3 Blockset

Introduction

After you click the **DIO Type 3** button in one of the hardware-specific libraries, the **DIO Type 3** library window is displayed.



The DIO Type 3 blockset provides the following capabilities for the DIO Type 3 module:

- Bit I/O on page 155
- PWM Signal Generation with a Variable Period on page 238
- Multi-Channel PWM Signal Generation on page 286
- PWM Signal Measurement on page 308
- Pulse Pattern Measurement on page 323
- Single Edge Nibble Transmission (SENT) on page 397
- Incremental Encoder Interface on page 347
- Interrupts on page 49
- Serial Periperal Interface, refer to Serial Peripheral Interface on page 419.

For basic information on the DIO Type 3 features, refer to the feature-specific descriptions in MicroAutoBox II Features 🕮.

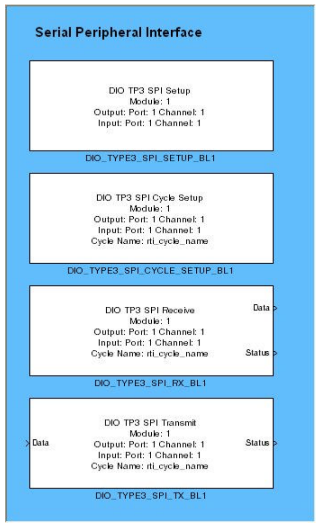
Related topics

References

DIO Type 3 Blockset: Serial Peripheral Interface

Introduction

After you click the **Serial Peripheral Interface** button in the DIO Type 3 library, the **Serial Peripheral Interface** library window is displayed.



The Serial Peripheral Interface blockset provides the following capabilities for the DIO Type 3 module:

- Serial Peripheral Interface on page 419

For basic information on the DIO Type 3 features, refer to the feature-specific descriptions in MicroAutoBox II Features .

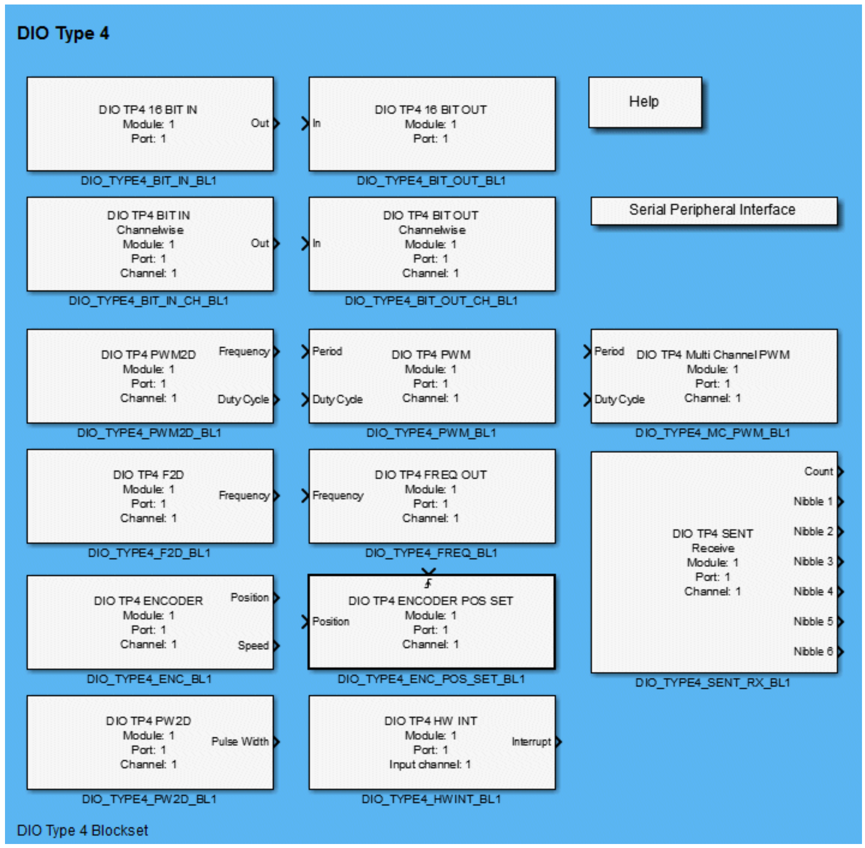
Related topics

References

DIO Type 4 Blockset

Introduction

After you click the **DIO Type 4** button in one of the hardware-specific libraries, the **DIO Type 4** library window is displayed.



The DIO Type 4 blockset provides the following capabilities for the DIO Type 4 module:

- Bit I/O on page 155
- PWM Signal Generation with a Variable Period on page 238
- Multi-Channel PWM Signal Generation on page 286
- PWM Signal Measurement on page 308
- Pulse Pattern Measurement on page 323
- Single Edge Nibble Transmission (SENT) on page 397
- Incremental Encoder Interface on page 347
- Interrupts on page 49
- Serial Periperal Interface, refer to Serial Peripheral Interface on page 419.

For basic information on the DIO Type 4 features, refer to the feature-specific descriptions in MicroAutoBox II Features 📖.

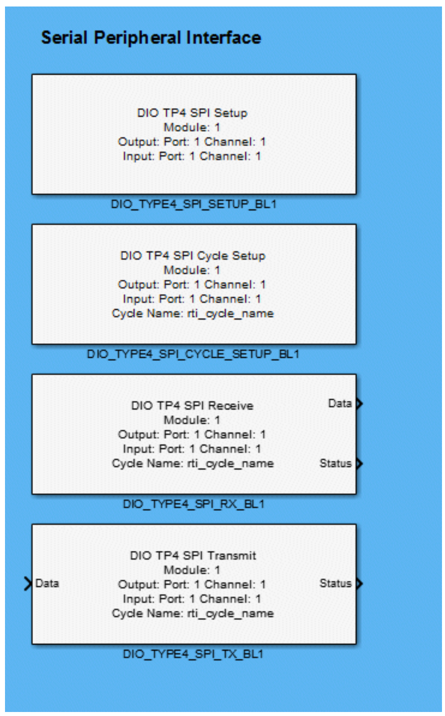
Related topics

References

DIO Type 4 Blockset: Serial Peripheral Interface

Introduction

After you click the Serial Peripheral Interface button in the DIO Type 4 library, the Serial Peripheral Interface library window is displayed.



The Serial Peripheral Interface blockset provides the following capabilities for the DIO Type 4 module:

- Serial Peripheral Interface on page 419

For basic information on the DIO Type 4 features, refer to the feature-specific descriptions in MicroAutoBox II Features 📖.

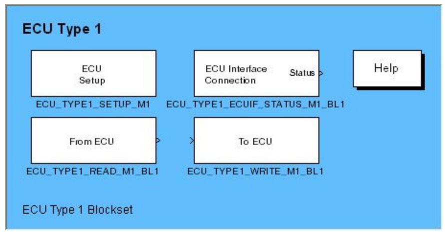
Related topics

References

ECU Type 1 Blockset

Introduction

After you click the **ECU Type 1** button in one of the hardware-specific libraries, the **ECU Type 1** library window is displayed.



The ECU Type1 blockset provides access to the ECU interface:

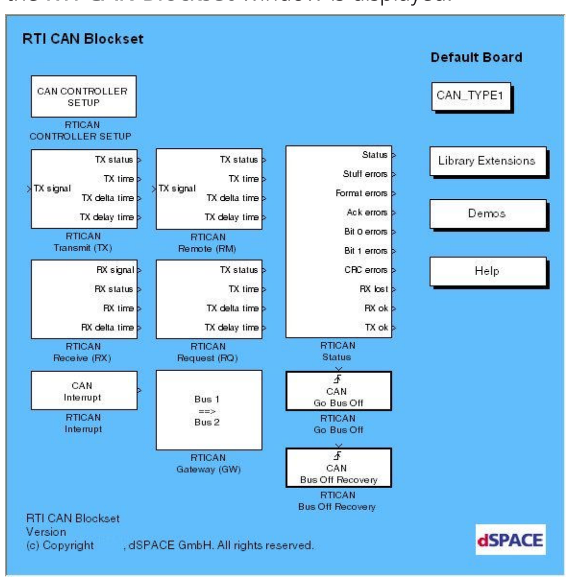
- ECU Interface Unit on page 71

For basic information on the ECU Type 1 features, refer to ECU Interface (MicroAutoBox II Features 🕮).

CAN Type 1 Blockset

Introduction

After you click the **CAN Type 1** button in one of the hardware-specific libraries, the **RTI CAN Blockset** window is displayed.



The RTI CAN Blockset provides access to the CAN interface:

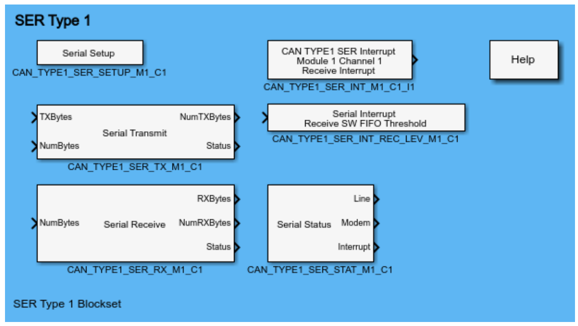
- Basics on the RTI CAN Blockset (RTI CAN Blockset Reference 🕮)

For basic information on the CAN Type 1 features, refer to CAN Support (MicroAutoBox II Features 🕮).

SER Type 1 Blockset

Introduction

After you click the **SER Type 1** button in one of the hardware-specific libraries, the **SER Type 1** library window is displayed.



The SER Type1 blockset provides access to the serial interface:

- Serial Interface on page 367

For basic information on the SER Type 1 features, refer to Serial Interface (MicroAutoBox II Features 📖).

Overview of the Optional RTI Blocksets

Introduction

The buttons of the optional RTI blocksets are only enabled if the blocksets were installed according to the required licenses.

Where to go from here

Information in this section

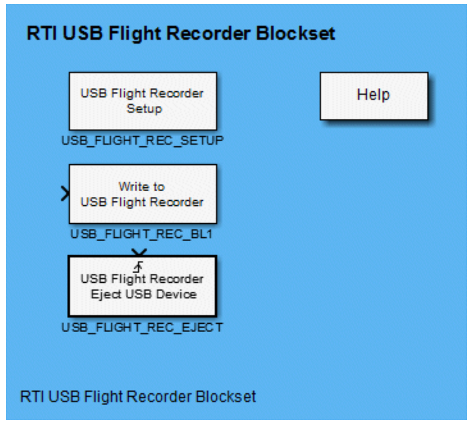
RTI USB Flight Recorder Blockset

Introduction

Note

A separate license is required for the RTI USB Flight Recorder Blockset.

With the RTI USB Flight Recorder Blockset you can perform long-term data acquisition. The values of selectable variables are written to the connected USB mass storage device during simulation.



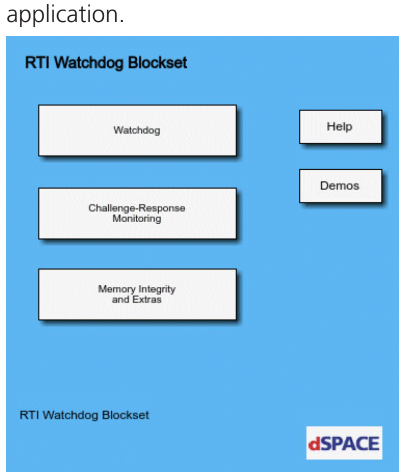
For further information, refer to RTI USB Flight Recorder Blockset Reference 📖.

RTI Watchdog Blockset

Introduction

> **Note**
>
> A separate license is required for the RTI Watchdog Blockset.

The RTI Watchdog Blockset allows implementing a multistage run-time monitoring of tasks and entities in your Simulink model and the built real-time application.

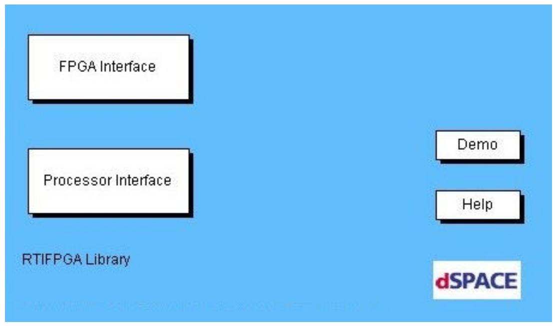


For further information, refer to RTI Watchdog Blockset Reference 📖.

RTI FPGA Type 1 Blockset

Introduction

After you click the **FPGA Type 1** button in one of the hardware-specific libraries, the **RTIFPGA Library** window is displayed.



The RTI FPGA Type 1 blockset provides access to the programmable FPGA Type 1 module of the DS1514 I/O board and the available piggyback boards, for example, the DS1552 Multi-I/O Module. To use it, the optional RTI FPGA Programming Blockset is required.

> **Note**
>
> You cannot use blocks from the RTI FPGA Programming Blockset configured with one of the FPGA1401Tp1 frameworks and the RTI DS1552 I/O Extension Blockset in the same model.

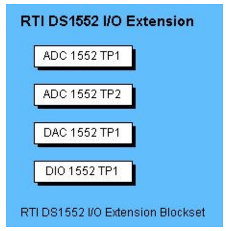
RTI DS1552 I/O Extension Blockset

Introduction

> **Note**
>
> A separate license is required for the RTI DS1552 I/O Extension Blockset.

The blockset supports the standard I/O features of the DS1552 Multi-I/O module that can be installed on a MicroAutoBox II variant with a DS1514 I/O board. For further information, refer to MicroAutoBox II with DS1552 Multi-I/O Module (MicroAutoBox II Features 🕮).

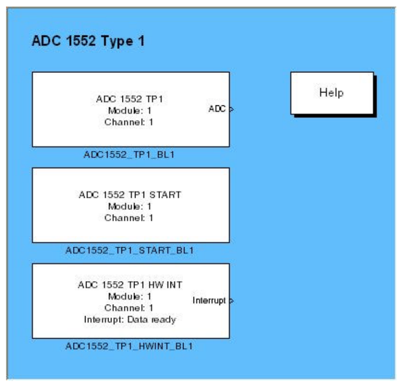
After you click the **RTI DS1552 I/O Ext.** button in the **MicroAutoBox II DS1511/DS1514** or **MicroAutoBox II DS1513/DS1514** library, the **RTI DS1552 I/O Extension** library window is displayed.



The blockset provides specific sublibraries for A/D conversion, D/A conversion and digital I/O such as PWM signal generation and square-wave signal measurement.

ADC 1552 Type 1

After you click the ADC 1552 Type 1 button in the RTI DS1552 I/O Extension Blockset, the ADC 1552 Type 1 library window is displayed.



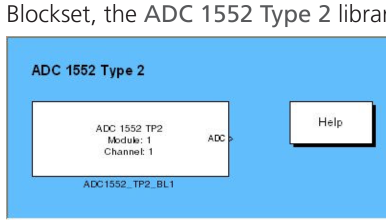
The ADC 1552 Type 1 blockset provides the following RTI blocks:

- ADC1552_TP1_BLx on page 139
- ADC1552_TP1_START_BLx on page 145
- ADC1552_TP1_HWINT_BLx on page 68

For basic information on the ADC 1552 Type 1 features, refer to ADC 1552 Type 1 Unit (MicroAutoBox II Features).

ADC 1552 Type 2

After you click the ADC 1552 Type 2 button in the RTI DS1552 I/O Extension Blockset, the ADC 1552 Type 2 library window is displayed.



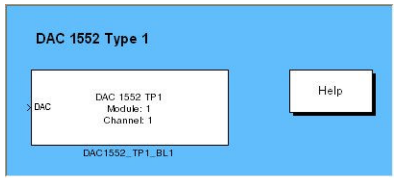
The ADC 1552 Type 2 blockset provides the following RTI block:

- ADC1552_TP2_BLx on page 148

For basic information on the ADC 1552 Type 2 features, refer to ADC 1552 Type 2 Unit (MicroAutoBox II Features).

DAC 1552 Type 1

After you click the **DAC 1552 Type 1** button in the RTI DS1552 I/O Extension Blockset, the **DAC 1552 Type 1** library window is displayed.



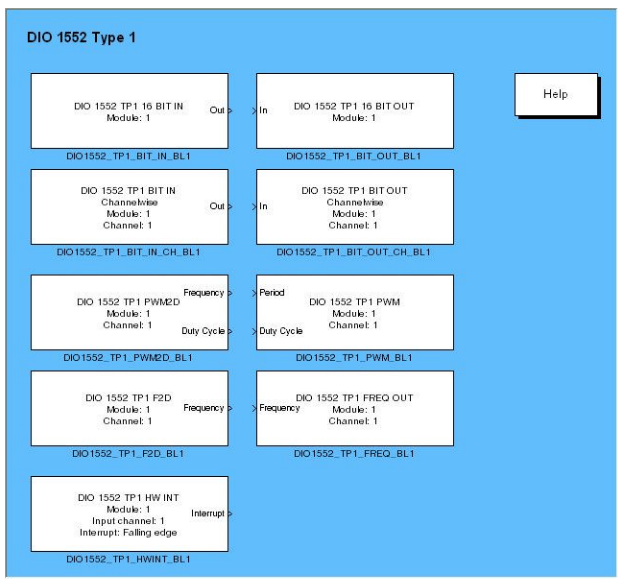
The DAC 1552 Type 1 blockset provides the following RTI block:

- DAC1552_TP1_BLx on page 232

For basic information on the DAC 1552 Type 1 features, refer to DAC 1552 Type 1 Unit (MicroAutoBox II Features).

DIO 1552 Type 1

After you click the **DIO 1552 Type 1** button in the RTI DS1552 I/O Extension Blockset, the **DIO 1552 Type 1** library window is displayed.



The DIO 1552 Type 1 blockset provides the following capabilities of the DIO 1552 Type 1 module:

- Bit I/O
  - DIO1552_TP1_BIT_IN_BLx on page 204
  - DIO1552_TP1_BIT_IN_CH_BLx on page 207
  - DIO1552_TP1_BIT_OUT_BLx on page 210
  - DIO1552_TP1_BIT_OUT_CH_BLx on page 216
- PWM Signal Generation with a Variable Period
  - DIO1552_TP1_PWM_BLx on page 271
  - DIO1552_TP1_FREQ_BLx on page 278
- PWM Signal Measurement
  - DIO1552_TP1_PWM2D_BLx on page 318

- Pulse Pattern Measurement
  - DIO1552_TP1_F2D_BLx on page 332
- Interrupts
  - DIO1552_TP1_HWINT_BLx on page 64

For basic information on the DIO 1552 Type 1 features, refer to the feature-specific descriptions in MicroAutoBox II Features 📖 .

Overview of the Dependencies for the Available Features

Hardware Requirements

Introduction

This topic describes which hardware supports a certain RTI block. For further details, for example, whether a certain firmware version is required, refer to the block-specific descriptions of the hardware requirements.

Required MicroAutoBox II hardware

The following table shows the availability of the RTI blocks depending on the hardware.

RTI Block	DS1401 Base Board	MicroAutoBox II with I/O Boards			
		DS1507	DS1511	DS1513	DS1514
DS1401BASE_HWINT	✓	–	–	–	–
ADC_TYPE4_HWINT	–	–	✓	✓	–
DIO_TYPE3_HWINT	–	–	✓	–	–
DIO_TYPE4_HWINT	–	–	–	✓	–
DS1401_POWER_DOWN	✓	–	–	–	–
DS1401_REMOTE_IN	✓	–	–	–	–
DS1401_RAM_WRITE	✓	–	–	–	–
DS1401_RAM_READ	✓	–	–	–	–
DS1401_NV_RAM_WRITE_BLx	✓	–	–	–	–
DS1401_NV_RAM_READ_BLx	✓	–	–	–	–
DS1401_PRESSURE_BLx	✓	–	–	–	–

RTI Block	DS1401 Base Board	MicroAutoBox II with I/O Boards			
		DS1507	DS1511	DS1513	DS1514
DS1401_ACCEL_READ_BLx	✓	–	–	–	–
FLASH_SETUP	✓	–	–	–	–
STORE_TO_FLASH_BLx	✓	–	–	–	–
RESTORE_FROM_FLASH_BLx	✓	–	–	–	–
FLIGHT_REC_BLx	✓	–	–	–	–
ECU_TYPE1_SETUP_Mx	✓	✓	–	–	–
ECU_TYPE1_READ_Mx_BLy	✓	✓	–	–	–
ECU_TYPE1_WRITE_Mx_BLy	✓	✓	–	–	–
ECU_TYPE1_ECUIF_STATUS_Mx_BLy	✓	✓	–	–	–
ADC_TYPE4_BLx	–	–	✓	✓	–
ADC_TYPE4_START_BLx	–	–	✓	✓	–
AIO_TYPE1_ADC_BLx	–	–	–	✓	–
AIO_TYPE1_DAC_BLx	–	–	–	✓	–
DAC_TYPE3_Mx_Cy	–	–	✓	–	–
DIO_TYPE3_BIT_IN_BLx	–	–	✓	–	–
DIO_TYPE3_BIT_IN_CH_BLx	–	–	✓	–	–
DIO_TYPE3_BIT_OUT_BLx	–	–	✓	–	–
DIO_TYPE3_BIT_OUT_CH_BLx	–	–	✓	–	–
DIO_TYPE3_PWM_BLx	–	–	✓	–	–
DIO_TYPE3_FREQ_BLx	–	–	✓	–	–
DIO_TYPE3_PWM2D_BLx	–	–	✓	–	–
DIO_TYPE3_F2D_BLx	–	–	✓	–	–
DIO_TYPE3_PW2D_BLx	–	–	✓	–	–
DIO_TYPE3_MC_PWM_BLx	–	–	✓	–	–
DIO_TYPE3_ENC_BLx	–	–	✓	–	–
DIO_TYPE3_ENC_POS_SET_BLx	–	–	✓	–	–
DIO_TYPE3_SENT_RX_BLx	–	–	✓	–	–
DIO_TYPE3_SPI_SETUP_BLx	–	–	✓	–	–
DIO_TYPE3_SPI_CYCLE_SETUP_BLx	–	–	✓	–	–
DIO_TYPE3_SPI_RX_BLx	–	–	✓	–	–
DIO_TYPE3_SPI_TX_BLx	–	–	✓	–	–
DIO_TYPE4_BIT_IN_BLx	–	–	–	✓	–
DIO_TYPE4_BIT_IN_CH_BLx	–	–	–	✓	–

RTI Block	DS1401 Base Board	MicroAutoBox II with I/O Boards			
		DS1507	DS1511	DS1513	DS1514
DIO_TYPE4_BIT_OUT_BLx	–	–	–	✓	–
DIO_TYPE4_BIT_OUT_CH_BLx	–	–	–	✓	–
DIO_TYPE4_PWM_BLx	–	–	–	✓	–
DIO_TYPE4_FREQ_BLx	–	–	–	✓	–
DIO_TYPE4_PWM2D_BLx	–	–	–	✓	–
DIO_TYPE4_F2D_BLx	–	–	–	✓	–
DIO_TYPE4_PW2D_BLx	–	–	–	✓	–
DIO_TYPE4_MC_PWM_BLx	–	–	–	✓	–
DIO_TYPE4_ENC_BLx	–	–	–	✓	–
DIO_TYPE4_ENC_POS_SET_BLx	–	–	–	✓	–
DIO_TYPE4_SENT_RX_BLx	–	–	–	✓	–
DIO_TYPE4_SPI_SETUP_BLx	–	–	–	✓	–
DIO_TYPE4_SPI_CYCLE_SETUP_BLx	–	–	–	✓	–
DIO_TYPE4_SPI_RX_BLx	–	–	–	✓	–
DIO_TYPE4_SPI_TX_BLx	–	–	–	✓	–

Required MicroAutoBox II hardware for the optional RTI blocksets

The following RTI blockset is only installed if the required license is available.

RTI DS1552 I/O Extension Blockset

RTI Block	MicroAutoBox II with I/O Boards	
	DS1514 with DS1552 Multi-I/O Module	DS1514 with DS1554 Engine Control I/O Module
ADC1552_TYPE1_HWINT	✓	–
DIO1552_TYPE1_HWINT	✓	–

RTI Block	MicroAutoBox II with I/O Boards	
	DS1514 with DS1552 Multi-I/O Module	DS1514 with DS1554 Engine Control I/O Module
ADC1552_TYPE1_BLx	✓	–
ADC1552_TYPE1_START_BLx	✓	–
ADC1552_TYPE2_BLx	✓	–
DAC1552_TYPE1_BLx	✓	–
DIO1552_TYPE1_BIT_IN_BLx	✓	–
DIO1552_TYPE1_BIT_IN_CH_BLx	✓	–
DIO1552_TYPE1_BIT_OUT_BLx	✓	–
DIO1552_TYPE1_BIT_OUT_CH_BLx	✓	–
DIO1552_TYPE1_PWM_BLx	✓	–
DIO1552_TYPE1_FREQ_BLx	✓	–
DIO1552_TYPE1_PWM2D_BLx	✓	–
DIO1552_TYPE1_F2D_BLx	✓	–

Interrupts

Introduction	The RTI Blockset of MicroAutoBox II (RTI1401) provides several blocks that you can use for making hardware interrupts available as trigger sources in a Simulink model.
Where to go from here	Information in this section

DS1401BASE_HWINT

Purpose

To make the hardware interrupts of the DS1401 Base Board and its I/O boards available as trigger sources in a Simulink model.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
✓	–	–	–	–

Where to go from here

Information in this section

Information in other sections

Block Description (DS1401BASE_HWINT)

Block

Purpose

To make the hardware interrupts of the DS1401 Base Board and its I/O boards available as trigger sources in a Simulink model.

I/O mapping

For information on the I/O mapping of the external interrupts, refer to Basics on Interrupt Handling (MicroAutoBox II Features 📖).

Description

The DS1401 Base Board provides 16 interrupt sources, of which at most 8 interrupt sources are available for the application.

Note

- If you use MicroAutoBox II 1401/1511 or MicroAutoBox II 1401/1511/1514, you should use the specific interrupt blocks for the DIO Type 3 unit and the ADC Type 4 unit, refer to DIO_TYPE3_HWINT_BLx on page 58 and ADC_TYPE4_HWINT_BLx on page 55.
- If you use MicroAutoBox II 1401/1513 or MicroAutoBox II 1401/1513/1514, you should use the specific interrupt blocks for the DIO Type 4 unit and the ADC Type 4 unit, refer to DIO_TYPE4_HWINT_BLx on page 61 and ADC_TYPE4_HWINT_BLx on page 55.

The following table gives an overview of the available interrupts:

Interrupts	Description	Class	Class Type	Module Number	Interrupt Number	Subinterrupt Number
16 ECU interrupts	Delivered from ECU to PPC Activated when ECU writes on special memory location	ECU	1	1 … 4[1)]	0	0 … 15
1 CAN Type 1 interrrupt	Used with RTI CAN Blockset and the serial interface.	Specified by the related RTI blocks.				
1 ADC Type 4 interrupt	Used with the ADC Type 4 Blockset.	Specified by ADC_TYPE4_HWINT_BLx.				
4 DIO Type 3 interrupts	You can access the single-source interrupt lines 1 and 2 of the DIO Type 3 module.	DIO	3	1	0 (for an input channel) 1 (for an output channel)	does not care, select 0
	To access the multi-source interrupt lines 3 and 4, you must use the DIO_TYPE3_HWINT_BLx block.	Specified by DIO_TYPE3_HWINT_BLx.				

Interrupts	Description	Class	Class Type	Module Number	Interrupt Number	Subinterrupt Number
4 DIO Type 4 interrupts	You can access the single-source interrupt lines 1 and 2 of the DIO Type 4 module.	DIO	4	1	0 (for an input channel) 1 (for an output channel)	does not care, select 0
	To access the multi-source interrupt lines 3 and 4, you must use the DIO_TYPE4_HWINT_BLx block.	Specified by DIO_TYPE4_HWINT_BLx.				
1 FPGA Type 1 interrupt	To access the interrupt lines of the FPGA Type 1 module.	The subinterrupts can be accessed by using the specific interrupt blocks of the RTI DS1552 I/O Extension Blockset or the RTI FPGA Programming Blockset.				

[1] Depends on the MicroAutoBox II variant used

For information on the channel characteristics, refer to the data sheets in MicroAutoBox II Hardware Reference.

Note

To use the interrupts in your application, the interrupts must be additionally initialized via the related RTI block. If there is no RTI block available which triggers the interrupt generation, you must use the related RTLib function in an S-function or the <model>_usr.c file.

Dialog pages

The dialog settings can be specified on the Parameters page (refer to Parameters Page (DS1401BASE_HWINT) on page 52).

Related topics

Basics

Basics on Interrupt Handling (MicroAutoBox II Features)

Parameters Page (DS1401BASE_HWINT)

Purpose

To specify the hardware interrupt.

Dialog settings

Class Enter the type of the interrupt source.

Class	Meaning
DIO	Digital I/O subsystem as interrupt source:

Class	Meaning
	▪ DIO Type 3 (only interrupt lines 1 and 2) ▪ DIO Type 4 (only interrupt lines 1 and 2)
ECU	ECU interface unit as interrupt source
FPGA	FPGA Type 1 module as interrupt source: ▪ DIO 1552 Type 1 ▪ ADC 1552 Type 1 ▪ Interrupts used by the RTI FPGA Programming Blockset

Note

The Hardware Interrupt block makes all interrupts available, except for
- The CAN interrupt available through the RTICAN Interrupt block of the RTI CAN Blockset (see RTICAN Interrupt (RTI CAN Blockset Reference)) and
- The interrupt of the Serial Interface available through the corresponding block of the Serial Interface (see Serial Interface on page 367).
- The ADC Type 4 interrupt available through the ADC_TYPE4_HWINT_BLx block.

Especially for external interrupts, you need not specify the Class type, Module number, and Subinterrupt number.

Class type Lets you enter the number that identifies the version of the specified class. It corresponds to the type specification "TYPEx" in the blockname, where x denotes the type.

Module number Lets you select the number that identifies the module to be used. The Module number differentiates between modules of the same class and class type.

Interrupt number Lets you enter the number in the range 0 ... 11 that identifies the interrupt. Interrupt numbers are related to the same module.

Subinterrupt number Lets you enter the number that identifies the subinterrupt for sub-scheduling of the interrupt line specified by its Class, Class type, Module number, and Interrupt number.

Note

Your input is not checked. If you specify an interrupt source that does not exist, your Hardware Interrupt block will not work. For an overview of possible interrupt source specifications (combinations of Class, Class type, Module number, Interrupt number, and Subinterrupt number), refer to DS1401BASE_HWINT on page 50.

Related topics

References

ADC_TYPE4_HWINT_BLx

Purpose

To make the hardware interrupts of the ADC Type 4 module available as trigger sources in a Simulink model.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	✓	–

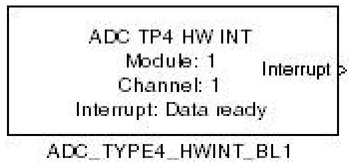
Where to go from here

Information in this section

Information in other sections

Block Description (ADC_TYPE4_HWINT_BLx)

Block



Purpose

To make the interrupts of the ADC Type 4 module available as the trigger sources for subsystems in a Simulink model.

Description

The ADC_TYPE4_HWINT_BLx block allows you to make one of the MicroAutoBox II hardware interrupts available on one A/D conversion channel.

> **Note**
>
> It is not allowed to use interrupt blocks in the same model which are identically configured regarding the module number, the channel number, and the interrupt type.

For more information on the MicroAutoBox II interrupts, refer to Basics on Interrupt Handling (MicroAutoBox II Features 🕮).

Other RTI blocks

The ADC_TYPE4_BLx block must also reside in the model, with the same module number and channel number. For details on the ADC_TYPE4_BLx block, refer to ADC_TYPE4_BLx on page 127.

I/O mapping

For information on the mapping of converter and channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to .

I/O characteristics

The following table describes the port of the block:

Port	Description
Output	
Interrupt	Trigger output. Data type: Function call

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (ADC_TYPE4_HWINT_BLx) on page 57)

Related RTLib functions

None

Unit Page (ADC_TYPE4_HWINT_BLx)

Purpose

To reference the related ADC Type 4 module and channel and to choose an interrupt as the trigger source.

Description

You can provide interrupts of different types for the same channel by adding separate ADC_TYPE4_HWINT_BLx blocks to the model.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 🕮).

Channel number Lets you select a channel number in the range 1 … 16.

Type Lets you select the interrupt type:

Interrupt Type	Meaning
Burst start	The interrupt is generated on the start of an A/D conversion burst. In single conversion mode the interrupt is generated on the start of an A/D conversion.
Data ready	The interrupt is generated on the completion of an A/D conversion burst. In single conversion mode the interrupt is generated on the completion of an A/D conversion. The interrupt indicates that a buffer with new conversion results is ready to be read.
Conversion trigger overflow	The interrupt is generated if an A/D conversion trigger is received before the current A/D conversion has completed.
Data lost	The interrupt is generated if a buffer with conversion results, which still has not been read by the application, is overwritten with new conversion results.

Related topics

References

Block Description (ADC_TYPE4_HWINT_BLx)... 56

DIO_TYPE3_HWINT_BLx

Purpose

To make the hardware interrupts of the DIO Type 3 module available as trigger sources in a Simulink model.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

Where to go from here

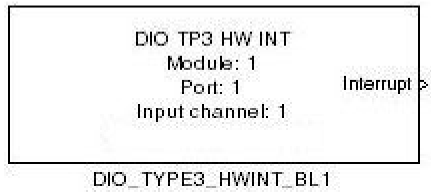
Information in this section

Information in other sections

Block Description (DIO_TYPE3_HWINT_BLx)

Block

To give information about the appearance and purpose of the block.



Purpose

To make the hardware interrupts of the DIO Type 3 module available as trigger sources in a Simulink model.

Description

The block manages the interrupt handling for the DIO Type 3 module. It makes the interrupt of the DIO Type 3 module available as a trigger source. You can use input channels and output channels for interrupt generation.

Note

- It is not allowed to use interrupt blocks in the same model which are identically configured regarding the module number, the port number, the channel number, and the channel direction.
- Each DIO_TYPE3_HWINT block in your model must have a corresponding DIO_TYPE3 I/O block, for example, a DIO_TYPE3_BIT_IN_BLx block, with interrupt generation enabled.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Bit I/O Unit (DIO Type 3) (MicroAutoBox II Features 📖).

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE3_HWINT_BLx) on page 60)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- dio_tp3_multi_source_int_mode_set

Unit Page (DIO_TYPE3_HWINT_BLx)

Purpose

To specify the channel to be used for interrupt generation.

Description

If you specify an output channel for interrupt generation, your model must contain a related RTI block for an output function, which generates an interrupt on the same channel.

If you specify an input channel for interrupt generation, your model must contain a related RTI block for an input function, which generates an interrupt on the same channel.

Otherwise the build process stops with an error message.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.
For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 🕮).

Port number Lets you select the port number in the range 1 … 3.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1, 2	1 … 16
3	1 … 8

Channel direction Lets you specify whether the above settings are valid for an input or an output channel of the DIO TYPE 3 module.

Related topics

References

Block Description (DIO_TYPE3_HWINT_BLx).. 59

DIO_TYPE4_HWINT_BLx

Purpose

To make the hardware interrupts of the DIO Type 4 module available as trigger sources in a Simulink model.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

Where to go from here

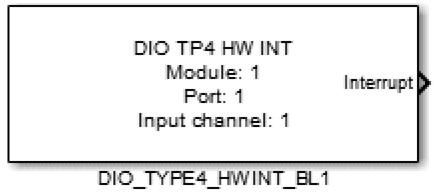
Information in this section

Information in other sections

Block Description (DIO_TYPE4_HWINT_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To make the hardware interrupts of the DIO Type 4 module available as trigger sources in a Simulink model.

Description

The block manages the interrupt handling for the DIO Type 4 module. It makes the interrupt of the DIO Type 4 module available as a trigger source. You can use input channels and output channels for interrupt generation.

Note

- It is not allowed to use interrupt blocks in the same model which are identically configured regarding the module number, the port number, the channel number, and the channel direction.
- Each DIO_TYPE4_HWINT block in your model must have a corresponding DIO_TYPE 4 I/O block, for example, a DIO_TYPE4_BIT_IN_BLx block, with interrupt generation enabled.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Bit I/O Unit (DIO Type 4) (MicroAutoBox II Features 🕮).

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE4_HWINT_BLx) on page 63)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- dio_tp4_multi_source_int_mode_set

Unit Page (DIO_TYPE4_HWINT_BLx)

Purpose

To specify the channel to be used for interrupt generation.

Description

If you specify an output channel for interrupt generation, your model must contain a related RTI block for an output function, which generates an interrupt on the same channel.

If you specify an input channel for interrupt generation, your model must contain a related RTI block for an input function, which generates an interrupt on the same channel.

Otherwise the build process stops with an error message.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 📖).

Port number Lets you select the port number in the range 1 … 2.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1	1 … 16
2	1 … 8

Channel direction Lets you specify whether the above settings are valid for an input or an output channel of the DIO TYPE 4 module.

Related topics

References

DIO1552_TP1_HWINT_BLx

Purpose

To make the hardware interrupts of the DIO 1552 Type 1 unit of the DS1552 Multi-I/O Module available as trigger sources in a Simulink model.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	–	✓ [1]

[1] Requires a DS1552 Multi-I/O Module.

Where to go from here

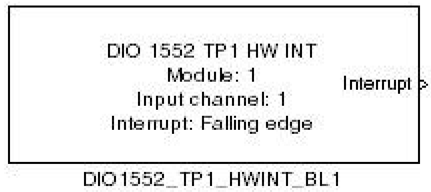
Information in this section

Information in other sections

Block Description (DIO1552_TP1_HWINT_BLx)

Block

To give information about the appearance and purpose of the block.



Purpose

To make the hardware interrupts of the DIO 1552 Type 1 unit available as trigger sources in a Simulink model.

Description

The block manages the interrupt handling for the DIO 1552 Type 1 unit. It makes the interrupts of the DIO 1552 Type 1 unit available as a trigger sources. You can use input channels and output channels for interrupt generation. With the **Edge type** setting you can specify whether an interrupt is generated at rising edges, falling edges, or at both edges of the external input and output signals.

> **Note**
>
> It is not allowed to use interrupt blocks in the same model which are identically configured regarding the module number, the channel number, and the channel direction.

> **Note**
>
> You cannot use blocks from the RTI FPGA Programming Blockset configured with one of the FPGA1401Tp1 frameworks and the RTI DS1552 I/O Extension Blockset in the same model.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Bit I/O Unit (DIO 1552 Type 1) (MicroAutoBox II Features 📖).

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO1552_TP1_HWINT_BLx) on page 66)
- Interrupt page (refer to Interrupt Page (DIO1552_TP1_HWINT_BLx) on page 66)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- ds_1552_init
- dio_1552_tp1_init
- dio_1552_tp1_int_mode_set

Unit Page (DIO1552_TP1_HWINT_BLx)

Purpose

To specify the channel to be used for interrupt generation.

Description

If you specify an output channel for interrupt generation, your model must contain a related RTI block, which generates an interrupt on the same channel. Otherwise there is no interrupt to be delivered by this block.

If you specify an input channel for interrupt generation, this block delivers an interrupt independently from a consuming block in the model.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several FPGA Type 1 modules, RTI uses the module number to distinguish between them.

Channel number Lets you select the channel number in the range 1 … 16.

Channel direction Lets you specify Input or Output to make the above settings valid for an input or an output channel of the DIO 1552 Type 1 unit.

Related topics

References

Block Description (DIO1552_TP1_HWINT_BLx)........ 65
Interrupt Page (DIO1552_TP1_HWINT_BLx)........ 66

Interrupt Page (DIO1552_TP1_HWINT_BLx)

Purpose

To specify the edge type for an input or output signal which is used for interrupt generation.

Description

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 📖).

Dialog settings

Channel Displays the channel number that you selected on the Unit page.

Edge type Lets you select the edge type which is used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Related topics

References

Block Description (DIO1552_TP1_HWINT_BLx).. 65
Unit Page (DIO1552_TP1_HWINT_BLx)... 66

ADC1552_TP1_HWINT_BLx

Purpose

To make the hardware interrupts of the ADC 1552 Type 1 unit of the DS1552 Multi-I/O Module available as trigger sources in a Simulink model.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	–	✓[1]

[1] Requires a DS1552 Multi-I/O Module.

Where to go from here

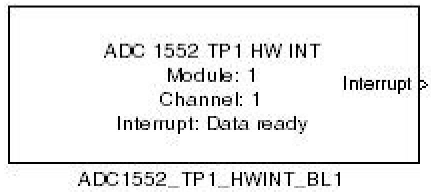
Information in this section

Information in other sections

Block Description (ADC1552_TP1_HWINT_BLx)

Block

To give information about the appearance and purpose of the block.



Purpose

To make the interrupts of the ADC 1552 Type 1 unit available as the trigger sources for subsystems in a Simulink model.

Description

The block manages the interrupt handling for the ADC 1552 Type 1 unit. It makes the interrupts of the ADC 1552 Type 1 unit available as a trigger sources. For each conversion channel, you can separately specify which of the three available interrupt types is to be used.

> **Note**
>
> It is not allowed to use interrupt blocks in the same model which are identically configured regarding the module number, the channel number, and the interrupt type.

For more information on the MicroAutoBox II interrupts, refer to Basics on Interrupt Handling (MicroAutoBox II Features 📖).

Other RTI blocks

The ADC1552_TP1_BLx block must also reside in the model, with the same module number and channel number. For details on the ADC1552_TP1_BLx block, refer to ADC1552_TP1_BLx on page 139.

I/O mapping

For information on the mapping of converter and channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to ADC 1552 Type 1 Unit (MicroAutoBox II Features 📖).

I/O characteristics

The following table describes the port of the block:

Port	Description
Output	
Interrupt	Trigger output. Data type: Function call

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (ADC1552_TP1_HWINT_BLx) on page 70)

Related RTLib functions

None

Unit Page (ADC1552_TP1_HWINT_BLx)

Purpose

To choose an interrupt as the trigger source.

Description

You can provide interrupts of different types for the same channel by adding separate ADC1552_TP1_HWINT_BLx blocks to the model.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several FPGA Type 1 modules, RTI uses the module number to distinguish between them.

Channel number Lets you select a channel number in the range 1 … 8.

Type Lets you select the interrupt type:

Interrupt Type	Meaning
Data ready	The interrupt is generated on the completion of an A/D conversion. The interrupt indicates that a buffer with new conversion results is ready to be read.
Conversion trigger overflow	The interrupt is generated if an A/D conversion trigger is received before the current A/D conversion has completed.
Data lost	The interrupt is generated if a buffer with conversion results, which still has not been read by the application, is overwritten with new conversion results.

Related topics

References

Block Description (ADC1552_TP1_HWINT_BLx).. 69

ECU Interface Unit

Where to go from here

Information in this section

ECU_TYPE1_SETUP_Mx

Purpose

To set up the ECU interface unit for data transfer.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
✓	✓	–	–	–

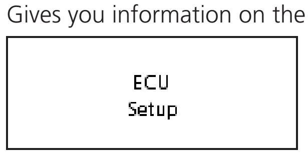
Where to go from here

Information in this section

Block Description (ECU_TYPE1_SETUP_Mx)

Block

Gives you information on the appearance and purpose of the block.



ECU_TYPE1_SETUP_M1

Purpose

To set up the ECU interface unit for data transfer.

Description

The ECU Setup block provides the other ECU-related blocks with the ECU-hardware-related information. You have to specify the ECU identification string to access the file where the hardware-related parameters are stored. Then the blocks ECU_TYPE1_READ_Mx_BLy and ECU_TYPE1_WRITE_Mx_BLy, which have the same module number Mx, will get the same ECU hardware parameters.

I/O mapping

For information on the I/O mapping, refer to ECU Interface (MicroAutoBox II Features 📖).

> **Note**
>
> - When you insert additional ECU Setup blocks, the module number Mx is increased by 1 and the module number in the dialog is increased, too.
> - If the connection between the ECU and ECU interface unit is disturbed, the warning "ECUx is disconnected" is reported to the dSPACE experiment software. After recovery, you get the message "Connection to ECUx is valid again".

Dialog pages

The dialog settings can be specified on the following pages:

- Parameters page (refer to Parameters Page (ECU_TYPE1_SETUP_Mx) on page 73)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- ecu_tp1_check_connection

Related topics

Basics

ECU Interface (MicroAutoBox II Features 📖)

References

ECU_TYPE1_READ_Mx_BLy.. 75
ECU_TYPE1_WRITE_Mx_BLy.. 78

Parameters Page (ECU_TYPE1_SETUP_Mx)

Purpose

To specify the setup parameters for the data transfer to the ECU interface.

Dialog settings

Module number Lets you select the module number within the range of 1 … 16. The module number defines the module address in the memory.

Check for overlapping DPMEM addresses Lets you select the checkbox to enable the check for overlapping addresses.

ECU identification string Lets you enter the ECU identification string to form the name of the hardware-related parameter file (`ECU_<ECU identification string>.m`). This file is provided by dSPACE for each specific ECU/target adapter.

The file can be located in one of the following folders:

- MATLAB working directory
- `<RCP_HIL_InstallationPath>\matlab\rti\rti1401\rti`

If *both* folders contain a hardware-related parameter file named according to the specified ECU identification string, the Setup block uses the file in the MATLAB working directory.

Related topics

References

ECU_TYPE1_SETUP_Mx..72

ECU_TYPE1_READ_Mx_BLy

Purpose

To read from the dual-port memory (DPMEM) of the ECU interface unit.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
✓	✓	–	–	–

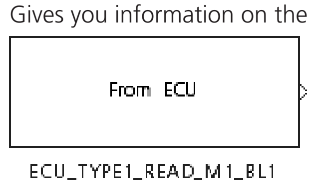
Where to go from here

Information in this section

Block Description (ECU_TYPE1_READ_Mx_BLy)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To read from the dual-port memory (DPMEM) of the ECU interface unit.

Note

- The read access depends on the hardware-related parameters of the ECU/plug-on device (target adapter). Therefore, you have to insert an ECU_TYPE1_SETUP_Mx block first. The ECU_TYPE1_READ_Mx_BLy block must have the same module number as the ECU Setup block.
- When you insert additional ECU read blocks, the module number Mx is increased by 1 and the module number in the dialog is increased, too.

I/O mapping

For information on the I/O mapping, refer to ECU Interface (MicroAutoBox II Features 🕮).

I/O characteristics

The block outputs a vector of values – converted to the specified data type – from the specified DPMEM addresses. The contents of the DPMEM addresses are read depending on the specified data type. If one of the 32-bit data types is selected, the following DPMEM address is also used to build up the output values. The DPMEM addresses specified in the dialog are identical to the addresses in the ECU code.

Dialog pages

The dialog settings can be specified on the following pages:

- Parameters page (refer to Parameters Page (ECU_TYPE1_READ_Mx_BLy) on page 76)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- ecu_tp1_read

Related topics

Basics

ECU Interface (MicroAutoBox II Features 🕮)

Parameters Page (ECU_TYPE1_READ_Mx_BLy)

Purpose

To specify the read parameters for data transfer from the ECU interface.

Dialog settings

Module number Lets you select the module number within the range of 1 … 16. The module number defines the module address in the memory.

DPMEM addresses Lets you enter the vector containing the DPMEM addresses to be read. The values must be given in hexadecimal format (0xXXXX). The available address range is ECU/target adapter specific.

Data type Lets you select one of the following data types for the block output data.

Data Type
16 bit signed
16 bit unsigned
32 bit signed
32 bit unsigned
Single float 32 bit (IEEE Std. 754)

Related topics

References

ECU_TYPE1_READ_Mx_BLy........ 75

ECU_TYPE1_WRITE_Mx_BLy

Purpose

To write to the dual-port memory (DPMEM) of the ECU interface unit.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
✓	✓	–	–	–

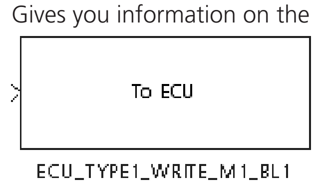
Where to go from here

Information in this section

Block Description (ECU_TYPE1_WRITE_Mx_BLy)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To write to the dual-port memory (DPMEM) of the ECU interface unit.

Note

- The write access depends on the hardware-related parameters of the ECU and plug-on device (target adapter). Therefore, you have to insert an ECU_TYPE1_SETUP_Mx block first. The ECU_TYPE1_WRITE_Mx_BLy block must have the same module number Mx as the ECU Setup block.
- When you insert additional ECU write blocks, the module number Mx is increased by 1 and the module number in the dialog is increased, too.

I/O mapping

For information on the I/O mapping, refer to ECU Interface (MicroAutoBox II Features 🕮).

I/O characteristics

The block input expects a vector of values – converted from the given data type to 16-bit values – that will be written to the specified DPMEM addresses.

The input values will be written to the DPMEM addresses you have specified in the dialog. With Data type, you choose the type of the block input variable as well as the way the values will be written to the DPMEM. If one of the 32-bit data types is selected, the following DPMEM address is also used to build up the output values. The DPMEM addresses specified in the dialog are identical to the addresses in the ECU code.

Dialog pages

The dialog settings can be specified on the following pages:

- Parameters page (refer to Parameters Page (ECU_TYPE1_WRITE_Mx_BLy) on page 80)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- ecu_tp1_write

Related topics

Basics

ECU Interface (MicroAutoBox II Features 🕮)

Parameters Page (ECU_TYPE1_WRITE_Mx_BLy)

Purpose

To specify the write parameters for data transfer to the ECU interface.

Dialog settings

Module number Lets you select the module number within the range of 1 … 16. The module number defines the module address in the memory.

DPMEM addresses Lets you enter the vector containing the DPMEM addresses to be written. The values must be given in hexadecimal format (0xXXXX). The available address range is ECU/target adapter-specific.

Data type Lets you select one of the following data types for the block output data.

