DS2210 HIL I/O Board

RTI Reference

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

Angular Processing Unit 61

About This Reference

Contents

This RTI Reference provides a full description of the Real-Time Interface (RTI) software for the DS2210 HIL I/O Board.

Symbols

dSPACE user documentation uses the following symbols:

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

Naming conventions

dSPACE user documentation uses the following naming conventions:

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

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

Examples:

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

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

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

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

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

Special folders

Some software products use the following special folders:

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

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

or

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

Documents folder A standard folder for user-specific documents.

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

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

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

Accessing dSPACE Help and PDF Files

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

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

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

dSPACE Help (Web) You can access the Web version of dSPACE Help at www.dspace.com/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 DS2210 Blockset

Overview of the DS2210 Blockset

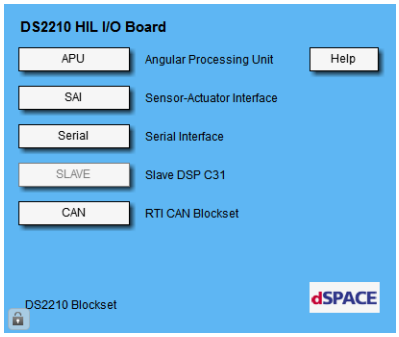
Introduction

The Real-Time Interface (RTI) board library for the DS2210 – rti2210lib – provides RTI blocks that implement the functionality and I/O capabilities of the DS2210 HIL I/O Board.

The RTI blocks are designed to specify the hardware setup for real-time applications.

Access

After you double-click the **DS2210** button in a block library of a processor board, the **Library: rti2210lib** window is displayed.



Libray components

The following rti2210lib components are available in the **Library: rti2210lib** window:

Note

Several features are supported only for DS2210 boards with specific revisions or higher, for example, if you want to use the ignition capture unit for injection capture. Refer to DS2210 Board Revision (DS2210 Features 🕮).

APU The sublibrary comprises RTI blocks for the angular processing unit. This sublibrary provides access to crankshaft sensor signal generation and ignition signal capturing, for example. For detailed information, see Angular Processing Unit on page 61.

SAI The sublibrary comprises RTI blocks for the sensor and actuator interface. This sublibrary provides access to A/D conversion, digital I/O and PWM measurement, for example. Refer to Sensor and Actuator Interface on page 15.

SERIAL The sublibrary comprises RTI blocks for the serial interface. Refer to Serial Interface on page 131

SLAVE Slave DSP programming is not supported by RTI yet. However, in the APU and SAI sublibraries are RTI blocks that provide the slave DSP's ready-to-use applications for knock sensor signal generation and wheel speed sensor simulation. Refer to DS2210SL_KNSG_Bx_Cy on page 124 and DS2210SL_WSSG_Bx_Cy on page 54.

CAN The sublibrary comprises RTI blocks for CAN access. Refer to Basics on the RTI CAN Blockset (RTI CAN Blockset Reference 🕮).

Sensor and Actuator Interface

Where to go from here

Information in this section

Overview of the Sensor and Actuator Interface

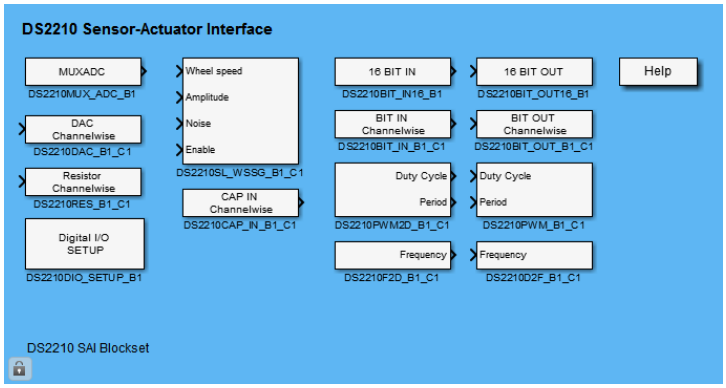
Overview of the Sensor and Actuator Interface

Introduction

The sensor and actuator interface (SAI) provides standard I/O components and timing I/O components.

Access

After you click the SAI button in the Library: rti2210lib, the Library: rti2210sailib window is displayed.



The buttons of this library provide access to the RTI I/O blocks of the sensor and actuator interface (SAI).