Data Type
16 bit signed
16 bit unsigned
32 bit signed
32 bit unsigned
Single float 32 bit (IEEE Std. 754)

Related topics

References

ECU_TYPE1_WRITE_Mx_BLy.. 78

ECU_TYPE1_ECUIF_STATUS_Mx_BLy

Purpose

To read the connection status of the ECU interface.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
✓	✓	–	–	–

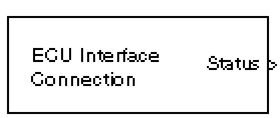
Where to go from here

Information in this section

Block Description (ECU_TYPE1_ECUIF_STATUS_Mx_BLy)

Block

Gives you information on the appearance and purpose of the block.



ECU_TYPE1_ECUIF_STATUS_M1_BL1

Purpose

To read the connection status of the ECU interface.

Description

The block outputs whether a plug-on device (POD) is connected to the ECU interface or not.

I/O characteristics

The following table shows the characteristics of the block's output in Simulink:

Port	Value	Description
Status	1	POD is connected and powered
	0	POD is not connected and/or not powered

Dialog pages

The dialog settings can be specified on the following pages:

- Parameters page (refer to Parameters Page (ECU_TYPE1_ECUIF_STATUS_Mx_BLy) on page 82)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- ecu_tp1_check_connection

Related topics

References

ecu_tp1_check_connection (MicroAutoBox II RTLib Reference)
MicroAutoBox II RTLib Reference
Parameters Page (ECU_TYPE1_ECUIF_STATUS_Mx_BLy).. 82

Parameters Page (ECU_TYPE1_ECUIF_STATUS_Mx_BLy)

Purpose

To specify the parameters for reading the connection status.

Dialog settings

Module number Lets you select the module number within the range of 1 … 16. The module number defines the module address in the memory.

Nonvolatile Data Handling

Introduction

MicroAutoBox II provides three different memory types for handling nonvolatile data.

Where to go from here

Information in this section

RTC RAM Access

Introduction

MicroAutoBox II's real-time clock (RTC) provides a user RAM that you can use to store up to 16 bytes.

Where to go from here

Information in this section

DS1401_RAM_WRITE

Purpose

To write data to the nonvolatile real-time clock (RTC) user RAM.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
✓	–	–	–	–

Where to go from here

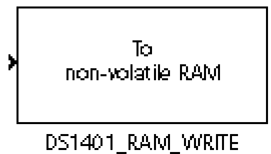
Information in this section

Information in other sections

Block Description (DS1401_RAM_WRITE)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To write data to the nonvolatile real-time clock (RTC) user RAM.

Description

Up to 16 bytes can be stored in the nonvolatile RAM of the real-time clock. The data is not deleted if you switch off the system, because the real-time clock is battery-buffered.

I/O characteristics

The input range depends on the data type that you have selected:

Data Type	Range
Int8	–128 … 127
UInt8	0 … 255
Int16	–32,768 … 32,767
UInt16	0 … 65,535
Int32	–2,147,483,648 … 2,147,483,647
UInt32	0 … 4,294,967,295
Single (Float32)	FLT32_MIN … FLT32_MAX
Double (Float64)	FLT64_MIN … FLT64_MAX

Dialog pages

The dialog settings can be specified on the following pages:

- Parameters page (refer to Parameters Page (DS1401_RAM_WRITE) on page 86)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- ds1401_rtc_ram_write

Related topics

Basics

Basics on RTC RAM Access (MicroAutoBox II Features 🕮)

Parameters Page (DS1401_RAM_WRITE)

Purpose

To specify data writing to the real time clock's nonvolatile RAM.

Dialog settings

Data type Lets you select the data type you want to write. The following are available:

Data Type	Meaning
Int8	8-bit integer values
UInt8	8-bit integer values (unsigned)
Int16	16-bit integer values
UInt16	16-bit integer values (unsigned)
Int32	32-bit integer values
UInt32	32-bit integer values (unsigned)
Single (Float32)	32-bit float values
Double (Float64)	64-bit float values

RTC RAM address Lets you select the RAM address. The address depends on the data type that you have selected. The table shows the data types with the corresponding RTC RAM addresses:

Data Type	RTC RAM Address
Int8	0 ... 15
UInt8	0 ... 15
Int16	0, 2, 4, 6, 8, 10, 12, 14
UInt16	0, 2, 4, 6, 8, 10, 12, 14
Int32	0, 4, 8, 12
UInt32	0, 4, 8, 12

Data Type	RTC RAM Address
Single (Float32)	0, 4, 8, 12
Double (Float64)	0, 8

Sample time Lets you enter the sample time the data should be written at.

Sample Time	Meaning
–1	Inherited sample time
≥0	Discrete sample time as specified

Related topics

References

DS1401_RAM_READ

Purpose

To read data from the nonvolatile real-time clock (RTC) user RAM.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
✓	–	–	–	–

Where to go from here

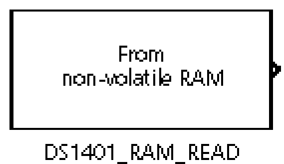
Information in this section

Information in other sections

Block Description (DS1401_RAM_READ)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To read data from the nonvolatile real-time clock (RTC) user RAM.

Description

Up to 16 bytes can be stored in the nonvolatile RAM of the real-time clock. The data is not deleted if you switch off the system, because the real-time clock is battery-buffered.

I/O characteristics

The output range depends on the data type that you have selected:

Data Type	Range
Int8	–128 … 127
UInt8	0 … 255
Int16	–32,768 … 32,767
UInt16	0 … 65,535
Int32	–2,147,483,648 … 2,147,483,647
UInt32	0 … 4,294,967,295
Single (Float32)	FLT32_MIN … FLT32_MAX
Double (Float64)	FLT64_MIN … FLT64_MAX

Dialog pages

The dialog settings can be specified on the following pages:

- Parameters page (refer to Parameters Page (DS1401_RAM_READ) on page 89)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- ds1401_rtc_ram_read

Related topics

Basics

Basics on RTC RAM Access (MicroAutoBox II Features 📖)

Parameters Page (DS1401_RAM_READ)

Purpose

To specify data reading from the real time clock's RAM.

Dialog settings

Data type Lets you select the data type you want to read. The following are available:

Data Type	Meaning
Int8	8-bit integer values
UInt8	8-bit integer values (unsigned)
Int16	16-bit integer values
UInt16	16-bit integer values (unsigned)
Int32	32-bit integer values
UInt32	32-bit integer values (unsigned)
Single (Float32)	32-bit float values
Double (Float64)	64-bit float values

RTC RAM address Lets you select the RAM address. The address depends on the data type that you have selected. The table shows the data types with the corresponding RTC RAM addresses:

Data Type	RTC RAM Address
Int8	0 ... 15
UInt8	0 ... 15
Int16	0, 2, 4, 6, 8, 10, 12, 14
UInt16	0, 2, 4, 6, 8, 10, 12, 14
Int32	0, 4, 8, 12
UInt32	0, 4, 8, 12

Data Type	RTC RAM Address
Single (Float32)	0, 4, 8, 12
Double (Float64)	0, 8

Sample time Lets you enter the sample time the data should be read at.

Sample Time	Meaning
–1	Inherited sample time
≥0	Discrete sample time as specified

Related topics

References

DS1401_RAM_READ.. 87

Nonvolatile RAM Access

Introduction

MicroAutoBox II provides a nonvolatile RAM that you can use to store intermediate results of up to 4096 bytes.

Where to go from here

Information in this section

DS1401_NV_RAM_WRITE_BLx

Purpose

To write data to the nonvolatile RAM.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
✓	–	–	–	–

Where to go from here

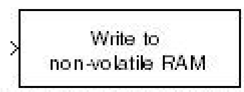
Information in this section

Information in other sections

Block Description (DS1401_NV_RAM_WRITE_BLx)

Block

Gives you information on the appearance and purpose of the block.



DS1401_NV_RAM_WRITE_BL1

Purpose

To write data to the nonvolatile RAM.

Description

Up to 4096 bytes can be stored in the nonvolatile RAM.

I/O characteristics

The input range depends on the data type that you have selected:

Data Type	Range
Int8	–128 … 127
UInt8	0 … 255
Int16	–32,768 … 32,767
UInt16	0 … 65,535
Int32	–2,147,483,648 … 2,147,483,647
UInt32	0 … 4,294,967,295
Single (Float32)	FLT32_MIN … FLT32_MAX
Double (Float64)	FLT64_MIN … FLT64_MAX

Dialog pages

The dialog settings can be specified on the following pages:

- Parameters page (refer to Parameters Page (DS1401_NV_RAM_WRITE_BLx) on page 93)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- ds1401_nvram_init
- ds1401_nvram_write

Related topics

Basics

Basics on Nonvolatile RAM Access (MicroAutoBox II Features)

Parameters Page (DS1401_NV_RAM_WRITE_BLx)

Purpose

To specify data writing to the nonvolatile RAM.

Dialog settings

Data type Lets you select the data type you want to write.

Data Type	Meaning
Int8	8-bit integer values Allocates 1 byte
UInt8	8-bit integer values (unsigned) Allocates 1 byte
Int16	16-bit integer values Allocates 2 bytes
UInt16	16-bit integer values (unsigned) Allocates 2 bytes
Int32	32-bit integer values Allocates 4 bytes
UInt32	32-bit integer values (unsigned) Allocates 4 bytes
Single (Float32)	32-bit float values Allocates 4 bytes
Double (Float64)	64-bit float values Allocates 8 bytes

RAM write address Lets you select the RAM address you want to write to. The valid start address depends on the data type that you have selected.

Data Type	RAM Address
Int8	0 … 4095
UInt8	0 … 4095

Data Type	RAM Address
Int16	0 … 4094
UInt16	0 … 4094
Int32	0 … 4092
UInt32	0 … 4092
Single (Float32)	0 … 4092
Double (Float64)	0 … 4088

Note

You are responsible for the correctness of the memory management. The RTI block does not check the consistency of your settings.

Sample time Lets you enter the sample time the data should be written to.

Sample Time	Meaning
–1	Inherited sample time
≥0	Discrete sample time as specified

Related topics

References

Block Description (DS1401_NV_RAM_WRITE_BLx)........ 92

DS1401_NV_RAM_READ_BLx

Purpose

To read data from the nonvolatile RAM.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
✓	–	–	–	–

Where to go from here

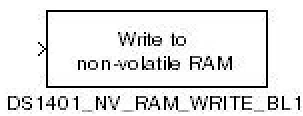
Information in this section

Information in other sections

Block Description (DS1401_NV_RAM_READ_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To read data from the nonvolatile RAM.

Description

Up to 4096 bytes can be stored in the nonvolatile RAM.

I/O characteristics

The output range depends on the data type that you have selected:

Data Type	Range
Int8	–128 … 127
UInt8	0 … 255
Int16	–32,768 … 32,767
UInt16	0 … 65,535
Int32	–2,147,483,648 … 2,147,483,647
UInt32	0 … 4,294,967,295
Single (Float32)	FLT32_MIN … FLT32_MAX
Double (Float64)	FLT64_MIN … FLT64_MAX

Dialog pages

The dialog settings can be specified on the following pages:

- Parameters page (refer to Parameters Page (DS1401_NV_RAM_READ_BLx) on page 96)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- ds1401_nvram_init
- ds1401_nvram_read

Related topics

Basics

Basics on Nonvolatile RAM Access (MicroAutoBox II Features)

Parameters Page (DS1401_NV_RAM_READ_BLx)

Purpose

To specify data reading from the nonvolatile RAM.

Dialog settings

Data type Lets you select the data type you want to read.

Data Type	Meaning
Int8	8-bit integer values Allocates 1 byte
UInt8	8-bit integer values (unsigned) Allocates 1 byte
Int16	16-bit integer values Allocates 2 bytes
UInt16	16-bit integer values (unsigned) Allocates 2 bytes
Int32	32-bit integer values Allocates 4 bytes
UInt32	32-bit integer values (unsigned) Allocates 4 bytes
Single (Float32)	32-bit float values Allocates 4 bytes
Double (Float64)	64-bit float values Allocates 8 bytes

RAM read address Lets you select the RAM address you want to read from. The valid start address depends on the data type that you have selected.

Data Type	RAM Address
Int8	0 … 4095
UInt8	0 … 4095
Int16	0 … 4094
UInt16	0 … 4094
Int32	0 … 4092
UInt32	0 … 4092
Single (Float32)	0 … 4092
Double (Float64)	0 … 4088

Note

You are responsible for the correctness of the memory management. The RTI block does not check the consistency of your settings.

Sample time Lets you enter the sample time the data should be read at.

Sample Time	Meaning
–1	Inherited sample time
≥0	Discrete sample time as specified

Related topics

References

DS1401_RAM_WRITE..84

Flash Memory Access

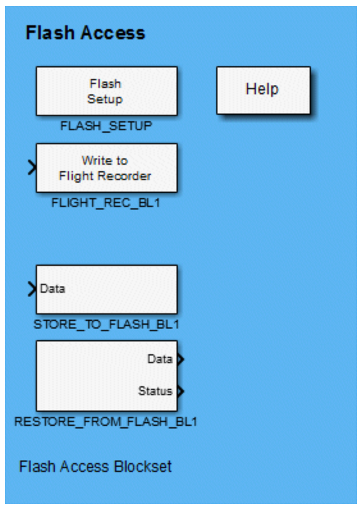
Introduction

MicroAutoBox II provides a flash memory of up to 16 MB that can be used for stand-alone booting of an application or writing flight recorder data.

For general information on configuring data sets in the flash memory, refer to Basics on Flash Memory Access (MicroAutoBox II Features 📖).

Access

After you double-click the Flash Access button in MicroAutoBox II's base board blockset, the Library: rtiflashlib is displayed.



For general information on flash access and long-term data acquisition, refer to Flight Recorder (Flash Memory) (MicroAutoBox II Features 📖).

Tip

You can store calibrated parameter values to the flash memory of the MicroAutoBox II. Using the *Store Calibration Parameter to Flash* solution, you can let a flash application store calibrated parameter values during the regular shutdown process or when you switch the SimState from RUN to STOP in ControlDesk.

When the application restarts from the flash memory of the MicroAutoBox II, the application starts with the parameter values recently calibrated. Without the solution, the application would start with the original parameter values as defined in the Simulink® model.

For detailed information on the solution, install it from the dSPACE Solutions DVD and read the user guide. For information on installing it, refer to the `ReadMe.txt` file.

Demo model

For a demo model using the Flash Memory Access feature and the flash memory-based flight recorder, refer to `<RCP_HIL_InstallationPath>\Demos\DS1401\RTI\Demo1401FlashAccess.slx`. You find the **Flash Access** demo also in the MicroAutoBox II's RTI demo library.

Note

This demo does not run correctly, if you use the preconfigured cabling by dSPACE for the power input connector, because the **REMOTE** pin is shortened to VBAT. For further information on the power input connector and the required cabling, refer to Connecting to Power Supply (MicroAutoBox II Hardware Installation and Configuration Guide 📖).

Where to go from here

Information in this section

FLASH_SETUP

Purpose

To initialize and configure the flash memory for flight recording and nonvolatile data blocks.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
✓	–	–	–	–

Where to go from here

Information in this section

Block Description (FLASH_SETUP)

Block

Gives you information on the appearance and purpose of the block.

FLASH_SETUP

Purpose

To initialize and configure the flash memory for flight recording and nonvolatile data blocks.

Description

The block can be used to specify the flash memory for the nonvolatile data feature and the flight recorder. The flash memory is divided into three parts. One part is reserved for the application. The remaining can be split into two parts, for the nonvolatile data and for flight recording. The nonvolatile data feature can be used to store data you want to use when calling the application the next time, for example, if you need the mileage again. Nonvolatile data is stored with the STORE_TO_FLASH_BLx block and restored with the RESTORE_FROM_FLASH_BLx block.

Note

Only one Flash Setup block is allowed within one model.

Dialog pages

The dialog settings can be specified on the Parameters page.

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dsnvdata_init
- dsflrec_initialize

Related topics

References

Parameters Page (FLASH_SETUP)

Purpose

To specify the flash memory.

Dialog settings

Enable nonvolatile data feature Lets you store the data with the nonvolatile data feature, for example to store vectors in the flash. The data remains in the flash after shut down. If you select the checkbox, parts of the flash are reserved and are no longer available for flight recording.

Enable flight recorder feature Lets you use the flash for recording data. The data remains in the flash after shut down.

Assign remaining flash memory to flight recorder Lets you assign all the remaining flash memory for data recording. The remaining memory depends on the application downloaded to the flash and whether or not the nonvolatile data feature is used. The flash memory is partitioned with the current memory configuration. If you later on want to download an application that needs more memory than the reserved range of 2 MB or a specified application data section greater than 2 MB, you must clear the flash to allow a new partitioning. For instructions how to clear the flash, refer to Clear Flash (ControlDesk Platform Management 📖).

If you select this option, the Flash memory assigned to flight recorder option is automatically disabled.

Flash memory assigned to flight recorder [MB] Lets you enter the memory size that should be reserved for the flight recorder. If you do not want to assign all the remaining flash memory to the flight recorder automatically, you can specify a static size of the flight recorder memory. As long as the memory size that is reserved for the application is sufficient, you must not clear the flash to change its partition. The maximum memory size for the flight recorder depends on whether the nonvolatile data feature is used:

Memory with Nonvolatile Data Feature	Memory without Nonvolatile Data Feature
1 ... 13 MB	1 ... 13.25 MB

Applications up to a size of 2 MB have no influence on the maximum memory available for the flight recorder.

For further information, refer to Basics on Flight Recorder (MicroAutoBox II Features 📖).

Flight recorder overwrite mode Lets you select the flight recorder mode from the list:

Mode	Meaning
Discard new data	When the memory block for flight recording is full, no further data will be recorded.
Replace old data with FIFO method	When the memory block for flight recording is full, the oldest entries will be overwritten by new data.

Related topics

References

FLIGHT_REC_BLx

Purpose

To create detailed data histories of real-time variables over a longer period.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
✓	–	–	–	–

Where to go from here

Information in this section

Block Description (FLIGHT_REC_BLx)

Block

Gives you information on the appearance and purpose of the block.

Purpose

To create detailed data histories of real-time variables over a longer period.

Description

During the simulation, the values of selected real-time variables are written to the flash memory of the DS1401 processor board.

After the simulation has finished, the acquired data can be read out by the host PC. For detailed information, refer to How to Upload Flight Recorder Data Written to a USB Mass Storage Device (ControlDesk Measurement and Recording 🕮).

You can insert as many **FLIGHT_REC_BLx** blocks into the model as desired. A maximum of 250 different real-time variables can be recorded at the same time.

> **Note**
>
> - Only scalar input values are allowed.
> - The block requires the FLASH_SETUP block with the **Enable flight recorder feature** checkbox selected.

I/O characteristics

This table shows the characteristics of the Simulink input:

Simulink Input	Data Type	Range	Meaning
Write to Flight Recorder	Selected data type	Depends on the selected data type	Writes the value to the flight recorder

Dialog pages

The dialog settings can be specified on the Parameters page (refer to Parameters Page (FLIGHT_REC_BLx) on page 104).

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- dsflrec_start
- dsflrec_add_variable

- dsflrec_write_int32
- dsflrec_write_float32

Parameters Page (FLIGHT_REC_BLx)

Purpose

To specify the flight recorder parameter.

Dialog settings

Variable name Lets you enter the name of the real-time variable to be recorded (name of the input data). The recorded data is referenced by variable names.

Note

- For each FLIGHT_REC_BLx block in your model, you must specify a different variable name.
- A valid variable name consists of letters, digits and underscores.
  There are the following naming restrictions for the variable name:
  - The name must not exceed 63 characters.
  - The first character must be a letter.
  - The name must not be a keyword, such as `while` or `if`.

Data type Lets you select the recording format of the input data.

Data Type	Meaning
Single	32-bit float values
Int32	32-bit integer values
Int16	16-bit integer values
Int8	8-bit integer values
UInt32	32-bit integer values (unsigned)
UInt16	16-bit integer values (unsigned)
UInt8	8-bit integer values (unsigned)

Sample time Lets you enter the sample time in seconds for the recording.

Sample Time	Meaning
–1	Inherited sample time
0	Continuous sample time
> 0	Discrete sample time as specified

Related topics

References

STORE_TO_FLASH_BLx

Purpose

To write data to the nonvolatile flash memory.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
✓	–	–	–	–

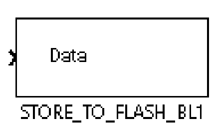
Where to go from here

Information in this section

Block Description (STORE_TO_FLASH_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To write data to the nonvolatile flash memory.

Note

- The FLASH_SETUP block, the DS1401_POWER_DOWN block and the RESTORE_FROM_FLASH_BLx block must be used together with the STORE_TO_FLASH_BLx block. The DS1401_POWER_DOWN block makes sure to set the simState from *Run* to *Stop* before shutting down MicroAutoBox II. The termination routine stores the data to the flash memory. See also the Demo1401FlashAccess model in MicroAutoBox II's RTI demo library.
- Nonvolatile data can only be restored with RESTORE_FROM_FLASH_BLx. They cannot be uploaded like the flight recorder data.

Description

The data is intermediately stored in a temporary buffer and then transferred to the flash memory. The block is executed only once before the termination of the application. You can use the nonvolatile data feature to reuse data when starting the application the next time, for example, to store the settings of an air conditioner.

I/O characteristics

This table shows the characteristics of the Simulink input:

Simulink Input	Data Type	Range	Meaning
Data	Selected data type	Depends on the selected data type	Data to be stored in the flash memory

Dialog pages

The dialog settings can be specified on the Parameters page (refer to Parameters Page (STORE_TO_FLASH_BLx) on page 107).

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dsnvdata_write
- dsnvdata_flashtransfer

Parameters Page (STORE_TO_FLASH_BLx)

Purpose

To specify data writing to the nonvolatile flash memory.

Dialog settings

Data label Lets you enter a name for the data block. The data label is used for restoring data with the RESTORE_FROM_FLASH_BLx block.

Note

- For each STORE_TO_FLASH_BLx block in your model, you must specify a different data label. For each of such a data label, a RESTORE_FROM_FLASH_BLx block with identical data label and data type must exist in the model.
- A valid data label consists of letters, digits and underscores.
  There are the following naming restrictions for the variable name:
  - The name must not exceed 10 characters.
  - The first character must be a letter.
  - The name must not be a keyword, such as `while` or `if`.

Number of elements Lets you enter the number of elements the named data set consists of (size of the vector).

Data type Lets you select the recording format of the input data.

Data Type	Meaning
Single	32-bit float values
Int32	32-bit integer values
Int16	16-bit integer values
Int8	8-bit integer values
UInt32	32-bit integer values (unsigned)
UInt16	16-bit integer values (unsigned)
UInt8	8-bit integer values (unsigned)
Double	32-bit float values

Related topics

References

STORE_TO_FLASH_BLx.. 105

RESTORE_FROM_FLASH_BLx

Purpose

To restore data from the nonvolatile flash memory. The block is executed only once during initialization and checks whether or not data is stored in the flash memory.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
✓	–	–	–	–

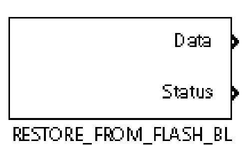
Where to go from here

Information in this section

Block Description (RESTORE_FROM_FLASH_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To restore data from the nonvolatile flash memory. The block is executed only once during initialization and checks whether or not data is stored in the flash memory.

Note

The FLASH_SETUP block and the STORE_TO_FLASH_BLx block must be used together with the RESTORE_FROM_FLASH_BL block.

Description

The data that is stored in the nonvolatile memory of the flash can be restored. The restored data has the same format as the stored.

I/O characteristics

This table shows the characteristics of the Simulink output:

Simulink Output	Data Type	Range	Meaning
Data	Selected data type	Depends on the selected data type	Data restored from the flash memory
Status	Int16	0/1	Returns information about the source of the data: ▪ 0: Value is read out from the flash ▪ 1: Default values are returned If Status permanently outputs 1, the reason might be that the nonvolatile data handling feature is not able to leave its initialization state. If so, clear the flash memory, reload the real-time application and set `simState` to *Stop* (0) in ControlDesk.

Dialog pages

The dialog settings can be specified on the Parameters page (refer to Parameters Page (RESTORE_FROM_FLASH_BLx) on page 110).

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- dsnvdata_read

Parameters Page (RESTORE_FROM_FLASH_BLx)

Purpose

To specify data restoring from the nonvolatile flash memory.

Dialog settings

Data label Lets you enter the name of the data block. The data blocks are referenced by the `data label` parameter.

Note

- For each RESTORE_FROM_FLASH_BLx block in your model, you must specify a different data label. For each of such a data label, a STORE_TO_FLASH_BLx block with identical data label and data type must exist in the model.
- A valid data label consists of letters, digits and underscores.
  There are the following naming restrictions for the variable name:
  - The name must not exceed 10 characters.
  - The first character must be a letter.
  - The name must not be a keyword, such as `while` or `if`.

Number of elements Lets you specify the number of elements the named data set consists of (size of the vector).

Data type Lets you select the format of the restored data.

Data Type	Meaning
Single	32-bit float values
Int32	32-bit integer values
Int16	16-bit integer values
Int8	8-bit integer values
UInt32	32-bit integer values (unsigned)
UInt16	16-bit integer values (unsigned)
UInt8	8-bit integer values (unsigned)
Double	32-bit float values

Default values Lets you specify the default values for the specified data set. The number of values in the vector must match the specified value for the Number of elements setting.

For example, if you set the number of elements to 3, the default values setting might be `[0 0 0]`.

Related topics

References

RESTORE_FROM_FLASH_BLx.. 108

Power Hold Control

Where to go from here

Information in this section

DS1401_POWER_DOWN

Purpose

To stop and power down the MicroAutoBox II.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
✓	–	–	–	–

Demo model

For a demo model using the DS1401_POWER_DOWN block, refer to `<RCP_HIL_InstallationPath>\Demos\DS1401\RTI\Demo1401FlashAccess.slx`. You find this demo in the MicroAutoBox II's RTI demo library.

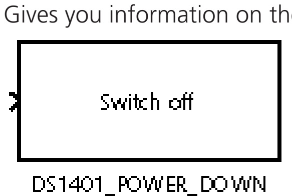
Where to go from here

Information in this section

Block Description (DS1401_POWER_DOWN)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To stop and power down the MicroAutoBox II.

Description

If the Switch off input is set, the block sets the simState to STOP, and the termination tasks of the blocks in the model are executed. Termination tasks can be used, for example, to set the outputs to specified termination values.

MicroAutoBox II is powered down after termination, if the Remote In hardware input pin (KL15) is set to low.

> **Note**
>
> No termination task is executed when you do a hard reset, for example, disconnecting the MicroAutoBox II from UBAT (KL30).

The Switch off input port of the DS1401_POWER_DOWN block is typically connected to the Not Remote In output port of the DS1401_REMOTE_IN_BLx block. However you can use any other Simulink signal to trigger the DS1401_POWER_DOWN block. For further information, refer to Notes on Connecting to Power Supply, Sensors and Actuators (MicroAutoBox II Hardware Installation and Configuration Guide 📖).

I/O Characteristics

The following table shows the input characteristics of the block input:

Simulink Input	Meaning
0	The block is not executed.
1	The block sets simState to STOP and shuts down MicroAutoBox II. The shut down works only if the hardware input Remote In is switched off.

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- ds1401_power_hold_on
- ds1401_power_hold_off

Related topics

Basics

Basics of Power Hold Control (MicroAutoBox II Features 📖)

Unit Page (DS1401_POWER_DOWN)

Dialog settings

There are no dialog settings to be specified on the Unit page.

DS1401_REMOTE_IN_BLx

Purpose

To monitor the Remote in hardware input via the MicroAutoBox II base board.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
✓	–	–	–	–

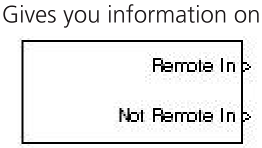
Where to go from here

Information in this section

Block Description (DS1401_REMOTE_IN_BLx)

Block

Gives you information on the appearance and purpose of the block.



DS1401_REMOTE_IN_BL1

Purpose

To monitor the hardware input "Remote In".

Description

This block monitors the hardware input “Remote In”. In general, the “Not Remote In” port is connected to the DS1401_POWER_DOWN block to power down the MicroAutoBox II.

I/O mapping

For information on the I/O mapping, refer to Basics of Power Hold Control (MicroAutoBox II Features 📖).

I/O characteristics

The input signal is captured from the hardware line "Remote In":

Input Signal	Input Voltage Range
Remote In	0 … 5 V

The output ports of the blocks have the following data types:

Output	Simulink Data Type
Remote In	Boolean
Inverted Remote In (inverted value of Remote In)	Boolean

Dialog pages

There is no setting to be specified on the Unit page (refer to Unit Page (DS1401_REMOTE_IN_BLx) on page 115).

Demo model

For a demo model using the DS1401_REMOTE_IN_BLx block, refer to <RCP_HIL_InstallationPath>\Demos\DS1401\RTI\Demo1401FlashAccess.slx. You find this demo in the MicroAutoBox II's RTI demo library.

Related topics

References

DS1401_POWER_DOWN.. 112

Unit Page (DS1401_REMOTE_IN_BLx)

Dialog settings

There is no setting to be specified.

Sensor Support

Introduction

MicroAutoBox II provides two onboard sensors for pressure and acceleration measurement.

Where to go from here

Information in this section

DS1401_ACCEL_READ_BLx

Purpose

To read the measured values from the onboard acceleration sensor.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
✓ [1]	–	–	–	–

[1] Board revision DS1401-23 and later required.

System PLD firmware version 1.4 and later required.

Where to go from here

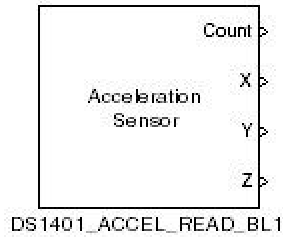
Information in this section

Information in other sections

Block Description (DS1401_ACCEL_READ_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To read the current acceleration values from the onboard acceleration sensor.

Description

The onboard acceleration sensor provides data for movement changes in the three-dimensional domain. If the velocity is constant or null, the measured data can be used to calculate the gradient of the board. The data is continuously measured and stored in an internal FIFO buffer with a maximum size of 512 values. Each sensor value provides the data for all three axes. With this block, you can read either the most recent value or the entire contents of the buffer. Each axis has its own outport to read the values separately.

I/O characteristics

The following table describes the ports of the block:

Port	Description
Output	
Count	Returns the number of currently read result values. If there is no new value, 0 is returned. Data type: UInt32 Data width: 1 Range: 0 … 512
X	Returns the data that is read from the acceleration sensor for the x-axis. The number of returned data depends on the **Read mode** parameter on the **Parameters** page. Data type: Double Data width: 1 … 512 Range: Depends on the **Range** parameter on the **Parameters** page.
Y	Returns the data that is read from the acceleration sensor for the y-axis. The number of returned data depends on the **Read mode** parameter on the **Parameters** page. Data type: Double

Port	Description
	Data width: 1 … 512 Range: Depends on the **Range** parameter on the **Parameters** page.
Z	Returns the data that is read from the acceleration sensor for the z-axis. The number of returned data depends on the **Read mode** parameter on the **Parameters** page. Data type: Double Data width: 1 … 512 Range: Depends on the **Range** parameter on the **Parameters** page.

Dialog pages

The dialog settings can be specified on the following page:

- Parameters page (refer to Parameters Page (DS1401_ACCEL_READ_BLx) on page 120)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- ds1401_accel_sensor_init
- ds1401_accel_sensor_xyz_axis_read

Parameters Page (DS1401_ACCEL_READ_BLx)

Purpose

To configure the acceleration sensor.

Dialog settings

Sample rate Lets you specify the sample rate of the acceleration sensor in the range 1.25 ms … 640 ms.

Read mode Lets you specify the mode of the read access to the acceleration sensor.

Read Mode	Meaning
Most recent value	To read only the most recent value. The **Count** outport always returns 1.
All values	To read all the measured values available in the FIFO buffer (max. 512 values). The **Count** outport returns the number of measured values.

Range Lets you specify the output range of the acceleration sensor in the range +/- 2g, +/- 4g or +/- 8g.

The selected range leads to a certain output resolution. For further information, refer to Sensor for Acceleration Measurement (MicroAutoBox II Features 📖).

Related topics

References

DS1401_PRESSURE_BLx

Purpose

To read the measured value from the onboard pressure sensor.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
✓ [1]	–	–	–	–

[1] Board revision DS1401-23 and later required.

System PLD firmware version 1.3 and later required.

Where to go from here

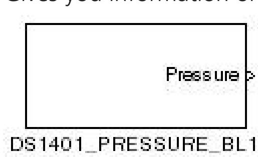
Information in this section

Information in other sections

Block Description (DS1401_PRESSURE_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To read the current pressure values from the onboard pressure sensor.

Description

The onboard pressure sensor provides data for the environmental air pressure. The data is continuously measured with a rate of approximately 200 Hz. With this block, you can read the currently measured pressure value and use it in your Simulink model.

I/O characteristics

The following table describes the ports of the block:

Port	Description
Output	
Pressure	Returns the measured value of the pressure sensor in kPa. Data type: Double Data width: 1 Range: 50 … 115 kPa

Dialog pages

There are no settings to be specified.

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- ds1401_pressure_init
- ds1401_pressure_read

A/D Conversion

Introduction

The RTI Blockset of MicroAutoBox II (RTI1401) provides several blocks that you can use for converting analog signals. For an overview on which RTI block is appropriate for your use case, refer to A/D Conversion (MicroAutoBox II Features 📖).

Where to go from here

Information in this section

Information in other sections

ADC_TYPE4_BLx

Purpose

To read from the A/D converters of an ADC Type 4 module.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	✓	–

Where to go from here

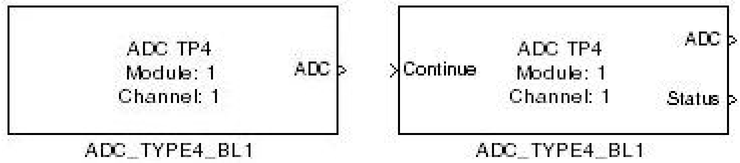
Information in this section

Information in other sections

Block Description (ADC_TYPE4_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To provide read access to one of the ADC Type 4 converters.

Description

One ADC_TYPE4_BLx block controls one A/D converter. MicroAutoBox II 1401/1511 provides 16 independent A/D conversion channels with a separate converter each.

I/O mapping

For information on the mapping of converter and channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to ADC Unit Type 4 (MicroAutoBox II Features 📖).

I/O characteristics

Input Voltage Range	Simulink Output
0 … +5 V	0 … +1
-10 … +10 V	-1 … +1

Note

The applicable input voltage range depends on the I/O board used:
- DS1511: 0 … +5 V
- DS1511*B1*: -10 … +10 V
- DS1513: -10 … +10 V

If the specified input voltage range does not suit to the connected hardware, the real-time application stops with an error message.
The board versions are printed on a type plate on the bottom of your MicroAutoBox II.

Note

Due to adjustment of the conversion channels, the typical maximum input voltage can be less or greater than 5.0 V/10.0 V (see the data sheets in MicroAutoBox II Hardware Reference 📖). Accordingly, the function returns a value less or greater than +1.

The following table describes the ports of the block:

Port	Description
Input	
Continue	Controls A/D conversion. Available only if the sample mode of the burst conversion mode is set to continuous. Data type: Boolean ▪ 1: Successive A/D conversion bursts are activated. ▪ 0: Successive A/D conversion bursts are stopped immediately. The conversion results of the aborted burst are not available. The conversion results of the preceding burst are read again instead.
Output	
ADC	Outputs the current results of the A/D conversions on the current channel. If the conversion settings are set to burst conversion mode, the output comprises the A/D conversion results of the last burst of A/D conversions on the selected channel. This is a vector of 1 … 8192 results depending on the buffer settings. The earliest value is stored in the first element of the vector. If the conversion settings are set to single conversion mode, the output is the result of the last A/D conversion on the current channel. Data type: Double Range: ▪ 0 ... +1 (on input voltage range 0 … +5 V) ▪ -1 ... +1 (on input voltage range -10 … +10 V)
Status	Represents the current status of the output. Available only if the **Enable status outport** checkbox is selected. Data type: UInt8 ▪ 1: A buffer with new conversion results was read. ▪ 0: A buffer was read repeatedly. New conversion results are not yet available.

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (ADC_TYPE4_BLx) on page 130)
- Parameters page (refer to Parameters Page (ADC_TYPE4_BLx) on page 130)
- Advanced page (refer to Advanced Page (ADC_TYPE4_BLx) on page 134)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- adc_tp4_init
- adc_tp4_channel_control
- adc_tp4_sw_trigger

- adc_tp4_burst_init2
- adc_tp4_burst_current_read
- adc_tp4_burst_new_read
- adc_tp4_single_init2
- adc_tp4_single_current_read
- adc_tp4_single_new_read

Unit Page (ADC_TYPE4_BLx)

Purpose

To provide access to an A/D converter by referencing the related module and channel.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 📖).

Channel number Lets you select a channel number in the range 1 ... 16.

Related topics

References

Advanced Page (ADC_TYPE4_BLx).. 134
Block Description (ADC_TYPE4_BLx)... 128
Parameters Page (ADC_TYPE4_BLx).. 130

Parameters Page (ADC_TYPE4_BLx)

Purpose

To specify the A/D conversion settings.

Dialog settings

Single conversion mode Lets you choose the single conversion mode to use a conversion channel of an ADC Type 4 module without its burst capabilities. Only one conversion mode, single or burst, can be set on an A/D conversion channel at the same time.

Trigger source (Single conversion settings) Lets you select the trigger source for the single A/D conversions:

Trigger Source	Meaning
Sample base rate	The start of an A/D conversion is triggered by the model step size. You additionally can set the sample time. For details, refer to Sample Time (refer to Advanced Page (ADC_TYPE4_BLx) on page 134).
External trigger input 1 External trigger input 2 External trigger input 3 External trigger input 4	The start of an A/D conversion is triggered by the trigger signal on the selected external trigger input. You additionally can set the edge polarity. An external trigger input can be used for several conversion channels. The specified edge polarity can vary on each channel.

Edge polarity (Single conversion settings) Lets you select the edge of the trigger signal to be used as the trigger source. This setting can be made only if an external trigger input is set as the trigger source in the single conversion settings:

Edge Polarity	Meaning
Rising edge	The rising edge of the trigger signal is used as the trigger.
Falling edge	The falling edge of the trigger signal is used as the trigger.

Note

If the sample base rate is selected as the A/D conversion trigger source, the block uses the polling functions for reading the conversion results. If an external trigger input is selected as the A/D conversion trigger source, the current read buffer is read immediately without using the polling functions. You can evaluate the read buffer state for reading the conversion results by enabling the status outport of the ADC_TYPE4_BLx block. Alternatively, you can evaluate the data ready interrupt for reading the conversion. For details on the reading methods, refer to ADC Unit Type 4 (MicroAutoBox II Features 📖).

Burst conversion mode Lets you choose burst conversion mode to use the burst capabilities of a conversion channel of the ADC Type 4 module. Only one conversion mode, single or burst, can be set on an A/D conversion channel at the same time.

Sample mode Lets you select the sample mode if burst conversion mode is selected:

Sample Mode	Meaning
Triggered	The start of an A/D conversion burst is triggered by the burst trigger source which you additionally have to set. The trigger source for the A/D conversion within a burst must be also set. See Trigger source (Burst trigger settings).
Continuous	The starts of successive A/D conversion bursts are triggered internally. An additional burst trigger source cannot be set. The A/D conversions within the bursts must be set with the selected conversion trigger source. See Trigger source (Conversion trigger settings).

Trigger source (Conversion trigger settings) Lets you select the trigger source for the A/D conversions within a burst:

Trigger Source	Meaning
Sample base rate	The start of an A/D conversion is triggered by the model step size. You additionally can set the sample time. For details, refer to Sample Time (refer to Advanced Page (ADC_TYPE4_BLx) on page 134).
Timer	The start of an A/D conversion is triggered by the channel timer. You additionally have to specify the trigger interval.
External trigger input 1 External trigger input 2 External trigger input 3 External trigger input 4	The start of an A/D conversion is triggered by the trigger signal on the selected external trigger input. You additionally can set the edge polarity. An external trigger input can be used for several conversion channels. The specified edge polarity can vary on each channel.

Edge polarity (Conversion trigger settings) Lets you select the edge of the trigger signal which is used as the trigger source. This setting can be made only if an external trigger input is set as the trigger source in the conversion trigger settings:

Edge Polarity	Meaning
Rising edge	The rising edge of the trigger signal is used as the trigger.
Falling edge	The falling edge of the trigger signal is used as the trigger.

Trigger interval [0.8 µs ... 1 s] Lets you specify the time interval between two conversions in the range 0.8 µs ... 1 s with a resolution of 10 ns. Variables of your Simulink model can be used. This setting can be made only if the channel timer is set as the trigger source in the conversion trigger settings.

Trigger source (Burst trigger settings) Lets you select the trigger source for the A/D conversion bursts, if sample mode is set to *Triggered*:

Trigger Source	Meaning
Sample base rate	The start of an A/D conversion burst is triggered by the model step size. You additionally have to set the sample time. For details, refer to Sample Time (refer to Advanced Page (ADC_TYPE4_BLx) on page 134).
External trigger input 1 External trigger input 2 External trigger input 3 External trigger input 4	The start of an A/D conversion burst is triggered by the trigger signal on the selected external trigger input. You additionally can set the edge polarity. An external trigger input can be used for several conversion channels. The specified edge polarity can vary on each channel.

Edge polarity (Burst trigger settings) Lets you select the edge of the trigger signal which is used as the trigger source. This setting can be made only if an external trigger input is set as the trigger source in the burst trigger settings:

Edge Polarity	Meaning
Rising edge	The rising edge of the trigger signal is used as the trigger.
Falling edge	The falling edge of the trigger signal is used as the trigger.

Note

- If the sample base rate is selected as the burst trigger source and the timer is specified as the A/D conversion trigger source, the block uses the polling functions for reading the conversion results. In all other cases in burst mode, the current read buffer is read immediately without using the polling functions. You can evaluate the read buffer state for reading the conversion results by enabling the status outport of the ADC_TYPE4_BLx block. Alternatively, you can evaluate the data ready interrupt for reading the conversion. For details on the reading methods, refer to ADC Unit Type 4 (MicroAutoBox II Features 📖).
- The burst and conversion trigger sources must not be identical on a channel at the same time.

Burst size Lets you specify the number of A/D conversions within a burst in the range 1 ... 8192. The number specifies the capacity of each of 3 swinging buffers, which are used for writing and reading conversion results interchangeably. Variables of your Simulink model can be used. For details on swinging buffers, refer to ADC Unit Type 4 (MicroAutoBox II Features 📖).

Offset Lets you specify a read position in the read buffer to start the read-out at, in the range 0 ... <Burst size>-1. Variables of your Simulink model can be used. You additionally have to specify the length.

Length Lets you specify the number of conversion results which are read from the read buffer. The length can be specified in the range 1 ... <Burst size>-<Offset>. Variables of your Simulink model can be used. You additionally have to specify the buffer offset from which the conversion results must be read out.

The offset and length allow you to read a burst of conversion results in fractions of the burst size.

Note

- You can specify the buffer settings only in burst conversion mode.
- You can specify the buffer offset and buffer length only in triggered sample mode, if the specified burst size is greater than 1.

Related topics

References

Advanced Page (ADC_TYPE4_BLx)

Purpose

To specify additional options, like the use of the ADC_TYPE4_START_BLx block.

Dialog settings

Use separate ADC_TYPE4_START block Lets you specify if A/D conversion is to be started from a separate task. This setting can be made only if the sample base rate is set as the trigger source for the conversion trigger or the burst trigger.

This setting must be made if the sample base rate is set as one of the three trigger sources and the read-out of the conversion results is performed in a triggered subsystem using the data ready or burst start interrupt. For more information on Simulink models which require an ADC_TYPE4_START_BLx block, refer to ADC Unit Type 4 (MicroAutoBox II Features 🕮).

Sample time Lets you select or specify the sample time. This setting can be made only if the sample base rate is set as the trigger source:

Sample Time	Meaning
–1	The sample time is inherited from the blocks the block is connected to. If the block is in a triggered subsystem, you must select this setting.
0	The block uses the discrete sample time of the Simulink model.
>0	The block uses the sample time you specify.

You can make the setting for the sample time in the ADC_TYPE4_BLx block independently of the sample time setting in a corresponding ADC_TYPE4_START_BLx block, if used.

> **Note**
>
> If the ADC_TYPE4_BLx block is executed in a timer task, it works with the sample time of the fastest block in the task it is part of. To avoid this behavior, the sample time has to be set to the sample time of the model.

Enable status outport Lets you enable the status outport, which indicates whether a read buffer with new conversion results was read, or if the read buffer was already read before. For more information on the reading methods, refer to ADC Unit Type 4 (MicroAutoBox II Features 🕮).

Input voltage range Lets you select the input voltage range 0 V … +5 V or -10 V … +10 V.

Note

The applicable input voltage range depends on the I/O board used:
- DS1511: 0 … +5 V
- DS1511*B1*: -10 … +10 V
- DS1513: -10 … +10 V

If the specified input voltage range does not suit to the connected hardware, the real-time application stops with an error message.
The board versions are printed on a type plate on the bottom of your MicroAutoBox II.

Related topics

References

Block Description (ADC_TYPE4_BLx)........ 128
Parameters Page (ADC_TYPE4_BLx)........ 130
Unit Page (ADC_TYPE4_BLx)........ 130

ADC_TYPE4_START_BLx

Purpose

To start the A/D conversion by software in a separate task.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	✓	–

Where to go from here

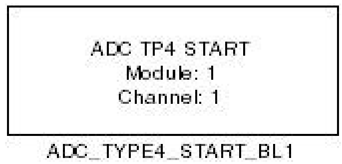
Information in this section

Information in other sections

Block Description (ADC_TYPE4_START_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To start A/D conversion or A/D burst conversion by software in a separate task with the specified sample time.

Description

The ADC_TYPE4_START_BLx block allows you to start A/D conversion or A/D burst conversion by software on the specified A/D conversion channel.

You can use a separate ADC_TYPE4_START_BLx block in your Simulink model, if the conversion trigger source or the burst trigger source is set to the sample base rate and the read-out of the conversion results is to be performed in a different task, for example, in a subsystem driven by the data ready interrupt. In all other cases it is recommended to start A/D conversion in the ADC_TYPE4_BLx block. For basic information on the ADC_TYPE4_START_BLx block, refer to ADC Unit Type 4 (MicroAutoBox II Features 🕮).

Note

The ADC_TYPE4_ADC_START_BLx block is unsuitable for use in an *Enabled Subsystem*. The A/D converter is always started independently of the state of the Enable port.

If you want to start the block only under specific conditions, you must place it in a *Triggered Subsystem* or a *Function-Call Subsystem*.

Other RTI blocks

The ADC_TYPE4_BLx block must also reside in the model, with the same module number and channel number. Additionally, *Use separate ADC_TYPE4_START block* must be selected in the ADC_TYPE4_BLx block settings. For details on the ADC_TYPE4_BLx block, refer to ADC_TYPE4_BLx on page 127.

I/O mapping

For information on the mapping of converter and channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to ADC Unit Type 4 (MicroAutoBox II Features 🕮).

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (ADC_TYPE4_START_BLx) on page 138)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- adc_tp4_sw_trigger

Unit Page (ADC_TYPE4_START_BLx)

Purpose

To reference the related ADC Type 4 module and channel and to start A/D conversion by software.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 🕮).

Channel number Lets you select a channel number in the range 1 … 16.

Sample time Lets you select or specify the sample time:

Sample Time	Meaning
–1	The sample time is inherited from the blocks the block is connected to. If the block is in a triggered subsystem, you must select this setting.
0	The block uses the discrete sample time of the Simulink model.
>0	The block uses the sample time you specify.

You can make the setting for the sample time in the ADC_TYPE4_START_BLx block independently of the sample time setting in a corresponding ADC_TYPE4_BLx block.

Note

If the ADC_TYPE4_BLx block is executed in a timer task, it works with the sample time of the fastest block in the task it is part of. To avoid this behavior the sample time has to be set to the sample time of the model.

Related topics

References

Block Description (ADC_TYPE4_START_BLx).. 137

ADC1552_TP1_BLx

Purpose

To read from the A/D converters of an ADC 1552 Type 1 unit of the DS1552 Multi-I/O Module.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	–	✓[1]

[1] Requires a DS1552 Multi-I/O Module.

Where to go from here

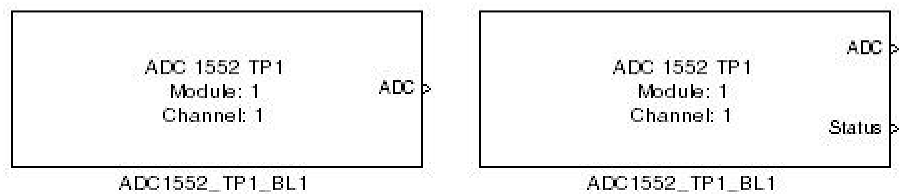
Information in this section

Information in other sections

Block Description (ADC1552_TP1_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To provide read access to one of the ADC 1552 Type 1 converters.

Description

A DS1552 Multi-I/O Module provides 8 independent A/D conversion channels of type 1 with a separate converter each. One ADC1552_TP1_BLx block controls one A/D converter.

> **Note**
>
> You cannot use blocks from the RTI FPGA Programming Blockset configured with one of the FPGA1401Tp1 frameworks and the RTI DS1552 I/O Extension Blockset in the same model.

I/O mapping

For information on the mapping of converter and channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to ADC 1552 Type 1 Unit (MicroAutoBox II Features).

I/O characteristics

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

Input Voltage Range	Simulink Output
0 … +5 V	0 … +1
-10 … +10 V	-1 … +1

> **Note**
>
> The applicable input voltage range depends on the I/O module used:
> - DS1552: 0 … +5 V
> - DS1552*B1*: -10 … +10 V
>
> If the specified input voltage range does not suit to the connected hardware, the real-time application stops with an error message.
> If the DS1552 module has been installed by dSPACE, the board versions are printed on a type plate on the bottom of your MicroAutoBox II.

Note

Due to adjustment of the conversion channels, the typical maximum input voltage can be less or greater than 5.0 V (see the data sheets in MicroAutoBox II Hardware Reference 📖). Accordingly, the function returns a value less or greater than +1.

The following table describes the ports of the block:

Port	Description
Output	
ADC	Outputs the result of the last A/D conversion on the current channel. Data type: Double Range: ▪ 0.0 … +1.0 (on input voltage range 0 … +5 V) ▪ -1.0 … +1.0 (on input voltage range -10 … +10 V)
Status	Represents the current status of the output. Available only if the **Enable status outport** checkbox is selected. Data type: UInt8 ▪ 1: A buffer with new conversion results was read. ▪ 0: A buffer was read repeatedly. New conversion results are not yet available.

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (ADC1552_TP1_BLx) on page 141)
- Parameters page (refer to Parameters Page (ADC1552_TP1_BLx) on page 142)
- Advanced page (refer to Advanced Page (ADC1552_TP1_BLx) on page 143)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- ds_1552_init
- adc_1552_tp1_init
- adc_1552_tp1_single_init2
- adc_1552_tp1_sw_trigger
- adc_1552_tp1_single_current_read
- adc_1552_tp1_single_new_read

Unit Page (ADC1552_TP1_BLx)

Purpose

To provide access to an A/D converter by referencing the related module and channel.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several FPGA Type 1 modules, RTI uses the module number to distinguish between them.

Channel number Lets you select a channel number in the range 1 ... 8.

Related topics

References

Advanced Page (ADC1552_TP1_BLx)......143
Block Description (ADC1552_TP1_BLx)......140
Parameters Page (ADC1552_TP1_BLx)......142

Parameters Page (ADC1552_TP1_BLx)

Purpose

To specify the A/D conversion settings.

Dialog settings

Channel number Displays the channel number specified in the Unit page.

Trigger source Lets you select the trigger source for the single A/D conversions:

Trigger Source	Meaning
Sample base rate	If the block's sample time is set to -1, the start of an A/D conversion is triggered by the task's step size. You additionally can set the sample time. For details, refer to Sample Time (refer to Advanced Page (ADC1552_TP1_BLx) on page 143).
External trigger input 1 External trigger input 2 External trigger input 3 External trigger input 4	The start of an A/D conversion is triggered by the trigger signal on the selected external trigger input. You additionally can set the edge polarity. An external trigger input can be used for several conversion channels. The specified edge polarity can vary on each channel.

Note

DigIn ch 1 … DigIn ch 4 of the DIO 1552 Type 1 unit are shared with the external trigger inputs of the ADC 1552 Type 1 unit.

Edge polarity Lets you select the edge of the trigger signal to be used as the trigger source. This setting can be made only if an external trigger input is set as the trigger source in the single conversion settings:

Edge Polarity	Meaning
Rising edge	The rising edge of the trigger signal is used as the trigger.
Falling edge	The falling edge of the trigger signal is used as the trigger.

Note

If the sample base rate is selected as the A/D conversion trigger source, the block uses the polling functions for reading the conversion results. If an external trigger input is selected as the A/D conversion trigger source, the current read buffer is read immediately without using the polling functions. You can evaluate the read buffer state for reading the conversion results by enabling the status outport of the ADC1552_TP1_BLx block. Alternatively, you can evaluate the data ready interrupt for reading the conversion. For details on the reading methods, refer to ADC 1552 Type 1 Unit (MicroAutoBox II Features 🕮).

Related topics

References

Advanced Page (ADC1552_TP1_BLx)

Purpose

To specify additional options, like the use of the ADC1552_TP1_START_BLx block.

Dialog settings

Channel number Displays the channel number specified in the Unit page.

Use separate ADC1552_TP1_START block Lets you specify if A/D conversion is to be started from a separate task. This setting can be made only if the sample base rate is set as the trigger source for the conversion trigger.

This setting must be made if the sample base rate is set as trigger source and the read-out of the conversion results is performed in a triggered subsystem using the data ready interrupt. For more information on Simulink models which require an ADC1552_TP1_START_BLx block, refer to ADC 1552 Type 1 Unit (MicroAutoBox II Features 🕮).

Sample time Lets you select or specify the sample time. This setting can be made only if the sample base rate is set as the trigger source and you do not use an ADC1552_TP1_START_BLx block:

Sample Time	Meaning
–1	The sample time is inherited from the blocks the block is connected to. If the block is in a triggered subsystem, you must select this setting.
0	The block uses the discrete sample time of the Simulink model.
>0	The block uses the sample time you specify.

Enable status outport Lets you enable the status outport, which indicates whether a read buffer with new conversion results was read, or if the read buffer was already read before. For more information on the reading methods, refer to ADC 1552 Type 1 Unit (MicroAutoBox II Features 🕮).

Range Lets you select the input voltage range 0 V … +5 V or -10 V … +10 V.

Note

The applicable input voltage range depends on the I/O module used:
- DS1552: 0 … +5 V
- DS1552*B1*: -10 … +10 V

If the specified input voltage range does not suit to the connected hardware, the real-time application stops with an error message.
If the DS1552 module has been installed by dSPACE, the board versions are printed on a type plate on the bottom of your MicroAutoBox II.

Related topics

References

ADC1552_TP1_START_BLx

Purpose

To start the A/D conversion by software in a separate task using the ADC 1552 Type 1 unit.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	–	✓[1]

[1] Requires a DS1552 Multi-I/O Module.

Where to go from here

Information in this section

Information in other sections

Block Description (ADC1552_TP1_START_BLx)

Block

Gives you information on the appearance and purpose of the block.

Purpose

To start A/D conversion by software in a separate task with the specified sample time.

Description

The ADC1552_TP1_START_BLx block allows you to start A/D conversion by software on the specified A/D conversion channel.

You can use a separate ADC1552_TP1_START_BLx block in your Simulink model, if the conversion trigger source is set to the sample base rate and the read-out of the conversion results is to be performed in a different task, for example, in a subsystem driven by the data ready interrupt. In all other cases it is recommended to start A/D conversion in the ADC1552_TP1_BLx block. For basic information on the ADC1552_TP1_START_BLx block, refer to ADC 1552 Type 1 Unit (MicroAutoBox II Features 📖).

Note

The ADC1552_TP1_START_BLx block is unsuitable for use in an *Enabled Subsystem*. The A/D converter is always started independently of the state of the Enable port.

If you want to start the block only under specific conditions, you must place it in a *Triggered Subsystem* or a *Function-Call Subsystem*.

Note

You cannot use blocks from the RTI FPGA Programming Blockset configured with one of the FPGA1401Tp1 frameworks and the RTI DS1552 I/O Extension Blockset in the same model.

Other RTI blocks

The ADC1552_TP1_BLx block must also reside in the model, with the same module number and channel number. Additionally, *Use separate ADC1552_TP1_START block* must be selected in the ADC1552_TP1_BLx block settings. For details on the ADC1552_TP1_BLx block, refer to ADC1552_TP1_BLx on page 139.

I/O mapping

For information on the mapping of converter and channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to ADC 1552 Type 1 Unit (MicroAutoBox II Features 📖).

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (ADC1552_TP1_START_BLx) on page 147)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- adc_1552_tp1_sw_trigger

Unit Page (ADC1552_TP1_START_BLx)

Purpose

To reference the related ADC 1552 Type 1 unit and channel and to start A/D conversion by software.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several FPGA Type 1 modules, RTI uses the module number to distinguish between them.

Channel number Lets you select a channel number in the range 1 … 8.

Sample time Lets you select or specify the sample time:

Sample Time	Meaning
–1	The sample time is inherited from the blocks the block is connected to. If the block is in a triggered subsystem, you must select this setting.
0	The block uses the discrete sample time of the Simulink model.
>0	The block uses the sample time you specify.

You can make the setting for the sample time in the ADC1552_TP1_START_BLx block only if the sample time setting in a corresponding ADC1552_TP1_BLx block is not set to sample base rate.

Related topics

References

ADC1552_TP2_BLx

Purpose

To read from the A/D converters of the ADC 1552 Type 2 unit of the DS1552 Multi-I/O Module.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	–	✓ [1]

[1] Requires a DS1552 Multi-I/O Module.

Where to go from here

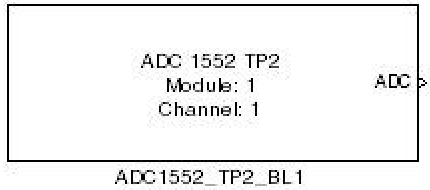
Information in this section

Information in other sections

Block Description (ADC1552_TP2_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To provide read access to one of the ADC 1552 Type 2 converters.

I/O mapping

For information on the mapping of converter and channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to ADC 1552 Type 2 Unit (MicroAutoBox II Features 📖).

I/O characteristics

This table shows the scaling between the analog input voltage and the output of the block:

Input Voltage Range	Simulink Output	Simulink Data Type
-10.0 … +10.0 V	-1.0 … +1.0	Double

Note

Due to adjustment of the conversion channels, the typical maximum input voltage can be less or greater than 10.0 V (see the data sheets in MicroAutoBox II Hardware Reference 📖). Accordingly, the function returns a value less or greater than +1 or -1.

The following table describes the ports of the block:

Port	Description
Output	
ADC	Outputs the result of the latest A/D conversion on the current channel. Data type: Double Range: -1.0 … +1.0

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (ADC1552_TP2_BLx) on page 150)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- ds_1552_init
- adc_1552_tp2_init
- adc_1552_tp2_conversion_init
- adc_1552_tp2_channel_control
- adc_1552_tp2_read

Unit Page (ADC1552_TP2_BLx)

Purpose

To provide access to an A/D converter by referencing the related module and channel.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several FPGA Type 1 modules, RTI uses the module number to distinguish between them.

Channel number Lets you select a channel number in the range 1 … 16.

Related topics

References

Block Description (ADC1552_TP2_BLx).. 149

AIO_TYPE1_ADC_BLx

Purpose

To read from the A/D converters of an AIO Type 1 module.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

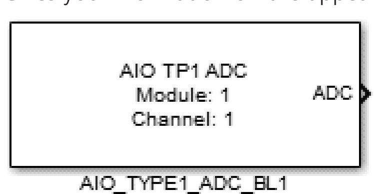
Where to go from here

Information in this section

Block Description (AIO_TYPE1_ADC_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To provide read access to one of the AIO Type 1 A/D converters.

I/O mapping

For information on the mapping of converter and channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to AIO Unit Type 1 (ADC) (MicroAutoBox II Features 📖).

I/O characteristics

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

Input Voltage Range	Simulink Output
-10.0 V … +10.0 V	-1.0 … +1.0

Note

Due to adjustment of the conversion channels, the typical maximum input voltage can be less or greater than ±10.0 V (see the data sheets in MicroAutoBox II Hardware Reference 📖). Accordingly, the function returns a value less or greater than +1 or -1.

The following table describes the ports of the block:

Port	Description
Output	
ADC	Outputs the result of the latest A/D conversion on the current channel. Data type: Double Range: -1.0 … +1.0

Dialog pages

The dialog settings can be specified on the following page:

- Unit page (refer to Unit Page (AIO_TYPE1_ADC_BLx) on page 152)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- aio_tp1_init
- aio_tp1_adc_init
- aio_tp1_adc_conversion_init
- aio_tp1_adc_channel_control
- aio_tp1_adc_read

Unit Page (AIO_TYPE1_ADC_BLx)

Purpose

To provide access to an A/D converter by referencing the related module and channel.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 🕮).

Channel number Lets you select a channel number in the range 1 … 16.

Related topics

References

Block Description (AIO_TYPE1_ADC_BLx)..151

Bit I/O

Introduction

The RTI Blockset of MicroAutoBox II (RTI1401) provides several blocks that you can use for accessing digital I/O (Bit I/O). For an overview on which RTI block is appropriate for your use case, refer to Bit I/O (MicroAutoBox II Features 📖).

Where to go from here

Information in this section

DIO_TYPE3_BIT_IN_BLx

Purpose

To provide word-wise read access to all the bits of a digital I/O port.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

Where to go from here

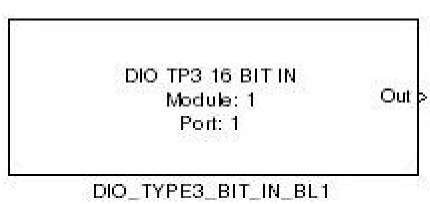
Information in this section

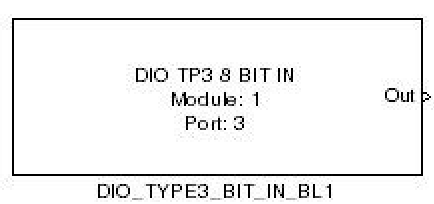
Information in other sections

Block Description (DIO_TYPE3_BIT_IN_BLx)

Block

Gives you information on the appearance and purpose of the block.





Purpose

To provide read access to all the bits of a digital I/O port.

Description

The block provides read access to all the channels (bits) of a digital I/O port. Because the ports provide a different number of channels, the block's output depends on the specified port number.

The single bits of the read value correspond directly to the related channels, i.e., the LSB corresponds to the state of channel 1 and the MSB corresponds to the state of channel 16.

Use the DIO_TYPE3_BIT_IN_CH_BLx block to read a single digital input channel of a port.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Bit I/O Unit (DIO Type 3) (MicroAutoBox II Features 📖).

I/O characteristics

The following table shows the relationship between the block's digital input and the block's Simulink output:

Port Number	Digital Input	Simulink Output
1, 2	0000 0000 0000 0000	0
	…	…
	0000 0000 1111 1101	253
	…	…
	1111 1111 1111 1111	65535
3	0000 0000	0
	…	…
	0101 1111	95
	…	…
	1111 1111	255

The following table describes the ports of the block:

Port	Description
Output	
Out	Outputs all the bits of the specified port. The number of bits depend on the specified digital I/O port. Data type: ▪ Ports 1, 2: UInt16 ▪ Port 3: UInt8 Range: ▪ Ports 1, 2: 0 … 2^{16}-1 ▪ Port 3: 0 … 2^{8}-1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE3_BIT_IN_BLx) on page 159)
- Interrupt page (refer to Interrupt Page (DIO_TYPE3_BIT_IN_BLx) on page 160)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- dio_tp3_init
- dio_tp3_digin_init
- dio_tp3_digin_read16
- dio_tp3_multi_source_int_mode_set

Unit Page (DIO_TYPE3_BIT_IN_BLx)

Purpose

To specify the digital I/O port to be read from.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 📖).

Port number Lets you select the port number in the range 1 … 3.

You have word-wise access to the 16 bits of digital I/O ports 1 and 2, and byte-wise access to the 8 bits of digital I/O port 3.

> **Note**
>
> Concurrent access to the same digital input port by other DIO_TYPE 3 blocks or functions is not allowed.

Related topics

References

Block Description (DIO_TYPE3_BIT_IN_BLx)............157
Interrupt Page (DIO_TYPE3_BIT_IN_BLx)............160

Interrupt Page (DIO_TYPE3_BIT_IN_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related DIO_TYPE3_HWINT_BLx block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference).

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the Edge type setting.

If interrupt generation is enabled, the model has to contain a related DIO_TYPE3_HWINT_BLx block.

If interrupt generation is disabled, the model must not contain a related DIO_TYPE3_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Related topics

References

Block Description (DIO_TYPE3_BIT_IN_BLx)........ 157
Unit Page (DIO_TYPE3_BIT_IN_BLx)........ 159

DIO_TYPE3_BIT_IN_CH_BLx

Purpose

To provide channel-wise read access to a single bit of a digital I/O port.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

Where to go from here

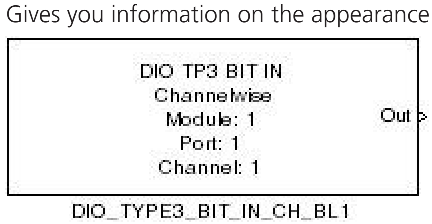
Information in this section

Information in other sections

Block Description (DIO_TYPE3_BIT_IN_CH_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To provide channel-wise read access to a single bit of a digital I/O port.

Description

The block provides channel-wise read access to a single bit of a digital I/O port. The block's output is a binary value representing the state of the digital input channel.

Use the DIO_TYPE3_BIT_IN_BLx block to read all the channels (bits) of the input port at the same time.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Bit I/O Unit (DIO Type 3) (MicroAutoBox II Features 📖).

I/O characteristics

The following table shows the relationship between the digital input and the block's output variable (binary representation relating to one channel) in Simulink:

Digital Input	Simulink Output
High	1
Low	0

The following table describes the ports of the block:

Port	Description
Output	
Out	Outputs the value of the specified bit. Data type: Boolean Range: 0, 1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE3_BIT_IN_CH_BLx) on page 163)
- Interrupt page (refer to Interrupt Page (DIO_TYPE3_BIT_IN_CH_BLx) on page 163)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- dio_tp3_init
- dio_tp3_digin_init
- dio_tp3_digin_read
- dio_tp3_multi_source_int_mode_set

Unit Page (DIO_TYPE3_BIT_IN_CH_BLx)

Purpose

To specify the digital input channel.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 🕮).

Port number Lets you select the port number in the range 1 … 3.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1, 2	1 … 16
3	1 … 8

Note

Concurrent access to the same digital input channel by other DIO Type 3 blocks or functions is not supported.

Related topics

References

Interrupt Page (DIO_TYPE3_BIT_IN_CH_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related DIO_TYPE3_HWINT_BLx block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 🕮).

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the Edge type setting.

If interrupt generation is enabled, the model has to contain a related DIO_TYPE3_HWINT_BLx block.

If interrupt generation is disabled, the model must not contain a related DIO_TYPE3_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Related topics

References

Block Description (DIO_TYPE3_BIT_IN_CH_BLx)........ 161
Unit Page (DIO_TYPE3_BIT_IN_CH_BLx)........ 163

DIO_TYPE3_BIT_OUT_BLx

Purpose

To provide write access to all the bits of a digital I/O port.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

Where to go from here

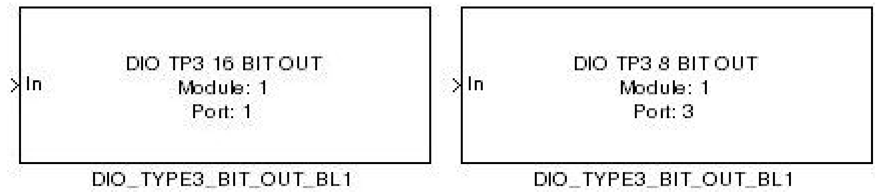
Information in this section

Information in other sections

Block Description (DIO_TYPE3_BIT_OUT_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To provide write access to all the bits of a digital I/O port.

Description

The block provides write access to all the channels (bits) of a digital I/O port. Because the ports provide a different number of channels, the block's input depends on the specified port number.

The single bits of the read value correspond directly to the related channels, i.e., the LSB corresponds to the setting of channel 1 and the MSB corresponds to the setting of channel 16.

Use the DIO_TYPE3_BIT_OUT_CH_BLx block to write a single bit of the digital output port.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Bit I/O Unit (DIO Type 3) (MicroAutoBox II Features 🕮).

I/O characteristics

The following table shows the relationship between the block's Simulink input and its digital output:

Port Number	Simulink Input	Digital Output
1, 2	0	0000 0000 0000 0000
	...	...
	253	0000 0000 1111 1101
	...	...
	65535	1111 1111 1111 1111
3	0	0000 0000
	...	...
	95	0101 1111
	...	...
	255	1111 1111

The following table describes the ports of the block:

Port	Description
Input	
In	Writes all the bits of the specified port. The number of bits depend on the specified digital I/O port. Data type: ▪ Ports 1, 2: UInt16 ▪ Port 3: UInt8 Range: ▪ Ports 1, 2: 0 … 2^{16}-1 ▪ Port 3: 0 … 2^{8}-1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE3_BIT_OUT_BLx) on page 167)
- Electrical Interface page (refer to Electrical Interface Page (DIO_TYPE3_BIT_OUT_BLx) on page 168)
- Parameters page (refer to Parameters Page (DIO_TYPE3_BIT_OUT_BLx) on page 169)
- Interrupt page (refer to Interrupt Page (DIO_TYPE3_BIT_OUT_BLx) on page 171)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dio_tp3_init
- dio_tp3_digout_init
- dio_tp3_digout_write16
- dio_tp3_digout_mode_set
- dio_tp3_multi_source_int_mode_set

Unit Page (DIO_TYPE3_BIT_OUT_BLx)

Purpose

To specify the digital I/O port to write to.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 📖).

Port number Lets you select the port number in the range 1 … 3.

You have word-wise access to the 16 bits of digital I/O ports 1 and 2, and byte-wise access to the 8 bits of digital I/O port 3.

Note

Multiple access to the same digital output port by other DIO_TYPE 3 blocks or functions is not allowed.

Related topics

References

Electrical Interface Page (DIO_TYPE3_BIT_OUT_BLx)

Purpose

To set the high-side and low-side switches of the connected supply rails for all the digital output channels of the specified port.

Description

The output state of a digital output channel depends on its individual settings for the low-side switch L (GND) and the high-side switch H (VDRIVE).

- If the low-side switch L (GND) is enabled, the output is actively driven to GND.
- If the high-side switch H (VDRIVE) is enabled, the output is actively driven to VDRIVE.
- If you set low-side switch L (GND) and high-side switch H (VDRIVE), the digital output channel is actively driven to both VDRIVE and GND (push-pull mode).

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigP1 ch 1 … DigP3 ch 8)	Description
0	Disabled	Disabled	High-Z	Individual output disabled
1	Disabled	Disabled	High-Z	
0	Disabled	Enabled	GND	Low-side switch
1	Disabled	Enabled	High-Z	
0	Enabled	Disabled	High-Z	High-side switch
1	Enabled	Disabled	VDRIVE	

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigP1 ch 1 ... DigP3 ch 8)	Description
0	Enabled	Enabled	GND	Push-pull output
1	Enabled	Enabled	VDRIVE	

Dialog settings

Port Displays the port number that you selected on the Unit page.

Setup of supply rails Lets you enable/disable the supply rails defined by the parameters L (Low) and H (High) for each single digital output channel individually.

Parameter	Meaning
L	Enables/disables the low-side switch for the selected digital output channel.
H	Enables/disables the high-side switch (VDRIVE) for the selected digital output channel.

If you specified digital I/O ports 1 or 2, you can select the supply rails for bits 1 … 16, and if you specified digital I/O port 3, you can select them for bits 1 … 8.

Set all Lets you enable/disable the supply rails for all the digital output channels of the specified port identically and at once.

Related topics

References

Block Description (DIO_TYPE3_BIT_OUT_BLx)..................... 166
Interrupt Page (DIO_TYPE3_BIT_OUT_BLx)..................... 171
Parameters Page (DIO_TYPE3_BIT_OUT_BLx)..................... 169
Unit Page (DIO_TYPE3_BIT_OUT_BLx)..................... 167

Parameters Page (DIO_TYPE3_BIT_OUT_BLx)

Purpose

To set the initial output state and the termination output state.

Description

Initialization During the model initialization phase, the initial digital output states specified by the Initial output settings are written to all the channels of the specified digital I/O port to ensure a defined output during this simulation phase. This is especially useful if the channels are used in a triggered or enabled subsystem that is not executed right from the start of the simulation. Before initialization, the digital outputs are set to high impedance.

Termination With the block's Termination settings, you can specify the output states of all the specified channels of the specified digital I/O port on model termination to drive your external hardware into a safe final condition.

The possible termination states at the end of the simulation are:

- All the specified digital outputs are set to high impedance (high-Z) state.
- Each output holds its last output value.
- Each output is set to a definite output value.

The specified termination values of I/O channels are set when the simulation executes its termination function by setting the `simState` variable to STOP. If the real-time application is stopped by using ControlDesk's Stop RTP command, the processor resets immediately without executing termination functions. The output channels are set to high impedance state and the specified termination values are not set.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Initial output value Lets you set the output value that is used for all the channels (bits) of a digital I/O port at the start of the simulation. The value range depends on the specified digital I/O port.

Port Number	Value Range
1, 2	0 … 65535
3	0 … 255

The specified output value is also displayed in hexadecimal and binary format.

Termination To enable or disable the setting of definite output values at the end of the simulation.

Termination Mode Checkbox	Meaning
Disabled	The digital outputs of all the channels of the specified digital I/O port are set to high state at the end of the simulation.
Enabled	The output behavior of all the channels of the specified digital I/O port is determined by the Output settings (see below) at the end of the simulation.

The termination mode checkbox is disabled by default.

Output To set all digital output channels to definite output values at the end of the simulation.

Option Button	Meaning
Last output state	Each output channel holds its last digital output value at the end of the simulation.
Value on termination	Lets you specify the output values for the channels by a decimal value. The value range depends on the specified digital I/O port. Ports 1, 2: 0 ... 65535 (0 … 2^{16}-1) Port 3: 0 … 255 (0 … 2^{8}-1)

Option Button	Meaning
	The single bits of this value correspond directly to the related channels, i.e., the LSB corresponds to the setting for channel 1 and the MSB corresponds to the setting for channel 8 or 16. The default value is 0. The decimal value is also displayed in hexadecimal and binary format.

Related topics

References

Block Description (DIO_TYPE3_BIT_OUT_BLx)........ 166
Electrical Interface Page (DIO_TYPE3_BIT_OUT_BLx)........ 168
Interrupt Page (DIO_TYPE3_BIT_OUT_BLx)........ 171
simState (RTI and RTI-MP Implementation Reference 🕮)
Stop RTP (ControlDesk Platform Management 🕮)
Unit Page (DIO_TYPE3_BIT_OUT_BLx)........ 167

Interrupt Page (DIO_TYPE3_BIT_OUT_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related DIO_TYPE3_HWINT_BLx block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 🕮).

Dialog settings

Port Displays the port number that you selected on the **Unit** page.

Channel Displays the channel number that you selected on the **Unit** page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the **Edge type** setting.

If interrupt generation is enabled, the model has to contain a related DIO_TYPE3_HWINT_BLx block.

If interrupt generation is disabled, the model must not contain a related DIO_TYPE3_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.

Parameter	Meaning
Both edges	Generates an interrupt at each falling and rising edge.

Note

If you enabled interrupt generation for output channels, you have to consider that interrupts might be generated because of the output state changes during initialization and termination.

Related topics

References

DIO_TYPE3_BIT_OUT_CH_BLx

Purpose

To provide channel-wise write access to a single bit of a digital I/O port.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

Where to go from here

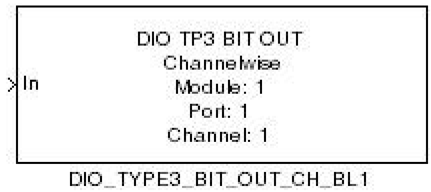
Information in this section

Information in other sections

Block Description (DIO_TYPE3_BIT_OUT_CH_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To provide channel-wise write access to a single bit of a digital I/O port.

Description

The block provides channel-wise write access to a single bit of a digital I/O port. The block's input is a binary value.

Use the DIO_TYPE3_BIT_OUT_BLx block to write to all the bits of the digital output port at the same time.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Bit I/O Unit (DIO Type 3) (MicroAutoBox II Features 🕮).

I/O characteristics

The following table describes the ports of the block:

Port	Description
Input	
In	To write to the specified I/O port. Data type: Boolean Range: 0, 1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE3_BIT_OUT_CH_BLx) on page 175)
- Electrical Interface page (refer to Electrical Interface Page (DIO_TYPE3_BIT_OUT_CH_BLx) on page 176)
- Parameters page (refer to Parameters Page (DIO_TYPE3_BIT_OUT_CH_BLx) on page 177)
- Interrupt page (refer to Interrupt Page (DIO_TYPE3_BIT_OUT_CH_BLx) on page 178)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dio_tp3_init
- dio_tp3_digout_init
- dio_tp3_digout_write
- dio_tp3_digout_mode_set
- dio_tp3_multi_source_int_mode_set

Unit Page (DIO_TYPE3_BIT_OUT_CH_BLx)

Purpose

To specify the channel you want to write to.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features).

Port number Lets you select the port number in the range 1 … 3.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1, 2	1 … 16
3	1 … 8

Note

Concurrent access to the same digital output channel(s) by other DIO Type 3 blocks or functions is not allowed.

Related topics

References

Block Description (DIO_TYPE3_BIT_OUT_CH_BLx) 174
Electrical Interface Page (DIO_TYPE3_BIT_OUT_CH_BLx) 176
Interrupt Page (DIO_TYPE3_BIT_OUT_CH_BLx) 178
Parameters Page (DIO_TYPE3_BIT_OUT_CH_BLx) 177

Electrical Interface Page (DIO_TYPE3_BIT_OUT_CH_BLx)

Purpose

To set the high-side and low-side switches of the connected supply rails for the selected output channel.

Description

The output state of a digital output channel depends on its individual settings for the low-side switch L (GND) and the high-side switch H (VDRIVE).

- If the low-side switch L (GND) is enabled, the output is actively driven to GND.
- If the high-side switch H (VDRIVE) is enabled, the output is actively driven to VDRIVE.
- If you set low-side switch L (GND) and high-side switch H (VDRIVE), the digital output channel is actively driven to both VDRIVE and GND (push-pull mode).

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigP1 ch 1 ... DigP3 ch 8)	Description
0 1	Disabled Disabled	Disabled Disabled	High-Z High-Z	Individual output disabled
0 1	Disabled Disabled	Enabled Enabled	GND High-Z	Low-side switch
0 1	Enabled Enabled	Disabled Disabled	High-Z VDRIVE	High-side switch
0 1	Enabled Enabled	Enabled Enabled	GND VDRIVE	Push-pull output

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Setup of supply rails Lets you enable/disable the supply rails defined by the parameters L (Low side) and H (High side).

Parameter	Meaning
L	Enables/disables the low-side switch for the selected digital output channel.
H	Enables/disables the high-side switch (VDRIVE) for the selected digital output channel.

Related topics

References

Block Description (DIO_TYPE3_BIT_OUT_CH_BLx) ... 174
Interrupt Page (DIO_TYPE3_BIT_OUT_CH_BLx) ... 178
Parameters Page (DIO_TYPE3_BIT_OUT_CH_BLx) ... 177

Parameters Page (DIO_TYPE3_BIT_OUT_CH_BLx)

Purpose

To set the initial output state and the termination output state.

Description

Initialization During the model initialization phase, the **Initial output state** is written to the selected channel (bit) to ensure a defined output during this simulation phase. This is especially useful if the channel is used in a triggered or enabled subsystem that is not executed right from the start of the simulation. Before initialization, the digital outputs are set to high impedance.

Termination With the block's **Termination** settings, you can specify an output state of the channel on model termination to drive your external hardware into a safe final condition.

The possible termination states at the end of the simulation are:

- All digital outputs are set to high impedance (high-Z) state.
- The output holds its last output value.
- The output is set to a definite output value.

The specified termination values of I/O channels are set when the simulation executes its termination function by setting the `simState` variable to STOP. If the real-time application is stopped by using ControlDesk's **Stop RTP** command, the processor resets immediately without executing termination functions. The output channels are set to high impedance state and the specified termination values are not set.

Dialog settings

Port Displays the port number that you selected on the **Unit** page.

Channel Displays the channel number that you selected on the **Unit** page.

Initial output state Lets you select the initial output state *Low(0)* or *High(1)* at the start of the simulation.

The default state is *Low(0)*.

Termination To enable or disable the setting of a definite output value at the end of the simulation.

Termination Mode Checkbox	Meaning
Disabled	All digital outputs are set to high impedance (high-Z) state at the end of the simulation.
Enabled	The channel's output behavior is determined by the Output settings (see below) at the end of the simulation.

The termination mode checkbox is disabled by default.

Output To set a definite output value at the end of the simulation.

Option Button	Meaning
Last output state	The channel holds its last digital output value at the end of the simulation.
State on termination	Lets you set the output value to *Low(0)* or *High(1)* at the end of the simulation.

Related topics

References

Interrupt Page (DIO_TYPE3_BIT_OUT_CH_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related DIO_TYPE3_HWINT_BLx block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 📖).

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the Edge type setting.

If interrupt generation is enabled, the model has to contain a related DIO_TYPE3_HWINT_BLx block.

If interrupt generation is disabled, the model must not contain a related DIO_TYPE3_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Note

If you enabled interrupt generation for output channels, you have to consider that interrupts might be generated because of the output state changes during initialization and termination.

Related topics

References

Block Description (DIO_TYPE3_BIT_OUT_CH_BLx)....174
Electrical Interface Page (DIO_TYPE3_BIT_OUT_CH_BLx)....176
Parameters Page (DIO_TYPE3_BIT_OUT_CH_BLx)....177
Unit Page (DIO_TYPE3_BIT_OUT_CH_BLx)....175

DIO_TYPE4_BIT_IN_BLx

Purpose

To provide word-wise read access to all the bits of a digital I/O port.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

Where to go from here

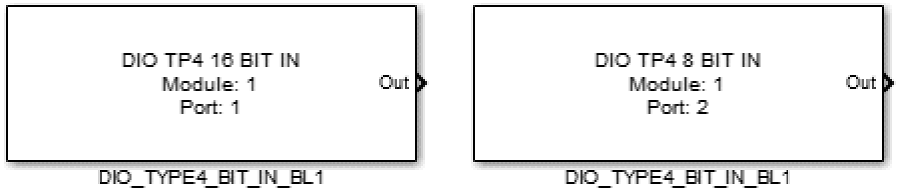
Information in this section

Information in other sections

Block Description (DIO_TYPE4_BIT_IN_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To provide read access to all the bits of a digital I/O port.

Description

The block provides read access to all the channels (bits) of a digital I/O port. Because the ports provide a different number of channels, the block's output depends on the specified port number.

The single bits of the read value correspond directly to the related channels, i.e., the LSB corresponds to the state of channel 1 and the MSB corresponds to the state of channel 16.

Use the DIO_TYPE4_BIT_IN_CH_BLx block to read a single digital input channel of a port.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Bit I/O Unit (DIO Type 4) (MicroAutoBox II Features 🕮).

I/O characteristics

The following table shows the relationship between the block's digital input and the block's Simulink output:

Port Number	Digital Input	Simulink Output
1	0000 0000 0000 0000	0
	…	…
	0000 0000 1111 1101	253
	…	…
	1111 1111 1111 1111	65535
2	0000 0000	0
	…	…
	0101 1111	95
	…	…
	1111 1111	255

The following table describes the ports of the block:

Port	Description
Output	
Out	Outputs all the bits of the specified port. The number of bits depend on the specified digital I/O port. Data type: ▪ Port 1: UInt16 ▪ Port 2: UInt8 Range: ▪ Port 1: 0 … 2^{16}-1 ▪ Port 2: 0 … 2^{8}-1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE4_BIT_IN_BLx) on page 182)
- Interrupt page (refer to Interrupt Page (DIO_TYPE4_BIT_IN_BLx) on page 183)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dio_tp4_init
- dio_tp4_digin_init
- dio_tp4_digin_read16
- dio_tp4_multi_source_int_mode_set

Unit Page (DIO_TYPE4_BIT_IN_BLx)

Purpose

To specify the digital I/O port to be read from.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features).

Port number Lets you select the port number in the range 1 … 2.

You have word-wise access to the 16 bits of digital I/O port 1, and byte-wise access to the 8 bits of digital I/O port 2.

Note

Concurrent access to the same digital input port by other DIO_TYPE 4 blocks or functions is not allowed.

Related topics

References

Interrupt Page (DIO_TYPE4_BIT_IN_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related DIO_TYPE4_HWINT_BLx on page 61 block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference).

Dialog settings

Port Displays the port number that you selected on the **Unit** page.

Channel Displays the channel number that you selected on the **Unit** page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the **Edge type** setting.

If interrupt generation is enabled, the model has to contain a related DIO_TYPE4_HWINT_BLx block.

If interrupt generation is disabled, the model must not contain a related DIO_TYPE4_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Related topics

References

DIO_TYPE4_BIT_IN_CH_BLx

Purpose

To provide channel-wise read access to a single bit of a digital I/O port.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

Where to go from here

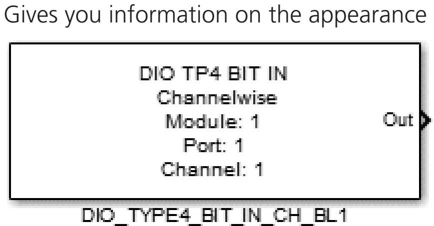
Information in this section

Information in other sections

Block Description (DIO_TYPE4_BIT_IN_CH_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To provide channel-wise read access to a single bit of a digital I/O port.

Description

The block provides channel-wise read access to a single bit of a digital I/O port. The block's output is a binary value representing the state of the digital input channel.

Use the DIO_TYPE4_BIT_IN_BLx on page 180 block to read all the channels (bits) of the input port at the same time.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Bit I/O Unit (DIO Type 4) (MicroAutoBox II Features 🕮).

I/O characteristics

The following table shows the relationship between the digital input and the block's output variable (binary representation relating to one channel) in Simulink:

Digital Input	Simulink Output
High	1
Low	0

The following table describes the ports of the block:

Port	Description
Output	
Out	Outputs the value of the specified bit. Data type: Boolean Range: 0, 1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE4_BIT_IN_CH_BLx) on page 187)
- Interrupt page (refer to Interrupt Page (DIO_TYPE4_BIT_IN_CH_BLx) on page 187)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- dio_tp4_init
- dio_tp4_digin_init
- dio_tp4_digin_read
- dio_tp4_multi_source_int_mode_set

Unit Page (DIO_TYPE4_BIT_IN_CH_BLx)

Purpose

To specify the digital input channel.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 📖).

Port number Lets you select the port number in the range 1 … 2.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1	1 … 16
2	1 … 8

Note

Concurrent access to the same digital input channel by other DIO Type 4 blocks or functions is not supported.

Related topics

References

Block Description (DIO_TYPE4_BIT_IN_CH_BLx)........ 185
Interrupt Page (DIO_TYPE4_BIT_IN_CH_BLx)........ 187

Interrupt Page (DIO_TYPE4_BIT_IN_CH_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related **DIO_TYPE4_HWINT_BLx** on page 61 block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 📖).

Dialog settings

Port Displays the port number that you selected on the **Unit** page.

Channel Displays the channel number that you selected on the **Unit** page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the **Edge type** setting.

If interrupt generation is enabled, the model has to contain a related DIO_TYPE4_HWINT_BLx block.

If interrupt generation is disabled, the model must not contain a related DIO_TYPE4_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Related topics

References

Block Description (DIO_TYPE4_BIT_IN_CH_BLx)....... 185
Unit Page (DIO_TYPE4_BIT_IN_CH_BLx)....... 187

DIO_TYPE4_BIT_OUT_BLx

Purpose

To provide write access to all the bits of a digital I/O port.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

Where to go from here

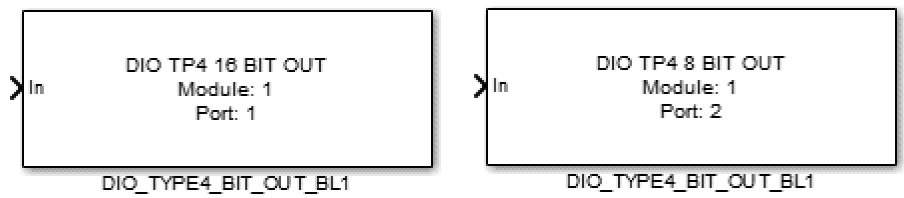
Information in this section

Information in other sections

Block Description (DIO_TYPE4_BIT_OUT_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To provide write access to all the bits of a digital I/O port.

Description

The block provides write access to all the channels (bits) of a digital I/O port. Because the ports provide a different number of channels, the block's input depends on the specified port number.

The single bits of the read value correspond directly to the related channels, i.e., the LSB corresponds to the setting of channel 1 and the MSB corresponds to the setting of channel 16.

Use the DIO_TYPE4_BIT_OUT_CH_BLx block to write a single bit of the digital output port.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Bit I/O Unit (DIO Type 4) (MicroAutoBox II Features 🕮).

I/O characteristics

The following table shows the relationship between the block's Simulink input and its digital output:

Port Number	Simulink Input	Digital Output
1	0	0000 0000 0000 0000
	...	...
	253	0000 0000 1111 1101
	...	...
	65535	1111 1111 1111 1111
2	0	0000 0000
	...	...
	95	0101 1111
	...	...
	255	1111 1111

The following table describes the ports of the block:

Port	Description
Input	
In	Writes all the bits of the specified port. The number of bits depend on the specified digital I/O port. Data type: ▪ Port 1: UInt16 ▪ Port 2: UInt8 Range: ▪ Port 1: 0 … 2^{16}-1 ▪ Port 2: 0 … 2^8-1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE4_BIT_OUT_BLx) on page 191)
- Electrical Interface page (refer to Electrical Interface Page (DIO_TYPE4_BIT_OUT_BLx) on page 192)
- Parameters page (refer to Parameters Page (DIO_TYPE4_BIT_OUT_BLx) on page 193)
- Interrupt page (refer to Interrupt Page (DIO_TYPE4_BIT_OUT_BLx) on page 195)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dio_tp4_init
- dio_tp4_digout_init
- dio_tp4_digout_write16
- dio_tp4_digout_mode_set
- dio_tp4_multi_source_int_mode_set

Unit Page (DIO_TYPE4_BIT_OUT_BLx)

Purpose

To specify the digital I/O port to write to.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 📖).

Port number Lets you select the port number in the range 1 … 2.

You have word-wise access to the 16 bits of digital I/O port 1, and byte-wise access to the 8 bits of digital I/O port 2.

Note

Multiple access to the same digital output port by other DIO_TYPE 4 blocks or functions is not allowed.

Related topics

References

Electrical Interface Page (DIO_TYPE4_BIT_OUT_BLx)

Purpose

To set the high-side and low-side switches of the connected supply rails for all the digital output channels of the specified port.

Description

The output state of a digital output channel depends on its individual settings for the low-side switch L (GND) and the high-side switch H (VDRIVE).

- If the low-side switch L (GND) is enabled, the output is actively driven to GND.
- If the high-side switch H (VDRIVE) is enabled, the output is actively driven to VDRIVE.
- If you set low-side switch L (GND) and high-side switch H (VDRIVE), the digital output channel is actively driven to both VDRIVE and GND (push-pull mode).

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigP1 ch 1 ... DigP2 ch 8)	Description
0	Disabled	Disabled	High-Z	Individual output disabled
1	Disabled	Disabled	High-Z	
0	Disabled	Enabled	GND	Low-side switch
1	Disabled	Enabled	High-Z	
0	Enabled	Disabled	High-Z	High-side switch
1	Enabled	Disabled	VDRIVE	

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigP1 ch 1 ... DigP2 ch 8)	Description
0	Enabled	Enabled	GND	Push-pull output
1	Enabled	Enabled	VDRIVE	

Dialog settings

Port Displays the port number that you selected on the Unit page.

Setup of supply rails Lets you enable/disable the supply rails defined by the parameters L (Low) and H (High) for each single digital output channel individually.

Parameter	Meaning
L	Enables/disables the low-side switch for the selected digital output channel.
H	Enables/disables the high-side switch (VDRIVE) for the selected digital output channel.

If you specified digital I/O port 1, you can select the supply rails for bits 1 … 16, and if you specified digital I/O port 2, you can select them for bits 1 … 8.

Set all Lets you enable/disable the supply rails for all the digital output channels of the specified port identically and at once.

Related topics

References

Block Description (DIO_TYPE4_BIT_OUT_BLx).......... 190
Interrupt Page (DIO_TYPE4_BIT_OUT_BLx).......... 195
Parameters Page (DIO_TYPE4_BIT_OUT_BLx).......... 193
Unit Page (DIO_TYPE4_BIT_OUT_BLx).......... 191

Parameters Page (DIO_TYPE4_BIT_OUT_BLx)

Purpose

To set the initial output state and the termination output state.

Description

Initialization During the model initialization phase, the initial digital output states specified by the Initial output settings are written to all the channels of the specified digital I/O port to ensure a defined output during this simulation phase. This is especially useful if the channels are used in a triggered or enabled subsystem that is not executed right from the start of the simulation. Before initialization, the digital outputs are set to high impedance.

Termination With the block's Termination settings, you can specify the output states of all the specified channels of the specified digital I/O port on model termination to drive your external hardware into a safe final condition.

The possible termination states at the end of the simulation are:

- All the specified digital outputs are set to high impedance (high-Z) state.
- Each output holds its last output value.
- Each output is set to a definite output value.

The specified termination values of I/O channels are set when the simulation executes its termination function by setting the `simState` variable to STOP. If the real-time application is stopped by using ControlDesk's Stop RTP command, the processor resets immediately without executing termination functions. The output channels are set to high impedance state and the specified termination values are not set.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Initial output value Lets you set the output value that is used for all the channels (bits) of a digital I/O port at the start of the simulation. The value range depends on the specified digital I/O port.

Port Number	Value Range
1	0 … 65535
2	0 … 255

The specified output value is also displayed in hexadecimal and binary format.

Termination To enable or disable the setting of definite output values at the end of the simulation.

Termination Mode Checkbox	Meaning
Disabled	The digital outputs of all the channels of the specified digital I/O port are set to high state at the end of the simulation.
Enabled	The output behavior of all the channels of the specified digital I/O port is determined by the Output settings (see below) at the end of the simulation.

The termination mode checkbox is disabled by default.

Output To set all digital output channels to definite output values at the end of the simulation.

Option Button	Meaning
Last output state	Each output channel holds its last digital output value at the end of the simulation.
Value on termination	Lets you specify the output values for the channels by a decimal value. The value range depends on the specified digital I/O port. Port 1: 0 ... 65535 (0 … 2^{16}-1) Port 2: 0 … 255 (0 … 2^{8}-1)

Option Button	Meaning
	The single bits of this value correspond directly to the related channels, i.e., the LSB corresponds to the setting for channel 1 and the MSB corresponds to the setting for channel 8 or 16. The default value is 0. The decimal value is also displayed in hexadecimal and binary format.

Related topics

References

Interrupt Page (DIO_TYPE4_BIT_OUT_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related DIO_TYPE4_HWINT_BLx on page 61 block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 🕮).

Dialog settings

Port Displays the port number that you selected on the **Unit** page.

Channel Displays the channel number that you selected on the **Unit** page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the **Edge type** setting.

If interrupt generation is enabled, the model has to contain a related DIO_TYPE4_HWINT_BLx block.

If interrupt generation is disabled, the model must not contain a related DIO_TYPE4_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.

Parameter	Meaning
Both edges	Generates an interrupt at each falling and rising edge.

Note

If you enabled interrupt generation for output channels, you have to consider that interrupts might be generated because of the output state changes during initialization and termination.

Related topics

References

DIO_TYPE4_BIT_OUT_CH_BLx

Purpose

To provide channel-wise write access to a single bit of a digital I/O port.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

Where to go from here

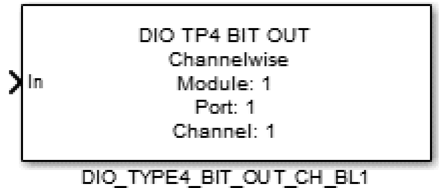
Information in this section

Information in other sections

Block Description (DIO_TYPE4_BIT_OUT_CH_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To provide channel-wise write access to a single bit of a digital I/O port.

Description

The block provides channel-wise write access to a single bit of a digital I/O port. The block's input is a binary value.

Use the DIO_TYPE4_BIT_OUT_BLx block to write to all the bits of the digital output port at the same time.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Bit I/O Unit (DIO Type 4) (MicroAutoBox II Features 📖).

I/O characteristics

The following table describes the ports of the block:

Port	Description
Input	
In	To write to the specified I/O port. Data type: Boolean Range: 0, 1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE4_BIT_OUT_CH_BLx) on page 199)
- Electrical Interface page (refer to Electrical Interface Page (DIO_TYPE4_BIT_OUT_CH_BLx) on page 200)
- Parameters page (refer to Parameters Page (DIO_TYPE4_BIT_OUT_CH_BLx) on page 201)
- Interrupt page (refer to Interrupt Page (DIO_TYPE4_BIT_OUT_CH_BLx) on page 202)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- dio_tp4_init
- dio_tp4_digout_init
- dio_tp4_digout_write
- dio_tp4_digout_mode_set
- dio_tp4_multi_source_int_mode_set

Unit Page (DIO_TYPE4_BIT_OUT_CH_BLx)

Purpose

To specify the channel you want to write to.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 📖).

Port number Lets you select the port number in the range 1 … 2.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1	1 … 16
2	1 … 8

Note

Concurrent access to the same digital output channel(s) by other DIO Type 4 blocks or functions is not allowed.

Related topics

References

DIO_TYPE4_BIT_OUT_CH_BLx 197
Electrical Interface Page (DIO_TYPE4_BIT_OUT_CH_BLx) 200
Interrupt Page (DIO_TYPE4_BIT_OUT_CH_BLx) 202
Parameters Page (DIO_TYPE4_BIT_OUT_CH_BLx) 201

Electrical Interface Page (DIO_TYPE4_BIT_OUT_CH_BLx)

Purpose

To set the high-side and low-side switches of the connected supply rails for the selected output channel.

Description

The output state of a digital output channel depends on its individual settings for the low-side switch L (GND) and the high-side switch H (VDRIVE).

- If the low-side switch L (GND) is enabled, the output is actively driven to GND.
- If the high-side switch H (VDRIVE) is enabled, the output is actively driven to VDRIVE.
- If you set low-side switch L (GND) and high-side switch H (VDRIVE), the digital output channel is actively driven to both VDRIVE and GND (push-pull mode).

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigP1 ch 1 ... DigP2 ch 8)	Description
0	Disabled	Disabled	High-Z	Individual output disabled
1	Disabled	Disabled	High-Z	
0	Disabled	Enabled	GND	Low-side switch
1	Disabled	Enabled	High-Z	
0	Enabled	Disabled	High-Z	High-side switch
1	Enabled	Disabled	VDRIVE	
0	Enabled	Enabled	GND	Push-pull output
1	Enabled	Enabled	VDRIVE	

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Setup of supply rails Lets you enable/disable the supply rails defined by the parameters L (Low side) and H (High side).

Parameter	Meaning
L	Enables/disables the low-side switch for the selected digital output channel.
H	Enables/disables the high-side switch (VDRIVE) for the selected digital output channel.