Library components

The library contains the following components:

- ADC Unit on page 18
- DAC Unit on page 20
- Digital I/O Set Up on page 23
- Bit I/O Unit on page 26
- D/R Converter on page 36
- PWM Signal Measurement on page 39
- PWM Signal Generation on page 42
- Square-Wave Signal Generation on page 47
- Frequency Measurement on page 51
- Wheel Speed Sensor Simulation on page 54
- Digital Capture of Event Capture Input on page 58

Related topics

Basics

Sensor and Actuator Interface (DS2210 Features 🕮)

ADC Unit

DS2210MUX_ADC_Bx

Purpose

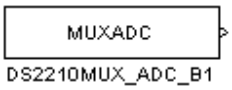
To read from up to 16 A/D channels.

Where to go from here

Information in this section

Block Description (DS2210MUX_ADC_Bx)

Illustration



Purpose

To read from up to 16 A/D channels.

I/O mapping

For information on the I/O mapping, refer to ADC Unit (DS2210 Features 🕮).

Note

Depending on your selection, A/D conversion will be started for channels 1 … 4, 1 … 8, 1 … 12, or 1 … 16. To speed up conversion time use low channel numbers.

I/O characteristics

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

Input Voltage Range	Simulink Output
0 V … 20 V	0 … 1

Dialog pages

The dialog settings can be specified on the Unit Page (refer to Unit Page (DS2210MUX_ADC_Bx) on page 19).

Related RTLib functions

`ds2210_adc_block_init`, `ds2210_adc_block_start`, `ds2210_adc_block_in`

Related topics

References

ADC Unit (DS2210 Features 🕮)

Unit Page (DS2210MUX_ADC_Bx)

Purpose

To specify the board number and select the channel to be used.

Dialog settings

Board number Lets you select the DS2210 board number within the range of 1 … 16.

Channel selection Lets you choose a set of up to 16 A/D channels. Use the None button to clear an obsolete selection.

Note

You have to select at least one channel.

DAC Unit

DS2210DAC_Bx_Cx

Purpose

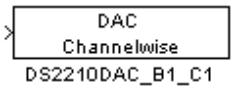
To write to a single D/A channel.

Where to go from here

Information in this section

Block Description (DS2210DAC_Bx_Cx)

Illustration



Purpose

To write to a single D/A channel.

I/O mapping

For information on the I/O mapping, refer to DAC Unit (DS2210 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 … V_{REF}

For information on V_{REF}, refer to DAC Unit (DS2210 Features 🕮).

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

Characteristic	Value
Datatype	Double
Range	0 … 1

- The block provides its outputs in unlatched mode, which means that the channel is converted and output immediately.

Dialog pages

The dialog settings can be specified on the following dialog pages:

- **Unit Page** (refer to Unit Page (DS2210DAC_Bx_Cx) on page 21)
- **Parameters Page** (refer to Parameters Page (DS2210DAC_Bx_Cx) on page 21)

Related RTLib functions

`ds2210_dac_out`

Related topics

References

DAC Unit (DS2210 Features 🕮)

Unit Page (DS2210DAC_Bx_Cx)

Purpose

To specify the board number and select the channel to be used.

Dialog settings

Board number Lets you select the DS2210 board number within the range of 1 … 16.

Channel selection Lets you select a single channel within the range of 1 … 12.

Parameters Page (DS2210DAC_Bx_Cx)

Purpose

To specify the initialization and termination.

Description

Initialization With the initialization value, the D/A channel has a defined output during the initialization phase. 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.

Termination When the simulation terminates, the D/A channel holds the last output value by default. Using the Termination mode and Termination value parameters, you can specify a user-defined output value on termination and use this setting to drive your external hardware into a safe final condition.

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 you stop the real-time application by using ControlDesk's Stop RTP command, the processor resets immediately without executing termination functions. The current values of the I/O channels are kept and the specified termination values are not set.

Dialog settings

Initialization value Lets you enter the initial value for the output voltage at the start of the simulation. The value within the range of 0 … 100% corresponds to the DAC output voltage range (0 … V_{REF}).

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.

Termination value Lets you enter the output value at the end of the simulation. The value within the range of 0 … 100% corresponds to the DAC output voltage range (0 … V_{REF}).