Related topics

References

DIO_TYPE4_BIT_OUT_CH_BLx.......197
Interrupt Page (DIO_TYPE4_BIT_OUT_CH_BLx).......202
Parameters Page (DIO_TYPE4_BIT_OUT_CH_BLx).......201

Parameters Page (DIO_TYPE4_BIT_OUT_CH_BLx)

Purpose

To set the initial output state and the termination output state.

Description

Initialization During the model initialization phase, the **Initial output state** is written to the selected channel (bit) to ensure a defined output during this simulation phase. This is especially useful if the channel is used in a triggered or enabled subsystem that is not executed right from the start of the simulation. Before initialization, the digital outputs are set to high impedance.

Termination With the block's **Termination** settings, you can specify an output state of the channel on model termination to drive your external hardware into a safe final condition.

The possible termination states at the end of the simulation are:

- All digital outputs are set to high impedance (high-Z) state.
- The output holds its last output value.
- The output is set to a definite output value.

The specified termination values of I/O channels are set when the simulation executes its termination function by setting the `simState` variable to STOP. If the real-time application is stopped by using ControlDesk's **Stop RTP** command, the processor resets immediately without executing termination functions. The output channels are set to high impedance state and the specified termination values are not set.

Dialog settings

Port Displays the port number that you selected on the **Unit** page.

Channel Displays the channel number that you selected on the **Unit** page.

Initial output state Lets you select the initial output state *Low(0)* or *High(1)* at the start of the simulation.

The default state is *Low(0)*.

Termination To enable or disable the setting of a definite output value at the end of the simulation.

Termination Mode Checkbox	Meaning
Disabled	All digital outputs are set to high impedance (high-Z) state at the end of the simulation.
Enabled	The channel's output behavior is determined by the **Output** settings (see below) at the end of the simulation.

The termination mode checkbox is disabled by default.

Output To set a definite output value at the end of the simulation.

Option Button	Meaning
Last output state	The channel holds its last digital output value at the end of the simulation.
State on termination	Lets you set the output value to *Low(0)* or *High(1)* at the end of the simulation.

Related topics

References

Interrupt Page (DIO_TYPE4_BIT_OUT_CH_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related DIO_TYPE4_HWINT_BLx on page 61 block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 📖).

Dialog settings

Port Displays the port number that you selected on the **Unit** page.

Channel Displays the channel number that you selected on the **Unit** page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the **Edge type** setting.

If interrupt generation is enabled, the model has to contain a related DIO_TYPE4_HWINT_BLx block.

If interrupt generation is disabled, the model must not contain a related DIO_TYPE4_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Note

If you enabled interrupt generation for output channels, you have to consider that interrupts might be generated because of the output state changes during initialization and termination.

Related topics

References

DIO1552_TP1_BIT_IN_BLx

Purpose

To provide word-wise read access to the digital input channels of the DS1552 Multi-I/O Module.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	–	✓[1]

[1] Requires a DS1552 Multi-I/O Module.

Where to go from here

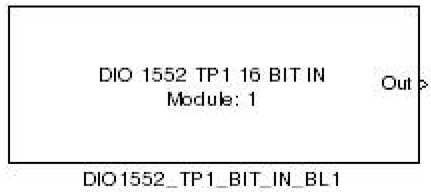
Information in this section

Information in other sections

Block Description (DIO1552_TP1_BIT_IN_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To provide read access to all the bits of the digital input channels.

Description

The single bits of the read value correspond directly to the related channels, i.e., the LSB corresponds to the state of channel 1 and the MSB corresponds to the state of channel 16.

Use the DIO1552_TP1_BIT_IN_CH_BLx block to read a single digital input channel.

Note

You cannot use blocks from the RTI FPGA Programming Blockset configured with one of the FPGA1401Tp1 frameworks and the RTI DS1552 I/O Extension Blockset in the same model.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Bit I/O Unit (DIO 1552 Type 1) (MicroAutoBox II Features 🕮).

I/O characteristics

The following table shows the relationship between the block's digital input and the block's Simulink output:

Digital Input	Simulink Output
0000 0000 0000 0000	0
...	...
0000 0000 1111 1101	253
...	...
1111 1111 1111 1111	65535

The following table describes the ports of the block:

Port	Description
Output	
Out	Outputs all the bits of the input channels. Data type: UInt16 Range: 0 … 2^{16}-1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO1552_TP1_BIT_IN_BLx) on page 206)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- ds_1552_init
- dio_1552_tp1_init
- dio_1552_tp1_digin_init
- dio_1552_tp1_digin_read16

Unit Page (DIO1552_TP1_BIT_IN_BLx)

Purpose

To specify the module to be read from.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several FPGA Type 1 modules, RTI uses the module number to distinguish between them.

Note

- Concurrent access to the same digital input channel by other DIO 1552 Type 1 blocks or functions is not allowed.
- DigIn ch 1 … DigIn ch 4 are shared with the external trigger inputs of the ADC 1552 Type 1 unit.

Related topics

References

Block Description (DIO1552_TP1_BIT_IN_BLx)....205

DIO1552_TP1_BIT_IN_CH_BLx

Purpose

To provide channel-wise read access to the digital input channels of the DS1552 Multi-I/O Module.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	–	✓[1]

[1] Requires a DS1552 Multi-I/O Module.

Where to go from here

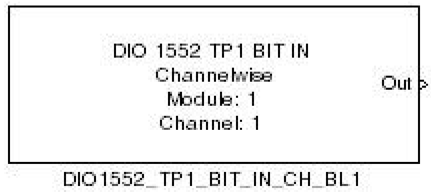
Information in this section

Information in other sections

Block Description (DIO1552_TP1_BIT_IN_CH_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To provide channel-wise read access to the digital input channels.

Description

The block's output is a binary value representing the state of the specified digital input channel.

Use the DIO1552_TP1_BIT_IN_BLx block to read all the bits of the digital input channels at once.

> **Note**
>
> You cannot use blocks from the RTI FPGA Programming Blockset configured with one of the FPGA1401Tp1 frameworks and the RTI DS1552 I/O Extension Blockset in the same model.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Bit I/O Unit (DIO 1552 Type 1) (MicroAutoBox II Features 📖).

I/O characteristics

The following table shows the relationship between the digital input and the block's output variable (binary representation relating to one channel) in Simulink:

Digital Input	Simulink Output
High	1
Low	0

The following table describes the ports of the block:

Port	Description
Output	
Out	Outputs the value of the specified bit. Data type: Boolean Range: 0, 1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO1552_TP1_BIT_IN_CH_BLx) on page 209)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- ds_1552_init
- dio_1552_tp1_init
- dio_1552_tp1_digin_init
- dio_1552_tp1_digin_read

Unit Page (DIO1552_TP1_BIT_IN_CH_BLx)

Purpose

To specify the digital input channel.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several FPGA Type 1 modules, RTI uses the module number to distinguish between them.

Channel number Lets you select the channel number in the range 1 … 16.

Note

- Concurrent access to the same digital input channel by other DIO 1552 Type 1 blocks or functions is not allowed.
- DigIn ch 1 … DigIn ch 4 are shared with the external trigger inputs of the ADC 1552 Type 1 unit.

Related topics

References

Block Description (DIO1552_TP1_BIT_IN_CH_BLx)......208

DIO1552_TP1_BIT_OUT_BLx

Purpose

To provide write access to all digital output channels of the DS1552 Multi-I/O Module.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	–	✓ [1]

[1] Requires a DS1552 Multi-I/O Module.

Where to go from here

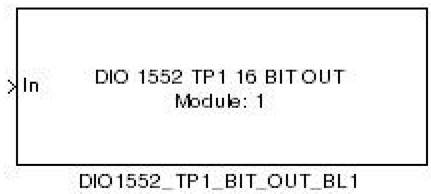
Information in this section

Information in other sections

Block Description (DIO1552_TP1_BIT_OUT_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To provide write access to all the digital output channels.

Description

The single bits of the read value correspond directly to the related channels, i.e., the LSB corresponds to the setting of channel 1 and the MSB corresponds to the setting of channel 16.

Use the DIO1552_TP1_BIT_OUT_CH_BLx block to write to a single digital output channel.

> **Note**
>
> You cannot use blocks from the RTI FPGA Programming Blockset configured with one of the FPGA1401Tp1 frameworks and the RTI DS1552 I/O Extension Blockset in the same model.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Bit I/O Unit (DIO 1552 Type 1) (MicroAutoBox II Features 📖).

I/O characteristics

The following table shows the relationship between the block's Simulink input and its digital output:

Simulink Input	Digital Output
0	0000 0000 0000 0000
...	...
253	0000 0000 1111 1101
...	...
65535	1111 1111 1111 1111

The following table describes the ports of the block:

Port	Description
Input	
In	Writes all the bits of the output channels. Data type: UInt16 Range: 0 … 2^{16}-1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO1552_TP1_BIT_OUT_BLx) on page 212)
- Electrical Interface page (refer to Electrical Interface Page (DIO1552_TP1_BIT_OUT_BLx) on page 213)
- Parameters page (refer to Parameters Page (DIO1552_TP1_BIT_OUT_BLx) on page 214)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- ds_1552_init
- dio_1552_tp1_init
- dio_1552_tp1_digout_init
- dio_1552_tp1_digout_mode_set
- dio_1552_tp1_digout_write16

Unit Page (DIO1552_TP1_BIT_OUT_BLx)

Purpose

To specify the module to write to.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several FPGA Type 1 modules, RTI uses the module number to distinguish between them.

> **Note**
>
> Multiple access to the same digital output channel by other DIO 1552_Type 1 blocks or functions is not allowed.

Related topics

References

Electrical Interface Page (DIO1552_TP1_BIT_OUT_BLx)

Purpose

To set the high-side and low-side switches of the connected supply rails for all the digital output channels.

Description

The output state of a digital output channel depends on its individual settings for the low-side switch L (GND) and the high-side switch H (VDRIVE).

- If the low-side switch L (GND) is enabled, the output is actively driven to GND.
- If the high-side switch H (VDRIVE) is enabled, the output is actively driven to VDRIVE.
- If you set low-side switch L (GND) and high-side switch H (VDRIVE), the digital output channel is actively driven to both VDRIVE and GND (push-pull mode).

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigOut ch 1 ... DigOut ch 16)	Description
0	Disabled	Disabled	High-Z	Individual output disabled
1	Disabled	Disabled	High-Z	
0	Disabled	Enabled	GND	Low-side switch
1	Disabled	Enabled	High-Z	
0	Enabled	Disabled	High-Z	High-side switch
1	Enabled	Disabled	VDRIVE	
0	Enabled	Enabled	GND	Push-pull output
1	Enabled	Enabled	VDRIVE	

Dialog settings

Setup of supply rails Lets you enable/disable the supply rails defined by the parameters L (Low) and H (High) for each single digital output channel individually.

Parameter	Meaning
L	Enables/disables the low-side switch for the selected digital output channel.
H	Enables/disables the high-side switch (VDRIVE) for the selected digital output channel.

Set all Lets you enable/disable the supply rails for all the digital output channels at once.

Related topics

References

Parameters Page (DIO1552_TP1_BIT_OUT_BLx)

Purpose

To set the initial output state and the termination output state.

Description

Initialization During the model initialization phase, the initial digital output states specified by the Initial output settings are written to all the channels of the specified digital I/O port to ensure a defined output during this simulation phase. This is especially useful if the channels are used in a triggered or enabled subsystem that is not executed right from the start of the simulation. Before initialization, the digital outputs are set to high impedance.

Termination With the block's Termination settings, you can specify the output states of all the specified channels of the specified digital I/O port on model termination to drive your external hardware into a safe final condition.

The possible termination states at the end of the simulation are:

- All the specified digital outputs are set to high impedance (high-Z) state.
- Each output holds its last output value.
- Each output is set to a definite output value.

The specified termination values of I/O channels are set when the simulation executes its termination function by setting the `simState` variable to STOP. If the real-time application is stopped by using ControlDesk's Stop RTP command, the processor resets immediately without executing termination functions. The output channels are set to high impedance state and the specified termination values are not set.

Dialog settings

Initial output value Lets you set the output value that is used for all the channels (bits) of the digital output port at the start of the simulation in the range 0 … 65535.

The specified output value is also displayed in hexadecimal and binary format.

Termination To enable or disable the setting of definite output values at the end of the simulation.

Termination Mode Checkbox	Meaning
Disabled	The digital outputs of all the channels are set to high state at the end of the simulation.
Enabled	The output behavior of all the channels is determined by the Output settings (see below) at the end of the simulation.

The termination mode checkbox is disabled by default.

Output To set all digital output channels to definite output values at the end of the simulation.

Option Button	Meaning
Last output state	Each output channel holds its last digital output value at the end of the simulation.
Value on termination	Lets you specify the output values for the channels by a decimal value in the range 0 ... 65535 (0 … 2^{16}-1). The single bits of this value correspond directly to the related channels, i.e., the LSB corresponds to the setting for channel 1 and the MSB corresponds to the setting for channel 16. The default value is 0. The decimal value is also displayed in hexadecimal and binary format.

Related topics

References

Block Description (DIO1552_TP1_BIT_OUT_BLx) 211
Electrical Interface Page (DIO1552_TP1_BIT_OUT_BLx) 213
simState (RTI and RTI-MP Implementation Reference 📖)
Stop RTP (ControlDesk Platform Management 📖)
Unit Page (DIO1552_TP1_BIT_OUT_BLx) 212

DIO1552_TP1_BIT_OUT_CH_BLx

Purpose

To provide channel-wise write access to the digital output channels of the DS1552 Multi-I/O Module.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	–	✓ 1)

1) Requires a DS1552 Multi-I/O Module.

Where to go from here

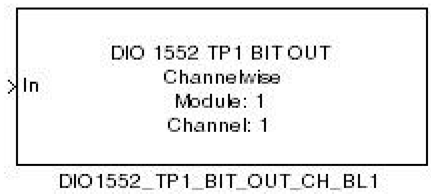
Information in this section

Information in other sections

Block Description (DIO1552_TP1_BIT_OUT_CH_BLx)

Block

Gives you information on the appearance and purpose of the block.



Purpose

To provide channel-wise write access to a single digital output channel.

Description

The block's input is a binary value.

Use the DIO1552_TP1_BIT_OUT_BLx on page 210 block to write to all the bits of the digital output channels at once.

> **Note**
>
> You cannot use blocks from the RTI FPGA Programming Blockset configured with one of the FPGA1401Tp1 frameworks and the RTI DS1552 I/O Extension Blockset in the same model.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Bit I/O Unit (DIO 1552 Type 1) (MicroAutoBox II Features 📖).

I/O characteristics

The following table shows the relationship between the block's input variable (binary representation relating to one channel) in Simulink and the digital output:

Simulink Input	Digital Output
1	High
0	Low

The following table describes the ports of the block:

Port	Description
Input	
In	To write to the output channel. Data type: Boolean Range: 0, 1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO1552_TP1_BIT_OUT_CH_BLx) on page 218)
- Electrical Interface page (refer to Electrical Interface Page (DIO1552_TP1_BIT_OUT_CH_BLx) on page 219)
- Parameters page (refer to Parameters Page (DIO1552_TP1_BIT_OUT_CH_BLx) on page 220)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- ds_1552_init
- dio_1552_tp1_init
- dio_1552_tp1_digout_init
- dio_1552_tp1_digout_mode_set
- dio_1552_tp1_digout_write

Unit Page (DIO1552_TP1_BIT_OUT_CH_BLx)

Purpose

To specify the channel you want to write to.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several FPGA Type 1 modules, RTI uses the module number to distinguish between them.

Channel number Lets you select the channel number in the range 1 … 16.

> **Note**
>
> Concurrent access to the same digital output channel by other DIO 1552 Type 1 blocks or functions is not allowed.

Related topics

References

Block Description (DIO1552_TP1_BIT_OUT_CH_BLx)........217
Electrical Interface Page (DIO1552_TP1_BIT_OUT_CH_BLx)........219
Parameters Page (DIO1552_TP1_BIT_OUT_CH_BLx)........220

Electrical Interface Page (DIO1552_TP1_BIT_OUT_CH_BLx)

Purpose

To set the high-side and low-side switches of the connected supply rails for the selected output channel.

Description

The output state of a digital output channel depends on its individual settings for the low-side switch L (GND) and the high-side switch H (VDRIVE).

- If the low-side switch L (GND) is enabled, the output is actively driven to GND.
- If the high-side switch H (VDRIVE) is enabled, the output is actively driven to VDRIVE.
- If you set low-side switch L (GND) and high-side switch H (VDRIVE), the digital output channel is actively driven to both VDRIVE and GND (push-pull mode).

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigOut ch 1 ... DigOut ch 16)	Description
0	Disabled	Disabled	High-Z	Individual output disabled
1	Disabled	Disabled	High-Z	
0	Disabled	Enabled	GND	Low-side switch
1	Disabled	Enabled	High-Z	
0	Enabled	Disabled	High-Z	High-side switch
1	Enabled	Disabled	VDRIVE	
0	Enabled	Enabled	GND	Push-pull output
1	Enabled	Enabled	VDRIVE	

Dialog settings

Channel Displays the channel number that you selected on the Unit page.

Setup of supply rails Lets you enable/disable the supply rails defined by the parameters L (Low side) and H (High side).

Parameter	Meaning
L	Enables/disables the low-side switch for the selected digital output channel.
H	Enables/disables the high-side switch (VDRIVE) for the selected digital output channel.

Related topics

References

Block Description (DIO1552_TP1_BIT_OUT_CH_BLx)........217
Parameters Page (DIO1552_TP1_BIT_OUT_CH_BLx)........220
Unit Page (DIO1552_TP1_BIT_OUT_CH_BLx)........218

Parameters Page (DIO1552_TP1_BIT_OUT_CH_BLx)

Purpose

To set the initial output state and the termination output state.

Description

Initialization During the model initialization phase, the Initial output state is written to the selected channel (bit) to ensure a defined output during this simulation phase. This is especially useful if the channel is used in a triggered or enabled subsystem that is not executed right from the start of the simulation.

Termination With the block's Termination settings, you can specify an output state of the channel on termination to drive your external hardware into a safe final condition.

The possible termination states at the end of the simulation are:

- All digital outputs are set to high impedance (high-Z) state.
- The output holds its last output value.
- The output is set to a definite output value.

The specified termination values of I/O channels are set when the simulation executes its termination function by setting the `simState` variable to STOP. If the real-time application is stopped by using ControlDesk's Stop RTP command, the processor resets immediately without executing termination functions. The output channels are set to high impedance state and the specified termination values are not set.

Dialog settings

Channel Displays the channel number that you selected on the Unit page.

Initial output state Lets you select the initial output state *Low(0)* or *High(1)* at the start of the simulation.

The default state is *Low(0)*.

Termination To enable or disable the setting of a definite output value at the end of the simulation.

Termination Mode Checkbox	Meaning
Disabled	All digital outputs are set to high impedance (high-Z) state at the end of the simulation.
Enabled	The channel's output behavior is determined by the Output settings (see below) at the end of the simulation.

The termination mode checkbox is disabled by default.

Output To set a definite output value at the end of the simulation.

Option Button	Meaning
Last output state	The channel holds its last digital output value at the end of the simulation.
State on termination	Lets you set the output value to *Low(0)* or *High(1)* at the end of the simulation.

Related topics

References

D/A Conversion

Introduction

The RTI Blockset of MicroAutoBox II (RTI1401) provides several blocks that you can use for converting digital signals to analog signals (D/A conversion). For an overview on which RTI block is appropriate for your use case, refer to D/A Conversion (MicroAutoBox II Features 📖).

Where to go from here

Information in this section

AIO_TYPE1_DAC_BLx

Purpose

To configure and perform D/A conversion using the AIO Type 1 module.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

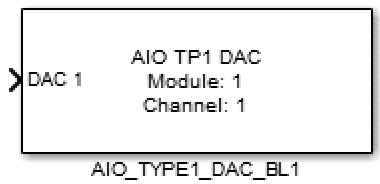
Where to go from here

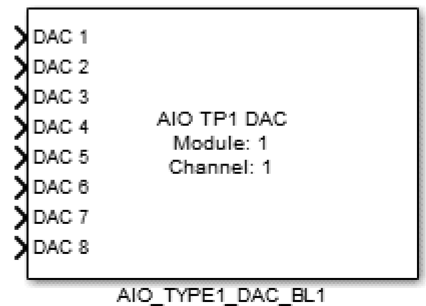
Information in this section

Block Description (AIO_TYPE1_DAC_BLx)

Block

Gives you information on the appearance and purpose of the block.





Purpose

To provide write access to the AIO Type 1 D/A converters.

Description

One AIO_TYPE1_DAC_BLx block controls up to 8 D/A converters. The D/A converters of one block are synchronously updated.

I/O mapping

For information on the mapping of converter and channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to AIO Unit Type 1 (DAC) (MicroAutoBox II Features 📖).

I/O characteristics

This table shows the scaling between the input of the block and the analog output voltage:

Simulink Input	Output Voltage Range
-1.0 … +1.0	-10.0 … +10.0 V

The following table describes the ports of the block:

Port	Description
Input	
DAC 1 … DAC 8	Writes the analog value to the D/A channel. Data type: Double

Initialization and termination

- During the model initialization phase, an initial output voltage value is written to each D/A channel. This is especially useful if a channel is used in a triggered or enabled subsystem that is not executed right from the start of the simulation.

- With the initialization value, the D/A channel has a defined output during this simulation phase.
- When the simulation terminates, the D/A channel holds the last output value by default. Using the parameters Termination mode and Value on termination, you can specify a user-defined output value on termination and use these settings to drive your external hardware into a safe final condition.

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (AIO_TYPE1_DAC_BLx) on page 226)
- Initialization page (refer to Initialization Page (AIO_TYPE1_DAC_BLx) on page 227)
- Termination page (refer to Termination Page (AIO_TYPE1_DAC_BLx) on page 227)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- aio_tp1_init
- aio_tp1_dac_init
- aio_tp1_dac_channel_control
- aio_tp1_dac_buffer_write
- aio_tp1_dac_buffer_release

Unit Page (AIO_TYPE1_DAC_BLx)

Purpose

To provide access to one or more D/A converters by referencing the related module and channel.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features).

Channel number Lets you select a channel number in the range 1 … 8.

If you want to access more than one D/A channel, this is the number of the first D/A channel.

Number of channels Lets you select the number of channels in the range 1 … 8.

The possible range depends on the specified first D/A channel via Channel number.

```
NumberOfChannels <= 8 - (ChannelNumber - 1)
```

Related topics

References

Initialization Page (AIO_TYPE1_DAC_BLx)

Purpose

To specify the initial values of the enabled D/A channels.

Dialog settings

Channel Displays the number of the first D/A channel specified on the Unit page.

Initial value Lets you specify the initial output voltage at the start of the simulation for each of the enabled D/A channels. The value must remain in the output voltage range of -10.0 V … +10.0 V.

Related topics

References

Termination Page (AIO_TYPE1_DAC_BLx)

Purpose

To specify the termination values of the enabled D/A channels.

Dialog settings

Channel Displays the number of the first D/A channel specified on the Unit page.

Termination mode Lets you set the output to the value specified by the termination value or keep the current output voltage when the simulation terminates. You can set the termination mode separately for each of the enabled D/A channels.

Value on termination Lets you select the output voltage at the end of the simulation. The value must remain in the output voltage range of -10.0 V … +10.0 V. This setting is enabled only, if the Termination mode option is set.

Related topics

References

DAC_TYPE3_Mx_Cy

Purpose

To configure and perform D/A conversion using the DAC Type 3 module.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

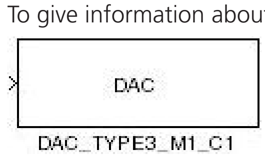
Where to go from here

Information in this section

Block Description (DAC_TYPE3_Mx_Cy)

Block

To give information about the appearance and purpose of the block.



Purpose

To write to one of 4 D/A channels.

I/O mapping

For information on the mapping of converter and channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to DAC Unit Type 3 (MicroAutoBox II Features 📖).

I/O characteristics

This table shows the scaling between the input of the block and the analog output voltage:

Simulink Input	Output Voltage Range
0 ... +1	0 ... +4.5 V

The following table describes the ports of the block:

Port	Description
Input	
	Writes the analog value to the A/D channel. Data type: Double

The block provides its outputs in unlatched mode, which means that the channel is converted and output immediately.

Initialization and termination

- During the model initialization phase, an initial output voltage value is written to each D/A channel. This is especially useful if a channel is used in a triggered or enabled subsystem that is not executed right from the start of the simulation.
- With the initialization value, the D/A channel has a defined output during this simulation phase.
- When the simulation terminates, the D/A channel holds the last output value by default. Using the parameters Termination state and Termination value, you can specify a user-defined output value on termination and use these settings to drive your external hardware into a safe final condition.

Dialog pages

The dialog settings can be specified on the following pages:

- Parameters page (refer to Parameters Page (DAC_TYPE3_Mx_Cy) on page 231)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dac_tp3_init
- dac_tp3_write

Parameters Page (DAC_TYPE3_Mx_Cy)

Purpose

To specify the parameters for D/A conversion.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features).

Channel Number Lets you select a single channel in the range 1 … 4.

Initialization value Lets you select the initial output voltage at the start of the simulation. The value must remain in the output voltage range of 0 V … +4.5 V.

Termination state Lets you set the output to the value specified by the Termination value or keep the current output voltage when the simulation terminates.

Termination value Lets you select the output voltage at the end of the simulation. The value must remain in the output voltage range of 0 V … +4.5 V.

Related topics

References

Block Description (DAC_TYPE3_Mx_Cy)..229

DAC1552_TP1_BLx

Purpose

To configure and perform D/A conversion using the DAC 1552 Type 1 unit of the DS1552 Multi-I/O Module.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	–	✓[1]

[1] Requires a DS1552 Multi-I/O Module.

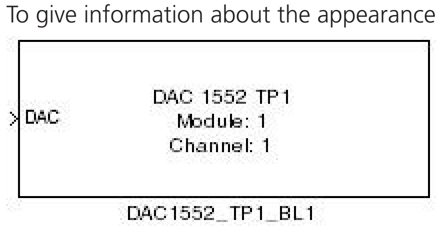
Where to go from here

Information in this section

Block Description (DAC1552_TP1_BLx)

Block

To give information about the appearance and purpose of the block.



Purpose

To provide write access to one of the DAC 1552 Type 1 converters.

Description

One DAC1552_TP1_BLx block controls one D/A converter.

I/O mapping

For information on the mapping of converter and channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to DAC 1552 Type 1 Unit (MicroAutoBox II Features 🕮).

I/O characteristics

This table shows the scaling between the input of the block and the analog output voltage:

Simulink Input	Output Voltage Range
0.0 … +1.0	0.0 … +5.0 V

The following table describes the ports of the block:

Port	Description
Input	
DAC	Writes the analog value to the D/A channel. Data type: Double

The block provides its outputs in unlatched mode, which means that the channel is converted and output immediately.

Initialization and termination

- During the model initialization phase, an initial output voltage value is written to each D/A channel. This is especially useful if a channel is used in a triggered or enabled subsystem that is not executed right from the start of the simulation.
- With the initialization value, the D/A channel has a defined output during this simulation phase.
- When the simulation terminates, the D/A channel holds the last output value by default. Using the parameters Termination mode and Value on termination, you can specify a user-defined output value on termination and use these settings to drive your external hardware into a safe final condition.

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DAC1552_TP1_BLx) on page 234)
- Parameters page (refer to Parameters Page (DAC1552_TP1_BLx) on page 234)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- ds_1552_init
- dac_1552_tp1_init
- dac_1552_tp1_channel_control
- dac_1552_tp1_immediate_write

Unit Page (DAC1552_TP1_BLx)

Purpose

To provide access to a D/A converter by referencing the related module and channel.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several FPGA Type 1 modules, RTI uses the module number to distinguish between them.

Channel number Lets you select a channel number in the range 1 … 4.

Related topics

References

Block Description (DAC1552_TP1_BLx)........232
Parameters Page (DAC1552_TP1_BLx)........234

Parameters Page (DAC1552_TP1_BLx)

Purpose

To specify the parameters for D/A conversion.

Dialog settings

Channel number Displays the channel number specified in the **Unit** page.

Initial value Lets you select the initial output voltage at the start of the simulation. The value must remain in the output voltage range of 0 V … +5.0 V.

Termination mode Lets you set the output to the value specified by the termination value or keep the current output voltage when the simulation terminates.

Value on termination Lets you select the output voltage at the end of the simulation. The value must remain in the output voltage range of 0 V … +5.0 V. This setting is enabled only, if the **Termination mode** option is set.

Related topics

References

Timing I/O

Introduction

The RTI Blockset of MicroAutoBox II (RTI1401) provides several blocks that you can use for generating and measuring PWM signals. The expression *PWM signals* means pulse width modulated square-wave signals. For an overview on which RTI block is appropriate for your use case, refer to the timing I/O feature descriptions in MicroAutoBox II Features 🕮 .

Where to go from here

Information in this section

PWM Signal Generation with a Variable Period

Purpose

To generate single PWM signals whose period and duty cycle are adjustable at run-time (PWM resp. PWM_VP).

Where to go from here

Information in this section

DIO_TYPE3_PWM_BLx

Purpose

To generate a PWM signal with the period and duty cycle adjustable during run time.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

Where to go from here

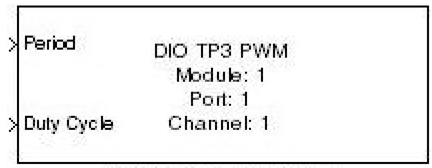
Information in this section

Information in other sections

Block Description (DIO_TYPE3_PWM_BLx)

Block

Gives you information about the appearance and purpose of the block.



DIO_TYPE3_PWM_BL1

Purpose

To generate a PWM signal with the period and duty cycle adjustable during run time.

Description

The block's Simulink inputs Period and Duty cycle can be changed during run time. If the input value for the period is outside the selected period range, a higher value is saturated to the maximum period value and a smaller value is saturated to the minimum period value.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to PWM Generation (PWM) on the DIO Type 3 Unit (MicroAutoBox II Features).

I/O characteristics

The following table shows the scaling between the duty cycle and the block's Simulink input:

Simulink Input	Duty Cycle
0 … 1	0 … 100%

The following table describes the ports of the block:

Port	Description
Input	
Period	Specifies the period of the PWM signal. Data type: Double Range: Depends on the specified period range (see Generation Page (DIO_TYPE3_PWM_BLx) on page 243) Unit: Seconds [sec]
Duty cycle	Specifies the duty cycle of the PWM signal. Data type: Double Range: 0 … 1

Dialog pages

The dialog settings can be specified on the following pages:
- Unit page (refer to Unit Page (DIO_TYPE3_PWM_BLx) on page 241)
- Electrical Interface page (refer to Electrical Interface Page (DIO_TYPE3_PWM_BLx) on page 242)
- Generation page (refer to Generation Page (DIO_TYPE3_PWM_BLx) on page 243)
- Parameters page (refer to Parameters Page (DIO_TYPE3_PWM_BLx) on page 244)
- Interrupt page (refer to Interrupt Page (DIO_TYPE3_PWM_BLx) on page 246)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.
- dio_tp3_init
- dio_tp3_pwm_init
- dio_tp3_pwm_update
- dio_tp3_multi_source_int_mode_set

Unit Page (DIO_TYPE3_PWM_BLx)

Purpose

To specify the channel for PWM signal generation.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 🕮).

Port number Lets you select the port number in the range 1 … 3.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1, 2	1 … 16
3	1 … 8

Note

Concurrent access to the same digital output channel(s) by other DIO Type 3 blocks or functions is not allowed.

Related topics

References

Electrical Interface Page (DIO_TYPE3_PWM_BLx)

Purpose

To set the high-side and low-side switches of the connected supply rails for the selected output channel.

Description

The output state of a digital output channel depends on its individual settings for the low-side switch L (GND) and the high-side switch H (VDRIVE).

- If the low-side switch L (GND) is enabled, the output is actively driven to GND.
- If the high-side switch H (VDRIVE) is enabled, the output is actively driven to VDRIVE.
- If you set low-side switch L (GND) and high-side switch H (VDRIVE), the digital output channel is actively driven to both VDRIVE and GND (push-pull mode).

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigP1 ch 1 ... DigP3 ch 8)	Description
0	Disabled	Disabled	High-Z	Individual output disabled
1	Disabled	Disabled	High-Z	
0	Disabled	Enabled	GND	Low-side switch
1	Disabled	Enabled	High-Z	
0	Enabled	Disabled	High-Z	High-side switch
1	Enabled	Disabled	VDRIVE	
0	Enabled	Enabled	GND	Push-pull output
1	Enabled	Enabled	VDRIVE	

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Setup of supply rails Lets you enable/disable the supply rails defined by the parameters L (Low side) and H (High side).

Parameter	Meaning
L	Enables/disables the low-side switch for the selected digital output channel.
H	Enables/disables the high-side switch (VDRIVE) for the selected digital output channel.

Related topics

References

Generation Page (DIO_TYPE3_PWM_BLx)

Purpose

To specify the PWM update mode and the PWM period range.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Update mode Lets you select the PWM update mode for the new values of the period and/or the duty cycle:

Mode	Description
Asynchronous	New values for T_{high} and T_{low} are updated immediately. This can result in period and/or duty cycle values that differ from the old *and* the new values for one period.
Synchronous	New values for T_{high} and T_{low} are updated at the next rising edge of the PWM output signal. The output period is constant if $T = T_{high} + T_{low}$ is constant.

For further information on the update mode, refer to PWM Generation (PWM) on the DIO Type 3 Unit (MicroAutoBox II Features 📖).

Range of period Lets you select one of the 16 predefined period ranges for the PWM signal to be generated.

Note

The resolution of the period to be generated depends on the selected period range.
Due to quantization effects, you might encounter considerable deviations between the desired PWM period and the generated PWM period, especially for higher PWM frequencies. To avoid poor frequency resolution, you should therefore select the period range with the best possible resolution (resolution values as small as possible).

Range of frequency Displays the corresponding frequency range.

Resolution of period Displays the resolution for the selected period range.

For further information on the ranges and resolutions, refer to PWM Generation (PWM) on the DIO Type 3 Unit (MicroAutoBox II Features 📖).

Related topics

References

Parameters Page (DIO_TYPE3_PWM_BLx)

Purpose

To specify the initial output behavior and the termination output behavior.

Description

Initialization During the model initialization phase, the PWM output signal is generated with either an initial period or set to constant low or high potential. With Initial period and Initial duty cycle, the channel has a defined output during this simulation phase. This is especially useful if the channels are used in a triggered or enabled subsystem that is not executed right from the start of the simulation. Before initialization, the digital outputs are set to high impedance.

Termination With the block's Termination settings, you can specify an output behavior of the channel on model termination to drive your external hardware into a safe final condition.

The possible output behaviors at the end of the simulation are:

- The output is set to high impedance (high-Z) state.
- The output holds the last duty cycle and period.
- The output is set to a definite duty cycle and period.

The specified termination values of I/O channels are set when the simulation executes its termination function by setting the `simState` variable to STOP. If the real-time application is stopped by using ControlDesk's **Stop RTP** command, the processor resets immediately without executing termination functions. The output channels are set to high impedance state and the specified termination values are not set.

Dialog settings

Port Displays the port number that you selected on the **Unit** page.

Channel Displays the channel number that you selected on the **Unit** page.

Initial duty cycle Lets you enter the duty cycle at the start of the simulation in the range 0 … 1. The duty cycle values 0 and 1 yield a constant low and constant high output signal respectively.

Range Displays the selected period range and the corresponding frequency range.

Resolution Displays the resolution for the selected period.

Initial period Lets you enter the period at the start of the simulation. The value must be specified in seconds and should remain in the stated period range.

Termination To enable or disable the setting of a definite output behavior at the end of simulation.

Termination Mode Checkbox	Meaning
Disabled	The output channel is set to high impedance (high-Z) state at the end of simulation.
Enabled	The channel's output behavior is determined by the **Output** settings (see below) at the end of simulation.

The termination mode checkbox is disabled by default.

If the **Termination mode** is enabled, this setting lets you specify a definite frequency at the end of simulation.

Option Button	Meaning
Last output values	Each output channel holds the last duty cycle and period at the end of simulation.
Specific output values	Lets you set a definite duty cycle and period at the end of simulation.

Duty cycle on termination Lets you set the duty cycle at the end of the simulation in the range 0 … 1. The duty cycle values 0 and 1 yield a constant low and constant high output signal respectively.

Period on termination Lets you set the period at the end of the simulation. The value must be specified in seconds and should remain in the stated period range.

Related topics

References

Interrupt Page (DIO_TYPE3_PWM_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related DIO_TYPE3_HWINT_BLx block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 📖).

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the Edge type setting.

If interrupt generation is enabled, the model has to contain a related DIO_TYPE3_HWINT_BLx block.

If interrupt generation is disabled, the model must not contain a related DIO_TYPE3_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Note

If you enabled interrupt generation for output channels, you have to consider that interrupts might be generated because of the output state changes during initialization and termination.

Related topics

References

DIO_TYPE3_FREQ_BLx

Purpose

To generate a square-wave signal with the frequency adjustable during run time.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

Where to go from here

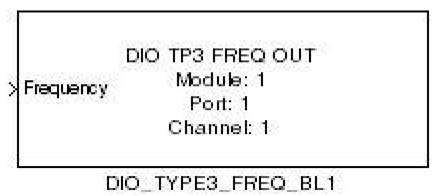
Information in this section

Information in other sections

Block Description (DIO_TYPE3_FREQ_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To generate a square-wave signal with the frequency adjustable during run time.

Description

The block's Simulink input **Frequency** can be changed during run time. If the input value for the frequency is outside the selected frequency range, a higher value is saturated to the maximum frequency value and a smaller value is set to the output specified by the **Set output channel** setting.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Square-Wave Signal Generation (FREQ) on the DIO Type 3 Unit (MicroAutoBox II Features).

I/O characteristics

The following table describes the ports of the block:

Port	Description
Input	
Frequency	To specify the frequency to be updated with the next period. Data type: Double Range: Depends on the selected frequency range (see Square-Wave Signal Generation (FREQ) on the DIO Type 3 Unit (MicroAutoBox II Features 📖))

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE3_FREQ_BLx) on page 249)
- Electrical Interface page (refer to Electrical Interface Page (DIO_TYPE3_FREQ_BLx) on page 250)
- Generation page (refer to Generation Page (DIO_TYPE3_FREQ_BLx) on page 251)
- Parameters page (refer to Parameters Page (DIO_TYPE3_FREQ_BLx) on page 252)
- Interrupt page (refer to Interrupt Page (DIO_TYPE3_FREQ_BLx) on page 254)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- dio_tp3_init
- dio_tp3_freq_init
- dio_tp3_freq_update
- dio_tp3_multi_source_int_mode_set

Unit Page (DIO_TYPE3_FREQ_BLx)

Purpose

To specify the channel on which the frequency is to be updated.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 📖).

Port number Lets you select the port number in the range 1 … 3.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1, 2	1 … 16
3	1 … 8

Note

Concurrent access to the same digital output channel(s) by other DIO Type 3 blocks or functions is not allowed.

Related topics

References

Electrical Interface Page (DIO_TYPE3_FREQ_BLx)

Purpose

To set the high-side and low-side switches of the connected supply rails for the selected output channel.

Description

The output state of a digital output channel depends on its individual settings for the low-side switch L (GND) and the high-side switch H (VDRIVE).

- If the low-side switch L (GND) is enabled, the output is actively driven to GND.
- If the high-side switch H (VDRIVE) is enabled, the output is actively driven to VDRIVE.
- If you set low-side switch L (GND) and high-side switch H (VDRIVE), the digital output channel is actively driven to both VDRIVE and GND (push-pull mode).

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigP1 ch 1 ... DigP3 ch 8)	Description
0 1	Disabled Disabled	Disabled Disabled	High-Z High-Z	Individual output disabled
0 1	Disabled Disabled	Enabled Enabled	GND High-Z	Low-side switch
0 1	Enabled Enabled	Disabled Disabled	High-Z VDRIVE	High-side switch
0 1	Enabled Enabled	Enabled Enabled	GND VDRIVE	Push-pull output

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Setup of supply rails Lets you enable/disable the supply rails defined by the parameters L (Low side) and H (High side).

Parameter	Meaning
L	Enables/disables the low-side switch for the selected digital output channel.
H	Enables/disables the high-side switch (VDRIVE) for the selected digital output channel.

Related topics

References

Block Description (DIO_TYPE3_FREQ_BLx)......248
Generation Page (DIO_TYPE3_FREQ_BLx)......251
Interrupt Page (DIO_TYPE3_FREQ_BLx)......254
Parameters Page (DIO_TYPE3_FREQ_BLx)......252
Unit Page (DIO_TYPE3_FREQ_BLx)......249

Generation Page (DIO_TYPE3_FREQ_BLx)

Purpose

To specify the frequency range and the zero frequency mode.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Range of frequency Lets you select one of 16 predefined frequency ranges.

Note

The resolution of the square-wave signal to be generated depends on the selected frequency range.
To get the best signal resolution, you should select the frequency range with the best possible resolution (the frequency range with the lowest possible range number). For example, if your desired frequency is 100 Hz, you should use frequency range 1 (9.54 Hz … 150 kHz) rather than frequency range 2 (4.77 Hz … 150 kHz). For details, refer to Square-Wave Signal Generation (FREQ) on the DIO Type 3 Unit (MicroAutoBox II Features).

Resolution of frequency Displays the frequency resolution for the selected frequency range.

Set output channel Lets you select the Zero frequency mode (the behavior of the output channel if the frequency falls below the lower limit of the frequency range). The following settings are available:

Output Level	Meaning
Low	The output is set to low (default).
High	The output is set to high.
Hold	The output holds its last signal level (low or high).

Related topics

References

Parameters Page (DIO_TYPE3_FREQ_BLx)

Purpose

To set the initial output behavior and the termination output behavior.

Description

Initialization During the model initialization phase, the output signal is either generated with an initial frequency or zero. This is especially useful if a channel is used in a triggered or enabled subsystem that is not executed right from the start

of the simulation. With Initial frequency, the channel has a defined output during this simulation phase.

Termination With the block's Termination settings, you can specify an output behavior of the channel of the specified digital I/O port on termination to drive your external hardware into a safe final condition.

The possible output behaviors at the end of the simulation are:

- The output is set to high impedance (high-Z) state.
- The output holds the last frequency.
- The output is set to a definite frequency.

The specified termination values of I/O channels are set when the simulation executes its termination function by setting the `simState` variable to STOP. If the real-time application is stopped by using ControlDesk's Stop RTP command, the processor resets immediately without executing termination functions. The output channels are set to high impedance state and the specified termination values are not set.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Initial frequency Lets you enter the initial frequency at the start of the simulation.

The frequency should remain in the stated frequency range. Otherwise, it is saturated to f_{max} or set to 0 Hz.

Termination To enable or disable the setting of a definite output behavior at the end of simulation.

Termination Mode Checkbox	Meaning
Disabled	The output channel is set to high impedance (high-Z) state at the end of simulation.
Enabled	The channel's output behavior is determined by the Frequency on termination setting (see below) at the end of simulation.

The termination mode checkbox is disabled by default.

Frequency on termination If the Termination mode is enabled, this setting lets you specify a definite frequency at the end of simulation.

Option Button	Meaning
Last output value	Each output channel holds the last frequency at the end of simulation.
Specific output value	Lets you set a definite frequency at the end of simulation.

Related topics

References

Block Description (DIO_TYPE3_FREQ_BLx)........248
Electrical Interface Page (DIO_TYPE3_FREQ_BLx)........250

Interrupt Page (DIO_TYPE3_FREQ_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related **DIO_TYPE3_HWINT_BLx** block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 📖).

Dialog settings

Port Displays the port number that you selected on the **Unit** page.

Channel Displays the channel number that you selected on the **Unit** page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the **Edge type** setting.
If interrupt generation is enabled, the model has to contain a related DIO_TYPE3_HWINT_BLx block.
If interrupt generation is disabled, the model must not contain a related DIO_TYPE3_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Note

If you enabled interrupt generation for output channels, you have to consider that interrupts might be generated because of the output state changes during initialization and termination.

Related topics

References

DIO_TYPE4_PWM_BLx

Purpose

To generate a PWM signal with the period and duty cycle adjustable during run time.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

Where to go from here

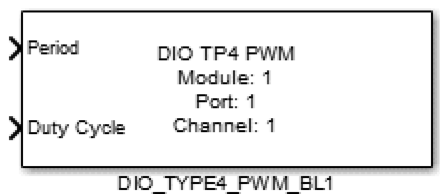
Information in this section

Information in other sections

Block Description (DIO_TYPE4_PWM_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To generate a PWM signal with the period and duty cycle adjustable during run time.

Description

The block's Simulink inputs Period and Duty cycle can be changed during run time. If the input value for the period is outside the selected period range, a higher value is saturated to the maximum period value and a smaller value is saturated to the minimum period value.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to PWM Generation (PWM) on the DIO Type 4 Unit (MicroAutoBox II Features 📖).

I/O characteristics

The following table shows the scaling between the duty cycle and the block's Simulink input:

Simulink Input	Duty Cycle
0 … 1	0 … 100%

The following table describes the ports of the block:

Port	Description
Input	
Period	Specifies the period of the PWM signal. Data type: Double Range: Depends on the specified period range (see Generation Page (DIO_TYPE4_PWM_BLx) on page 259) Unit: Seconds [sec]
Duty cycle	Specifies the duty cycle of the PWM signal. Data type: Double Range: 0 … 1

Dialog pages

The dialog settings can be specified on the following pages:
- Unit page (refer to Unit Page (DIO_TYPE4_PWM_BLx) on page 257)
- Electrical Interface page (refer to Electrical Interface Page (DIO_TYPE4_PWM_BLx) on page 258)
- Generation page (refer to Generation Page (DIO_TYPE4_PWM_BLx) on page 259)
- Parameters page (refer to Parameters Page (DIO_TYPE4_PWM_BLx) on page 260)
- Interrupt page (refer to Interrupt Page (DIO_TYPE4_PWM_BLx) on page 262)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.
- dio_tp4_init
- dio_tp4_pwm_init
- dio_tp4_pwm_update
- dio_tp4_multi_source_int_mode_set

Unit Page (DIO_TYPE4_PWM_BLx)

Purpose

To specify the channel for PWM signal generation.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 📖).

Port number Lets you select the port number in the range 1 … 2.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1	1 … 16
2	1 … 8

Note

Concurrent access to the same digital output channel(s) by other DIO Type 4 blocks or functions is not allowed.

Related topics

References

Electrical Interface Page (DIO_TYPE4_PWM_BLx)

Purpose

To set the high-side and low-side switches of the connected supply rails for the selected output channel.

Description

The output state of a digital output channel depends on its individual settings for the low-side switch L (GND) and the high-side switch H (VDRIVE).

- If the low-side switch L (GND) is enabled, the output is actively driven to GND.
- If the high-side switch H (VDRIVE) is enabled, the output is actively driven to VDRIVE.
- If you set low-side switch L (GND) and high-side switch H (VDRIVE), the digital output channel is actively driven to both VDRIVE and GND (push-pull mode).

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigP1 ch 1 ... DigP2 ch 8)	Description
0	Disabled	Disabled	High-Z	Individual output disabled
1	Disabled	Disabled	High-Z	
0	Disabled	Enabled	GND	Low-side switch
1	Disabled	Enabled	High-Z	
0	Enabled	Disabled	High-Z	High-side switch
1	Enabled	Disabled	VDRIVE	
0	Enabled	Enabled	GND	Push-pull output
1	Enabled	Enabled	VDRIVE	

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Setup of supply rails Lets you enable/disable the supply rails defined by the parameters L (Low side) and H (High side).

Parameter	Meaning
L	Enables/disables the low-side switch for the selected digital output channel.
H	Enables/disables the high-side switch (VDRIVE) for the selected digital output channel.

Related topics

References

Block Description (DIO_TYPE4_PWM_BLx)....256
Generation Page (DIO_TYPE4_PWM_BLx)....259
Interrupt Page (DIO_TYPE4_PWM_BLx)....262
Parameters Page (DIO_TYPE4_PWM_BLx)....260
Unit Page (DIO_TYPE4_PWM_BLx)....257

Generation Page (DIO_TYPE4_PWM_BLx)

Purpose

To specify the PWM update mode and the PWM period range.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Update mode Lets you select the PWM update mode for the new values of the period and/or the duty cycle:

Mode	Description
Asynchronous	New values for T_{high} and T_{low} are updated immediately. This can result in period and/or duty cycle values that differ from the old *and* the new values for one period.
Synchronous	New values for T_{high} and T_{low} are updated at the next rising edge of the PWM output signal. The output period is constant if $T = T_{high} + T_{low}$ is constant.

For further information on the update mode, refer to PWM Generation (PWM) on the DIO Type 4 Unit (MicroAutoBox II Features 📖).

Range of period Lets you select one of the 16 predefined period ranges for the PWM signal to be generated.

> **Note**
>
> The resolution of the period to be generated depends on the selected period range.
> Due to quantization effects, you might encounter considerable deviations between the desired PWM period and the generated PWM period, especially for higher PWM frequencies. To avoid poor frequency resolution, you should therefore select the period range with the best possible resolution (resolution values as small as possible).

Range of frequency Displays the corresponding frequency range.

Resolution of period Displays the resolution for the selected period range.

For further information on the ranges and resolutions, refer to PWM Generation (PWM) on the DIO Type 4 Unit (MicroAutoBox II Features 📖).

Related topics

References

Parameters Page (DIO_TYPE4_PWM_BLx)

Purpose To specify the initial output behavior and the termination output behavior.

Description

Initialization During the model initialization phase, the PWM output signal is generated with either an initial period or set to constant low or high potential. With Initial period and Initial duty cycle, the channel has a defined output during this simulation phase. This is especially useful if the channels are used in a triggered or enabled subsystem that is not executed right from the start of the simulation. Before initialization, the digital outputs are set to high impedance.

Termination With the block's Termination settings, you can specify an output behavior of the channel on model termination to drive your external hardware into a safe final condition.

The possible output behaviors at the end of the simulation are:

- The output is set to high impedance (high-Z) state.
- The output holds the last duty cycle and period.
- The output is set to a definite duty cycle and period.

The specified termination values of I/O channels are set when the simulation executes its termination function by setting the `simState` variable to STOP. If the real-time application is stopped by using ControlDesk's Stop RTP command, the processor resets immediately without executing termination functions. The output channels are set to high impedance state and the specified termination values are not set.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Initial duty cycle Lets you enter the duty cycle at the start of the simulation in the range 0 … 1. The duty cycle values 0 and 1 yield a constant low and constant high output signal respectively.

Range Displays the selected period range and the corresponding frequency range.

Resolution Displays the resolution for the selected period.

Initial period Lets you enter the period at the start of the simulation. The value must be specified in seconds and should remain in the stated period range.

Termination To enable or disable the setting of a definite output behavior at the end of simulation.

Termination Mode Checkbox	Meaning
Disabled	The output channel is set to high impedance (high-Z) state at the end of simulation.
Enabled	The channel's output behavior is determined by the Output settings (see below) at the end of simulation.

The termination mode checkbox is disabled by default.

If the **Termination mode** is enabled, this setting lets you specify a definite frequency at the end of simulation.

Option Button	Meaning
Last output values	Each output channel holds the last duty cycle and period at the end of simulation.
Specific output values	Lets you set a definite duty cycle and period at the end of simulation.

Duty cycle on termination Lets you set the duty cycle at the end of the simulation in the range 0 … 1. The duty cycle values 0 and 1 yield a constant low and constant high output signal respectively.

Period on termination Lets you set the period at the end of the simulation. The value must be specified in seconds and should remain in the stated period range.

Related topics

References

Interrupt Page (DIO_TYPE4_PWM_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related DIO_TYPE4_HWINT_BLx on page 61 block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 🕮).

Dialog settings

Port Displays the port number that you selected on the **Unit** page.

Channel Displays the channel number that you selected on the **Unit** page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the **Edge type** setting.

If interrupt generation is enabled, the model has to contain a related DIO_TYPE4_HWINT_BLx block.

If interrupt generation is disabled, the model must not contain a related DIO_TYPE4_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Note

If you enabled interrupt generation for output channels, you have to consider that interrupts might be generated because of the output state changes during initialization and termination.

Related topics

References

Block Description (DIO_TYPE4_PWM_BLx)........256
Electrical Interface Page (DIO_TYPE4_PWM_BLx)........258
Generation Page (DIO_TYPE4_PWM_BLx)........259
Parameters Page (DIO_TYPE4_PWM_BLx)........260
Unit Page (DIO_TYPE4_PWM_BLx)........257

DIO_TYPE4_FREQ_BLx

Purpose

To generate a square-wave signal with the frequency adjustable during run time.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

Where to go from here

Information in this section

Information in other sections

Block Description (DIO_TYPE4_FREQ_BLx)

Block

Gives you information about the appearance and purpose of the block.

Purpose

To generate a square-wave signal with the frequency adjustable during run time.

Description

The block's Simulink input Frequency can be changed during run time. If the input value for the frequency is outside the selected frequency range, a higher value is saturated to the maximum frequency value and a smaller value is set to the output specified by the Set output channel setting.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Square-Wave Signal Generation (FREQ) on the DIO Type 4 Unit (MicroAutoBox II Features 📖).

I/O characteristics

The following table describes the ports of the block:

Port	Description
Input	
Frequency	To specify the frequency to be updated with the next period. Data type: Double Range: Depends on the selected frequency range (see Square-Wave Signal Generation (FREQ) on the DIO Type 4 Unit (MicroAutoBox II Features 📖))

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE4_FREQ_BLx) on page 265)
- Electrical Interface page (refer to Electrical Interface Page (DIO_TYPE4_FREQ_BLx) on page 266)
- Generation page (refer to Generation Page (DIO_TYPE4_FREQ_BLx) on page 267)
- Parameters page (refer to Parameters Page (DIO_TYPE4_FREQ_BLx) on page 268)
- Interrupt page (refer to Interrupt Page (DIO_TYPE4_FREQ_BLx) on page 270)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- dio_tp4_init
- dio_tp4_freq_init
- dio_tp4_freq_update
- dio_tp4_multi_source_int_mode_set

Unit Page (DIO_TYPE4_FREQ_BLx)

Purpose

To specify the channel on which the frequency is to be updated.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 🕮).

Port number Lets you select the port number in the range 1 … 2.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1	1 … 16
2	1 … 8

Note

Concurrent access to the same digital output channel(s) by other DIO Type 4 blocks or functions is not allowed.

Related topics

References

Electrical Interface Page (DIO_TYPE4_FREQ_BLx)

Purpose

To set the high-side and low-side switches of the connected supply rails for the selected output channel.

Description

The output state of a digital output channel depends on its individual settings for the low-side switch L (GND) and the high-side switch H (VDRIVE).

- If the low-side switch L (GND) is enabled, the output is actively driven to GND.
- If the high-side switch H (VDRIVE) is enabled, the output is actively driven to VDRIVE.
- If you set low-side switch L (GND) and high-side switch H (VDRIVE), the digital output channel is actively driven to both VDRIVE and GND (push-pull mode).

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigP1 ch 1 ... DigP2 ch 8)	Description
0 1	Disabled Disabled	Disabled Disabled	High-Z High-Z	Individual output disabled
0 1	Disabled Disabled	Enabled Enabled	GND High-Z	Low-side switch
0 1	Enabled Enabled	Disabled Disabled	High-Z VDRIVE	High-side switch
0 1	Enabled Enabled	Enabled Enabled	GND VDRIVE	Push-pull output

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Setup of supply rails Lets you enable/disable the supply rails defined by the parameters L (Low side) and H (High side).

Parameter	Meaning
L	Enables/disables the low-side switch for the selected digital output channel.
H	Enables/disables the high-side switch (VDRIVE) for the selected digital output channel.

Related topics

References

Block Description (DIO_TYPE4_FREQ_BLx)......264
Generation Page (DIO_TYPE4_FREQ_BLx)......267
Interrupt Page (DIO_TYPE4_FREQ_BLx)......270
Parameters Page (DIO_TYPE4_FREQ_BLx)......268
Unit Page (DIO_TYPE4_FREQ_BLx)......265

Generation Page (DIO_TYPE4_FREQ_BLx)

Purpose

To specify the frequency range and the zero frequency mode.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Range of frequency Lets you select one of 16 predefined frequency ranges.

> **Note**
>
> The resolution of the square-wave signal to be generated depends on the selected frequency range.
> To get the best signal resolution, you should select the frequency range with the best possible resolution (the frequency range with the lowest possible range number). For example, if your desired frequency is 100 Hz, you should use frequency range 1 (9.54 Hz … 150 kHz) rather than frequency range 2 (4.77 Hz … 150 kHz). For details, refer to Square-Wave Signal Generation (FREQ) on the DIO Type 4 Unit (MicroAutoBox II Features 📖).

Resolution of frequency Displays the frequency resolution for the selected frequency range.

Set output channel Lets you select the Zero frequency mode (the behavior of the output channel if the frequency falls below the lower limit of the frequency range). The following settings are available:

Output Level	Meaning
Low	The output is set to low (default).
High	The output is set to high.
Hold	The output holds its last signal level (low or high).

Related topics

References

Parameters Page (DIO_TYPE4_FREQ_BLx)

Purpose

To set the initial output behavior and the termination output behavior.

Description

Initialization During the model initialization phase, the output signal is either generated with an initial frequency or zero. This is especially useful if a channel is used in a triggered or enabled subsystem that is not executed right from the start

of the simulation. With Initial frequency, the channel has a defined output during this simulation phase.

Termination With the block's Termination settings, you can specify an output behavior of the channel of the specified digital I/O port on termination to drive your external hardware into a safe final condition.

The possible output behaviors at the end of the simulation are:

- The output is set to high impedance (high-Z) state.
- The output holds the last frequency.
- The output is set to a definite frequency.

The specified termination values of I/O channels are set when the simulation executes its termination function by setting the `simState` variable to STOP. If the real-time application is stopped by using ControlDesk's Stop RTP command, the processor resets immediately without executing termination functions. The output channels are set to high impedance state and the specified termination values are not set.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Initial frequency Lets you enter the initial frequency at the start of the simulation.

The frequency should remain in the stated frequency range. Otherwise, it is saturated to f_{max} or set to 0 Hz.

Termination To enable or disable the setting of a definite output behavior at the end of simulation.

Termination Mode Checkbox	Meaning
Disabled	The output channel is set to high impedance (high-Z) state at the end of simulation.
Enabled	The channel's output behavior is determined by the Frequency on termination setting (see below) at the end of simulation.

The termination mode checkbox is disabled by default.

Frequency on termination If the Termination mode is enabled, this setting lets you specify a definite frequency at the end of simulation.

Option Button	Meaning
Last output value	Each output channel holds the last frequency at the end of simulation.
Specific output value	Lets you set a definite frequency at the end of simulation.

Related topics

References

Block Description (DIO_TYPE4_FREQ_BLx)........264
Electrical Interface Page (DIO_TYPE4_FREQ_BLx)........266

Interrupt Page (DIO_TYPE4_FREQ_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related **DIO_TYPE4_HWINT_BLx** on page 61 block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 📖).

Dialog settings

Port Displays the port number that you selected on the **Unit** page.

Channel Displays the channel number that you selected on the **Unit** page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the **Edge type** setting.
If interrupt generation is enabled, the model has to contain a related DIO_TYPE4_HWINT_BLx block.
If interrupt generation is disabled, the model must not contain a related DIO_TYPE4_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Note

If you enabled interrupt generation for output channels, you have to consider that interrupts might be generated because of the output state changes during initialization and termination.

Related topics

References

DIO1552_TP1_PWM_BLx

Purpose

To generate a PWM signal with the period and duty cycle adjustable during run time using the DIO 1552 Type 1 unit of the DS1552 Multi-I/O Module.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	–	✓ [1]

[1] Requires a DS1552 Multi-I/O Module.

Where to go from here

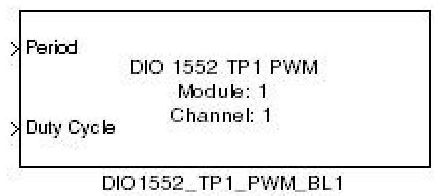
Information in this section

Information in other sections

Block Description (DIO1552_TP1_PWM_BLx)

Block

To give information about the appearance and purpose of the block.



Purpose

To generate a PWM signal with the period and duty cycle adjustable during run time.

Description

The block's Simulink inputs Period and Duty cycle can be changed during run time. If the input value for the period is outside the selected period range, a higher value is saturated to the maximum period value and a smaller value is saturated to the minimum period value.

Note

You cannot use blocks from the RTI FPGA Programming Blockset configured with one of the FPGA1401Tp1 frameworks and the RTI DS1552 I/O Extension Blockset in the same model.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to PWM Generation (PWM) on the DIO 1552 Type 1 Unit (MicroAutoBox II Features 🕮).

I/O characteristics

The following table shows the scaling between the duty cycle and the block's Simulink input:

Simulink Input	Duty Cycle
0 … 1	0 … 100%

The following table describes the ports of the block:

Port	Description
Input	
Period	Specifies the period of the PWM signal. Data type: Double Range: Depends on the specified period range (see Generation Page (DIO1552_TP1_PWM_BLx) on page 275) Unit: Seconds [sec]
Duty cycle	Specifies the duty cycle of the PWM signal. Data type: Double Range: 0 … 1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO1552_TP1_PWM_BLx) on page 274)
- Electrical Interface page (refer to Electrical Interface Page (DIO1552_TP1_PWM_BLx) on page 274)
- Generation page (refer to Generation Page (DIO1552_TP1_PWM_BLx) on page 275)
- Parameters page (refer to Parameters Page (DIO1552_TP1_PWM_BLx) on page 276)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- ds_1552_init
- dio_1552_tp1_init
- dio_1552_tp1_digout_mode_set
- dio_1552_tp1_pwm_init
- dio_1552_tp1_pwm_update

Unit Page (DIO1552_TP1_PWM_BLx)

Purpose

To specify the channel for PWM signal generation.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several FPGA Type 1 modules, RTI uses the module number to distinguish between them.

Channel number Lets you select the channel number in the range 1 … 16.

Note

- Concurrent access to the same digital input channel by other DIO 1552 Type 1 blocks or functions is not allowed.
- DigIn ch 1 … DigIn ch 4 are shared with the external trigger inputs of the ADC 1552 Type 1 unit.

Related topics

References

Electrical Interface Page (DIO1552_TP1_PWM_BLx)

Purpose

To set the high-side and low-side switches of the connected supply rails for the selected output channel.

Description

The output state of a digital output channel depends on its individual settings for the low-side switch L (GND) and the high-side switch H (VDRIVE).

- If the low-side switch L (GND) is enabled, the output is actively driven to GND.
- If the high-side switch H (VDRIVE) is enabled, the output is actively driven to VDRIVE.
- If you set low-side switch L (GND) and high-side switch H (VDRIVE), the digital output channel is actively driven to both VDRIVE and GND (push-pull mode).

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigOut ch 1 ... DigOut ch 16)	Description
0	Disabled	Disabled	High-Z	Individual output disabled
1	Disabled	Disabled	High-Z	
0	Disabled	Enabled	GND	Low-side switch
1	Disabled	Enabled	High-Z	
0	Enabled	Disabled	High-Z	High-side switch
1	Enabled	Disabled	VDRIVE	
0	Enabled	Enabled	GND	Push-pull output
1	Enabled	Enabled	VDRIVE	

Dialog settings

Channel Displays the channel number that you selected on the Unit page.

Setup of supply rails Lets you enable/disable the supply rails defined by the parameters L (Low side) and H (High side).

Parameter	Meaning
L	Enables/disables the low-side switch for the selected digital output channel.
H	Enables/disables the high-side switch (VDRIVE) for the selected digital output channel.

Related topics

References

Block Description (DIO1552_TP1_PWM_BLx)......272
Generation Page (DIO1552_TP1_PWM_BLx)......275
Parameters Page (DIO1552_TP1_PWM_BLx)......276
Unit Page (DIO1552_TP1_PWM_BLx)......274

Generation Page (DIO1552_TP1_PWM_BLx)

Purpose

To specify the PWM update mode and the PWM period range.

Dialog settings

Channel Displays the channel number that you selected on the Unit page.

Update mode Lets you select the PWM update mode for the new values of the period and/or the duty cycle:

Mode	Description
Asynchronous	New values for T_{high} and T_{low} are updated immediately. This can result in period and/or duty cycle values that differ from the old *and* the new values for one period.
Synchronous	New values for T_{high} and T_{low} are updated at the next rising edge of the PWM output signal. The output period is constant if $T = T_{high} + T_{low}$ is constant.

For further information on the update mode, refer to PWM Generation (PWM) on the DIO 1552 Type 1 Unit (MicroAutoBox II Features).

Range of period Lets you select one of the 16 predefined period ranges for the PWM signal to be generated.

Note

The resolution of the period to be generated depends on the selected period range.
Due to quantization effects, you might encounter considerable deviations between the desired PWM period and the generated PWM period, especially for higher PWM frequencies. To avoid poor frequency resolution, you should therefore select the period range with the best possible resolution (resolution values as small as possible).

Range of frequency Displays the corresponding frequency range.

Resolution of period Displays the resolution for the selected period range.

For further information on the ranges and resolutions, refer to PWM Generation (PWM) on the DIO 1552 Type 1 Unit (MicroAutoBox II Features).

Related topics

References

Block Description (DIO1552_TP1_PWM_BLx)........272
Electrical Interface Page (DIO1552_TP1_PWM_BLx)........274
Parameters Page (DIO1552_TP1_PWM_BLx)........276
Unit Page (DIO1552_TP1_PWM_BLx)........274

Parameters Page (DIO1552_TP1_PWM_BLx)

Purpose

To specify the initial output behavior and the termination output behavior.

Description

Initialization During the model initialization phase, the PWM output signal is generated with either an initial period or set to constant low or high potential. With Initial period and Initial duty cycle, the channel has a defined output during this simulation phase. This is especially useful if the channels are used in a triggered or enabled subsystem that is not executed right from the start of the simulation.

Termination With the block's Termination settings, you can specify an output behavior of the channel on termination to drive your external hardware into a safe final condition.

The possible output behaviors at the end of the simulation are:

- The output is set to high impedance (high-Z) state.
- The output holds the last duty cycle and period.
- The output is set to a definite duty cycle and period.

The specified termination values of I/O channels are set when the simulation executes its termination function by setting the `simState` variable to STOP. If the real-time application is stopped by using ControlDesk's Stop RTP command, the processor resets immediately without executing termination functions. The output channels are set to high impedance state and the specified termination values are not set.

Dialog settings

Channel Displays the channel number that you selected on the Unit page.

Initial duty cycle Lets you enter the duty cycle at the start of the simulation in the range 0 … 1. The duty cycle values 0 and 1 yield a constant low and constant high output signal respectively.

Range Displays the selected period range and the corresponding frequency range.

Resolution Displays the resolution for the selected period.

Initial period Lets you enter the period at the start of the simulation. The value must be specified in seconds and should remain in the stated period range.

Termination mode To enable or disable the setting of a definite output behavior at the end of simulation.

Termination Mode	Meaning
Disabled	The output channel is set to high impedance (high-Z) state at the end of simulation.
Enabled	The channel's output behavior is determined by the Output settings (see below) at the end of simulation.

The termination mode checkbox is disabled by default.

If the **Termination mode** is enabled, this setting lets you specify a definite frequency at the end of simulation.

Option Button	Meaning
Last output values	Each output channel holds the last duty cycle and period at the end of simulation.
Specific output values	Lets you set a definite duty cycle and period at the end of simulation.

Duty cycle on termination Lets you set the duty cycle at the end of the simulation in the range 0 … 1. The duty cycle values 0 and 1 yield a constant low and constant high output signal respectively.

Period on termination Lets you set the period at the end of the simulation. The value must be specified in seconds and should remain in the stated period range.

Related topics

References

Block Description (DIO1552_TP1_PWM_BLx)........272
Electrical Interface Page (DIO1552_TP1_PWM_BLx)........274
Generation Page (DIO1552_TP1_PWM_BLx)........275
simState (RTI and RTI-MP Implementation Reference 📖)
Stop RTP (ControlDesk Platform Management 📖)
Unit Page (DIO1552_TP1_PWM_BLx)........274

DIO1552_TP1_FREQ_BLx

Purpose

To generate a square-wave signal with the frequency adjustable during run time using the DIO 1552 Type 1 unit of the DS1552 Multi-I/O Module.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	–	✓ [1]

[1] Requires a DS1552 Multi-I/O Module.

Where to go from here

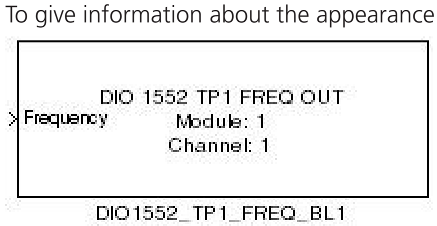
Information in this section

Information in other sections

Block Description (DIO1552_TP1_FREQ_BLx)

Block

To give information about the appearance and purpose of the block.



Purpose

To generate a square-wave signal with the frequency adjustable during run time.

Description

The block's Simulink input Frequency can be changed during run time. If the input value for the frequency is outside the selected frequency range, a higher value is saturated to the maximum frequency value and a smaller value is set to the output specified by the Set output channel setting.

Note

You cannot use blocks from the RTI FPGA Programming Blockset configured with one of the FPGA1401Tp1 frameworks and the RTI DS1552 I/O Extension Blockset in the same model.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Square-Wave Signal Generation (FREQ) on the DIO 1552 Type 1 Unit (MicroAutoBox II Features 🕮).

I/O characteristics

The following table describes the ports of the block:

Port	Description
Input	
Frequency	To specify the frequency to be updated with the next period. Data type: Double Range: Depends on the selected frequency range (see Square-Wave Signal Generation (FREQ) on the DIO 1552 Type 1 Unit (MicroAutoBox II Features 🕮))

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO1552_TP1_FREQ_BLx) on page 281)
- Electrical Interface page (refer to Electrical Interface Page (DIO1552_TP1_FREQ_BLx) on page 281)
- Generation page (refer to Generation Page (DIO1552_TP1_FREQ_BLx) on page 282)
- Parameters page (refer to Parameters Page (DIO1552_TP1_FREQ_BLx) on page 283)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- ds_1552_init
- dio_1552_tp1_init
- dio_1552_tp1_digout_mode_set
- dio_1552_tp1_freq_init
- dio_1552_tp1_freq_update

Unit Page (DIO1552_TP1_FREQ_BLx)

Purpose

To specify the channel on which the frequency is to be updated.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several FPGA Type 1 modules, RTI uses the module number to distinguish between them.

Channel number Lets you select the channel number in the range 1 … 16.

Note

Concurrent access to the same digital output channel by other DIO 1552 Type 1 blocks or functions is not allowed.

Related topics

References

Electrical Interface Page (DIO1552_TP1_FREQ_BLx)

Purpose

To set the high-side and low-side switches of the connected supply rails for the selected output channel.

Description

The output state of a digital output channel depends on its individual settings for the low-side switch L (GND) and the high-side switch H (VDRIVE).

- If the low-side switch L (GND) is enabled, the output is actively driven to GND.
- If the high-side switch H (VDRIVE) is enabled, the output is actively driven to VDRIVE.
- If you set low-side switch L (GND) and high-side switch H (VDRIVE), the digital output channel is actively driven to both VDRIVE and GND (push-pull mode).

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigOut ch 1 ... DigOut ch 16)	Description
0 1	Disabled Disabled	Disabled Disabled	High-Z High-Z	Individual output disabled
0 1	Disabled Disabled	Enabled Enabled	GND High-Z	Low-side switch
0 1	Enabled Enabled	Disabled Disabled	High-Z VDRIVE	High-side switch
0 1	Enabled Enabled	Enabled Enabled	GND VDRIVE	Push-pull output

Dialog settings

Channel Displays the channel number that you selected on the Unit page.

Setup of supply rails Lets you enable/disable the supply rails defined by the parameters L (Low side) and H (High side).

Parameter	Meaning
L	Enables/disables the low-side switch for the selected digital output channel.
H	Enables/disables the high-side switch (VDRIVE) for the selected digital output channel.

Related topics

References

Block Description (DIO1552_TP1_FREQ_BLx)......279
Generation Page (DIO1552_TP1_FREQ_BLx)......282
Parameters Page (DIO1552_TP1_FREQ_BLx)......283
Unit Page (DIO1552_TP1_FREQ_BLx)......281

Generation Page (DIO1552_TP1_FREQ_BLx)

Purpose

To specify the frequency range and the zero frequency mode.

Dialog settings

Channel Displays the channel number that you selected on the Unit page.

Range of frequency Lets you select one of 16 predefined frequency ranges.

Note

The resolution of the square-wave signal to be generated depends on the selected frequency range.
To get the best signal resolution, you should select the frequency range with the best possible resolution (the frequency range with the lowest possible range number). For example, if your desired frequency is 100 Hz, you should use frequency range 1 (9.54 Hz … 150 kHz) rather than frequency range 2 (4.77 Hz … 150 kHz). For details, refer to Square-Wave Signal Generation (FREQ) on the DIO 1552 Type 1 Unit (MicroAutoBox II Features 📖).

Resolution of frequency Displays the frequency resolution for the selected frequency range.

Set output channel Lets you select the Zero frequency mode (the behavior of the output channel if the frequency falls below the lower limit of the frequency range). The following settings are available:

Output Level	Meaning
Low	The output is set to low (default).
High	The output is set to high.
Hold	The output holds its last signal level (low or high).

Related topics

References

Parameters Page (DIO1552_TP1_FREQ_BLx)

Purpose

To set the initial output behavior and the termination output behavior.

Description

Initialization During the model initialization phase, the output signal is either generated with an initial frequency or zero. This is especially useful if a channel is used in a triggered or enabled subsystem that is not executed right from the start

of the simulation. With Initial frequency, the channel has a defined output during this simulation phase.

Termination With the block's Termination settings, you can specify an output behavior of the channel of the specified digital I/O port on termination to drive your external hardware into a safe final condition.

The possible output behaviors at the end of the simulation are:

- The output is set to high impedance (high-Z) state.
- The output holds the last frequency.
- The output is set to a definite frequency.

The specified termination values of I/O channels are set when the simulation executes its termination function by setting the `simState` variable to STOP. If the real-time application is stopped by using ControlDesk's Stop RTP command, the processor resets immediately without executing termination functions. The output channels are set to high impedance state and the specified termination values are not set.

Dialog settings

Channel Displays the channel number that you selected on the Unit page.

Initial frequency Lets you enter the initial frequency at the start of the simulation.

The frequency should remain in the stated frequency range. Otherwise, it is saturated to f_{max} or set to 0 Hz.

Termination mode To enable or disable the setting of a definite output behavior at the end of simulation.

Termination Mode	Meaning
Disabled	The output channel is set to high impedance (high-Z) state at the end of simulation.
Enabled	The channel's output behavior is determined by the Frequency on termination setting (see below) at the end of simulation.

The termination mode checkbox is disabled by default.

Frequency on termination If the Termination mode is enabled, this setting lets you specify a definite frequency at the end of simulation.

Option Button	Meaning
Last output value	Each output channel holds the last frequency at the end of simulation.
Specific output value	Lets you set a definite frequency at the end of simulation.

Related topics

References

Multi-Channel PWM Signal Generation

Purpose

To generate multi-channel PWM signals (MC_PWM).

Where to go from here

Information in this section

DIO_TYPE3_MC_PWM_BLx

Purpose

To generate a multi-channel PWM signal.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

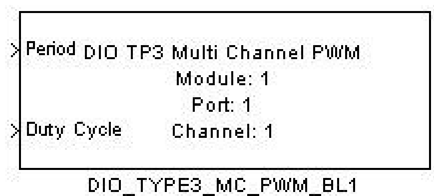
Where to go from here

Information in this section

Block Description (DIO_TYPE3_MC_PWM_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To generate a PWM signal on the specified number of channels with their periods and duty cycles adjustable during run time.

Description

The multi-channel PWM signal generation on the DIO Type 3 is very flexible. You can specify any number of channels to be used for signal generation within the limits of available output channels per port. The high-side and low-side switches, the initialization values and the termination values can be separately configured for each channel. For each block you can specify the generation of inverted signals and the usage of a trigger channel. You can also specify the period range and whether an interrupt is generated. For enabled interrupts and triggers, you can configure the position, delay and rate.

For center-aligned signal generation, you can additionally specify the update mode and the dead time between inverted and non-inverted channels.

For edge-aligned signal generation, the update mode is always synchronous and the dead time setting is not available.

The block's Simulink inputs **Period** and **Duty Cycle** can be changed during run time. If the input values for the period are outside the selected period range, they are saturated to the maximum or minimum period value.

The number of available output channels depends on the following settings:

- Inverted channels

  If set to *On*, the block automatically reserves the same number of channels for the inverted signals as specified for the non-inverted signals. The first inverted channel is `(Channel number + Number of channels)`. If there are not enough free output channels at the specified port, the specified channel number is reset to 1.
- Trigger channel

  If set to *On*, the block automatically reserves one channel for generating a trigger signal. The trigger channel's position is the next channel after the PWM output channels. If there is no more free output channel at the specified port, the specified channel number is reset to 1. Triggers and interrupts can be configured on the Interrupt page.

I/O mapping

For information on the mapping of the logical channel numbers, as used in RTI, to the related I/O pins of the MicroAutoBox II I/O connector, refer to Basics on Multi-Channel PWM Signal Generation on the DIO Type 3 (MicroAutoBox II Features 📖).

I/O characteristics

The following table shows the scaling between the duty cycle and the block's Simulink input:

Simulink Input	Duty Cycle
0 … 1	0 … 100%

The following table describes the ports of the block:

Port	Description
Input	
Period	To specify the period to be updated with the next period. Data type: Double Range: Depends on the selected period range (see Basics on Multi-Channel PWM Signal Generation on the DIO Type 3 (MicroAutoBox II Features 📖))
Duty Cycle	To specify the duty cycle to be updated with the next period. Data type: Double Range: 0 … 1 (0 … 100%)

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE3_MC_PWM_BLx) on page 289)
- Electrical Interface page (refer to Electrical Interface Page (DIO_TYPE3_MC_PWM_BLx) on page 291)
- Parameters page (refer to Parameters Page (DIO_TYPE3_MC_PWM_BLx) on page 292)

- Initialization page (refer to Initialization Page (DIO_TYPE3_MC_PWM_BLx) on page 293)
- Termination page (refer to Termination Page (DIO_TYPE3_MC_PWM_BLx) on page 294)
- Interrupt page (refer to Interrupt Page (DIO_TYPE3_MC_PWM_BLx) on page 296)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dio_tp3_init
- dio_tp3_mc_pwm_init
- dio_tp3_mc_pwm_lshs_cfg_set
- dio_tp3_mc_pwm_update

Related topics

Basics

Basics on Multi-Channel PWM Signal Generation on the DIO Type 3 (MicroAutoBox II Features)

Unit Page (DIO_TYPE3_MC_PWM_BLx)

Purpose

To specify the channels and basic settings for the multi-channel PWM signal generation.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features).

Port number Lets you select the port number in the range 1 … 3.

Channel number Lets you select the first channel used for signal generation. The available value range depends on the specified port.

Port Number	Channel Number
1, 2	1 … 16
3	1 … 8

The value range for the first channel is automatically decreased if you specify more than one channel for the PWM signal generation. Using inverted channels, the number of channels is reserved twice. For triggering, one further output channel is reserved.

For example, if you want to generate a PWM signal on three channels on port 1 including inverted signals, you can choose between channel 1 up to channel 11.

If you want to generate a PWM signal on six channels on port 3 including one trigger channel, you can choose between channel 1 and channel 2.

If the specified channel number exceeds the range when configuring the other settings, the channel number is reset to 1.

Note

Concurrent access to the same digital output channel(s) by other DIO Type 3 blocks or functions is not allowed.

Number of channels Lets you specify the number of channels used for multi-channel PWM signal generation. The available value range depends on the specified port.

Port Number	Channel Number
1, 2	1 … 16
3	1 … 8

If you use inverted channels, the range is automatically halved. If you use a trigger channel, the range is reduced by one. If the specified value exceeds the range when configuring the other settings, the number of channels specified for signal generation is reset to 1.

Inverted channels Lets you specify whether to generate inverted signals additionally. The number of channels reserved for multi-channel PWM signal generation is then doubled. This option effects the Channel number and the Number of channels settings.

Alignment Lets you specify whether to generate center-aligned or edge-aligned multi-channel PWM signals.

Trigger channel Lets you specify whether to generate a trigger signal. If you set it to *On*, a further channel is reserved for the trigger signal. This option effects the Channel number and the Number of channels settings. If the trigger channel is enabled, you can configure the trigger events on the Interrupt (refer to Interrupt Page (DIO_TYPE3_MC_PWM_BLx) on page 296) page.

Related topics

References

Electrical Interface Page (DIO_TYPE3_MC_PWM_BLx)

Purpose

To set the high-side and low-side switches of the connected supply rail for the selected output channel.

Description

The output state of a digital output channel depends on its individual settings for the low-side switch L (GND) and the high-side switch H (VDRIVE).

- If the low-side switch L (GND) is enabled, the output is actively driven to GND.
- If the high-side switch H (VDRIVE) is enabled, the output is actively driven to VDRIVE.
- If you set low-side switch L (GND) and high-side switch H (VDRIVE), the digital output channel is actively driven to both VDRIVE and GND (push-pull mode).

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigP1 ch 1 ... DigP3 ch 8)	Description
0 1	Disabled Disabled	Disabled Disabled	High-Z High-Z	Individual output disabled
0 1	Disabled Disabled	Enabled Enabled	GND High-Z	Low-side switch
0 1	Enabled Enabled	Disabled Disabled	High-Z VDRIVE	High-side switch
0 1	Enabled Enabled	Enabled Enabled	GND VDRIVE	Push-pull output

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the start channel number that you selected on the Unit page.

Setup of supply rails Lets you enable/disable the low-side and high-side switches defined by the parameters L (Low) and H (High) for each single digital output channel individually.

Parameter	Meaning
L	Enables/disables the low-side switch for the selected digital output channel.
H	Enables/disables the high-side switch (VBAT) for the selected digital output channel.

If you specified digital I/O ports 1 or 2, you can select the switches for channels 1 … 16, and if you specified digital I/O port 3, you can select them for channels 1 … 8.

Only those channels can be configured that are specified for signal generation on the Unit page (refer to Unit Page (DIO_TYPE3_MC_PWM_BLx) on page 289) including the channels for the enabled inverted signals and the trigger channel.

Set all Lets you enable/disable the low-side and high-side switches for all the specified digital output channels of the specified port identically and at once.

Related topics

References

Parameters Page (DIO_TYPE3_MC_PWM_BLx)

Purpose

To configure the multi-channel PWM signal generation.

Description

According to the signal characteristic you want to generate, you must select a suitable period range. Using the period range with the minimum lower limit, you can achieve the highest resolution.

For center-aligned multi-channel PWM signal generation, you can specify the update mode and the dead time to be used.

For further information, refer to Basics on Multi-Channel PWM Signal Generation on the DIO Type 3 (MicroAutoBox II Features 📖).

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the start channel number that you selected on the Unit page.

Update mode Lets you choose the PWM update mode for center-aligned PWM signal generation. You can decide whether to update at the start of the PWM period, in the middle of a period, or at both times.

For edge-aligned PWM signal generation, the setting cannot be modified andthe synchronous update mode is automatically used.

Range of period Lets you select one of 16 predefined period ranges.

Note

The resolution of the multi-channel PWM signal to be generated depends on the selected period range.
To get the best signal resolution, you should select the period range with the best possible resolution. For details, refer to Basics on Multi-Channel PWM Signal Generation on the DIO Type 3 (MicroAutoBox II Features 📖).

Range of frequency Displays the frequency range according to the specified period.

Resolution of period Displays the resolution according to the specified period.

Dead time Lets you specify the PWM dead time in seconds for center-aligned PWM signal generation. The value is in the range 0 … 12.8 µs with a resolution of 50 ns.

Related topics

References

Initialization Page (DIO_TYPE3_MC_PWM_BLx)

Purpose

To specify the initial values for the period and the duty cycle.

Description

Initialization During the model initialization phase, the initial digital output states specified by the Initial output settings are written to all the channels of the specified digital I/O port to ensure a defined output during this simulation phase. This is especially useful if the channels are used in a triggered or enabled subsystem that is not executed right from the start of the simulation. Before initialization, the digital outputs are set to high impedance.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the start channel number that you selected on the Unit page.

Range Displays the period range specified on the Parameters page and its related frequency range.

Resolution Displays the resolution of the specified period range.

Initial period Lets you enter the period at the start of the simulation. The value must be specified in seconds and should remain in the stated period range.

Initial duty cycle Lets you enter the duty cycle at the start of the simulation in the range 0 … 1. The value can be separately set for each enabled non-inverted channel. The duty cycle values 0 and 1 yield a constant low and constant high output signal respectively. For further information, refer to Bit I/O Unit (DIO Type 3) (MicroAutoBox II Features 🕮).

Related topics

References

Block Description (DIO_TYPE3_MC_PWM_BLx) 287
Electrical Interface Page (DIO_TYPE3_MC_PWM_BLx) 291
Interrupt Page (DIO_TYPE3_MC_PWM_BLx) 296
Parameters Page (DIO_TYPE3_MC_PWM_BLx) 292
Termination Page (DIO_TYPE3_MC_PWM_BLx) 294
Unit Page (DIO_TYPE3_MC_PWM_BLx) 289

Termination Page (DIO_TYPE3_MC_PWM_BLx)

Purpose

To specify the termination values for the period and the duty cycle.

Description

Termination With the block's Termination settings, you can specify the output states of all the specified channels of the specified digital I/O port on model termination to drive your external hardware into a safe final condition.

The possible termination states at the end of the simulation are:

- All the specified digital outputs are set to high impedance (high-Z) state.
- Each output holds its last output value.
- Each output is set to a definite output value.

The specified termination values of I/O channels are set when the simulation executes its termination function by setting the `simState` variable to STOP. If the real-time application is stopped by using ControlDesk's Stop RTP command, the processor resets immediately without executing termination functions. The output channels are set to high impedance state and the specified termination values are not set.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the start channel number that you selected on the Unit page.

Termination To enable or disable the setting of a definite output behavior at the end of simulation.

Termination Mode Checkbox	Meaning
Disabled (default)	The output channel is set to high impedance (high-Z) state at the end of simulation.
Enabled	The channel's output behavior is determined by the Output settings (see below) at the end of simulation.

If the Termination mode is enabled, this setting lets you specify a definite frequency at the end of simulation.

Option Button	Meaning
Last output values	Each output channel holds the last duty cycle and period at the end of simulation.
Specific output values	Lets you set a definite duty cycle and period at the end of simulation.

Range Displays the period range specified on the Parameters page and its related frequency range.

Resolution Displays the resolution of the specified period range.

Period on termination Lets you enter the period at the end of the simulation. The value must be specified in seconds and has to remain in the stated period range.

Duty cycle on termination Lets you set the duty cycle for each specified output channel at the end of the simulation in the range 0 … 1. The value can be separately set for each enabled non-inverted channel. The duty cycle values 0 and 1 yield a constant low and constant high output signal respectively.

Related topics

References

Block Description (DIO_TYPE3_MC_PWM_BLx)....287
Electrical Interface Page (DIO_TYPE3_MC_PWM_BLx)....291
Initialization Page (DIO_TYPE3_MC_PWM_BLx)....293
Interrupt Page (DIO_TYPE3_MC_PWM_BLx)....296
Parameters Page (DIO_TYPE3_MC_PWM_BLx)....292
simState (RTI and RTI-MP Implementation Reference 📖)
Stop RTP (ControlDesk Platform Management 📖)
Unit Page (DIO_TYPE3_MC_PWM_BLx)....289

Interrupt Page (DIO_TYPE3_MC_PWM_BLx)

Purpose

To enable and configure trigger and interrupt signals.

Description

If you enable interrupt generation, your model has to contain a related DIO_TYPE3_HWINT_BLx block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 🕮).

Dialog settings

Port Displays the port number that you selected on the **Unit** page.

Channel Displays the start channel number that you selected on the **Unit** page.

Enable interrupt Lets you enable the interrupt generation.

If the interrupt generation is enabled or the **Trigger channel** setting on the **Unit** page is set to *On*, you can use the following settings for the interrupt configuration.

Event on position Lets you select the position where the interrupt is triggered and / or the trigger channel is generating a trigger signal.

Position	Meaning
Start	Event is triggered at the start of the period.
Center	Event is triggered in the middle of the period.
Both	Event is triggered at the start and in the middle of the period.

Event delay Lets you specify the delay time for trigger and interrupt signals in seconds. The value range depends on the specified period range. If the specified delay value is outside the valid range no event is generated. The value affects the signal of the trigger channel as well as the generation of the interrupt.

Event rate Lets you specify the event rate in the range 1 … 255. It specifies after how many periods an event is triggered. For example, if you set **Event rate** to 3, an event will be generated each third period. The value affects the signal of the trigger channel as well as the generation of the interrupt.

Related topics

References

DIO_TYPE4_MC_PWM_BLx

Purpose

To generate a multi-channel PWM signal.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

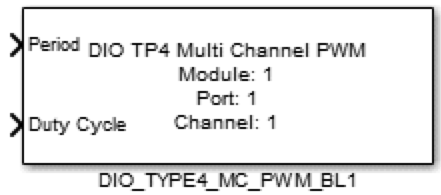
Where to go from here

Information in this section

Block Description (DIO_TYPE4_MC_PWM_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To generate a PWM signal on the specified number of channels with their periods and duty cycles adjustable during run time.

Description

The multi-channel PWM signal generation on the DIO Type 4 is very flexible. You can specify any number of channels to be used for signal generation within the limits of available output channels per port. The high-side and low-side switches, the initialization values and the termination values can be separately configured for each channel. For each block you can specify the generation of inverted signals and the usage of a trigger channel. You can also specify the period range and whether an interrupt is generated. For enabled interrupts and triggers, you can configure the position, delay and rate.

For center-aligned signal generation, you can additionally specify the update mode and the dead time between inverted and non-inverted channels.

For edge-aligned signal generation, the update mode is always synchronous and the dead time setting is not available.

The block's Simulink inputs Period and Duty Cycle can be changed during run time. If the input values for the period are outside the selected period range, they are saturated to the maximum or minimum period value.

The number of available output channels depends on the following settings:

- Inverted channels

  If set to *On*, the block automatically reserves the same number of channels for the inverted signals as specified for the non-inverted signals. The first inverted channel is `(Channel number + Number of channels)`. If there are not enough free output channels at the specified port, the specified channel number is reset to 1.
- Trigger channel

  If set to *On*, the block automatically reserves one channel for generating a trigger signal. The trigger channel's position is the next channel after the PWM output channels. If there is no more free output channel at the specified port, the specified channel number is reset to 1. Triggers and interrupts can be configured on the Interrupt page.

I/O mapping

For information on the mapping of the logical channel numbers, as used in RTI, to the related I/O pins of the MicroAutoBox II I/O connector, refer to Basics on Multi-Channel PWM Signal Generation on the DIO Type 4 (MicroAutoBox II Features 🕮).

I/O characteristics

The following table shows the scaling between the duty cycle and the block's Simulink input:

Simulink Input	Duty Cycle
0 … 1	0 … 100%

The following table describes the ports of the block:

Port	Description
Input	
Period	To specify the period to be updated with the next period. Data type: Double Range: Depends on the selected period range (see Basics on Multi-Channel PWM Signal Generation on the DIO Type 4 (MicroAutoBox II Features 🕮))
Duty Cycle	To specify the duty cycle to be updated with the next period. Data type: Double Range: 0 … 1 (0 … 100%)

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE4_MC_PWM_BLx) on page 300)
- Electrical Interface page (refer to Electrical Interface Page (DIO_TYPE4_MC_PWM_BLx) on page 301)
- Parameters page (refer to Parameters Page (DIO_TYPE4_MC_PWM_BLx) on page 303)
- Initialization page (refer to Initialization Page (DIO_TYPE4_MC_PWM_BLx) on page 304)
- Termination page (refer to Termination Page (DIO_TYPE4_MC_PWM_BLx) on page 305)
- Interrupt page (refer to Interrupt Page (DIO_TYPE4_MC_PWM_BLx) on page 306)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- dio_tp4_init
- dio_tp4_mc_pwm_init
- dio_tp4_mc_pwm_lshs_cfg_set
- dio_tp4_mc_pwm_update

Related topics

Basics

Basics on Multi-Channel PWM Signal Generation on the DIO Type 3 (MicroAutoBox II Features)

Unit Page (DIO_TYPE4_MC_PWM_BLx)

Purpose

To specify the channels and basic settings for the multi-channel PWM signal generation.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features).

Port number Lets you select the port number in the range 1 … 2.

Channel number Lets you select the first channel used for signal generation. The available value range depends on the specified port.

Port Number	Channel Number
1	1 … 16
2	1 … 8

The value range for the first channel is automatically decreased if you specify more than one channel for the PWM signal generation. Using inverted channels, the number of channels is reserved twice. For triggering, one further output channel is reserved.

For example, if you want to generate a PWM signal on three channels on port 1 including inverted signals, you can choose between channel 1 up to channel 11.

If you want to generate a PWM signal on six channels on port 2 including one trigger channel, you can choose between channel 1 and channel 2.

If the specified channel number exceeds the range when configuring the other settings, the channel number is reset to 1.

Note

Concurrent access to the same digital output channel(s) by other DIO Type 4 blocks or functions is not allowed.

Number of channels Lets you specify the number of channels used for multi-channel PWM signal generation. The available value range depends on the specified port.

Port Number	Channel Number
1	1 … 16
2	1 … 8

If you use inverted channels, the range is automatically halved. If you use a trigger channel, the range is reduced by one. If the specified value exceeds the range when configuring the other settings, the number of channels specified for signal generation is reset to 1.

Inverted channels Lets you specify whether to generate inverted signals additionally. The number of channels reserved for multi-channel PWM signal generation is then doubled. This option effects the Channel number and the Number of channels settings.

Alignment Lets you specify whether to generate center-aligned or edge-aligned multi-channel PWM signals.

Trigger channel Lets you specify whether to generate a trigger signal. If you set it to *On*, a further channel is reserved for the trigger signal. This option effects the Channel number and the Number of channels settings. If the trigger channel is enabled, you can configure the trigger events on the Interrupt (refer to Interrupt Page (DIO_TYPE4_MC_PWM_BLx) on page 306) page.

Related topics

References

Electrical Interface Page (DIO_TYPE4_MC_PWM_BLx)

Purpose

To set the high-side and low-side switches of the connected supply rail for the selected output channel.

Description

The output state of a digital output channel depends on its individual settings for the low-side switch L (GND) and the high-side switch H (VDRIVE).

- If the low-side switch L (GND) is enabled, the output is actively driven to GND.

- If the high-side switch H (VDRIVE) is enabled, the output is actively driven to VDRIVE.
- If you set low-side switch L (GND) and high-side switch H (VDRIVE), the digital output channel is actively driven to both VDRIVE and GND (push-pull mode).

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigP1 ch 1 ... DigP2 ch 8)	Description
0 1	Disabled Disabled	Disabled Disabled	High-Z High-Z	Individual output disabled
0 1	Disabled Disabled	Enabled Enabled	GND High-Z	Low-side switch
0 1	Enabled Enabled	Disabled Disabled	High-Z VDRIVE	High-side switch
0 1	Enabled Enabled	Enabled Enabled	GND VDRIVE	Push-pull output

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the start channel number that you selected on the Unit page.

Setup of supply rails Lets you enable/disable the low-side and high-side switches defined by the parameters L (Low) and H (High) for each single digital output channel individually.

Parameter	Meaning
L	Enables/disables the low-side switch for the selected digital output channel.
H	Enables/disables the high-side switch (VBAT) for the selected digital output channel.

If you specified digital I/O ports 1 or 2, you can select the switches for channels 1 … 16, and if you specified digital I/O port 3, you can select them for channels 1 … 8.

Only those channels can be configured that are specified for signal generation on the Unit page (refer to Unit Page (DIO_TYPE4_MC_PWM_BLx) on page 300) including the channels for the enabled inverted signals and the trigger channel.

Set all Lets you enable/disable the low-side and high-side switches for all the specified digital output channels of the specified port identically and at once.

Related topics

References

Parameters Page (DIO_TYPE4_MC_PWM_BLx)

Purpose

To configure the multi-channel PWM signal generation.

Description

According to the signal characteristic you want to generate, you must select a suitable period range. Using the period range with the minimum lower limit, you can achieve the highest resolution.

For center-aligned multi-channel PWM signal generation, you can specify the update mode and the dead time to be used.

For further information, refer to Basics on Multi-Channel PWM Signal Generation on the DIO Type 4 (MicroAutoBox II Features 🕮).

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the start channel number that you selected on the Unit page.

Update mode Lets you choose the PWM update mode for center-aligned PWM signal generation. You can decide whether to update at the start of the PWM period, in the middle of a period, or at both times.

For edge-aligned PWM signal generation, the setting cannot be modified andthe synchronous update mode is automatically used.

Range of period Lets you select one of 16 predefined period ranges.

Note

The resolution of the multi-channel PWM signal to be generated depends on the selected period range.

To get the best signal resolution, you should select the period range with the best possible resolution. For details, refer to Basics on Multi-Channel PWM Signal Generation on the DIO Type 4 (MicroAutoBox II Features 🕮).

Range of frequency Displays the frequency range according to the specified period.

Resolution of period Displays the resolution according to the specified period.

Dead time Lets you specify the PWM dead time in seconds for center-aligned PWM signal generation. The value is in the range 0 … 12.8 µs with a resolution of 50 ns.

Related topics

References

Initialization Page (DIO_TYPE4_MC_PWM_BLx)

Purpose

To specify the initial values for the period and the duty cycle.

Description

Initialization During the model initialization phase, the initial digital output states specified by the Initial output settings are written to all the channels of the specified digital I/O port to ensure a defined output during this simulation phase. This is especially useful if the channels are used in a triggered or enabled subsystem that is not executed right from the start of the simulation. Before initialization, the digital outputs are set to high impedance.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the start channel number that you selected on the Unit page.

Range Displays the period range specified on the Parameters page and its related frequency range.

Resolution Displays the resolution of the specified period range.

Initial period Lets you enter the period at the start of the simulation. The value must be specified in seconds and should remain in the stated period range.

Initial duty cycle Lets you enter the duty cycle at the start of the simulation in the range 0 … 1. The value can be separately set for each enabled non-inverted channel. The duty cycle values 0 and 1 yield a constant low and constant high output signal respectively. For further information, refer to Bit I/O Unit (DIO Type 4) (MicroAutoBox II Features 📖).

Related topics

References

Termination Page (DIO_TYPE4_MC_PWM_BLx)

Purpose

To specify the termination values for the period and the duty cycle.

Description

Termination With the block's Termination settings, you can specify the output states of all the specified channels of the specified digital I/O port on model termination to drive your external hardware into a safe final condition.

The possible termination states at the end of the simulation are:

- All the specified digital outputs are set to high impedance (high-Z) state.
- Each output holds its last output value.
- Each output is set to a definite output value.

The specified termination values of I/O channels are set when the simulation executes its termination function by setting the `simState` variable to STOP. If the real-time application is stopped by using ControlDesk's Stop RTP command, the processor resets immediately without executing termination functions. The output channels are set to high impedance state and the specified termination values are not set.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the start channel number that you selected on the Unit page.

Termination To enable or disable the setting of a definite output behavior at the end of simulation.

Termination Mode Checkbox	Meaning
Disabled (default)	The output channel is set to high impedance (high-Z) state at the end of simulation.
Enabled	The channel's output behavior is determined by the Output settings (see below) at the end of simulation.

If the Termination mode is enabled, this setting lets you specify a definite frequency at the end of simulation.