Related topics

References

simState (RTI and RTI-MP Implementation Reference 🕮)
Stop RTP (ControlDesk Platform Management 🕮)

Digital I/O Set Up

Purpose

To set up all digital I/O ports.

DS2210DIO_SETUP_Bx

Purpose

To configure the threshold level for digital inputs and the termination mode for all digital outputs.

Where to go from here

Information in this section

Block Description (DS2210DIO_SETUP_Bx)..... 23
To describe the purpose and function of the block.

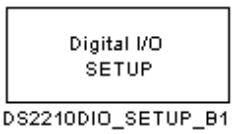
Unit Page (DS2210DIO_SETUP_Bx)..... 24
To specify the board number, the trigger level and the termination mode.

Information in other sections

Signal Connection to External Devices (PHS Bus System Hardware Reference 🕮)
Shows the I/O circuits of the board and gives tips and notes on connecting devices.

Block Description (DS2210DIO_SETUP_Bx)

Illustration



Purpose

To configure the threshold level for digital inputs and the termination mode for all digital outputs.

Description

To set the basic parameters of the digital I/O blocks, the sensor and actuator interface (rti2210sailib) and the angular processing unit (rti2210apulib) provide a common block that affects the bit I/O unit, PWM signal generation, PWM signal measurement, spark event capture, injection pulse position and fuel amount measurement and the digital outputs of camshaft and crankshaft sensor signal generation.

For information on digital I/O, refer to Signal Connection to External Devices (PHS Bus System Hardware Reference 🕮).

Dialog pages

The dialog settings can be specified on the **Unit Page** (refer to Unit Page (DS2210DIO_SETUP_Bx) on page 24).

Related RTLib functions

`ds2210_digout_mode_set`, `ds2210_digin_threshold_set`

Unit Page (DS2210DIO_SETUP_Bx)

Purpose

To specify the board number, the trigger level and the termination mode.

Dialog settings

Board number Lets you select the DS2210 board number within the range of 1 … 16.

Trigger level Lets you enter the threshold level value for digital inputs within the range of 1 … 7 V. This parameter affects the following blocks:

- DS2210BIT_IN16_Bx
- DS2210BIT_IN_Bx_Cy
- DS2210PWM2D_Bx_Cy
- DS2210APU_INJ_Bx_Gy
- DS2210APU_IGN_Bx
- DS2210APU_AUXCAP_Bx_Cy
- DS2210F2D_Bx_Cy
- DS2210CAP_IN_Bx_Cy
- DS2210APU_IGNCONT_Bx
- DS2210APU_INJCONT_Bx_Gy
- DS2210APU_AUXCAPCONT_Bx_Cy

Termination mode Lets you select the termination mode. If you set the termination mode to "disable," all digital outputs will be set to high-Z when the simulation terminates. If you set the termination mode to "enable," the output

on termination will be determined by the block-specific settings. This parameter affects the following blocks:

- DS2210BIT_OUT16_Bx
- DS2210BIT_OUT_Bx_Cy
- DS2210PWM_Bx_Cy
- DS2210APU_CRANK_Bx
- DS2210APU_CAM_Bx_Cy
- DS2210D2F_Bx_Cy

Related topics

References

DS2210DIO_SETUP_Bx.....23

Bit I/O Unit

Purpose

To access the digital I/O ports.

Note

Before operating the digital outputs of the bit I/O unit, an external power supply (V_{Bat}) must be connected.

Where to go from here

Information in this section

DS2210BIT_IN16_Bx....26
To read all 16 bits from the digital input.

DS2210BIT_OUT16_Bx....28
To write to all 16 bits of the digital output.

DS2210BIT_IN_Bx_Cy....31
To read from a single bit of the digital input.

DS2210BIT_OUT_Bx_Cy....33
To write to a single bit of the digital output.

Information in other sections

Bit I/O Unit (DS2210 Features 🕮)
The bit I/O unit contains one 16-bit port for input that provides 16 discrete digital input lines, and one 16-bit port for output that provides 16 discrete digital outputs.

DS2210BIT_IN16_Bx

Purpose

To read all 16 bits from the digital input.

Where to go from here

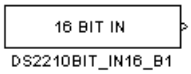
Information in this section

Block Description (DS2210BIT_IN16_Bx)....27
To describe the purpose and function of the block.