Option Button	Meaning
Last output values	Each output channel holds the last duty cycle and period at the end of simulation.
Specific output values	Lets you set a definite duty cycle and period at the end of simulation.

Range Displays the period range specified on the Parameters page and its related frequency range.

Resolution Displays the resolution of the specified period range.

Period on termination Lets you enter the period at the end of the simulation. The value must be specified in seconds and has to remain in the stated period range.

Duty cycle on termination Lets you set the duty cycle for each specified output channel at the end of the simulation in the range 0 … 1. The value can be separately set for each enabled non-inverted channel. The duty cycle values 0 and 1 yield a constant low and constant high output signal respectively.

Related topics

References

Block Description (DIO_TYPE4_MC_PWM_BLx)........ 298
Electrical Interface Page (DIO_TYPE4_MC_PWM_BLx)........ 301
Initialization Page (DIO_TYPE4_MC_PWM_BLx)........ 304
Interrupt Page (DIO_TYPE4_MC_PWM_BLx)........ 306
Parameters Page (DIO_TYPE4_MC_PWM_BLx)........ 303
simState (RTI and RTI-MP Implementation Reference 🕮)
Stop RTP (ControlDesk Platform Management 🕮)
Unit Page (DIO_TYPE4_MC_PWM_BLx)........ 300

Interrupt Page (DIO_TYPE4_MC_PWM_BLx)

Purpose

To enable and configure trigger and interrupt signals.

Description

If you enable interrupt generation, your model has to contain a related DIO_TYPE4_HWINT_BLx on page 61 block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 🕮).

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the start channel number that you selected on the Unit page.

Enable interrupt Lets you enable the interrupt generation.

If the interrupt generation is enabled or the Trigger channel setting on the Unit page is set to *On*, you can use the following settings for the interrupt configuration.

Event on position Lets you select the position where the interrupt is triggered and / or the trigger channel is generating a trigger signal.

Position	Meaning
Start	Event is triggered at the start of the period.
Center	Event is triggered in the middle of the period.
Both	Event is triggered at the start and in the middle of the period.

Event delay Lets you specify the delay time for trigger and interrupt signals in seconds. The value range depends on the specified period range. If the specified delay value is outside the valid range no event is generated. The value affects the signal of the trigger channel as well as the generation of the interrupt.

Event rate Lets you specify the event rate in the range 1 ... 255. It specifies after how many periods an event is triggered. For example, if you set Event rate to 3, an event will be generated each third period. The value affects the signal of the trigger channel as well as the generation of the interrupt.

Related topics

References

Block Description (DIO_TYPE4_MC_PWM_BLx)...298
Electrical Interface Page (DIO_TYPE4_MC_PWM_BLx)..301
Initialization Page (DIO_TYPE4_MC_PWM_BLx)..304
Parameters Page (DIO_TYPE4_MC_PWM_BLx)..303
Termination Page (DIO_TYPE4_MC_PWM_BLx)...305
Unit Page (DIO_TYPE4_MC_PWM_BLx)..300

PWM Signal Measurement

Purpose

To measure the frequency and duty cycle of a single PWM signal (PWM2D).

Where to go from here

Information in this section

DIO_TYPE3_PWM2D_BLx

Purpose

To measure the period and duty cycle of a PWM input signal.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

Where to go from here

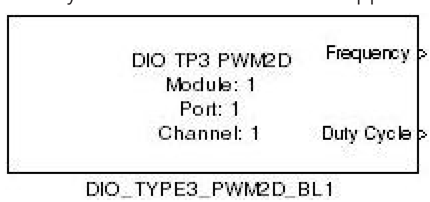
Information in this section

Information in other sections

Block Description (DIO_TYPE3_PWM2D_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To measure the period and duty cycle of a PWM input signal.

Description

In a Simulink model, the block provides channel-wise read access to the duty cycle and period of a PWM signal.

If the value to be measured is outside the selected frequency range, a higher value is saturated to `frequency=0` and `duty cycle=1` and a smaller value is saturated to `frequency=0` and `duty cycle=0`.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to PWM Measurement (PWM2D) on the DIO Type 3 Unit (MicroAutoBox II Features 📖).

I/O characteristics

The following table shows the scaling between the duty cycle of the measured signal and the block's output in Simulink:

Duty Cycle	Simulink Output
0 … 100%	0 … 1

The following table describes the ports of the block:

Port	Description
Output	
Frequency	Outputs the current frequency. Data type: Double Range: Depends on the selected frequency range
Duty Cycle	Outputs the current duty cycle. Data type: Double Range: 0 … 1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE3_PWM2D_BLx) on page 310)
- Measurement page (refer to Measurement Page (DIO_TYPE3_PWM2D_BLx) on page 311)
- Interrupt page (refer to Interrupt Page (DIO_TYPE3_PWM2D_BLx) on page 312)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dio_tp3_init
- dio_tp3_pwm2d_init
- dio_tp3_pwm2d_read
- dio_tp3_multi_source_int_mode_set

Unit Page (DIO_TYPE3_PWM2D_BLx)

Purpose

To specify the channel on which you want to measure the frequency and duty cycle.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 📖).

Port number Lets you select the port number in the range 1 … 3.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1, 2	1 … 16
3	1 … 8

Note

Concurrent access to the same digital input channel by other DIO Type 3 blocks or functions is not supported.

Related topics

References

Measurement Page (DIO_TYPE3_PWM2D_BLx)

Purpose

To specify the PWM update mode and the PWM frequency range.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Update mode Lets you select the update mode of the PWM measurement:

Mode	Description
Asynchronous	The measured values are updated at each edge of the PWM signal. The update is asynchronous to the period.
Synchronous	The measured values are updated at the end of each T_{low} period of the PWM signal only. The update is synchronous to the period.

Range of frequency Lets you select one of the 16 predefined measurement ranges for the input PWM frequency.

Note

The measurement resolution depends on the selected frequency range. Due to quantization effects, you will encounter considerable deviations between the input PWM period and the measured PWM period, especially for higher PWM frequencies. To avoid poor measurement resolution, you should therefore select the frequency range with the best possible resolution (resolution values as small as possible). For details, refer to PWM Measurement (PWM2D) on the DIO Type 3 Unit (MicroAutoBox II Features 📖).

Range of period Displays the corresponding period range.

Resolution of frequency Displays the measurement resolution for the selected frequency range.

Related topics

References

Interrupt Page (DIO_TYPE3_PWM2D_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related DIO_TYPE3_HWINT_BLx block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 📖).

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the Edge type setting.

If interrupt generation is enabled, the model has to contain a related DIO_TYPE3_HWINT_BLx block.

If interrupt generation is disabled, the model must not contain a related DIO_TYPE3_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Related topics

References

DIO_TYPE4_PWM2D_BLx

Purpose

To measure the period and duty cycle of a PWM input signal.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

Where to go from here

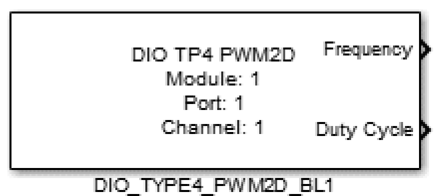
Information in this section

Information in other sections

Block Description (DIO_TYPE4_PWM2D_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To measure the period and duty cycle of a PWM input signal.

Description

In a Simulink model, the block provides channel-wise read access to the duty cycle and period of a PWM signal.

If the value to be measured is outside the selected frequency range, a higher value is saturated to `frequency=0` and `duty cycle=1` and a smaller value is saturated to `frequency=0` and `duty cycle=0`.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to PWM Measurement (PWM2D) on the DIO Type 4 Unit (MicroAutoBox II Features 📖).

I/O characteristics

The following table shows the scaling between the duty cycle of the measured signal and the block's output in Simulink:

Duty Cycle	Simulink Output
0 … 100%	0 … 1

The following table describes the ports of the block:

Port	Description
Output	
Frequency	Outputs the current frequency. Data type: Double Range: Depends on the selected frequency range
Duty Cycle	Outputs the current duty cycle. Data type: Double Range: 0 … 1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE4_PWM2D_BLx) on page 315)
- Measurement page (refer to Measurement Page (DIO_TYPE4_PWM2D_BLx) on page 316)
- Interrupt page (refer to Interrupt Page (DIO_TYPE4_PWM2D_BLx) on page 317)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- dio_tp4_init
- dio_tp4_pwm2d_init
- dio_tp4_pwm2d_read
- dio_tp4_multi_source_int_mode_set

Unit Page (DIO_TYPE4_PWM2D_BLx)

Purpose

To specify the channel on which you want to measure the frequency and duty cycle.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 🕮).

Port number Lets you select the port number in the range 1 … 2.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1	1 … 16
2	1 … 8

Note

Concurrent access to the same digital input channel by other DIO Type 4 blocks or functions is not supported.

Related topics

References

Measurement Page (DIO_TYPE4_PWM2D_BLx)

Purpose

To specify the PWM update mode and the PWM frequency range.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Update mode Lets you select the update mode of the PWM measurement:

Mode	Description
Asynchronous	The measured values are updated at each edge of the PWM signal. The update is asynchronous to the period.
Synchronous	The measured values are updated at the end of each T_{low} period of the PWM signal only. The update is synchronous to the period.

Range of frequency Lets you select one of the 16 predefined measurement ranges for the input PWM frequency.

> **Note**
>
> The measurement resolution depends on the selected frequency range. Due to quantization effects, you will encounter considerable deviations between the input PWM period and the measured PWM period, especially for higher PWM frequencies. To avoid poor measurement resolution, you should therefore select the frequency range with the best possible resolution (resolution values as small as possible). For details, refer to PWM Measurement (PWM2D) on the DIO Type 4 Unit (MicroAutoBox II Features 📖).

Range of period Displays the corresponding period range.

Resolution of frequency Displays the measurement resolution for the selected frequency range.

Related topics

References

Interrupt Page (DIO_TYPE4_PWM2D_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related **DIO_TYPE4_HWINT_BLx** on page 61 block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 📖).

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the Edge type setting.

If interrupt generation is enabled, the model has to contain a related DIO_TYPE4_HWINT_BLx block.

If interrupt generation is disabled, the model must not contain a related DIO_TYPE4_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Related topics

References

DIO1552_TP1_PWM2D_BLx

Purpose

To measure the period and duty cycle of a PWM input signal using the DIO 1552 Type 1 unit of the DS1552 Multi-I/O Module.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	–	✓[1]

[1] Requires a DS1552 Multi-I/O Module.

Where to go from here

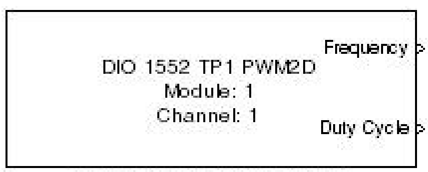
Information in this section

Information in other sections

Block Description (DIO1552_TP1_PWM2D_BLx)

Block

To give information about the appearance and purpose of the block.



DIO1552_TP1_PWM2D_BL1

Purpose

To measure the frequency and duty cycle of a PWM input signal.

Description

In a Simulink model, the block provides channel-wise read access to the duty cycle and frequency of a PWM signal.

If the value to be measured is outside the selected frequency range, a higher value is saturated to `frequency=0` and `duty cycle=1` and a smaller value is saturated to `frequency=0` and `duty cycle=0`.

Note

You cannot use blocks from the RTI FPGA Programming Blockset configured with one of the FPGA1401Tp1 frameworks and the RTI DS1552 I/O Extension Blockset in the same model.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to PWM Measurement (PWM2D) on the DIO 1552 Type 1 Unit (MicroAutoBox II Features 🕮).

I/O characteristics

The following table shows the scaling between the duty cycle of the measured signal and the block's output in Simulink:

Duty Cycle	Simulink Output
0 … 100%	0 … 1

The following table describes the ports of the block:

Port	Description
Output	
Frequency	Outputs the current frequency. Data type: Double Range: Depends on the selected frequency range
Duty Cycle	Outputs the current duty cycle. Data type: Double Range: 0 … 1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO1552_TP1_PWM2D_BLx) on page 320)
- Measurement page (refer to Measurement Page (DIO1552_TP1_PWM2D_BLx) on page 321)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- ds_1552_init
- dio_1552_tp1_init
- dio_1552_tp1_pwm2d_init
- dio_1552_tp1_pwm2d_read

Unit Page (DIO1552_TP1_PWM2D_BLx)

Purpose

To specify the channel on which you want to measure the frequency and duty cycle.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several FPGA Type 1 modules, RTI uses the module number to distinguish between them.

Channel number Lets you select the channel number in the range 1 … 16.

Note

- Concurrent access to the same digital input channel by other DIO 1552 Type 1 blocks or functions is not allowed.
- DigIn ch 1 … DigIn ch 4 are shared with the external trigger inputs of the ADC 1552 Type 1 unit.

Related topics

References

Measurement Page (DIO1552_TP1_PWM2D_BLx)

Purpose

To specify the update mode and the frequency range of the PWM measurement.

Dialog settings

Channel Displays the channel number that you selected on the Unit page.

Update mode Lets you select the update mode of the PWM measurement:

Mode	Description
Asynchronous	The measured values are updated at each edge of the PWM signal. The update is asynchronous to the period.
Synchronous	The measured values are updated at the end of each T_{low} period of the PWM signal only. The update is synchronous to the period.

Range of frequency Lets you select one of the 16 predefined measurement ranges for the input PWM frequency.

Note

The measurement resolution depends on the selected frequency range. Due to quantization effects, you will encounter considerable deviations between the input PWM period and the measured PWM period, especially for higher PWM frequencies. To avoid poor measurement resolution, you should therefore select the frequency range with the best possible resolution (resolution values as small as possible). For example, if your desired frequency is 100 Hz, you should use frequency range 1 (9.54 Hz … 150 kHz) rather than frequency range 2 (4.77 Hz … 150 kHz). For details, refer to PWM Measurement (PWM2D) on the DIO 1552 Type 1 Unit (MicroAutoBox II Features 📖).

Range of period Displays the corresponding period range.

Resolution of frequency Displays the measurement resolution for the selected frequency range.

Related topics

References

Pulse Pattern Measurement

Purpose

To measure the pulse pattern (frequency or pulse width) of PWM signals (FPW2D).

Where to go from here

Information in this section

DIO_TYPE3_F2D_BLx

Purpose

To measure the frequency of a square-wave signal.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

Where to go from here

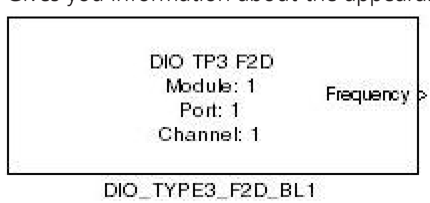
Information in this section

Information in other sections

Block Description (DIO_TYPE3_F2D_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To measure the frequency of a signal.

Description

In a Simulink model, the block provides channel-wise read access to the frequency of a signal. You can configure the resolution for the specified frequency range.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Frequency Measurement (F2D) on the DIO Type 3 Unit (MicroAutoBox II Features 📖).

I/O characteristics

The following table describes the ports of the block:

Port	Description
Output	
Frequency	Outputs the measured frequency value. Unit: Hz Data type: Double Range: Depends on the selected frequency range (see Frequency Measurement (F2D) on the DIO Type 3 Unit (MicroAutoBox II Features 📖))

The frequency of the input signal must remain in the specified measurement range, otherwise the measured value is not correct.

- If the frequency is less than the lower limit, the measured frequency is detected as a 0 Hz signal.
- If the frequency is higher than the upper limit, the measurement is erroneous due to undersampling effects.

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE3_F2D_BLx) on page 325)
- Measurement page (refer to Measurement Page (DIO_TYPE3_F2D_BLx) on page 326)
- Interrupt page (refer to Interrupt Page (DIO_TYPE3_F2D_BLx) on page 327)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- dio_tp3_init
- dio_tp3_f2d_init
- dio_tp3_f2d_read
- dio_tp3_multi_source_int_mode_set

Unit Page (DIO_TYPE3_F2D_BLx)

Purpose

To specify the signal's channel on which you want to measure the frequency.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 📖).

Port number Lets you select the port number in the range 1 … 3.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1, 2	1 … 16
3	1 … 8

Note

Concurrent access to the same digital input channel by other DIO Type 3 blocks or functions is not supported.

Related topics

References

Measurement Page (DIO_TYPE3_F2D_BLx)

Purpose

To specify the frequency range.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Range of frequency Lets you select one of 16 predefined frequency ranges.

Note

The measurement resolution depends on the selected frequency range.
To get the best possible resolution of the measured input signal, you should select the frequency range with the best possible resolution (the frequency range with the lowest possible range number). For example, if your desired frequency is 100 Hz, you should use frequency range 1 (9.54 Hz … 150 kHz) rather than frequency range 2 (4.77 Hz … 150 kHz). For details, refer to Frequency Measurement (F2D) on the DIO Type 3 Unit (MicroAutoBox II Features 📖).

Resolution of frequency Displays the measurement resolution for the selected frequency range.

Related topics

References

Interrupt Page (DIO_TYPE3_F2D_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related **DIO_TYPE3_HWINT_BLx** block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference).

Dialog settings

Port Displays the port number that you selected on the **Unit** page.

Channel Displays the channel number that you selected on the **Unit** page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the **Edge type** setting.

If interrupt generation is enabled, the model has to contain a related DIO_TYPE3_HWINT_BLx block.

If interrupt generation is disabled, the model must not contain a related DIO_TYPE3_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Related topics

References

DIO_TYPE4_F2D_BLx

Purpose

To measure the frequency of a square-wave signal.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

Where to go from here

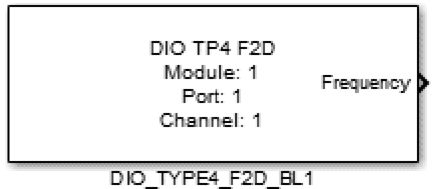
Information in this section

Information in other sections

Block Description (DIO_TYPE4_F2D_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To measure the frequency of a signal.

Description

In a Simulink model, the block provides channel-wise read access to the frequency of a signal. You can configure the resolution for the specified frequency range.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Frequency Measurement (F2D) on the DIO Type 4 Unit (MicroAutoBox II Features 📖).

I/O characteristics

The following table describes the ports of the block:

Port	Description
Output	
Frequency	Outputs the measured frequency value. Unit: Hz Data type: Double Range: Depends on the selected frequency range (see Frequency Measurement (F2D) on the DIO Type 4 Unit (MicroAutoBox II Features 📖))

The frequency of the input signal must remain in the specified measurement range, otherwise the measured value is not correct.

- If the frequency is less than the lower limit, the measured frequency is detected as a 0 Hz signal.
- If the frequency is higher than the upper limit, the measurement is erroneous due to undersampling effects.

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE4_F2D_BLx) on page 330)
- Measurement page (refer to Measurement Page (DIO_TYPE4_F2D_BLx) on page 331)
- Interrupt page (refer to Interrupt Page (DIO_TYPE4_F2D_BLx) on page 332)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- dio_tp4_init
- dio_tp4_f2d_init
- dio_tp4_f2d_read
- dio_tp4_multi_source_int_mode_set

Unit Page (DIO_TYPE4_F2D_BLx)

Purpose

To specify the signal's channel on which you want to measure the frequency.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 📖).

Port number Lets you select the port number in the range 1 … 2.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1	1 … 16
2	1 … 8

Note

Concurrent access to the same digital input channel by other DIO Type 4 blocks or functions is not supported.

Related topics

References

Measurement Page (DIO_TYPE4_F2D_BLx)

Purpose

To specify the frequency range.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Range of frequency Lets you select one of 16 predefined frequency ranges.

Note

The measurement resolution depends on the selected frequency range.
To get the best possible resolution of the measured input signal, you should select the frequency range with the best possible resolution (the frequency range with the lowest possible range number). For example, if your desired frequency is 100 Hz, you should use frequency range 1 (9.54 Hz … 150 kHz) rather than frequency range 2 (4.77 Hz … 150 kHz). For details, refer to Frequency Measurement (F2D) on the DIO Type 4 Unit (MicroAutoBox II Features 📖).

Resolution of frequency Displays the measurement resolution for the selected frequency range.

Related topics

References

Interrupt Page (DIO_TYPE4_F2D_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related DIO_TYPE4_HWINT_BLx on page 61 block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 📖).

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the Edge type setting.

If interrupt generation is enabled, the model has to contain a related DIO_TYPE4_HWINT_BLx block.

If interrupt generation is disabled, the model must not contain a related DIO_TYPE4_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Related topics

References

DIO1552_TP1_F2D_BLx

Purpose

To measure the frequency of a square-wave signal using the DIO 1552 Type 1 unit of the DS1552 Multi-I/O Module.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	–	✓ [1)]

[1)] Requires a DS1552 Multi-I/O Module.

Where to go from here

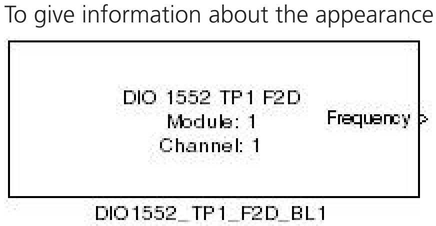
Information in this section

Information in other sections

Block Description (DIO1552_TP1_F2D_BLx)

Block

To give information about the appearance and purpose of the block.



Purpose

To measure the frequency of a square-wave signal.

Description

In a Simulink model, the block provides channel-wise read access to the frequency of a square-wave signal. You can configure the resolution for the specified frequency range.

> **Note**
>
> You cannot use blocks from the RTI FPGA Programming Blockset configured with one of the FPGA1401Tp1 frameworks and the RTI DS1552 I/O Extension Blockset in the same model.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Frequency Measurement (F2D) on the DIO 1552 Type 1 Unit (MicroAutoBox II Features 🕮).

I/O characteristics

The following table describes the ports of the block:

Port	Description
Output	
Frequency	Outputs the measured frequency value. Unit: Hz Data type: Double Range: Depends on the selected frequency range (see Frequency Measurement (F2D) on the DIO 1552 Type 1 Unit (MicroAutoBox II Features 🕮))

The frequency of the input signal must remain in the specified measurement range, otherwise the measured value is not correct.

- If the frequency is less than the lower limit, the measured frequency is detected as a 0 Hz signal.
- If the frequency is higher than the upper limit, the measurement is erroneous due to undersampling effects.

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO1552_TP1_F2D_BLx) on page 335)
- Measurement page (refer to Measurement Page (DIO1552_TP1_F2D_BLx) on page 335)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- ds_1552_init
- dio_1552_tp1_init
- dio_1552_tp1_f2d_init
- dio_1552_tp1_f2d_read

Unit Page (DIO1552_TP1_F2D_BLx)

Purpose

To specify the signal's channel on which you want to measure the frequency.

Dialog settings

Module number Lets you select the module number in the range 1 ... 16. If your system contains several FPGA Type 1 modules, RTI uses the module number to distinguish between them.

Channel number Lets you select the channel number in the range 1 ... 16.

Note

- Concurrent access to the same digital input channel by other DIO 1552 Type 1 blocks or functions is not allowed.
- DigIn ch 1 ... DigIn ch 4 are shared with the external trigger inputs of the ADC 1552 Type 1 unit.

Related topics

References

Block Description (DIO1552_TP1_F2D_BLx)............ 333
Measurement Page (DIO1552_TP1_F2D_BLx)............ 335

Measurement Page (DIO1552_TP1_F2D_BLx)

Purpose

To specify the frequency range.

Dialog settings

Channel Displays the channel number that you selected on the Unit page.

Range of frequency Lets you select one of 16 predefined frequency ranges.

Note

The measurement resolution depends on the selected frequency range. Due to quantization effects, you will encounter considerable deviations between the input signal period and the measured signal period, especially for higher frequencies. To avoid poor measurement resolution, you should therefore select the frequency range with the best possible resolution (resolution values as small as possible). For example, if your desired frequency is 100 Hz, you should use frequency range 1 (9.54 Hz … 150 kHz) rather than frequency range 2 (4.77 Hz … 150 kHz). For details, refer to Frequency Measurement (F2D) on the DIO 1552 Type 1 Unit (MicroAutoBox II Features).

Resolution of frequency Displays the measurement resolution for the selected frequency range.

Related topics

References

DIO_TYPE3_PW2D_BLx

Purpose

To measure the pulse width of a square-wave signal.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

Where to go from here

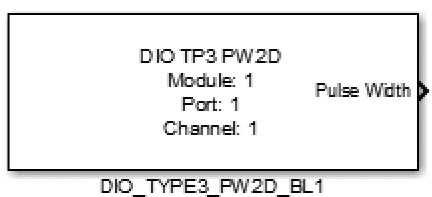
Information in this section

Information in other sections

Block Description (DIO_TYPE3_PW2D_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To measure the pulse width of a signal.

Description

In a Simulink model, the block provides channel-wise read access to the pulse width of a signal. You can configure the pulse width range to get the desired measurement resolution.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Pulse Width Measurement (PW2D) on the DIO Type 3 Unit (MicroAutoBox II Features 📖).

I/O characteristics

The following table describes the ports of the block:

Port	Description
Output	
Pulse Width	Outputs the measured pulse width. Unit: s Data type: Double Range: Depends on the selected pulse width range (see Pulse Width Measurement (PW2D) on the DIO Type 3 Unit (MicroAutoBox II Features 📖))

The pulse width of the input signal must remain in the specified pulse width range, otherwise the measured value is not correct.

- If the pulse width is less than the lower limit, the measured pulse width is unpredictable.
- If the pulse width is higher than the upper limit, the measured pulse width is detected as the maximum float value (FLT_MAX).

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE3_PW2D_BLx) on page 338)
- Measurement page (refer to Measurement Page (DIO_TYPE3_PW2D_BLx) on page 339)
- Interrupt page (refer to Interrupt Page (DIO_TYPE3_PW2D_BLx) on page 340)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- dio_tp3_init
- dio_tp3_pw2d_init
- dio_tp3_pw2d_read
- dio_tp3_multi_source_int_mode_set

Unit Page (DIO_TYPE3_PW2D_BLx)

Purpose

To specify the signal's channel on which you want to measure the pulse width.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 🕮).

Port number Lets you select the port number in the range 1 … 3.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1, 2	1 … 16
3	1 … 8

Note

Concurrent access to the same digital input channel by other DIO Type 3 blocks or functions is not supported.

Related topics

References

Measurement Page (DIO_TYPE3_PW2D_BLx)

Purpose

To specify the measurement mode and the pulse width range.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Measurement mode Lets you select the edge polarity of the pulse width measurement.

Measurement Mode	Meaning
Rising edge	The measurement starts with a rising edge of the connected signal so that the high time of the pulse is measured.

Measurement Mode	Meaning
Falling edge	The measurement starts with a falling edge of the connected signal so that the low time of the pulse is measured.

Range of pulse width Lets you select one of 16 predefined pulse width ranges.

Resolution of pulse width Displays the measurement resolution for the selected pulse width range.

Note

The measurement resolution depends on the selected pulse width range. To get the best possible resolution of the measured input signal, you should select the pulse width range with the best possible resolution (the pulse width range with the lowest possible range number). For example, if your desired pulse width is 1 ms, you should use pulse width range 1 (3.33 µs … 1.63 ms) rather than pulse width range 2 (3.33 µs … 3.27 ms). For details, refer to Pulse Width Measurement (PW2D) on the DIO Type 3 Unit (MicroAutoBox II Features 📖).

Related topics

References

Interrupt Page (DIO_TYPE3_PW2D_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related DIO_TYPE3_HWINT_BLx block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 📖).

Dialog settings

Port Displays the port number that you selected on the **Unit** page.

Channel Displays the channel number that you selected on the **Unit** page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the **Edge type** setting.

If interrupt generation is enabled, the model has to contain a related DIO_TYPE3_HWINT_BLx block.

If interrupt generation is disabled, the model must not contain a related DIO_TYPE3_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Related topics

References

DIO_TYPE4_PW2D_BLx

Purpose

To measure the pulse width of a square-wave signal.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

Where to go from here

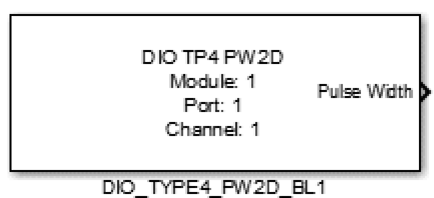
Information in this section

Information in other sections

Block Description (DIO_TYPE4_PW2D_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To measure the pulse width of a signal.

Description

In a Simulink model, the block provides channel-wise read access to the pulse width of a signal. You can configure the pulse width range to get the desired measurement resolution.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Pulse Width Measurement (PW2D) on the DIO Type 4 Unit (MicroAutoBox II Features 📖).

I/O characteristics

The following table describes the ports of the block:

Port	Description
Output	
Pulse Width	Outputs the measured pulse width. Unit: s Data type: Double Range: Depends on the selected pulse width range (see Pulse Width Measurement (PW2D) on the DIO Type 4 Unit (MicroAutoBox II Features 🕮))

The pulse width of the input signal must remain in the specified pulse width range, otherwise the measured value is not correct.

- If the pulse width is less than the lower limit, the measured pulse width is unpredictable.
- If the pulse width is higher than the upper limit, the measured pulse width is detected as the maximum float value (FLT_MAX).

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE4_PW2D_BLx) on page 343)
- Measurement page (refer to Measurement Page (DIO_TYPE4_PW2D_BLx) on page 344)
- Interrupt page (refer to Interrupt Page (DIO_TYPE4_PW2D_BLx) on page 345)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- dio_tp4_init
- dio_tp4_pw2d_init
- dio_tp4_pw2d_read
- dio_tp4_multi_source_int_mode_set

Unit Page (DIO_TYPE4_PW2D_BLx)

Purpose

To specify the signal's channel on which you want to measure the pulse width.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 📖).

Port number Lets you select the port number in the range 1 … 2.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1	1 … 16
2	1 … 8

Note

Concurrent access to the same digital input channel by other DIO Type 4 blocks or functions is not supported.

Related topics

References

Measurement Page (DIO_TYPE4_PW2D_BLx)

Purpose

To specify the measurement mode and the pulse width range.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Measurement mode Lets you select the edge polarity of the pulse width measurement.

Measurement Mode	Meaning
Rising edge	The measurement starts with a rising edge of the connected signal so that the high time of the pulse is measured.

Measurement Mode	Meaning
Falling edge	The measurement starts with a falling edge of the connected signal so that the low time of the pulse is measured.

Range of pulse width Lets you select one of 16 predefined pulse width ranges.

Resolution of pulse width Displays the measurement resolution for the selected pulse width range.

Note

The measurement resolution depends on the selected pulse width range. To get the best possible resolution of the measured input signal, you should select the pulse width range with the best possible resolution (the pulse width range with the lowest possible range number). For example, if your desired pulse width is 1 ms, you should use pulse width range 1 (3.33 µs … 1.63 ms) rather than pulse width range 2 (3.33 µs … 3.27 ms). For details, refer to Pulse Width Measurement (PW2D) on the DIO Type 4 Unit (MicroAutoBox II Features 📖).

Related topics

References

Interrupt Page (DIO_TYPE4_PW2D_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

If you enable interrupt generation, your model has to contain a related **DIO_TYPE4_HWINT_BLx** on page 61 block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 📖).

Dialog settings

Port Displays the port number that you selected on the **Unit** page.

Channel Displays the channel number that you selected on the **Unit** page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the **Edge type** setting.

If interrupt generation is enabled, the model has to contain a related DIO_TYPE4_HWINT_BLx block.

If interrupt generation is disabled, the model must not contain a related DIO_TYPE4_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Related topics

References

Block Description (DIO_TYPE4_PW2D_BLx)............342
DIO_TYPE4_HWINT_BLx............61
Measurement Page (DIO_TYPE4_PW2D_BLx)............344
Unit Page (DIO_TYPE4_PW2D_BLx)............343

Incremental Encoder Interface

Purpose

To decode the TTL signals of an incremental encoder (rotation measurement), for example, to measure an engine's speed.

Where to go from here

Information in this section

DIO_TYPE3_ENC_BLx

Purpose

To read the position and speed of an incremental encoder interface.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

Where to go from here

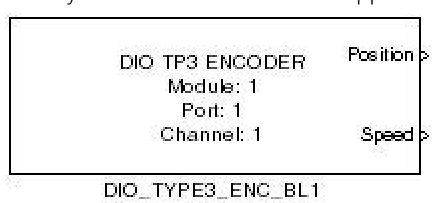
Information in this section

Information in other sections

Block Description (DIO_TYPE3_ENC_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To provide read access to the position and speed of an incremental encoder interface.

Description

You can specify up to 4 encoders. Each encoder requires two channels (PHI0 and PHI90) or three channels when using an index signal (PHI0, PHI90 and IDX). An encoder interface is specified by its first channel. The successive channels are automatically allocated.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Incremental Encoder Interface on the DIO Type 3 Unit (MicroAutoBox II Features 📖).

I/O characteristics

The following table describes the ports of the block:

Port	Description
Output	
Position	Outputs the current encoder position. Data type: Double Range: depends on the adjusted upper and lower encoder limits on the **Parameters** page (maximal range: -2,097,152.0 … +2,097,151.75)
Speed	Outputs the current encoder speed. The unit is in lines/s in steps of 0.25. The rotation direction is given by a positive or negative value. A positive value represents a clockwise rotation. For further information, refer to Basics on the Incremental Encoder Interface (MicroAutoBox II Features 📖) and Incremental Encoder Interface on the DIO Type 3 Unit (MicroAutoBox II Features 📖). Data type: Double Range: depends on the position range

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE3_ENC_BLx) on page 349)
- Parameters page (refer to Parameters Page (DIO_TYPE3_ENC_BLx) on page 350)
- Advanced page (refer to Advanced Page (DIO_TYPE3_ENC_BLx) on page 351)
- Interrupt page (refer to Interrupt Page (DIO_TYPE3_ENC_BLx) on page 352)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- dio_tp3_init
- dio_tp3_enc_init
- dio_tp3_enc_read
- dio_tp3_multi_source_int_mode_set

Unit Page (DIO_TYPE3_ENC_BLx)

Purpose

To provide access to an incremental encoder interface by referencing the related module and channel.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 📖).

Port number Lets you select the port number in the range 1 … 3.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number	
	Index Enabled	Index Disabled
1, 2	1 … 14	1 … 15
3	1 … 6	1 … 7

Note

Concurrent access to the same digital input channel by other DIO Type 3 blocks or functions is not supported.

Related topics

References

Parameters Page (DIO_TYPE3_ENC_BLx)

Purpose

To configure an incremental encoder interface channel.

Description

To adapt the length of the position counter to the resolution of the connected encoder, you can specify the minimum and maximum position count values. For further information, refer to Incremental Encoder Interface on the DIO Type 3 Unit (MicroAutoBox II Features 📖).

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Minimum position value Lets you enter the lower limit for the position value to be read in the range -2,097,152.0 … +2,097,151.5 in steps of 0.25.

Maximum position value Lets you enter the upper limit for the position value to be read in the range -2,097,151.75 … +2,097,151.75 in steps of 0.25.

Initial position Lets you enter the initial position at the start of the simulation. The value can be specified in the range Minimum position value … Maximum position value in steps of 0.25.

Index input Lets you select the index mode to be used. The number of available channels depends on this setting, refer to Unit Page (DIO_TYPE3_ENC_BLx) on page 349.

Index Mode	Meaning
Not used	The index signal is not used.
Reset position value only at the first index transition	The index signal is only used at the first time of appearance to set the position value to the specified index position.
Reset position value every index transition	The index signal is used at each index transition to set the position value to the specified index position.

On index set position to Lets you enter the position value to be set if an index signal appeared. This setting can only be modified, if you have specified to react on an index signal. The position can be set in the range Minimum position value … Maximum position value in steps of 0.25.

Related topics

References

Advanced Page (DIO_TYPE3_ENC_BLx)

Purpose

To specify additional options, like the gated mode or the noise filter.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Enable gated mode Lets you enable the gated mode. In gated mode, the index signal is only valid if the PHI0 and PHI90 signals are also high, otherwise the index signal is evaluated independently from the PHI0 and PHI90 signals.

Noise filter Lets you select the noise filter sample rate for all inputs of the specified incremental encoder in the range 312.5 kHz … 20 MHz. For further information, refer to Incremental Encoder Interface on the DIO Type 3 Unit (MicroAutoBox II Features 📖).

Related topics

References

Interrupt Page (DIO_TYPE3_ENC_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

The interrupt generation is triggered by the PHI0 signal.

If you enable the interrupt generation, your model has to contain a related DIO_TYPE3_HWINT_BLx block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 📖).

Dialog settings

Port Displays the port number that you selected on the **Unit** page.

Channel Displays the channel number that you selected on the **Unit** page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the **Edge type** setting.
If interrupt generation is enabled, the model has to contain a related DIO_TYPE3_HWINT_BLx block.
If interrupt generation is disabled, the model must not contain a related DIO_TYPE3_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Related topics

References

DIO_TYPE3_ENC_POS_SET_BLx

Purpose

To write a value to the position count of an incremental encoder.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

Where to go from here

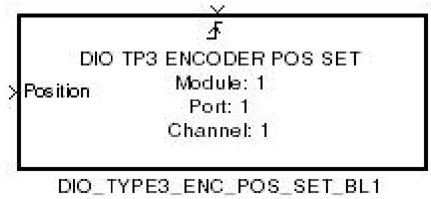
Information in this section

Information in other sections

Block Description (DIO_TYPE3_ENC_POS_SET_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To write the position value to the incremental encoder interface.

Description

The encoder position is written to the position count register if the trigger input is set.

If the Position inport of the block is not connected to an appropriated block, the block writes the initial value of 0 to the position count register of the encoder.

This blocks requires at least one DIO_TYPE3_ENC_BLx block in the model that is responsible for the configuration of the encoder. A modification in the related DIO_TYPE3_ENC_BLx block leads to a reset of a configured DIO_TYPE3_ENC_POS_SET_BLx block.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Incremental Encoder Interface on the DIO Type 3 Unit (MicroAutoBox II Features 📖).

I/O characteristics

When the port is triggered via the trigger input, the position count is set to the specified value.

The following table describes the ports of the block:

Port	Description
Input	
Trigger input	Input port for the trigger signal.
Position	Writes the value to the position count register of the specified encoder. Data type: Double Range: depends on the upper and lower encoder limits specified in the related DIO_TYPE3_ENC_BLx block

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE3_ENC_POS_SET_BLx) on page 355)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dio_tp3_enc_write

Unit Page (DIO_TYPE3_ENC_POS_SET_BLx)

Purpose

To specify the encoder to write the position value to.

Dialog settings

Select encoder Lets you select an encoder from the encoder list that contains all the DIO_TYPE3_ENC_BLx blocks in the model. An encoder is identified by its module number, port number and channel number. If there is no DIO_TYPE3_ENC_BLx block in the model, or a previously specified block was deleted or modified, the setting is set to NOT SELECTED.

A second DIO_TYPE3_ENC_POS_SET_BLx block in the model with the same encoder configuration is not allowed.

Related topics

References

DIO_TYPE4_ENC_BLx

Purpose

To read the position and speed of an incremental encoder interface.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

Where to go from here

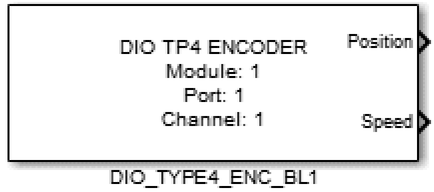
Information in this section

Information in other sections

Block Description (DIO_TYPE4_ENC_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To provide read access to the position and speed of an incremental encoder interface.

Description

You can specify up to 4 encoders. Each encoder requires two channels (PHI0 and PHI90) or three channels when using an index signal (PHI0, PHI90 and IDX). An encoder interface is specified by its first channel. The successive channels are automatically allocated.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Incremental Encoder Interface on the DIO Type 4 Unit (MicroAutoBox II Features 📖).

I/O characteristics

The following table describes the ports of the block:

Port	Description
Output	
Position	Outputs the current encoder position. Data type: Double Range: depends on the adjusted upper and lower encoder limits on the **Parameters** page (maximal range: -2,097,152.0 … +2,097,151.75)
Speed	Outputs the current encoder speed. The unit is in lines/s in steps of 0.25. The rotation direction is given by a positive or negative value. A positive value represents a clockwise rotation. For further information, refer to Basics on the Incremental Encoder Interface (MicroAutoBox II Features 📖) and Incremental Encoder Interface on the DIO Type 4 Unit (MicroAutoBox II Features 📖). Data type: Double Range: depends on the position range

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE4_ENC_BLx) on page 358)
- Parameters page (refer to Parameters Page (DIO_TYPE4_ENC_BLx) on page 359)
- Advanced page (refer to Advanced Page (DIO_TYPE4_ENC_BLx) on page 360)
- Interrupt page (refer to Interrupt Page (DIO_TYPE4_ENC_BLx) on page 361)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dio_tp4_init
- dio_tp4_enc_init
- dio_tp4_enc_read
- dio_tp4_multi_source_int_mode_set

Unit Page (DIO_TYPE4_ENC_BLx)

Purpose

To provide access to an incremental encoder interface by referencing the related module and channel.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features).

Port number Lets you select the port number in the range 1 … 2.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number	
	Index Enabled	Index Disabled
1	1 … 14	1 … 15
2	1 … 6	1 … 7

Note

Concurrent access to the same digital input channel by other DIO Type 4 blocks or functions is not supported.

Related topics

References

Parameters Page (DIO_TYPE4_ENC_BLx)

Purpose

To configure an incremental encoder interface channel.

Description

To adapt the length of the position counter to the resolution of the connected encoder, you can specify the minimum and maximum position count values. For further information, refer to Incremental Encoder Interface on the DIO Type 4 Unit (MicroAutoBox II Features 📖).

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Minimum position value Lets you enter the lower limit for the position value to be read in the range -2,097,152.0 … +2,097,151.5 in steps of 0.25.

Maximum position value Lets you enter the upper limit for the position value to be read in the range -2,097,151.75 … +2,097,151.75 in steps of 0.25.

Initial position Lets you enter the initial position at the start of the simulation. The value can be specified in the range Minimum position value … Maximum position value in steps of 0.25.

Index input Lets you select the index mode to be used. The number of available channels depends on this setting, refer to Unit Page (DIO_TYPE4_ENC_BLx) on page 358.

Index Mode	Meaning
Not used	The index signal is not used.
Reset position value only at the first index transition	The index signal is only used at the first time of appearance to set the position value to the specified index position.
Reset position value every index transition	The index signal is used at each index transition to set the position value to the specified index position.

On index set position to Lets you enter the position value to be set if an index signal appeared. This setting can only be modified, if you have specified to react on an index signal. The position can be set in the range Minimum position value … Maximum position value in steps of 0.25.

Related topics

References

Advanced Page (DIO_TYPE4_ENC_BLx)

Purpose

To specify additional options, like the gated mode or the noise filter.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Enable gated mode Lets you enable the gated mode. In gated mode, the index signal is only valid if the PHI0 and PHI90 signals are also high, otherwise the index signal is evaluated independently from the PHI0 and PHI90 signals.

Noise filter Lets you select the noise filter sample rate for all inputs of the specified incremental encoder in the range 312.5 kHz … 20 MHz. For further information, refer to Incremental Encoder Interface on the DIO Type 4 Unit (MicroAutoBox II Features 🕮).

Related topics

References

Interrupt Page (DIO_TYPE4_ENC_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

The interrupt generation is triggered by the PHI0 signal.

If you enable the interrupt generation, your model has to contain a related DIO_TYPE4_HWINT_BLx block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 📖).

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Enable interrupt Lets you enable or disable the generation of an interrupt. If interrupt generation is enabled, you can specify the Edge type setting.
If interrupt generation is enabled, the model has to contain a related DIO_TYPE4_HWINT_BLx block.
If interrupt generation is disabled, the model must not contain a related DIO_TYPE4_HWINT_BLx block.

Edge type Lets you select the edge type used for interrupt generation.

Parameter	Meaning
Falling edge	Generates an interrupt at each falling edge.
Rising edge	Generates an interrupt at each rising edge.
Both edges	Generates an interrupt at each falling and rising edge.

Related topics

References

Advanced Page (DIO_TYPE4_ENC_BLx)....360
Block Description (DIO_TYPE4_ENC_BLx)....357
Parameters Page (DIO_TYPE4_ENC_BLx)....359
Unit Page (DIO_TYPE4_ENC_BLx)....358

DIO_TYPE4_ENC_POS_SET_BLx

Purpose

To write a value to the position count of an incremental encoder.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

Where to go from here

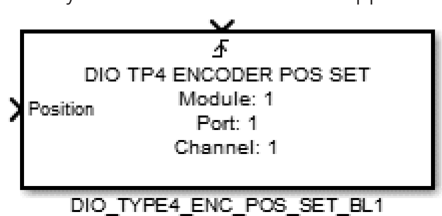
Information in this section

Information in other sections

Block Description (DIO_TYPE4_ENC_POS_SET_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To write the position value to the incremental encoder interface.

Description

The encoder position is written to the position count register if the trigger input is set.

If the Position inport of the block is not connected to an appropriated block, the block writes the initial value of 0 to the position count register of the encoder.

This blocks requires at least one DIO_TYPE4_ENC_BLx block in the model that is responsible for the configuration of the encoder. A modification in the related DIO_TYPE4_ENC_BLx block leads to a reset of a configured DIO_TYPE4_ENC_POS_SET_BLx block.

I/O mapping

For information on the mapping of channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Incremental Encoder Interface on the DIO Type 4 Unit (MicroAutoBox II Features).

I/O characteristics

When the port is triggered via the trigger input, the position count is set to the specified value.

The following table describes the ports of the block:

Port	Description
Input	
Trigger input	Input port for the trigger signal.
Position	Writes the value to the position count register of the specified encoder. Data type: Double Range: depends on the upper and lower encoder limits specified in the related DIO_TYPE4_ENC_BLx block

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE4_ENC_POS_SET_BLx) on page 364)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dio_tp4_enc_write

Unit Page (DIO_TYPE4_ENC_POS_SET_BLx)

Purpose

To specify the encoder to write the position value to.

Dialog settings

Select encoder Lets you select an encoder from the encoder list that contains all the DIO_TYPE4_ENC_BLx blocks in the model. An encoder is identified by its module number, port number and channel number. If there is no DIO_TYPE4_ENC_BLx block in the model, or a previously specified block was deleted or modified, the setting is set to NOT SELECTED.

A second DIO_TYPE4_ENC_POS_SET_BLx block in the model with the same encoder configuration is not allowed.

Related topics

References

Block Description (DIO_TYPE4_ENC_POS_SET_BLx)....................362

FlexRay Communication

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	✓	–	–	✓

FlexRay-Related Documentation

Introduction

The following provides a list of documents that you are recommended to read when implementing a real-time model on a FlexRay system. dSPACE provides the FlexRay Configuration Blockset which works on the base of a FIBEX file. The blocks are configured using the FlexRay Configuration Tool.

- FlexRay Support (MicroAutoBox II Features 🕮)
- RTI FlexRay Configuration Blockset Reference 🕮
- FlexRay Configuration Features 🕮
- FlexRay Configuration Tool Guide 🕮

Serial Interface

Where to go from here

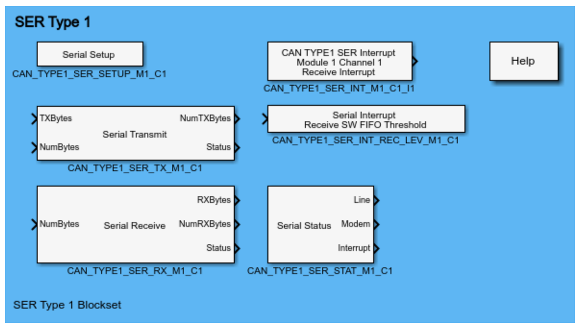
Information in this section

General Information on the Serial Interface

Overview of the Serial Interface

Introduction

After you double-click the SER TYPE 1 button in one of the hardware-specific sublibraries, the Library: rti1401stdasertplib is displayed.



The Serial Interface blocks can be used to implement serial communication.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	✓	✓	✓	–

Basic principles

Refer to Basic Principles of Serial Communication with RTI Blocks on page 370.

> **Note**
>
> Although the serial blocks of different boards are almost the same, you must always use the board-specific serial blocks.

Library components

The library contains the following RTI blocks:

- CAN_TYPE1_SER_SETUP_Mx_Cy on page 372
- CAN_TYPE1_SER_STAT_Mx_Cy on page 377

Basic Principles of Serial Communication with RTI Blocks

Purpose

This section explains the basic principles of serial communication with RTI blocks.

Where to go from here

Information in this section

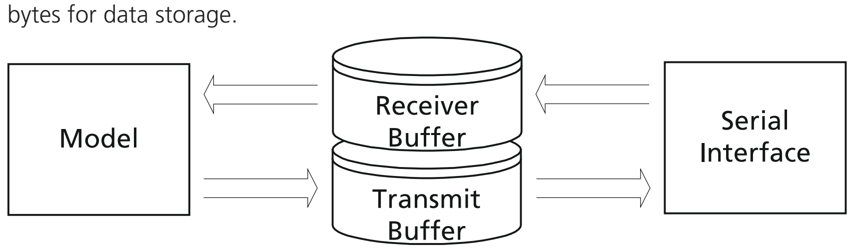
Information in other sections

Serial Interface (MicroAutoBox II Features 📖)

Basics on the Buffer Used for Serial Communication

Software FIFO buffer

The software FIFO buffer is a memory section of the DPMEM used for master/slave communication and therefore restricted to an additional space of 64 bytes for data storage.



The software FIFO buffer stores data that will be written to the UART (transmit buffer) or that was read by it (receive buffer).

Transmit buffer

To transmit data, you only have to write it to the transmit buffer (TX SW FIFO) with the CAN_TYPE1_SER_TX_Mx_Cy block. The data is then transmitted via the UART.

Receive buffer

Data that is received via the serial interface is first copied to the UART buffer. When the number of received bytes exceeds the UART threshold or when the UART timeout is triggered, the bytes are copied to the receive buffer.

UART threshold The UART threshold is defined in the CAN_TYPE1_SER_SETUP_Mx_Cy block.

UART timeout The UART timeout is triggered when no signal is received during an interval of 4 signals after the last signal. The time value depends on the number of bits per signal and the baud rate. The worst case is a signal with 12 bits (1 start bit, 8 data bits, 1 parity bit, and 2 stop bits) and a baud rate of 300 baud. In this case the timeout is 160 ms after the last signal is received.

To get the data into your model, use the CAN_TYPE1_SER_RX_Mx_Cy block. It reads the data from the receive buffer and copies it to an outport. To get a trigger signal when the receive buffer contains data, use the CAN_TYPE1_SER_INT_Mx_Cy_Iz block.

CAN_TYPE1_SER_SETUP_Mx_Cy

Where to go from here

Information in this section

Block Description (CAN_TYPE1_SER_SETUP_Mx_Cy)

Block

Purpose

To set the global parameters for the serial interface.

Note

- This block has to be placed in the model if any of the other serial blocks is used for the corresponding board.
- This block must not be used more than once per channel.

I/O mapping

For information on the I/O mapping, refer to Serial Interface (MicroAutoBox II Features 📖).

Dialog pages

The dialog settings can be specified on the following pages:

- **Unit Page** (refer to Unit Page (CAN_TYPE1_SER_SETUP_Mx_Cy) on page 373)
- **UART Page** (refer to UART Page (CAN_TYPE1_SER_SETUP_Mx_Cy) on page 374)

- FIFO Page (refer to FIFO Page (CAN_TYPE1_SER_SETUP_Mx_Cy) on page 375)
- Advanced Page (refer to Advanced Page (CAN_TYPE1_SER_SETUP_Mx_Cy) on page 376)

Related RTLib functions

This RTI block is implemented using the following RTLib functions:

- dsser_init
- dsser_config
- dsser_set

Related topics

References

Unit Page (CAN_TYPE1_SER_SETUP_Mx_Cy)

Purpose

To select the module number and channel number.

Dialog settings

Module number Lets you choose the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 📖).

Channel number Lets you choose the number of the channel in the range 1 … 2. The permitted values depend on the board used.

Related topics

References

UART Page (CAN_TYPE1_SER_SETUP_Mx_Cy)

Purpose

To specify the UART parameters.

Dialog settings

Transceiver Lets you select the transceiver mode:

Transceiver Mode	Meaning
RS232	RS232 mode
K-Line	K line (only for DS1401/CAN_TYPE1)

Note

The DS1401/CAN_TYPE1 has two channels:
- Channel 1 is fixed to a RS232 interface
- Channel 2 is fixed to a K line

Baud rate Lets you specify the baud rate in bits per second.

Mode	Baud Rate Range
RS232	5 … 115,200 baud
K-Line	5 … 38,400 baud

For further information, refer to Specifying the Baud Rate of the Serial Interface (MicroAutoBox II Features 🕮).

Data bits Lets you choose the number of data bits. The valid values are: 5, 6, 7, 8.

Stop bits Lets you choose the number of stop bits. The valid values are: 1, 1.5 or 2. If you select 1.5 or 2, the number of stop bits depends on the number of specified data bits: For 5 data bits there are 1.5 stop bits; for 6, 7 and 8 data bits there are 2 stop bits.

Parity Lets you choose the parity mode:

Parity Mode	Meaning
No	No parity bits
Odd	Parity bit is set so that there is an odd number of "1" bits in the byte, including the parity bit

Parity Mode	Meaning
Even	Parity bit is set so that there is an even number of "1" bits in the byte, including the parity bit
Forced parity one	Parity bit is forced to a logical 1

Copy data to RX SW FIFO after reception of <value> byte(s) at latest Lets you choose the UART threshold at which data is copied from the UART to the receive buffer. Values are: 1, 4, 8, 14.

Note

Use the highest UART threshold possible to generate fewer interrupts, i.e., to decrease the UART's workload.

Related topics

References

Advanced Page (CAN_TYPE1_SER_SETUP_Mx_Cy)....................376
Block Description (CAN_TYPE1_SER_SETUP_Mx_Cy)....................372
FIFO Page (CAN_TYPE1_SER_SETUP_Mx_Cy)....................375
Unit Page (CAN_TYPE1_SER_SETUP_Mx_Cy)....................373

FIFO Page (CAN_TYPE1_SER_SETUP_Mx_Cy)

Purpose

To specify the software FIFO buffer.

Dialog settings

SW FIFO size Lets you specify the size of the software buffer. The size must be a power of two (2^n) and at least 64 bytes great. The maximum size depends on the available memory. The software buffer of a DS1401/CAN_TYPE1 has a fixed size of 64 bytes.

Overwrite mode Lets you choose the behavior of the receive buffer when an overrun occurs:

Overwrite Mode	Meaning
Discard new data	If the receive buffer is full, the new data is discarded.
Replace old data with FIFO method	If the receive buffer is full, the new data replaces the oldest data in the buffer. The number of bytes that are replaced is defined by **Block size**.

Block size Lets you specify the number of bytes that are deleted in RX SW FIFO overrun (see table above). Use this parameter to set up the appropriate data consistency for your model. Value range: 1 … (`SW FIFO size`-1)

Related topics

References

Advanced Page (CAN_TYPE1_SER_SETUP_Mx_Cy)

Purpose

To specify the behavior on model termination.

Dialog settings

Disable UART on termination Lets you choose the UART behavior on model termination. If the UART is disabled, data is neither transmitted nor received. No interrupts are generated in this case.

Related topics

References

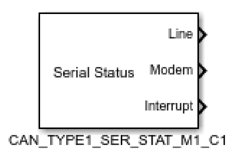
CAN_TYPE1_SER_STAT_Mx_Cy

Where to go from here

Information in this section

Block Description (CAN_TYPE1_SER_STAT_Mx_Cy)

Block



Purpose

To read the contents of the UART status register.

Note

This block can only be used in interrupt-driven subsystems (see CAN_TYPE1_SER_INT_Mx_Cy_Iz on page 391).

- The Line status delivers correct results only if the block resides in a subsystem driven by the Line status interrupt.
- The Modem status delivers correct results only if the block resides in a subsystem driven by the Modem status interrupt.
- The Interrupt status is non-functional at the moment.

Description

The block reads the line, modem and interrupt statuses and writes the values to the outports. If you do not want to evaluate a status register, you can disable its outport with the block dialog.

I/O mapping

For information on the I/O mapping, refer to Serial Interface (MicroAutoBox II Features 📖).

I/O characteristics

The outports show the values of the UART's register.

- The Line port outputs the 8 bits of the line status register. The following table shows the meanings of the individual bits:

Index	Meaning
1	Data ready (DR) indicator
2	Overrun error (OE) indicator
3	Parity error (PE) indicator
4	Framing error (FE) indicator
5	Break interrupt (BI) indicator
6	Transmitter holding register empty (THRE) indicator
7	Transmitter empty (TEMT) indicator
8	Error in receiver FIFO

- The Modem port outputs the 8 bits of the modem status register. The following table shows the meanings of the individual bits:

Index	Meaning
1	Clear-to-send (CTS) changed state
2	Data-set-ready (DSR) changed state
3	Ring-indicator (RI) changed state
4	Data-carrier-detect (DCD) changed state
5	Complement of CTSA DS1401/CAN_TYPE1 with channel 1 (K-line transceiver) uses this bit for the signal of the L line. This signal is inverted.
6	Complement of DSR
7	Complement of RI
8	Complement of DCD

Note

MicroAutoBox II does not support the Modem status interrupt. The modem status register therefore contains always the initial values: Bits 0 … 3 are cleared (=0), Bits 4 … 7 are input signals (=1).

- The Interrupt port outputs the 8 bits of the interrupt status register. The following table shows the meanings of the individual bits:

Index	Meaning
1	Interrupt status: 0 if interrupt pending
2	Interrupt ID bit 1
3	Interrupt ID bit 2
4	Interrupt ID bit 3
5	Not relevant
6	Not relevant

Index	Meaning
7	FIFOs enabled (bit 0)
8	FIFOs enabled (bit 1)

- The following table shows the characteristics of the block outputs:

Port	Characteristics	Value
Line	Datatype	Boolean
	Range	0, 1
	Size	8
Modem	Datatype	Boolean
	Range	0, 1
	Size	8
Interrupt	Datatype	Boolean
	Range	0, 1
	Size	8

Dialog pages

The dialog settings can be specified on the following pages:

- Unit Page (refer to Unit Page (CAN_TYPE1_SER_STAT_Mx_Cy) on page 379)
- Status Page (refer to Status Page (CAN_TYPE1_SER_STAT_Mx_Cy) on page 380)

Related RTLib functions

This RTI block is implemented using the following RTLib function:

- dsser_status_read

Related topics

References

Unit Page (CAN_TYPE1_SER_STAT_Mx_Cy)

Purpose

To specify module and channel number used for reading the status.

Dialog settings

Module number Lets you choose the module number within the range 1 … 16.

Channel number Lets you choose the number of the channel. The permitted values are:

Board	Permitted Values
DS1401/CAN_TYPE1	1 or 2

Related topics

References

Block Description (CAN_TYPE1_SER_STAT_Mx_Cy)........377
Status Page (CAN_TYPE1_SER_STAT_Mx_Cy)........380

Status Page (CAN_TYPE1_SER_STAT_Mx_Cy)

Purpose

To enable the status registers to be read.

Dialog settings

Enable Line status port Lets you enable the line status output of the UART.

Enable Modem status port Lets you enable the modem status output of the UART (not supported).

Enable Interrupt status port Lets you enable the interrupt status output of the UART.

Related topics

References

Block Description (CAN_TYPE1_SER_STAT_Mx_Cy)........377
Unit Page (CAN_TYPE1_SER_STAT_Mx_Cy)........379

CAN_TYPE1_SER_TX_Mx_Cy

Where to go from here

Information in this section

Block Description (CAN_TYPE1_SER_TX_Mx_Cy)

Block

Purpose

To send data via the serial interface.

Description

The block sends the bytes of the TXBytes input via the serial interface during one sample step. The number of bytes to be sent can be either fixed or variable. If the number of bytes to be sent is fixed, you have to specify it with a block parameter. If the number of bytes to be sent is variable, you can specify it with either a block parameter or an inport. The status and the number of bytes that were sent are returned via outports.

You can disable the NumBytes input, NumTXBytes output and Status output with the block dialog.

I/O mapping

For information on the I/O mapping, refer to Serial Interface (MicroAutoBox II Features 📖).

I/O characteristics

- The TXBytes input must be the stream of bytes to be written to the software buffer within one sample step.

- The **NumBytes** input must be the number of bytes to be sent within one sample step. The value must be less than or equal to the **Maximum number of bytes** block parameter. If it is less, only the specified number of bytes is sent.
- The **NumTXBytes** port outputs the number of bytes that could be written to the software buffer within the current sample step. You can use this output value and the **NumTXBytes** input to verify whether all the data could be sent.
- The **Status** port outputs the status of writing data to the software buffer within the current sample step. One of the following values is returned:

Return Value	Meaning
0	No error
4	The operation failed with no effect on the input or output data. No data is written to or read from the FIFO.
202	The FIFO is filled or not all data could be copied to the FIFO

- The following table shows the characteristics of the block inputs and outputs:

Port	Characteristics	Value
TXBytes	Datatype	UInt8
	Range	0 … 255
	Size	1 … (SW FIFO size - 1)
NumBytes	Datatype	UInt32
	Range	1 … (SW FIFO size - 1)
NumTXBytes	Datatype	UInt32
	Range	1 … (SW FIFO size - 1)
Status	Datatype	Int32
	Range	int32

SW FIFO size is a block parameter. For further information, refer to CAN_TYPE1_SER_SETUP_Mx_Cy on page 372.

Dialog pages

The dialog settings can be specified on the following pages:

- **Unit Page** (refer to Unit Page (CAN_TYPE1_SER_TX_Mx_Cy) on page 383)
- **Tx Parameters Page** (refer to TX Parameters Page (CAN_TYPE1_SER_TX_Mx_Cy) on page 384)
- **Advanced Page** (refer to Advanced Page (CAN_TYPE1_SER_TX_Mx_Cy) on page 384)

Related RTLib functions

This RTI block is implemented using the following RTLib function:

- dsser_transmit

Related topics

References

Advanced Page (CAN_TYPE1_SER_TX_Mx_Cy)........ 384
CAN_TYPE1_SER_SETUP_Mx_Cy........ 372
dsser_transmit (MicroAutoBox II RTLib Reference 📖)
TX Parameters Page (CAN_TYPE1_SER_TX_Mx_Cy)........ 384
Unit Page (CAN_TYPE1_SER_TX_Mx_Cy)........ 383

Unit Page (CAN_TYPE1_SER_TX_Mx_Cy)

Purpose

To specify module and channel number used for sending data.

Dialog settings

Module number Lets you choose the module number within the range 1 … 16.

Channel number Lets you choose the number of the channel. The permitted values are:

Board	Permitted Values
DS1401/CAN_TYPE1	1 or 2

Related topics

References

Advanced Page (CAN_TYPE1_SER_TX_Mx_Cy)........ 384
Block Description (CAN_TYPE1_SER_TX_Mx_Cy)........ 381
TX Parameters Page (CAN_TYPE1_SER_TX_Mx_Cy)........ 384

TX Parameters Page (CAN_TYPE1_SER_TX_Mx_Cy)

Purpose

To specify the transmitting parameters.

Dialog settings

Transmission SW FIFO mode Lets you specify how to react if there is not enough free space in the transmit buffer:

Data Handling	Meaning
Discard all new data	All data in the sample step is discarded. Data consistency is ensured but you have to repeat the complete data from this sample step.
Write as much data as possible	The transmit buffer is filled until it is full. You only have to repeat bytes which did not fit into the transmit buffer.

Parameter flexibility Lets you specify whether the number of bytes to be sent is fixed (non-tunable) or variable (tunable).

Number of bytes Lets you specify the number of bytes to be sent within one sample step.

Maximum number of bytes Lets you specify the maximum number of bytes that can be sent within one sample step. The valid value range is:
1 … (SW FIFO size-1) (SW FIFO size is a block parameter, see CAN_TYPE1_SER_SETUP_Mx_Cy on page 372).

Specify the number of bytes Lets you specify whether to set the number of bytes to be sent within one sample step via the **NumBytes** inport or the block parameter.

Related topics

References

Advanced Page (CAN_TYPE1_SER_TX_Mx_Cy)

Purpose

To specify the output.

Dialog settings

Enable TXBytes port Lets you specify whether to output the number of bytes that could be sent or not.

Enable Status port Lets you specify whether to output the transmission status or not.

Related topics

References

Block Description (CAN_TYPE1_SER_TX_Mx_Cy)........381
TX Parameters Page (CAN_TYPE1_SER_TX_Mx_Cy)........384
Unit Page (CAN_TYPE1_SER_TX_Mx_Cy)........383

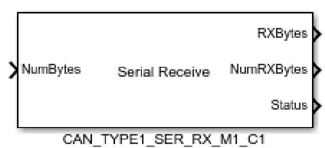
CAN_TYPE1_SER_RX_Mx_Cy

Where to go from here

Information in this section

Block Description (CAN_TYPE1_SER_RX_Mx_Cy)

Block



Purpose

To read bytes from the serial interface.

Description

The block receives bytes via a serial interface and writes them to the RXBytes output. The number of bytes to be received can be either fixed or variable. If the number of bytes to be received is fixed, you have to specify it with a block parameter. If the number of bytes to be received is variable, you can specify it with either a block parameter or an inport. The status and the number of received bytes are returned via outports.

You can disable the NumBytes input, NumRXBytes output and Status output with the block dialog.

I/O mapping

For information on the I/O mapping, refer to Serial Interface (MicroAutoBox II Features 📖).

I/O characteristics

- The **NumBytes** input must be the number of bytes to be read from the software buffer within one sample step.
- The **RXBytes** port outputs the stream of data that could be read from the software buffer within one sample step. If fewer than the expected number of bytes could be received, the last bytes of the output still contain the data from the previous sample step.
- The **NumRXBytes** port outputs the number of bytes that could be read from the software buffer within one sample step.
- The **Status** port outputs the reception status. One of the following values is returned:

Return Value	Meaning
0	No error
4	The operation failed with no effect on the input or output data. No data is written to or read from the FIFO.
5	No new data is read from the FIFO.
202	The FIFO is filled or not all data could be copied to the FIFO.

- The following table shows the characteristics of the block input and outputs:

Port	Characteristics	Value
NumBytes	Datatype	UInt32
	Range	1 … (SW FIFO size - 1)
RXBytes	Datatype	UInt8
	Range	0 … 255
	Size	1 … (SW FIFO size - 1)
NumRXBytes	Datatype	UInt32
	Range	1 … (SW FIFO size - 1)
Status	Datatype	Int32
	Range	Int32

SW FIFO size is a block parameter. For further information, refer to CAN_TYPE1_SER_SETUP_Mx_Cy on page 372.

Dialog pages

The dialog settings can be specified on the following pages:

- **Unit Page** (refer to Unit Page (CAN_TYPE1_SER_RX_Mx_Cy) on page 388)
- **RX Parameters Page** (refer to RX Parameters Page (CAN_TYPE1_SER_RX_Mx_Cy) on page 389)
- **Advanced Page** (refer to Advanced Page (CAN_TYPE1_SER_RX_Mx_Cy) on page 389)

Related RTLib functions

This RTI block is implemented using the following RTLib functions:
- dsser_receive
- dsser_receive_term

Related topics

References

Unit Page (CAN_TYPE1_SER_RX_Mx_Cy)

Purpose

To specify module and channel number used for reading data.

Dialog settings

Module number Lets you choose the module number within the range 1 ... 16.

Channel number Lets you choose the number of the channel. The permitted values are:

Board	Permitted Values
DS1401/CAN_TYPE1	1 or 2

Related topics

References

RX Parameters Page (CAN_TYPE1_SER_RX_Mx_Cy)

Purpose

To specify the receiving parameters.

Dialog settings

Reception mode Lets you specify how to react if there are fewer than the expected number of bytes in the receive buffer:

Data Handling	Meaning
Skip read operation	The new data is left in the receive buffer. The received data is collected in the receive buffer until the specified number of bytes is reached. Then it is copied to the **RXBytes** output.
Read available data anyway	All the available data is copied from the receive buffer to the **RXBytes** output.

Parameter flexibility Lets you specify whether the number of bytes to be received is fixed (non-tunable) or variable (tunable).

Number of bytes Lets you specify the number of bytes to be received within one sample step.

Maximum number of bytes Lets you specify the maximum number of bytes that can be received within one sample step. Value range: 1 … (SW FIFO size-1) (SW FIFO size is a block parameter, see CAN_TYPE1_SER_SETUP_Mx_Cy on page 372).

Specify the number of bytes Lets you specify whether to set the number of bytes to be received within one sample step via the **NumBytes** input or the block parameter.

Related topics

References

Advanced Page (CAN_TYPE1_SER_RX_Mx_Cy)

Purpose

To specify the output.

Dialog settings

Enable NumRXBytes port Lets you specify whether to output the number of bytes that could be received or not.

Enable Status port Lets you specify whether to output the transmission status or not.

Related topics

References

Block Description (CAN_TYPE1_SER_RX_Mx_Cy)........ 386
RX Parameters Page (CAN_TYPE1_SER_RX_Mx_Cy)........ 389
Unit Page (CAN_TYPE1_SER_RX_Mx_Cy)........ 388

CAN_TYPE1_SER_INT_Mx_Cy_Iz

Where to go from here

Information in this section

Block Description (CAN_TYPE1_SER_INT_Mx_Cy_Iz)

Block

Purpose

To make the interrupts of the serial interface available as trigger sources in the model.

I/O mapping

For information on the I/O mapping, refer to Serial Interface (MicroAutoBox II Features 📖).

I/O characteristics

The output triggers a function call to a subsystem if it is connected.

Dialog pages

The dialog settings can be specified on the following pages:

- Unit Page (refer to Unit Page (CAN_TYPE1_SER_INT_Mx_Cy_Iz) on page 392)
- Interrupt Page (refer to Interrupt Page (CAN_TYPE1_SER_INT_Mx_Cy_Iz) on page 393)

Related RTLib functions

This RTI block is implemented using the following RTLib functions:

- dsser_subint_handler_inst
- dsser_subint_enable
- dsser_subint_disable

Related topics

References

dsser_subint_disable (MicroAutoBox II RTLib Reference 📖)
dsser_subint_enable (MicroAutoBox II RTLib Reference 📖)
dsser_subint_handler_inst (MicroAutoBox II RTLib Reference 📖)
Interrupt Page (CAN_TYPE1_SER_INT_Mx_Cy_Iz)........ 393
Unit Page (CAN_TYPE1_SER_INT_Mx_Cy_Iz)........ 392

Unit Page (CAN_TYPE1_SER_INT_Mx_Cy_Iz)

Purpose

To specify module and channel on which an interrupt will be made available.

Dialog settings

Module number Lets you choose the module number in the range 1 … 16.

Channel number Lets you choose the number of the channel. The permitted values are:

Board	Permitted Values
DS1401/CAN_TYPE1	1 or 2

Related topics

References

Block Description (CAN_TYPE1_SER_INT_Mx_Cy_Iz)........ 391
Interrupt Page (CAN_TYPE1_SER_INT_Mx_Cy_Iz)........ 393

Interrupt Page (CAN_TYPE1_SER_INT_Mx_Cy_Iz)

Purpose

To specify the interrupt source.

Dialog settings

Interrupt source Lets you choose the interrupt type. The following table shows the available interrupt types:

Interrupt Type	Meaning
RX SW FIFO	Interrupt triggered when the number of bytes in the receive buffer reaches the specified threshold (see Initial RX SW FIFO threshold)
TX SW FIFO	Interrupt triggered when the transmit buffer is empty
Line status	Line status interrupt of the UART
Modem status	Modem status interrupt of the UART (Not supported by MicroAutoBox II)

Initial RX SW FIFO threshold Lets you specify the RX SW FIFO threshold for the receive interrupt in the range 1 … (SW FIFO size -1) . The value should be a multiple of the UART threshold (see CAN_TYPE1_SER_SETUP_Mx_Cy on page 372).

The RX SW FIFO threshold can be changed during run time by using the block CAN_TYPE1_SER_INT_REC_LEV_Mx_Cy on page 394.

Related topics

References

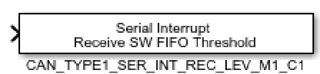
CAN_TYPE1_SER_INT_REC_LEV_Mx_Cy

Where to go from here

Information in this section

Block Description (CAN_TYPE1_SER_INT_REC_LEV_Mx_Cy)

Block



Purpose

To change the RX SW FIFO threshold during run time.

Description

The block changes the RX SW FIFO threshold that is initially specified by the CAN_TYPE1_SER_INT_Mx_Cy_Iz block (see CAN_TYPE1_SER_INT_Mx_Cy_Iz on page 391).

I/O mapping

For information on the I/O mapping, refer to Serial Interface (MicroAutoBox II Features 🕮).

I/O characteristics

- The Receive SW FIFO Threshold input sets a new RX SW FIFO threshold.
- The following table shows the characteristics of the block input:

Port	Characteristics	Value
Receive SW FIFO Threshold	Datatype	UInt32
	Range	1 … (SW FIFO size - 1)

SW FIFO size is a block parameter. For further information, refer to CAN_TYPE1_SER_SETUP_Mx_Cy on page 372.

Dialog pages

The dialog settings can be specified on the following page:

- Unit page (refer to Unit Page (CAN_TYPE1_SER_INT_REC_LEV_Mx_Cy) on page 395)

Related RTLib functions

This RTI block is implemented using the following RTLib functions:

- dsser_config
- dsser_fifo_reset
- dsser_transmit_fifo_level
- dsser_receive_fifo_level

Related topics

References

CAN_TYPE1_SER_INT_Mx_Cy_Iz..391
CAN_TYPE1_SER_SETUP_Mx_Cy...372
dsser_config (MicroAutoBox II RTLib Reference 📖)
dsser_fifo_reset (MicroAutoBox II RTLib Reference 📖)
dsser_receive_fifo_level (MicroAutoBox II RTLib Reference 📖)
dsser_transmit_fifo_level (MicroAutoBox II RTLib Reference 📖)
Unit Page (CAN_TYPE1_SER_INT_REC_LEV_Mx_Cy)..395

Unit Page (CAN_TYPE1_SER_INT_REC_LEV_Mx_Cy)

Purpose

To specify the module and channel on which the RX SW FIFO threshold will be changed.

Dialog settings

Module number Lets you choose the module number within the range 1 … 16.

Channel number Lets you choose the number of the channel. The permitted values are:

Board	Permitted Values
DS1401/CAN_TYPE1	1 or 2

Related topics

References

Block Description (CAN_TYPE1_SER_INT_REC_LEV_Mx_Cy)...394

Single Edge Nibble Transmission (SENT)

Purpose

To provide a receiver for signals based on the SENT protocol.

Description

SENT (Single Edge Nibble Transmission) is a protocol used between sensors and ECUs. It is defined in the SAE J2716 standard defined by the Society of Automotive Engineers (SAE). It is used to transmit data of high-resolution (10 bits or more) sensors as an alternative to an analog interface. The sensor signal is transmitted as a series of pulses with data measured as falling to falling edge times.

Where to go from here

Information in this section

DIO_TYPE3_SENT_RX_BLx

Purpose

To receive data on a MicroAutoBox II variant with a DS1511 I/O board using the SENT protocol.

If you use a MicroAutoBox II variant with a DS1513 I/O board, refer to DIO_TYPE4_SENT_RX_BLx on page 408.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

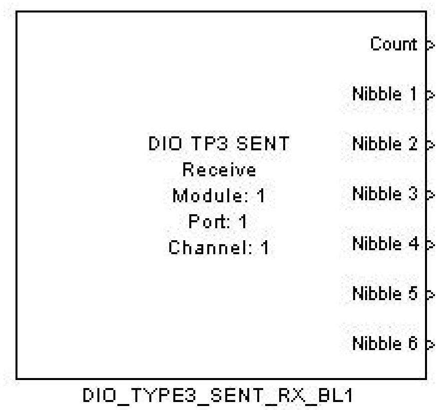
Where to go from here

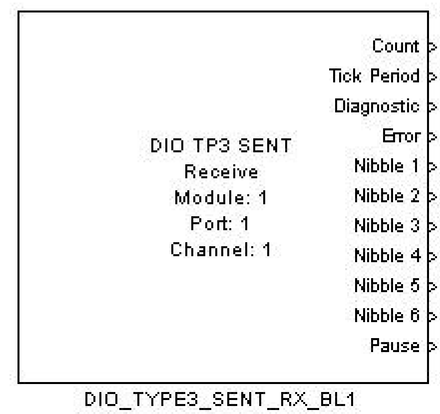
Information in this section

Block Description (DIO_TYPE3_SENT_RX_BLx)

Block

Gives you information about the appearance and purpose of the block.





Purpose

To receive data using the SENT protocol.

Description

The block reads the messages from a receive FIFO of a specified channel. The number of nibbles to be received in a message must be specified on the **RX Parameters** page. The block gets one outport for each specified nibble. The outports provide vectors with the nibble of several messages. The expected number of messages must be specified on the **RX Parameters** page.

The number of ticks which defines the pulses (low pulse, zero nibble high pulse, sync high pulse) and the tick period with its tolerance can be specified on the **RX Parameters** page.

The block has two read modes. It can read all new messages received since the last read operation or it can read the last recent complete message. The mode is set on the **RX Parameters** page.

During run time, your application can read the received messages stored in the receive FIFO when triggered periodically by a timer task or when triggered asynchronously by an interrupt. If interrupt generation is enabled on the **Interrupt** page, an interrupt is generated on MicroAutoBox II after receiving a certain number of SENT messages, specified by the **Number of messages to trigger interrupt** parameter.

The block has some outputs to provide information on the read operation. The optional outports can be enabled on the **Advanced** page:

- Count: Number of successfully read messages
- Tick Period (optional): Measured tick period
- Diagnostic (optional): Diagnostic information for each received message
- Error (optional): State of the read operation

If the received SENT messages contain pause pulses, you can enable the pause mode for the SENT receiver to consider them.

I/O mapping

For information on the mapping of the logical channel numbers, as used in RTI, to the related I/O pins of the MicroAutoBox II I/O connector, refer to Single Edge Nibble Transmission (SENT) Support (MicroAutoBox II Features 📖).

I/O characteristics

The table shows the block outport:

Simulink Output	Range	Simulink Data Type	Description
Count	0 … 512	UInt32	Number of messages that are received since the last read operation.
Tick Period[1)]	0.4e-6 … 53	Double	Current tick period in seconds. The tick period is measured from the last received valid synchronization pulse. If no message has been read, a tick period of 0 is returned. The pulse length must not exceed the specified range with its specified tolerance, otherwise pulses are not recognized as valid SENT pulses.
Diagnostic[1)]	0 … 255	UInt32	Diagnostic information on the received messages. It is a vector with the size of the expected number of messages (see RX Parameters page). The diagnostic information is reported via flags (UInt32 words). The number of words matches the number of returned messages indicated by the Count outport. For information on the meanings of the flags, refer to *Diagnostics flags* below.
Error[1)]	0 … 2	UInt32	State of the read operation of the messages from the receive FIFO: ▪ 0: No data loss. All messages were read from the receive FIFO. ▪ 1: Data loss. Not all messages could be read from the receive FIFO because the number of received messages exceeds the expected number of messages. The newest messages are discarded. The Count outport returns the number of expected messages. ▪ 2: Timeout. A SENT pulse was longer than the maximum measurable pulse length. ▪ 3: Data loss and timeout.
Nibble 1 … Nibble *nibble_count*[2)]	0 … 127 or -128	Int8	Contains the nibble values which are read from the receive FIFO. If the number of received messages between two subsequent calls is higher than the specified number of expected messages, the returned vector is filled from the first element up to the number of expected messages and the most recent messages are rejected. If the number of received messages is lower than the number of expected messages, the vector is filled from the first element up to the received number of messages. The unused elements are set to -128.

Simulink Output	Range	Simulink Data Type	Description
Pause[3)]	0 … 32767 or -32768	Int16	Contains the current pause pulse value. If no message has been read or no pause pulse inside the message was generated, a pause nibble of -32768 is returned. The returned value corresponds to a nibble value. That means that a pulse duration of low tick time and high tick time for zero nibble pulse duration corresponds to a zero as result at this output.

[1)] The port is only available if it is enabled on the Advanced page.
[2)] *nibble_count* is the number of nibbles per message. The maximum number of nibbles is 64.
[3)] The port is only available if it is enabled on the RX Parameters page.

Diagnostics flags

The following table shows the values and descriptions of the flags of the Diagnostic outport:

Bit	Value	Description
0	1	Too many nibbles in message.
1	2	Too few nibbles in message.
2	4	Nibble value is out of range [0 … 15].
3	8	Synchronization pulse too long.
4	16	Synchronization pulse too short.
5	32	The current synchronization pulse differs from the last synchronization pulse by a factor of more than 1/64.
6	64	Message has not the expected length.
7	128	Deviation of sync pulse to message length ratio too high.

To get the information, you must evaluate the returned Diagnostic word. For example, if a message has a nibble out of range (flag 2, value 4) and the synchronization pulse is too short (flag 4, value 16), the Diagnostic word value is 20.

For further information, refer to Basics on SENT Diagnostic Information (MicroAutoBox II Features 📖).

Dialog pages

The dialog settings can be specified on the following dialog pages:

- Unit page (refer to Unit Page (DIO_TYPE3_SENT_RX_BLx) on page 402)
- Parameters page (refer to RX Parameters Page (DIO_TYPE3_SENT_RX_BLx) on page 403)
- Advanced page (refer to Advanced Page (DIO_TYPE3_SENT_RX_BLx) on page 406)
- Interrupt page (refer to Interrupt Page (DIO_TYPE3_SENT_RX_BLx) on page 407)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dio_tp3_init
- dio_tp3_sent_rx_init
- dio_tp3_sent_rx_tick_period_get
- dio_tp3_sent_rx_receive

Unit Page (DIO_TYPE3_SENT_RX_BLx)

Purpose

To specify the board number and the number of the channel used for receiving SENT messages.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features).

Port number Lets you select the port number in the range 1 … 3.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1, 2	1 … 16
3	1 … 8

Note

- Concurrent access to the same digital input channel by other DIO Type 3 blocks or functions is not allowed.
- You can specify up to four DIO_TYPE3_SENT_RX_BLx blocks for the specified module.

Related topics

References

RX Parameters Page (DIO_TYPE3_SENT_RX_BLx)

Purpose

To specify parameters for receiving SENT messages.

Description

The messages are read from a receive FIFO. The size of the receive FIFO is limited. The number of messages (`MaxMessages`) that can be maximally buffered between two read operations depends on the number of nibbles in a message (`NumNibbles`).

```
MaxMessages = RoundDown(
   4096 / (NumNibbles + 1 + PauseModeEnabled))
```

If the pause mode is enabled, `PauseModeEnabled` is 1 otherwise it is 0.

When the receive FIFO runs full, all new received pulses get lost until the next read operation is executed. This leads to a loss of nibbles or messages and the Count outport is set to the maximum FIFO size.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Range of pulse length Lets you select one of the 8 predefined pulse length ranges.

Range Number	Pulse Length Range	Resolution
1	300 ns … 1.63 ms	50 ns
2	600 ns … 3.27 ms	100 ns
3	1.2 µs … 6.55 ms	200 ns
4	2.4 µs … 13.1 ms	400 ns
5	4.8 µs … 26.2 ms	800 ns
6	9.6 µs … 52.4 ms	1.6 µs
7	19.2 µs … 104 ms	3.2 µs
8	38.4 µs … 209 ms	6.4 µs

Note

The measurement resolution depends on the selected pulse length range. To get the best possible resolution of the measured pulses, you should select the range with the best possible resolution (the pulse length range with the lowest possible range number). For example, if your desired pulse length is 3 µs, you should use pulse length range 1 (300 ns … 1.63 ms) rather than pulse length range 2 (600 ns … 3.27 ms).

Resolution Displays the resolution that corresponds to the specified pulse length range.

Number of nibbles (incl. status, CRC) Lets you specify the number of nibbles included in a message in the range 1 … 64. The number includes the status nibble and the CRC nibble. The number of nibbles (`NumNibbles`) affects the maximum number of messages (`MaxMessages`) that can be buffered between two read operations. Additionally, the sync pulse and a desired pause pulse must be considered. When the pause mode is enabled, `PauseModeEnabled` is 1 otherwise it is 0:

```
Max_Messages = RoundDown(4096 / (Num_Nibble + 1 + PauseModeEnabled))
```

This parameter cannot be dynamically set by a model variable.

Expected number of messages Lets you specify the expected number of messages in the range 1 … 128. This setting is disabled, if the Read mode is set to *Most recent message*.

Number of ticks for low state Lets you select the number of tick periods which specify a low pulse in the range 1 … 15.

Number of ticks for high state of zero nibble Lets you select the number of tick periods which specify the zero nibble high pulse in the range 1 … 15.

Number of ticks for high state of sync pulse Lets you specify the number of tick periods which specify a sync high pulse.

The range of this parameter depends on the Number of ticks for high state of zero nibble setting, so that the minimum value of Number of ticks for high state of sync pulse is greater than the maximum length of a data nibble allowed by the specified tick period tolerance.

Tick period Lets you specify the expected tick period in the range 375 ns … 200 µs in seconds. The range depends on the specified tick period tolerance and the pulse length range. The value is required for decoding the received messages and calculating the diagnostic information (see I/O characteristics on page 400).

Tick period tolerance Lets you specify the maximum allowed tolerance of the tick period in the range 0.0 … 0.5. The value is the percentage of the expected tick period, for example, 0.2 is 20% of the expected tick period.

It is not recommended to use a tolerance of 0. Every transmitter and receiver has a minimum tolerance or clock drift, so the measured tick period varies.

Read mode Lets you choose the mode for reading messages.

Read Mode	Description
All messages	The block reads all new messages received since the last read operation. If no complete new message is available, the Count outport is 0 and the Nibble outports keep their values of the last read operation.
Most recent message	The block reads the newest complete message. If no complete message is available, a message is returned which nibbles have the value '-128' (see Diagnostic port in I/O characteristics on page 400) and the Count outport is 0. If more than one message is in the receive FIFO, the newest message is read and the older messages are cleared.

Enable pause mode Lets you decide whether to activate the pause pulse validation. The activation is required to correctly interpret received SENT messages which contain pause pulses.

If the pause mode is disabled, the last pulse in a message will be interpreted as a nibble.

If the pause mode is enabled, you have to define the message length including the sync pulse, data pulses, CRC pulse and the pause pulse. In this case, additional diagnostic messages can be generated. If you set the message length to 0, it is not checked whether the message has a fixed length.

Range of expected message length Displays the available range of the expected message length in ticks in the range 0 … `MsgLenMax`. These values are relevant to specify the Expected message length setting when you enabled the pause mode. The range displayed in the page is automatically adapted to the specified block settings.

The formula to calculate the upper range `MsgLenMax` is:

```
MsgLenMax = PauseMax + MsgWithoutPauseMin
```

with

```
PauseMax = (TimerReg · Resolution) / (TicPeriod ·
           (ClockDrift + 1))
```

and

```
MsgWithoutPauseMin = HighTicsOfSyncNib + (LowTics ·
           (NibbleNum + 1)) + (NibbleNum · HighTicsOfZeroNib)
```

For MicroAutoBox II: `TimerReg` = 2^{15} `-1`

Range of pause pulse length Displays the available range of pause pulses in ticks. These values are relevant when the pause mode is enabled. The length of the pause pulses of the received SENT messages can be in the calculated range `PauseMin` … `PauseMax`. The range displayed in the page is automatically adapted to the block settings.

The formula to calculate the range is:

```
PauseMin = LowTics + HighTicsOfZeroNib
PauseMax = (TimerReg · Resolution) / (TicPeriod ·
           (ClockDrift + 1))
```

Expected message length Lets you specify the expected message length in ticks if the pause mode is enabled. You can specify only a value in the range that is displayed in the Range of expected message length setting.

The value defines the expected message length in ticks of the complete message inclusive sync pulse, data pulses, crc pulse and the pause pulse. All ticks must be considered, including low pulse ticks and high pulse ticks.

If the value is set to 0 the pause pulse is expected but it is not checked whether the message has a fixed length. Then you have to guarantee that the maximum expected pause pulse length suits to the pause pulse length range.

Related topics

References

Advanced Page (DIO_TYPE3_SENT_RX_BLx) 406
Block Description (DIO_TYPE3_SENT_RX_BLx) 399
Interrupt Page (DIO_TYPE3_SENT_RX_BLx) 407
Unit Page (DIO_TYPE3_SENT_RX_BLx) 402

Advanced Page (DIO_TYPE3_SENT_RX_BLx)

Purpose

To disable or enable output ports.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Enable Tick Period port Indicates whether the Tick Period port is enabled or disabled. For details on the outport, refer to I/O characteristics on page 400.

Enable Diagnostic port Indicates whether the Diagnostic port is enabled or disabled. For details on the outport, refer to I/O characteristics on page 400.

Enable Error port Indicates whether the Error port is enabled or disabled. For details on the outport, refer to I/O characteristics on page 400.

Related topics

References

Block Description (DIO_TYPE3_SENT_RX_BLx) 399
Interrupt Page (DIO_TYPE3_SENT_RX_BLx) 407
RX Parameters Page (DIO_TYPE3_SENT_RX_BLx) 403

Interrupt Page (DIO_TYPE3_SENT_RX_BLx)

Purpose

To enable interrupt generation.

Description

If you enable interrupt generation, your model has to contain a related DIO_TYPE3_HWINT_BLx block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference 📖).

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Enable interrupt Lets you activate the interrupt generation.

Number of messages to trigger interrupt Lets you specify the number of messages to be received before an interrupt is triggered.

You can set the value only, if the Enable interrupt option is set.

If the Read mode option is set to *Most recent message*, the upper limit of this setting is set to the upper limit of the Expected number of messages setting specified on the RX Parameters page.

If the Expected number of messages setting contains an undefined variable, the number of messages to trigger an interrupt is also set to the upper limit of the expected number of messages.

Related topics

References

DIO_TYPE4_SENT_RX_BLx

Purpose

To receive data on a MicroAutoBox II variant with DS1513 I/O board using the SENT protocol.

If you use a MicroAutoBox II variant with DS1511 I/O board, refer to DIO_TYPE3_SENT_RX_BLx on page 398.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

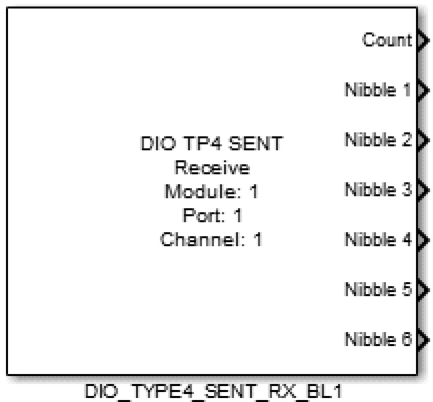
Where to go from here

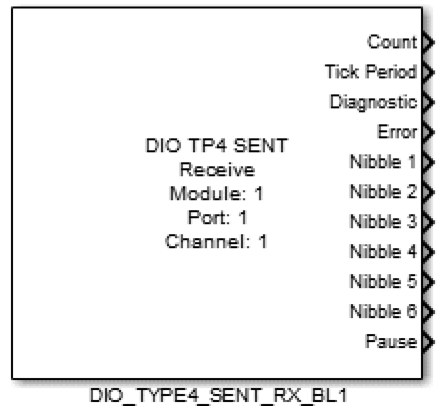
Information in this section

Block Description (DIO_TYPE4_SENT_RX_BLx)

Block

Gives you information about the appearance and purpose of the block.





Purpose

To receive data using the SENT protocol.

Description

The block reads the messages from a receive FIFO of a specified channel. The number of nibbles to be received in a message must be specified on the RX Parameters page. The block gets one outport for each specified nibble. The outports provide vectors with the nibble of several messages. The expected number of messages must be specified on the RX Parameters page.

The number of ticks which defines the pulses (low pulse, zero nibble high pulse, sync high pulse) and the tick period with its tolerance can be specified on the RX Parameters page.

The block has two read modes. It can read all new messages received since the last read operation or it can read the last recent complete message. The mode is set on the RX Parameters page.

During run time, your application can read the received messages stored in the receive FIFO when triggered periodically by a timer task or when triggered asynchronously by an interrupt. If interrupt generation is enabled on the Interrupt page, an interrupt is generated on MicroAutoBox II after receiving a certain number of SENT messages, specified by the Number of messages to trigger interrupt parameter.

The block has some outputs to provide information on the read operation. The optional outports can be enabled on the Advanced page:

- Count: Number of successfully read messages
- Tick Period (optional): Measured tick period
- Diagnostic (optional): Diagnostic information for each received message
- Error (optional): State of the read operation

If the received SENT messages contain pause pulses, you can enable the pause mode for the SENT receiver to consider them.

I/O mapping

For information on the mapping of the logical channel numbers, as used in RTI, to the related I/O pins of the MicroAutoBox II I/O connector, refer to Using the SENT Protocol on MicroAutoBox II (MicroAutoBox II Features 🕮).

I/O characteristics

The table shows the block outport:

Simulink Output	Range	Simulink Data Type	Description
Count	0 … 512	UInt32	Number of messages that are received since the last read operation.
Tick Period[1)]	0.4e-6 … 53	Double	Current tick period in seconds. The tick period is measured from the last received valid synchronization pulse. If no message has been read, a tick period of 0 is returned. The pulse length must not exceed the specified range with its specified tolerance, otherwise pulses are not recognized as valid SENT pulses.
Diagnostic[1)]	0 … 255	UInt32	Diagnostic information on the received messages. It is a vector with the size of the expected number of messages (see **RX Parameters** page). The diagnostic information is reported via flags (UInt32 words). The number of words matches the number of returned messages indicated by the **Count** outport. For information on the meanings of the flags, refer to *Diagnostics flags* below.
Error[1)]	0 … 2	UInt32	State of the read operation of the messages from the receive FIFO: ▪ 0: No data loss. All messages were read from the receive FIFO. ▪ 1: Data loss. Not all messages could be read from the receive FIFO because the number of received messages exceeds the expected number of messages. The newest messages are discarded. The **Count** outport returns the number of expected messages. ▪ 2: Timeout. A SENT pulse was longer than the maximum measurable pulse length. ▪ 3: Data loss and timeout.
Nibble 1 … Nibble *nibble_count*[2)]	0 … 127 or -128	Int8	Contains the nibble values which are read from the receive FIFO. If the number of received messages between two subsequent calls is higher than the specified number of expected messages, the returned vector is filled from the first element up to the number of expected messages and the most recent messages are rejected. If the number of received messages is lower than the number of expected messages, the vector is filled from the first element up to the received number of messages. The unused elements are set to -128.

Simulink Output	Range	Simulink Data Type	Description
Pause[3)]	0 … 32767 or -32768	Int16	Contains the current pause pulse value. If no message has been read or no pause pulse inside the message was generated, a pause nibble of -32768 is returned. The returned value corresponds to a nibble value. That means that a pulse duration of low tick time and high tick time for zero nibble pulse duration corresponds to a zero as result at this output.

1) The port is only available if it is enabled on the Advanced page.
2) *nibble_count* is the number of nibbles per message. The maximum number of nibbles is 64.
3) The port is only available if it is enabled on the RX Parameters page.

Diagnostics flags

The following table shows the values and descriptions of the flags of the Diagnostic outport:

Bit	Value	Description
0	1	Too many nibbles in message.
1	2	Too few nibbles in message.
2	4	Nibble value is out of range [0 … 15].
3	8	Synchronization pulse too long.
4	16	Synchronization pulse too short.
5	32	The current synchronization pulse differs from the last synchronization pulse by a factor of more than 1/64.
6	64	Message has not the expected length.
7	128	Deviation of sync pulse to message length ratio too high.

To get the information, you must evaluate the returned Diagnostic word. For example, if a message has a nibble out of range (flag 2, value 4) and the synchronization pulse is too short (flag 4, value 16), the Diagnostic word value is 20.

For further information, refer to Basics on SENT Diagnostic Information (MicroAutoBox II Features 🕮).

Dialog pages

The dialog settings can be specified on the following dialog pages:

- Unit page (refer to Unit Page (DIO_TYPE4_SENT_RX_BLx) on page 412)
- Parameters page (refer to RX Parameters Page (DIO_TYPE4_SENT_RX_BLx) on page 413)
- Advanced page (refer to Advanced Page (DIO_TYPE4_SENT_RX_BLx) on page 416)
- Interrupt page (refer to Interrupt Page (DIO_TYPE4_SENT_RX_BLx) on page 417)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dio_tp4_init
- dio_tp4_sent_rx_init
- dio_tp4_sent_rx_tick_period_get
- dio_tp4_sent_rx_receive

Unit Page (DIO_TYPE4_SENT_RX_BLx)

Purpose

To specify the board number and the number of the channel used for receiving SENT messages.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features).

Port number Lets you select the port number in the range 1 … 2.

Channel number Lets you select the channel number. The available value range depends on the specified port.

Port Number	Channel Number
1	1 … 16
2	1 … 8

Note

- Concurrent access to the same digital input channel by other DIO Type 4 blocks or functions is not allowed.
- You can specify up to four DIO_TYPE4_SENT_RX_BLx blocks for the specified module.

Related topics

References

RX Parameters Page (DIO_TYPE4_SENT_RX_BLx)

Purpose

To specify parameters for receiving SENT messages.

Description

The messages are read from a receive FIFO. The size of the receive FIFO is limited. The number of messages (`MaxMessages`) that can be maximally buffered between two read operations depends on the number of nibbles in a message (`NumNibbles`).

```
MaxMessages = RoundDown(
   4096 / (NumNibbles + 1 + PauseModeEnabled))
```

If the pause mode is enabled, `PauseModeEnabled` is 1 otherwise it is 0.

When the receive FIFO runs full, all new received pulses get lost until the next read operation is executed. This leads to a loss of nibbles or messages and the Count outport is set to the maximum FIFO size.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Range of pulse length Lets you select one of the 8 predefined pulse length ranges.

Range Number	Pulse Length Range	Resolution
1	300 ns … 1.63 ms	50 ns
2	600 ns … 3.27 ms	100 ns
3	1.2 µs … 6.55 ms	200 ns
4	2.4 µs … 13.1 ms	400 ns
5	4.8 µs … 26.2 ms	800 ns
6	9.6 µs … 52.4 ms	1.6 µs
7	19.2 µs … 104 ms	3.2 µs
8	38.4 µs … 209 ms	6.4 µs

Note

The measurement resolution depends on the selected pulse length range.

To get the best possible resolution of the measured pulses, you should select the range with the best possible resolution (the pulse length range with the lowest possible range number). For example, if your desired pulse length is 3 µs, you should use pulse length range 1 (300 ns … 1.63 ms) rather than pulse length range 2 (600 ns … 3.27 ms).

Resolution Displays the resolution that corresponds to the specified pulse length range.

Number of nibbles (incl. status, CRC) Lets you specify the number of nibbles included in a message in the range 1 … 64. The number includes the status nibble and the CRC nibble. The number of nibbles (`NumNibbles`) affects the maximum number of messages (`MaxMessages`) that can be buffered between two read operations. Additionally, the sync pulse and a desired pause pulse must be considered. When the pause mode is enabled, `PauseModeEnabled` is 1 otherwise it is 0:

```
Max_Messages = RoundDown(4096 / (Num_Nibble + 1 + PauseModeEnabled))
```

This parameter cannot be dynamically set by a model variable.

Expected number of messages Lets you specify the expected number of messages in the range 1 … 128. This setting is disabled, if the Read mode is set to *Most recent message*.

Number of ticks for low state Lets you select the number of tick periods which specify a low pulse in the range 1 … 15.

Number of ticks for high state of zero nibble Lets you select the number of tick periods which specify the zero nibble high pulse in the range 1 … 15.

Number of ticks for high state of sync pulse Lets you specify the number of tick periods which specify a sync high pulse.

The range of this parameter depends on the Number of ticks for high state of zero nibble setting, so that the minimum value of Number of ticks for high state of sync pulse is greater than the maximum length of a data nibble allowed by the specified tick period tolerance.

Tick period Lets you specify the expected tick period in the range 375 ns … 200 µs in seconds. The range depends on the specified tick period tolerance and the pulse length range. The value is required for decoding the received messages and calculating the diagnostic information (see I/O characteristics on page 410).

Tick period tolerance Lets you specify the maximum allowed tolerance of the tick period in the range 0.0 … 0.5. The value is the percentage of the expected tick period, for example, 0.2 is 20% of the expected tick period.

It is not recommended to use a tolerance of 0. Every transmitter and receiver has a minimum tolerance or clock drift, so the measured tick period varies.

Read mode Lets you choose the mode for reading messages.

Read Mode	Description
All messages	The block reads all new messages received since the last read operation. If no complete new message is available, the Count outport is 0 and the Nibble outports keep their values of the last read operation.
Most recent message	The block reads the newest complete message. If no complete message is available, a message is returned which nibbles have the value '-128' (see Diagnostic port in I/O characteristics on page 410) and the Count outport is 0. If more than one message is in the receive FIFO, the newest message is read and the older messages are cleared.

Enable pause mode Lets you decide whether to activate the pause pulse validation. The activation is required to correctly interpret received SENT messages which contain pause pulses.

If the pause mode is disabled, the last pulse in a message will be interpreted as a nibble.

If the pause mode is enabled, you have to define the message length including the sync pulse, data pulses, CRC pulse and the pause pulse. In this case, additional diagnostic messages can be generated. If you set the message length to 0, it is not checked whether the message has a fixed length.

Range of expected message length Displays the available range of the expected message length in ticks in the range 0 … `MsgLenMax`. These values are relevant to specify the Expected message length setting when you enabled the pause mode. The range displayed in the page is automatically adapted to the specified block settings.

The formula to calculate the upper range `MsgLenMax` is:

```
MsgLenMax = PauseMax + MsgWithoutPauseMin
```

with

```
PauseMax = (TimerReg · Resolution) / (TicPeriod ·
           (ClockDrift + 1))
```

and

```
MsgWithoutPauseMin = HighTicsOfSyncNib + (LowTics ·
           (NibbleNum + 1)) + (NibbleNum · HighTicsOfZeroNib)
```

For MicroAutoBox II: `TimerReg` = 2^{15} `-1`

Range of pause pulse length Displays the available range of pause pulses in ticks. These values are relevant when the pause mode is enabled. The length of the pause pulses of the received SENT messages can be in the calculated range `PauseMin` … `PauseMax`. The range displayed in the page is automatically adapted to the block settings.

The formula to calculate the range is:

```
PauseMin = LowTics + HighTicsOfZeroNib
PauseMax = (TimerReg · Resolution) / (TicPeriod ·
           (ClockDrift + 1))
```

Expected message length Lets you specify the expected message length in ticks if the pause mode is enabled. You can specify only a value in the range that is displayed in the Range of expected message length setting.

The value defines the expected message length in ticks of the complete message inclusive sync pulse, data pulses, crc pulse and the pause pulse. All ticks must be considered, including low pulse ticks and high pulse ticks.

If the value is set to 0 the pause pulse is expected but it is not checked whether the message has a fixed length. Then you have to guarantee that the maximum expected pause pulse length suits to the pause pulse length range.

Related topics

References

Advanced Page (DIO_TYPE4_SENT_RX_BLx)........416
Block Description (DIO_TYPE4_SENT_RX_BLx)........409
Interrupt Page (DIO_TYPE4_SENT_RX_BLx)........417
Unit Page (DIO_TYPE4_SENT_RX_BLx)........412

Advanced Page (DIO_TYPE4_SENT_RX_BLx)

Purpose

To disable or enable output ports.

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Enable Tick Period port Indicates whether the Tick Period port is enabled or disabled. For details on the outport, refer to I/O characteristics on page 410.

Enable Diagnostic port Indicates whether the Diagnostic port is enabled or disabled. For details on the outport, refer to I/O characteristics on page 410.

Enable Error port Indicates whether the Error port is enabled or disabled. For details on the outport, refer to I/O characteristics on page 410.

Related topics

References

Block Description (DIO_TYPE4_SENT_RX_BLx)........409
Interrupt Page (DIO_TYPE4_SENT_RX_BLx)........417
RX Parameters Page (DIO_TYPE4_SENT_RX_BLx)........413

Interrupt Page (DIO_TYPE4_SENT_RX_BLx)

Purpose

To enable interrupt generation.

Description

If you enable interrupt generation, your model has to contain a related DIO_TYPE4_HWINT_BLx on page 61 block configured with the same channel number and channel direction.

For detailed information on the electrical specifications of digital inputs and outputs, refer to Signal Descriptions (MicroAutoBox II Hardware Reference).

Dialog settings

Port Displays the port number that you selected on the Unit page.

Channel Displays the channel number that you selected on the Unit page.

Enable interrupt Lets you activate the interrupt generation.

Number of messages to trigger interrupt Lets you specify the number of messages to be received before an interrupt is triggered.

You can set the value only, if the Enable interrupt option is set.

If the Read mode option is set to *Most recent message*, the upper limit of this setting is set to the upper limit of the Expected number of messages setting specified on the RX Parameters page.

If the Expected number of messages setting contains an undefined variable, the number of messages to trigger an interrupt is also set to the upper limit of the expected number of messages.

Related topics

References

Serial Peripheral Interface

Introduction

The DIO Type 3 Blockset of a MicroAutoBox II variant with DS1511 I/O board and the DIO Type 4 Blockset of a MicroAutoBox II variant with DS1513 I/O board provide RTI blocks for implementing synchronous communication via a serial peripheral interface (SPI).

Where to go from here

Information in this section

DIO_TYPE3_SPI_SETUP_BLx

Purpose

To setup a serial peripheral interface on the DIO Type 3 module.

If you use a MicroAutoBox II variant with DS1513 I/O board, refer to DIO_TYPE4_SPI_SETUP_BLx on page 438.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

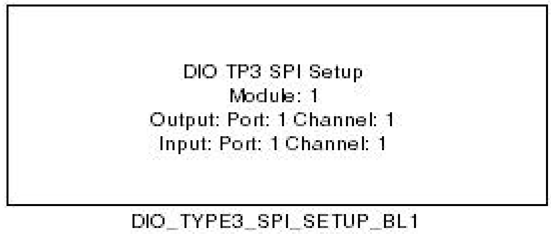
Where to go from here

Information in this section

Block Description (DIO_TYPE3_SPI_SETUP_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To setup a serial peripheral interface of a DIO Type 3 module.

Description

With this block, you can configure an SPI interface. The module number, output port number and output channel number are used to identify an interface. Within an SPI communication network, the DIO_TYPE3_SPI blocks support only the SPI master mode.

You have to specify the input channel (MISO) and the output channels (SCLK, MOSI, CS1 … CS4). The input channel can be configured as trigger source for interrupt generation. For the output channels, you can configure the electrical interface.

Signal	Channel	Description
MISO	ChannelIn	Master In, Slave Out (also known as Data Out) Specified by the **Channel number** parameter in the Input frame on the Unit page.
SCLK	ChannelOut	Serial clock (also known as SPI clock) Specified by the **Channel number** parameter in the Output frame on the Unit page.
MOSI	ChannelOut + 1	Master Out, Slave In (also known as Data In) Automatically reserved related to the specified first output channel for the SCLK signal.
CS1	ChannelOut + 2	Chip Select 1 (also known as Slave Select) A chip select channel is used to address a certain SPI slave. Automatically reserved related to the specified first output channel for the SCLK signal.
CS2	ChannelOut + 3	Chip Select 2 (optional)
CS3	ChannelOut + 4	Chip Select 3 (optional)
CS4	ChannelOut + 5	Chip Select 4 (optional) Using a multiplexer, you can address up to 15 SPI slaves, refer to Parameters Page (DIO_TYPE3_SPI_CYCLE_SETUP_BLx) on page 428.

Note

The DIO Type 3 module supports up to 2 SPI interfaces.

I/O mapping

For information on the mapping of the logical channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Serial Peripheral Interface on the DIO Type 3 Unit (MicroAutoBox II Features 🕮).

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE3_SPI_SETUP_BLx) on page 422)
- Electrical Interface page (refer to Electrical Interface Page (DIO_TYPE3_SPI_SETUP_BLx) on page 423)
- Interrupt page (refer to Interrupt Page (DIO_TYPE3_SPI_SETUP_BLx) on page 425)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- dio_tp3_init
- dio_tp3_digout_mode_set
- dio_tp3_spi_init

Unit Page (DIO_TYPE3_SPI_SETUP_BLx)

Purpose

To specify the input and output channels of the SPI interface.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 🕮).

Port number (Output) Lets you select the port number in the range 1 … 3 to be used for the output channels.

Channel number (Output) Lets you select the channel number used for the first output channel connected to the SPI clock (SCLK). The other output channels (MOSI, CS1 … CS4) are subsequently reserved. The available value range depends on the specified port and on the specified number of chip select channels (`NumOfCSChannels`).

Port Number	Channel Number
1, 2	1 … (15 - `NumOfCSChannels`)
3	1 … (7 - `NumOfCSChannels`)

Number of chip select channels Lets you select the number of chip select channels in the range 1 … 4. For each chip select channel an output channel will be reserved.

Note

Multiple access to the same digital output channels by other DIO TYPE 3 blocks or functions is not allowed.

Port number (Input) Lets you select the port number in the range 1 … 3 to be used for the input channel.

Channel number (Input) Lets you select the channel number used for the input channel (MISO). The available value range depends on the specified port.

Port Number	Channel Number
1, 2	1 … 16
3	1 … 8

Note

Multiple access to the same digital input channel by other DIO TYPE 3 blocks or functions is not allowed.

Related topics

References

Block Description (DIO_TYPE3_SPI_SETUP_BLx)........ 421
Electrical Interface Page (DIO_TYPE3_SPI_SETUP_BLx)........ 423
Interrupt Page (DIO_TYPE3_SPI_SETUP_BLx)........ 425

Electrical Interface Page (DIO_TYPE3_SPI_SETUP_BLx)

Purpose

To set the high-side and low-side switches of the connected supply rails for all the digital output channels of the specified port.

Description

The output state of a digital output channel depends on its individual settings for the low-side switch L (GND) and the high-side switch H (VDRIVE).

- If the low-side switch L (GND) is enabled, the output is actively driven to GND.

- If the high-side switch H (VDRIVE) is enabled, the output is actively driven to VDRIVE.
- If you set low-side switch L (GND) and high-side switch H (VDRIVE), the digital output channel is actively driven to both VDRIVE and GND (push-pull mode).

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigP1 ch 1 ... DigP3 ch 8)	Description
0	Disabled	Disabled	High-Z	Individual output disabled
1	Disabled	Disabled	High-Z	
0	Disabled	Enabled	GND	Low-side switch
1	Disabled	Enabled	High-Z	
0	Enabled	Disabled	High-Z	High-side switch
1	Enabled	Disabled	VDRIVE	
0	Enabled	Enabled	GND	Push-pull output
1	Enabled	Enabled	VDRIVE	

Dialog settings

Output Port Displays the port number that you selected on the Unit page to be used for the output channels.

Output Channel Displays the channel number that you selected on the Unit page to be used for the first output channel.

Setup of supply rails Lets you enable/disable the supply rails defined by the parameters L (Low) and H (High) for each single digital output channel individually. You can modify only the output channels that are reserved by the settings in the Unit page.

Parameter	Meaning
L	Enables/disables the low-side switch for the selected digital output channel.
H	Enables/disables the high-side switch (VDRIVE) for the selected digital output channel.

Set all Lets you enable/disable the supply rails for all the digital output channels that are reserved by the settings in the Unit page identically and at once.

Related topics

References

Block Description (DIO_TYPE3_SPI_SETUP_BLx) 421
Interrupt Page (DIO_TYPE3_SPI_SETUP_BLx) 425
Unit Page (DIO_TYPE3_SPI_SETUP_BLx) 422

Interrupt Page (DIO_TYPE3_SPI_SETUP_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

The interrupt channel is assigned to the specified SPI input channel, but the state of the input channel has no effect on interrupt generation. An interrupt is generated when an SPI cycle is finished (chip select signal is reset to inactive).

If you enable the interrupt generation, your model has to contain a related DIO_TYPE3_HWINT_BLx block configured with the same channel number and *Input* as the channel direction.

Dialog settings

Input Port Displays the port number that you selected on the Unit page to be used for the input channel.

Input Channel Displays the channel number that you selected on the Unit page to be used as input channel.

Enable interrupt Lets you enable or disable the generation of an interrupt.
If the interrupt generation is enabled, the model has to contain a related DIO_TYPE3_HWINT_BLx block.
If the interrupt generation is disabled, the model must not contain a related DIO_TYPE3_HWINT_BLx block.

Related topics

References

Block Description (DIO_TYPE3_SPI_SETUP_BLx)........421
Electrical Interface Page (DIO_TYPE3_SPI_SETUP_BLx)........423
Unit Page (DIO_TYPE3_SPI_SETUP_BLx)........422

DIO_TYPE3_SPI_CYCLE_SETUP_BLx

Purpose

To specify an SPI cycle configuration.

If you use a MicroAutoBox II variant with DS1513 I/O board, refer to DIO_TYPE4_SPI_CYCLE_SETUP_BLx on page 444.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

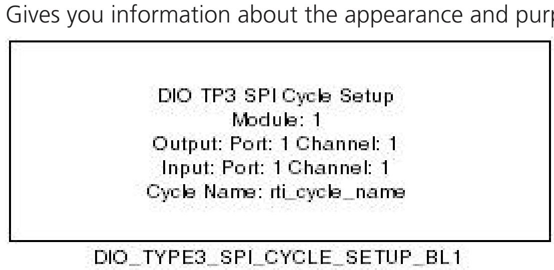
Where to go from here

Information in this section

Block Description (DIO_TYPE3_SPI_CYCLE_SETUP_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To specify an SPI chip select cycle.

Description

A chip select cycle or an SPI cycle configuration is used to specify the communication details. For example, it includes the parameters for the timing behavior, the baud rate, the signal polarity, and the number of words to be transmitted or received. For the RTI blocks for transmitting and receiving messages, it is sufficient for executing to specify the identifier of an existing SPI cycle configuration.

You can define up to 64 SPI cycle configurations per SPI interface. An SPI interface must be always represented by a DIO_TYPE3_SPI_SETUP_BLx block. If the related DIO_TYPE3_SPI_SETUP_BLx block is removed from the model, the SPI interface is unknown and the cycle configuration is invalid.

I/O mapping

For information on the mapping of the logical channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Serial Peripheral Interface on the DIO Type 3 Unit (MicroAutoBox II Features 🕮).

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE3_SPI_CYCLE_SETUP_BLx) on page 427)
- Parameters page (refer to Parameters Page (DIO_TYPE3_SPI_CYCLE_SETUP_BLx) on page 428)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- dio_tp3_spi_cycle_init

Unit Page (DIO_TYPE3_SPI_CYCLE_SETUP_BLx)

Purpose

To specify a name for the cycle configuration.

Dialog settings

Select SPI interface Lets you select a serial peripheral interface specified by a DIO_TYPE3_SPI_SETUP_BLx block in the model. The identifier of the SPI consists of the module number, the port number, and the channel number specified for the first output channel, for example, Module No: 1, Output Port No: 1, Output Channel No: 1.

The value of this setting is set to NOT SELECTED when this block is initially added to the model or if the specified SPI does not match the parameters of the DIO_TYPE3_SPI_SETUP_BLx block in the model.

Cycle name Lets you enter a name for the SPI cycle configuration. It must be unique for the specified SPI interface.

The string must follow the MATLAB naming conventions.

Related topics

References

Block Description (DIO_TYPE3_SPI_CYCLE_SETUP_BLx)..426
Parameters Page (DIO_TYPE3_SPI_CYCLE_SETUP_BLx)...428

Parameters Page (DIO_TYPE3_SPI_CYCLE_SETUP_BLx)

Purpose

To specify the parameters of the cycle configuration.

Description

For communicating via SPI bus, many settings must be specified. A chip select cycle configuration collects all these information.

A chip select cycle configuration consists of:

- Data settings

  To specify the data to be transmitted, for example, the number of words and the bits per word.
- Clock settings

  To specify the transfer protocol, for example, the baud rate, the polarity and the phase of the clock signal.
- Chip select settings

  To specify the timing behavior of the transmission and the chip select channels to be used.

For further information, refer to Serial Peripheral Interface on the DIO Type 3 Unit (MicroAutoBox II Features 📖).

Dialog settings

Cycle name Displays the cycle name specified on the Unit page.

Number of words Lets you specify the number of words to be transmitted within an SPI cycle in the range 1 … 64.

Bits per word Lets you specify the number of bits per word in the range 1 … 128.

Note

- The buffer size specified by the **Number of words** parameter and **Bits per word** parameter must not exceed 2048 bits. For example, if you specify 128 bits per word, the maximum number of words is 16.
- The data type used for transmitting is `UInt16`. If you specify a value greater than 16 bits, the **Data** inport of the DIO_TYPE3_SPI_TX_BLx block expects a vector. The width of the vector can be calculated as follows.

  ```
  Width = RoundUp(BitsPerWord / 16) · NumOfWords
  ```
  For example, if you have specified 2 words with 60 bits each, the resulting vector width is 8.

Bit direction Lets you specify the bit direction.

Setting	Description
LSB first	The sent data starts with the least significant bit. This is bit 0.
MSB first	The sent data starts with the most significant bit. This is bit <(BitsPerWord-1)>.

Baudrate Lets you specify the desired baud rate of the SPI clock output in the range 306 Hz … 300 kHz.

The specified baud rate is adjusted to the SPI clock precision. The resulting baud rate is calculated by the following formula:

$$Baudrate \; = \; 20 \cdot 10^6 / RoundDown\left(20 \cdot 10^6 / DesiredBaudRate + 0.5\right) Hz$$

If the desired baud rate contains an undefined variable or the value is out of range, the resulting baud rate is set to `"XXXX"`.

Polarity Lets you specify the polarity of the SPI clock signal (SCLK) before the first edge.

Setting	Description
Low	The idle clock signal is low.
High	The idle clock signal is high.

Phase Lets you specify the phase of the SPI clock signal (also known as CPHA) to start the data capture.

Setting	Description
Leading	Data is captured at each odd-numbered edge of the clock signal (CPHA = 0).
Trailing	Data is captured at each even-numbered edge of the clock signal (CPHA = 1).

The **Polarity** parameter specifies whether the edge is a rising or falling. The combination of polarity and phase is also known as *mode*.

Time before transfer Lets you specify the desired time before starting a data transfer in seconds in the range 0 … 793.6 µs.

This is the time during which the chip select signal is activated before the start of each word (Time between data words = 0) or the entire cycle (Time between data words > 0).

If the specified value contains an undefined variable or is out of range, the resulting value is set to "XXXX".

Time after transfer Lets you specify the desired time in seconds after stopping a data transfer in the range 0 … 793.6 µs.

This is the time during which the chip select signal remains active after the clock signal ends, either after the last word (Time between data words = 0) or the entire cycle (Time between data words > 0).

If the specified value contains an undefined variable or is out of range, the resulting value is set to "XXXX".

Time between chip select cycles Lets you specify the desired time between two chip select cycles in seconds in the range 25 ns … 793.6 µs.

This is the minimum time during which the chip select signal is driven to inactive state.

If the specified value contains an undefined variable or is out of range, the resulting value is set to "XXXX".

Note

This parameter is also used to specify the time during which the chip select signal is to be driven to inactive state between two *words* of a chip select cycle. Refer to the **Time between data words** parameter.

Time between data words Lets you specify the desired time between two data words in seconds in the range 25 ns … 793.6 µs or 0 µs.

This value specifies the time between the last bit of the current word of the MOSI signal and the first bit of the next word of the MOSI signal. The chip select signal remains active for the specified time instead of being negated between two consecutive words of an SPI cycle.

If you specify 0 for the time between data words, the chip select signal is negated for the time specified by the **Time between chip select cycles** parameter between two consecutive words of an SPI cycle. The other timing parameters are also adapted to the timing behavior.

If the specified value contains an undefined variable or is out of range, the resulting value is set to "XXXX".

Activate Lets you specify the chip select output(s) to be activated when this cycle is transferred.

Your selection is handled as a bit mask, so that you can use it for a multiplexer. For example, if you have specified four chip select channels and you activate all of them, you can address up to 15 channels using a multiplexer.

You can only activate the chip select channels configured by the DIO_TYPE3_SPI_SETUP_BLx block.

At least one chip select output channel must be selected.

Related topics

References

Block Description (DIO_TYPE3_SPI_CYCLE_SETUP_BLx)... 426
Unit Page (DIO_TYPE3_SPI_CYCLE_SETUP_BLx).. 427

DIO_TYPE3_SPI_RX_BLx

Purpose

To receive the data of a specific chip select cycle.

If you use a MicroAutoBox II variant with DS1513 I/O board, refer to DIO_TYPE4_SPI_RX_BLx on page 450.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

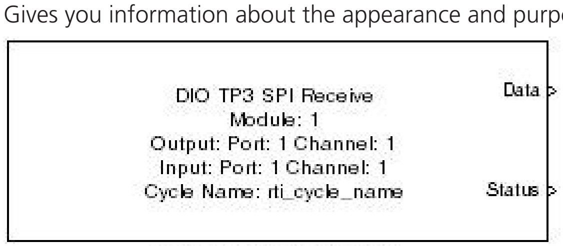
Where to go from here

Information in this section

Block Description (DIO_TYPE3_SPI_RX_BLx)

Block

Gives you information about the appearance and purpose of the block.



DIO_TYPE3_SPI_RX_BL1

Purpose

To receive the data of specific chip select cycle.

Description

This block is used to receive data from the SPI bus. The entire configuration of the communication is specified by the given SPI interface and cycle name. With the Data outport, you can read the received data. The result of the data receipt is returned by the Status outport.

Note

- There must be a related DIO_TYPE3_SPI_CYCLE_SETUP_BLx block for each DIO_TYPE3_SPI_RX_BLx block in the model to provide a chip select cycle configuration that can be referenced.
- There must be a related DIO_TYPE3_SPI_TX_BLx block for each DIO_TYPE3_SPI_RX_BLx block in the model to provide a sender of the data.

I/O mapping

For information on the mapping of the logical channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Serial Peripheral Interface on the DIO Type 3 Unit (MicroAutoBox II Features 📖).

I/O characteristics

The following table describes the ports of the block:

Port	Description
Output	
Data	Outputs the received data of a specific chip select cycle. Data type: UInt16 Range: Depends on the width. Width: Depends on the specified data settings in the DIO_TYPE3_SPI_CYCLE_SETUP_BLx block. The width can be calculated by the following formula: `Width = RoundUp(BitsPerWord / 16) · NumOfWords` The width is set to 1, if it cannot be calculated because of an undefined variable, the value is out of range or the reference to the SPI interface is missing.
Status	Outputs the status of the data receipt. Data type: UInt16 Range: 0 … 2 ▪ 0: No error, new data is available ▪ 1: No new data available ▪ 2: Data lost Width: 1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE3_SPI_RX_BLx) on page 434)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dio_tp3_spi_receive

Unit Page (DIO_TYPE3_SPI_RX_BLx)

Purpose

To specify the chip select cycle to receive data from.

Dialog settings

Select SPI interface Lets you select a serial peripheral interface specified by a DIO_TYPE3_SPI_SETUP_BLx block in the model. The identifier of the SPI consists of the module number, the port number, and the channel number specified for the first output channel, for example, Module No: 1, Output Port No: 1, Output Channel No: 1.

The value of this setting is set to NOT SELECTED when this block is initially added to the model or if the specified SPI does not match the parameters of the DIO_TYPE3_SPI_SETUP_BLx block in the model.

Cycle name Lets you select a chip select cycle specified by a DIO_TYPE3_SPI_CYCLE_SETUP_BLx block in the model.

The value of this setting is set to NOT SELECTED when this block is initially added to the model, and if the specified cycle name has been modified in the related DIO_TYPE3_SPI_CYCLE_SETUP_BLx block.

Related topics

References

DIO_TYPE3_SPI_TX_BLx

Purpose

To transmit data of a specific chip select cycle.

If you use a MicroAutoBox II variant with DS1513 I/O board, refer to DIO_TYPE4_SPI_TX_BLx on page 453.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	✓	–	–

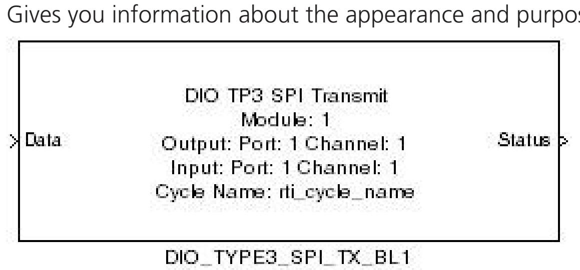
Where to go from here

Information in this section

Block Description (DIO_TYPE3_SPI_TX_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To transmit data of a specific chip select cycle.

Description

This block is used to send data to the SPI bus. The entire configuration of the communication is specified by the given SPI interface and cycle name. With the Data inport, you can specify the data to be sent. The result of the transmission is returned by the Status outport.

Note

- There must be a related DIO_TYPE3_SPI_CYCLE_SETUP_BLx block for each DIO_TYPE3_SPI_TX_BLx block in the model to provide a chip select cycle configuration.

I/O mapping

For information on the mapping of the logical channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Serial Peripheral Interface on the DIO Type 3 Unit (MicroAutoBox II Features 🕮).

I/O characteristics

The following table describes the ports of the block:

Port	Description
Input	
Data	Specifies the data of a specific chip select cycle to be sent. Data type: UInt16 Range: Depends on the width. Width: Depends on the specified data settings in the DIO_TYPE3_SPI_CYCLE_SETUP_BLx block. The width can be calculated by the following formula: `Width = RoundUp(BitsPerWord / 16) · NumOfWords` The width is set to 1, if it cannot be calculated because of an undefined variable, a value is out of range or the reference to the SPI interface is missing.
Output	
Status	Outputs the status of the data transmission. Data type: UInt16 Range: 0 … 2 ▪ 0: No error Transmission was successful. ▪ 1: FIFO overflow The current message length was greater than the FIFO buffer size currently available. The data was therefore not transmitted. ▪ 2: Data lost An attempt was made to transfer new data for this SPI cycle before the data of the previous transfer was completely sent. The data of the previous transfer is (partially) lost. Width: 1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE3_SPI_TX_BLx) on page 437)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dio_tp3_spi_transmit

Unit Page (DIO_TYPE3_SPI_TX_BLx)

Purpose

To specify the chip select cycle to send data to.

Dialog settings

Select SPI interface Lets you select a serial peripheral interface specified by a DIO_TYPE3_SPI_SETUP_BLx block in the model. The identifier of the SPI consists of the module number, the port number, and the channel number specified for the first output channel, for example, Module No: 1, Output Port No: 1, Output Channel No: 1.

The value of this setting is set to NOT SELECTED when this block is initially added to the model or if the specified SPI does not match the parameters of the DIO_TYPE3_SPI_SETUP_BLx block in the model.

Cycle name Lets you select a chip select cycle specified by a DIO_TYPE3_SPI_CYCLE_SETUP_BLx block in the model.

The value of this setting is set to NOT SELECTED when this block is initially added to the model, and if the specified cycle name has been modified in the related DIO_TYPE3_SPI_CYCLE_SETUP_BLx block.

Related topics

References

Block Description (DIO_TYPE3_SPI_TX_BLx)....................435

DIO_TYPE4_SPI_SETUP_BLx

Purpose

To setup a serial peripheral interface on the DIO Type 4 module.

If you use a MicroAutoBox II variant with DS1511 I/O board, refer to DIO_TYPE3_SPI_SETUP_BLx on page 420.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

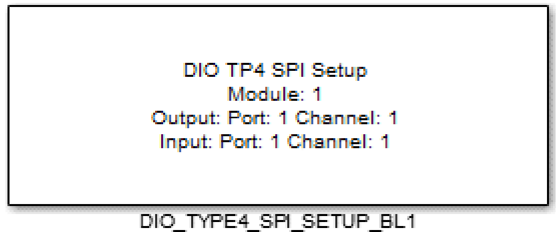
Where to go from here

Information in this section

Block Description (DIO_TYPE4_SPI_SETUP_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To setup a serial peripheral interface of a DIO Type 4 module.

Description

With this block, you can configure an SPI interface. The module number, output port number and output channel number are used to identify an interface. Within an SPI communication network, the DIO_TYPE4_SPI blocks support only the SPI master mode.

You have to specify the input channel (MISO) and the output channels (SCLK, MOSI, CS1 … CS4). The input channel can be configured as trigger source for interrupt generation. For the output channels, you can configure the electrical interface.

Signal	Channel	Description
MISO	ChannelIn	Master In, Slave Out (also known as Data Out) Specified by the **Channel number** parameter in the Input frame on the Unit page.
SCLK	ChannelOut	Serial clock (also known as SPI clock) Specified by the **Channel number** parameter in the Output frame on the Unit page.
MOSI	ChannelOut + 1	Master Out, Slave In (also known as Data In) Automatically reserved related to the specified first output channel for the SCLK signal.
CS1	ChannelOut + 2	Chip Select 1 (also known as Slave Select) A chip select channel is used to address a certain SPI slave. Automatically reserved related to the specified first output channel for the SCLK signal.
CS2	ChannelOut + 3	Chip Select 2 (optional)
CS3	ChannelOut + 4	Chip Select 3 (optional)
CS4	ChannelOut + 5	Chip Select 4 (optional) Using a multiplexer, you can address up to 15 SPI slaves, refer to Parameters Page (DIO_TYPE4_SPI_CYCLE_SETUP_BLx) on page 446.

Note

The DIO Type 4 module supports up to 2 SPI interfaces.

I/O mapping

For information on the mapping of the logical channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Serial Peripheral Interface on the DIO Type 4 Unit (MicroAutoBox II Features 📖).

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE4_SPI_SETUP_BLx) on page 440)
- Electrical Interface page (refer to Electrical Interface Page (DIO_TYPE4_SPI_SETUP_BLx) on page 441)
- Interrupt page (refer to Interrupt Page (DIO_TYPE4_SPI_SETUP_BLx) on page 443)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 📖 contains descriptions of these functions.

- dio_tp4_init
- dio_tp4_digout_mode_set
- dio_tp4_spi_init

Unit Page (DIO_TYPE4_SPI_SETUP_BLx)

Purpose

To specify the input and output channels of the SPI interface.

Dialog settings

Module number Lets you select the module number in the range 1 … 16. If your system contains several modules (I/O units) of the same type, RTI uses the module number to distinguish between them.

For information on the number of available I/O modules, refer to Overview of the Number of Available I/O Modules (MicroAutoBox II Features 📖).

Port number (Output) Lets you select the port number in the range 1 … 2 to be used for the output channels.

Channel number (Output) Lets you select the channel number used for the first output channel connected to the SPI clock (SCLK). The other output channels (MOSI, CS1 … CS4) are subsequently reserved. The available value range depends on the specified port and on the specified number of chip select channels (`NumOfCSChannels`).

Port Number	Channel Number
1	1 … (15 - `NumOfCSChannels`)
2	1 … (7 - `NumOfCSChannels`)

Number of chip select channels Lets you select the number of chip select channels in the range 1 … 4. For each chip select channel an output channel will be reserved.

> **Note**
>
> Multiple access to the same digital output channels by other DIO TYPE 4 blocks or functions is not allowed.

Port number (Input) Lets you select the port number in the range 1 … 2 to be used for the input channel.

Channel number (Input) Lets you select the channel number used for the input channel (MISO). The available value range depends on the specified port.

Port Number	Channel Number
1	1 … 16
2	1 … 8

> **Note**
>
> Multiple access to the same digital input channel by other DIO TYPE 4 blocks or functions is not allowed.

Related topics

References

Block Description (DIO_TYPE4_SPI_SETUP_BLx).......439
Electrical Interface Page (DIO_TYPE4_SPI_SETUP_BLx).......441
Interrupt Page (DIO_TYPE4_SPI_SETUP_BLx).......443

Electrical Interface Page (DIO_TYPE4_SPI_SETUP_BLx)

Purpose

To set the high-side and low-side switches of the connected supply rails for all the digital output channels of the specified port.

Description

The output state of a digital output channel depends on its individual settings for the low-side switch L (GND) and the high-side switch H (VDRIVE).

- If the low-side switch L (GND) is enabled, the output is actively driven to GND.

- If the high-side switch H (VDRIVE) is enabled, the output is actively driven to VDRIVE.
- If you set low-side switch L (GND) and high-side switch H (VDRIVE), the digital output channel is actively driven to both VDRIVE and GND (push-pull mode).

Model Value	High-Side Switch (VDRIVE)	Low-Side Switch (GND)	Output (DigP1 ch 1 ... DigP2 ch 8)	Description
0	Disabled	Disabled	High-Z	Individual output disabled
1	Disabled	Disabled	High-Z	
0	Disabled	Enabled	GND	Low-side switch
1	Disabled	Enabled	High-Z	
0	Enabled	Disabled	High-Z	High-side switch
1	Enabled	Disabled	VDRIVE	
0	Enabled	Enabled	GND	Push-pull output
1	Enabled	Enabled	VDRIVE	

Dialog settings

Output Port Displays the port number that you selected on the Unit page to be used for the output channels.

Output Channel Displays the channel number that you selected on the Unit page to be used for the first output channel.

Setup of supply rails Lets you enable/disable the supply rails defined by the parameters L (Low) and H (High) for each single digital output channel individually. You can modify only the output channels that are reserved by the settings in the Unit page.

Parameter	Meaning
L	Enables/disables the low-side switch for the selected digital output channel.
H	Enables/disables the high-side switch (VDRIVE) for the selected digital output channel.

Set all Lets you enable/disable the supply rails for all the digital output channels that are reserved by the settings in the Unit page identically and at once.

Related topics

References

Block Description (DIO_TYPE4_SPI_SETUP_BLx)....................439
Interrupt Page (DIO_TYPE4_SPI_SETUP_BLx)....................443
Unit Page (DIO_TYPE4_SPI_SETUP_BLx)....................440

Interrupt Page (DIO_TYPE4_SPI_SETUP_BLx)

Purpose

To enable interrupt generation for the specified channel.

Description

The interrupt channel is assigned to the specified SPI input channel, but the state of the input channel has no effect on interrupt generation. An interrupt is generated when an SPI cycle is finished (chip select signal is reset to inactive).

If you enable the interrupt generation, your model has to contain a related DIO_TYPE4_HWINT_BLx block configured with the same channel number and *Input* as the channel direction.

Dialog settings

Input Port Displays the port number that you selected on the Unit page to be used for the input channel.

Input Channel Displays the channel number that you selected on the Unit page to be used as input channel.

Enable interrupt Lets you enable or disable the generation of an interrupt.
If the interrupt generation is enabled, the model has to contain a related DIO_TYPE4_HWINT_BLx block.
If the interrupt generation is disabled, the model must not contain a related DIO_TYPE4_HWINT_BLx block.

Related topics

References

Block Description (DIO_TYPE4_SPI_SETUP_BLx) ... 439
Electrical Interface Page (DIO_TYPE4_SPI_SETUP_BLx) ... 441
Unit Page (DIO_TYPE4_SPI_SETUP_BLx) ... 440

DIO_TYPE4_SPI_CYCLE_SETUP_BLx

Purpose

To specify an SPI cycle configuration.

If you use a MicroAutoBox II variant with DS1511 I/O board, refer to DIO_TYPE3_SPI_CYCLE_SETUP_BLx on page 426.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

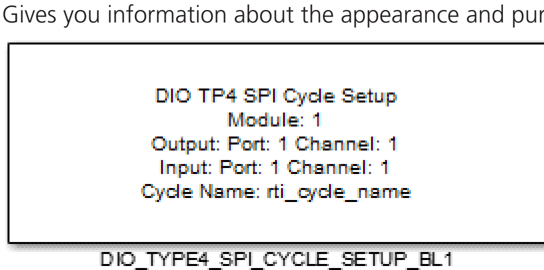
Where to go from here

Information in this section

Block Description (DIO_TYPE4_SPI_CYCLE_SETUP_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To specify an SPI chip select cycle.

Description

A chip select cycle or an SPI cycle configuration is used to specify the communication details. For example, it includes the parameters for the timing behavior, the baud rate, the signal polarity, and the number of words to be transmitted or received. For the RTI blocks for transmitting and receiving messages, it is sufficient for executing to specify the identifier of an existing SPI cycle configuration.

You can define up to 64 SPI cycle configurations per SPI interface. An SPI interface must be always represented by a DIO_TYPE4_SPI_SETUP_BLx block. If the related DIO_TYPE4_SPI_SETUP_BLx block is removed from the model, the SPI interface is unknown and the cycle configuration is invalid.

I/O mapping

For information on the mapping of the logical channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Serial Peripheral Interface on the DIO Type 4 Unit (MicroAutoBox II Features 🕮).

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE4_SPI_CYCLE_SETUP_BLx) on page 445)
- Parameters page (refer to Parameters Page (DIO_TYPE4_SPI_CYCLE_SETUP_BLx) on page 446)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference 🕮 contains descriptions of these functions.

- dio_tp4_spi_cycle_init

Unit Page (DIO_TYPE4_SPI_CYCLE_SETUP_BLx)

Purpose

To specify a name for the cycle configuration.

Dialog settings

Select SPI interface Lets you select a serial peripheral interface specified by a DIO_TYPE4_SPI_SETUP_BLx block in the model. The identifier of the SPI consists of the module number, the port number, and the channel number specified for the first output channel, for example, Module No: 1, Output Port No: 1, Output Channel No: 1.

The value of this setting is set to NOT SELECTED when this block is initially added to the model or if the specified SPI does not match the parameters of the DIO_TYPE4_SPI_SETUP_BLx block in the model.

Cycle name Lets you enter a name for the SPI cycle configuration. It must be unique for the specified SPI interface.

The string must follow the MATLAB naming conventions.

Related topics

References

Parameters Page (DIO_TYPE4_SPI_CYCLE_SETUP_BLx)

Purpose

To specify the parameters of the cycle configuration.

Description

For communicating via SPI bus, many settings must be specified. A chip select cycle configuration collects all these information.

A chip select cycle configuration consists of:

- Data settings

  To specify the data to be transmitted, for example, the number of words and the bits per word.
- Clock settings

  To specify the transfer protocol, for example, the baud rate, the polarity and the phase of the clock signal.
- Chip select settings

  To specify the timing behavior of the transmission and the chip select channels to be used.

For further information, refer to Serial Peripheral Interface on the DIO Type 4 Unit (MicroAutoBox II Features).

Dialog settings

Cycle name Displays the cycle name specified on the Unit page.

Number of words Lets you specify the number of words to be transmitted within an SPI cycle in the range 1 … 64.

Bits per word Lets you specify the number of bits per word in the range 1 … 128.

Note

- The buffer size specified by the **Number of words** parameter and **Bits per word** parameter must not exceed 2048 bits. For example, if you specify 128 bits per word, the maximum number of words is 16.
- The data type used for transmitting is `UInt16`. If you specify a value greater than 16 bits, the **Data** inport of the DIO_TYPE4_SPI_TX_BLx block expects a vector. The width of the vector can be calculated as follows.

  ```
  Width = RoundUp(BitsPerWord / 16) · NumOfWords
  ```

  For example, if you have specified 2 words with 60 bits each, the resulting vector width is 8.

Bit direction Lets you specify the bit direction.

Setting	Description
LSB first	The sent data starts with the least significant bit. This is bit 0.
MSB first	The sent data starts with the most significant bit. This is bit <(BitsPerWord-1)>.

Baudrate Lets you specify the desired baud rate of the SPI clock output in the range 306 Hz … 300 kHz.

The specified baud rate is adjusted to the SPI clock precision. The resulting baud rate is calculated by the following formula:

$$Baudrate\ =\ 20 \cdot 10^6 / RoundDown\left(20 \cdot 10^6 / DesiredBaudRate + 0.5\right)\ Hz$$

If the desired baud rate contains an undefined variable or the value is out of range, the resulting baud rate is set to "XXXX".

Polarity Lets you specify the polarity of the SPI clock signal (SCLK) before the first edge.

Setting	Description
Low	The idle clock signal is low.
High	The idle clock signal is high.

Phase Lets you specify the phase of the SPI clock signal (also known as CPHA) to start the data capture.

Setting	Description
Leading	Data is captured at each odd-numbered edge of the clock signal (CPHA = 0).
Trailing	Data is captured at each even-numbered edge of the clock signal (CPHA = 1).

The Polarity parameter specifies whether the edge is a rising or falling. The combination of polarity and phase is also known as *mode*.

Time before transfer Lets you specify the desired time before starting a data transfer in seconds in the range 0 … 793.6 µs.

This is the time during which the chip select signal is activated before the start of each word (Time between data words = 0) or the entire cycle (Time between data words > 0).

If the specified value contains an undefined variable or is out of range, the resulting value is set to "XXXX".

Time after transfer Lets you specify the desired time in seconds after stopping a data transfer in the range 0 … 793.6 µs.

This is the time during which the chip select signal remains active after the clock signal ends, either after the last word (Time between data words = 0) or the entire cycle (Time between data words > 0).

If the specified value contains an undefined variable or is out of range, the resulting value is set to "XXXX".

Time between chip select cycles Lets you specify the desired time between two chip select cycles in seconds in the range 25 ns … 793.6 µs.

This is the minimum time during which the chip select signal is driven to inactive state.

If the specified value contains an undefined variable or is out of range, the resulting value is set to "XXXX".

Note

This parameter is also used to specify the time during which the chip select signal is to be driven to inactive state between two *words* of a chip select cycle. Refer to the Time between data words parameter.

Time between data words Lets you specify the desired time between two data words in seconds in the range 25 ns … 793.6 µs or 0 µs.

This value specifies the time between the last bit of the current word of the MOSI signal and the first bit of the next word of the MOSI signal. The chip select signal remains active for the specified time instead of being negated between two consecutive words of an SPI cycle.

If you specify 0 for the time between data words, the chip select signal is negated for the time specified by the Time between chip select cycles parameter between two consecutive words of an SPI cycle. The other timing parameters are also adapted to the timing behavior.

If the specified value contains an undefined variable or is out of range, the resulting value is set to "XXXX".

Activate Lets you specify the chip select output(s) to be activated when this cycle is transferred.

Your selection is handled as a bit mask, so that you can use it for a multiplexer. For example, if you have specified four chip select channels and you activate all of them, you can address up to 15 channels using a multiplexer.

You can only activate the chip select channels configured by the DIO_TYPE4_SPI_SETUP_BLx block.

At least one chip select output channel must be selected.

Related topics

References

Block Description (DIO_TYPE4_SPI_CYCLE_SETUP_BLx).. 444
Unit Page (DIO_TYPE4_SPI_CYCLE_SETUP_BLx)... 445

DIO_TYPE4_SPI_RX_BLx

Purpose

To receive the data of a specific chip select cycle.

If you use a MicroAutoBox II variant with DS1511 I/O board, refer to DIO_TYPE3_SPI_RX_BLx on page 432.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

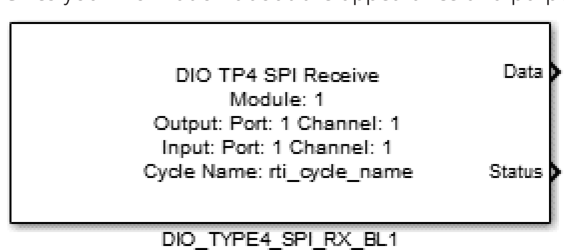
Where to go from here

Information in this section

Block Description (DIO_TYPE4_SPI_RX_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To receive the data of specific chip select cycle.

Description

This block is used to receive data from the SPI bus. The entire configuration of the communication is specified by the given SPI interface and cycle name. With the Data outport, you can read the received data. The result of the data receipt is returned by the Status outport.

Note

- There must be a related DIO_TYPE4_SPI_CYCLE_SETUP_BLx block for each DIO_TYPE4_SPI_RX_BLx block in the model to provide a chip select cycle configuration that can be referenced.
- There must be a related DIO_TYPE4_SPI_TX_BLx on page 453 block for each DIO_TYPE4_SPI_RX_BLx block in the model to provide a sender of the data.

I/O mapping

For information on the mapping of the logical channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Serial Peripheral Interface on the DIO Type 4 Unit (MicroAutoBox II Features).

I/O characteristics

The following table describes the ports of the block:

Port	Description
Output	
Data	Outputs the received data of a specific chip select cycle. Data type: UInt16 Range: Depends on the width. Width: Depends on the specified data settings in the DIO_TYPE4_SPI_CYCLE_SETUP_BLx block. The width can be calculated by the following formula: `Width = RoundUp(BitsPerWord / 16) · NumOfWords` The width is set to 1, if it cannot be calculated because of an undefined variable, the value is out of range or the reference to the SPI interface is missing.
Status	Outputs the status of the data receipt. Data type: UInt16 Range: 0 … 2 ▪ 0: No error, new data is available ▪ 1: No new data available ▪ 2: Data lost Width: 1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE4_SPI_RX_BLx) on page 452)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dio_tp4_spi_receive

Unit Page (DIO_TYPE4_SPI_RX_BLx)

Purpose

To specify the chip select cycle to receive data from.

Dialog settings

Select SPI interface Lets you select a serial peripheral interface specified by a DIO_TYPE4_SPI_SETUP_BLx block in the model. The identifier of the SPI consists of the module number, the port number, and the channel number specified for the first output channel, for example, Module No: 1, Output Port No: 1, Output Channel No: 1.

The value of this setting is set to NOT SELECTED when this block is initially added to the model or if the specified SPI does not match the parameters of the DIO_TYPE4_SPI_SETUP_BLx block in the model.

Cycle name Lets you select a chip select cycle specified by a DIO_TYPE4_SPI_CYCLE_SETUP_BLx block in the model.

The value of this setting is set to NOT SELECTED when this block is initially added to the model, and if the specified cycle name has been modified in the related DIO_TYPE4_SPI_CYCLE_SETUP_BLx block.

Related topics

References

Block Description (DIO_TYPE4_SPI_RX_BLx)..450

DIO_TYPE4_SPI_TX_BLx

Purpose

To transmit data of a specific chip select cycle.

If you use a MicroAutoBox II variant with DS1511 I/O board, refer to DIO_TYPE3_SPI_TX_BLx on page 435.

Hardware requirements

Supported MicroAutoBox II hardware:

DS1401 Base Board	MicroAutoBox II with I/O Boards			
	DS1507	DS1511	DS1513	DS1514
–	–	–	✓	–

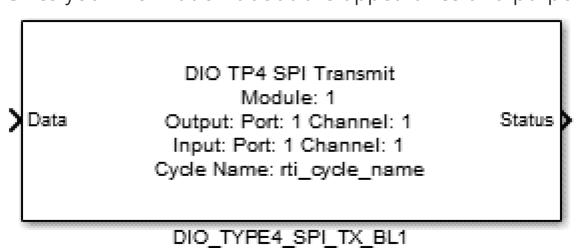
Where to go from here

Information in this section

Block Description (DIO_TYPE4_SPI_TX_BLx)

Block

Gives you information about the appearance and purpose of the block.



Purpose

To transmit data of a specific chip select cycle.

Description

This block is used to send data to the SPI bus. The entire configuration of the communication is specified by the given SPI interface and cycle name. With the Data inport, you can specify the data to be sent. The result of the transmission is returned by the Status outport.

> **Note**
>
> - There must be a related DIO_TYPE4_SPI_CYCLE_SETUP_BLx block for each DIO_TYPE4_SPI_TX_BLx block in the model to provide a chip select cycle configuration.

I/O mapping

For information on the mapping of the logical channel numbers to the related I/O pins of the MicroAutoBox II I/O connector, refer to Serial Peripheral Interface on the DIO Type 4 Unit (MicroAutoBox II Features 🕮).

I/O characteristics

The following table describes the ports of the block:

Port	Description
Input	
Data	Specifies the data of a specific chip select cycle to be sent. Data type: UInt16 Range: Depends on the width. Width: Depends on the specified data settings in the DIO_TYPE4_SPI_CYCLE_SETUP_BLx block. The width can be calculated by the following formula: `Width = RoundUp(BitsPerWord / 16) · NumOfWords` The width is set to 1, if it cannot be calculated because of an undefined variable, a value is out of range or the reference to the SPI interface is missing.
Output	
Status	Outputs the status of the data transmission. Data type: UInt16 Range: 0 … 2 ▪ 0: No error Transmission was successful. ▪ 1: FIFO overflow The current message length was greater than the FIFO buffer size currently available. The data was therefore not transmitted. ▪ 2: Data lost An attempt was made to transfer new data for this SPI cycle before the data of the previous transfer was completely sent. The data of the previous transfer is (partially) lost. Width: 1

Dialog pages

The dialog settings can be specified on the following pages:

- Unit page (refer to Unit Page (DIO_TYPE4_SPI_TX_BLx) on page 455)

Related RTLib functions

This RTI block is implemented using the following RTLib functions. The MicroAutoBox II RTLib Reference contains descriptions of these functions.

- dio_tp4_spi_transmit

Unit Page (DIO_TYPE4_SPI_TX_BLx)

Purpose

To specify the chip select cycle to send data to.

Dialog settings

Select SPI interface Lets you select a serial peripheral interface specified by a DIO_TYPE4_SPI_SETUP_BLx block in the model. The identifier of the SPI consists of the module number, the port number, and the channel number specified for the first output channel, for example, Module No: 1, Output Port No: 1, Output Channel No: 1.

The value of this setting is set to NOT SELECTED when this block is initially added to the model or if the specified SPI does not match the parameters of the DIO_TYPE4_SPI_SETUP_BLx block in the model.

Cycle name Lets you select a chip select cycle specified by a DIO_TYPE4_SPI_CYCLE_SETUP_BLx block in the model.

The value of this setting is set to NOT SELECTED when this block is initially added to the model, and if the specified cycle name has been modified in the related DIO_TYPE4_SPI_CYCLE_SETUP_BLx block.

Related topics

References

Block Description (DIO_TYPE4_SPI_TX_BLx)............453

A

B

C

D

E

F

H

I

L

O

P

R

S

T

U