Unit Page (DS2210BIT_IN16_Bx)..... 28
To specify the board number.

Block Description (DS2210BIT_IN16_Bx)

Illustration



Purpose

To read all 16 bits from the digital input.

Note

- Use DS2210BIT_IN_Bx_Cy to read from a single bit of the input port.
- Use DS2210DIO_SETUP_Bx to set the threshold level for digital inputs. If you do not include this block in your model the default threshold level of 2.5 V is valid.

I/O mapping

For information on the I/O mapping, refer to Bit I/O Unit (DS2210 Features 🕮).

I/O characteristics

This table shows the relationship between the block input and block output within the range of 0 … 65535:

Digital Input	Simulink Output
0000 0000 0000 0000	0
…	…
0000 0000 1111 1101	253
…	…
1111 1111 0000 0010	65282
…	…
1111 1111 1111 1111	65535

The following table shows the characteristics of the block output:

Characteristic	Value
Datatype	Uint16
Range	0 … 65535

Dialog pages	The dialog settings can be specified on the **Unit Page** (refer to Unit Page (DS2210BIT_IN16_Bx) on page 28).
Related RTLib functions	`ds2210_bit_io_in`
Related topics	References Bit I/O Unit (DS2210 Features 🕮)

Unit Page (DS2210BIT_IN16_Bx)

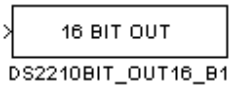
Purpose	To specify the board number.
Dialog settings	**Board number** Lets you select the DS2210 board number within the range of 1 … 16.
Related topics	References DS2210BIT_IN16_Bx....26

DS2210BIT_OUT16_Bx

Purpose	To write to all 16 bits of the digital output.
Where to go from here	Information in this section Block Description (DS2210BIT_OUT16_Bx)....29 To describe the purpose and function of the block. Unit Page (DS2210BIT_OUT16_Bx)....30 To specify the board number, the initialization and the termination.

Block Description (DS2210BIT_OUT16_Bx)

Illustration



Purpose

To write to all 16 bits of the digital output.

Note

- Use DS2210BIT_OUT_Bx_Cy to write to a single bit of the output port.
- Use DS2210DIO_SETUP_Bx to enable or disable the termination mode for all digital outputs.

I/O mapping

For information on the I/O mapping, refer to Bit I/O Unit (DS2210 Features 🕮).

I/O characteristics

This table shows the relationship between the block input and block output:

Simulink Input	Digital Output
0	0000 0000 0000 0000
…	…
253	0000 0000 1111 1101
…	…
65282	1111 1111 0000 0010
…	…
65535	1111 1111 1111 1111

The following table shows the characteristics of the block output:

Characteristic	Value
Datatype	Uint16
Range	0 … 65535

Dialog pages

The dialog settings can be specified on the **Unit Page** (refer to Unit Page (DS2210BIT_OUT16_Bx) on page 30).

Related RTLib functions	`ds2210_bit_io_out`
Related topics	References Bit I/O Unit (DS2210 Features 🕮)

Unit Page (DS2210BIT_OUT16_Bx)

Purpose

To specify the board number, the initialization and the termination.

Description

Initialization During the model initialization phase the initial output specified with **Initialization value** is written to each channel (bit) to ensure a defined output during this simulation phase. 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.

Termination When the simulation terminates, all channels hold their last digital output values by default. With **Output on termination** you can specify an output value on termination and use this setting to drive your external hardware into a safe final condition. Use **DS2210DIO_SETUP_Bx** to enable or disable the termination mode for all digital outputs.

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 you stop the real-time application by using ControlDesk's **Stop RTP** command, the processor resets immediately without executing termination functions. The current values of the I/O channels are kept and the specified termination values are not set.

Dialog settings

Board number Lets you select the DS2210 board number within the range of 1 … 16.

Initialization value Lets you enter the initial output value at the start of the simulation. The value must remain within the range of 0 … 65535. According to the corresponding binary value, the bits will be set.

Termination mode Lets you set the output value specified by **Output on termination** or keep the current output value when the simulation terminates.

Output on termination Lets you enter the output value at the end of the simulation. The value must remain within the range of 0 … 65535. According to the corresponding binary value, the bits will be set.

Related topics

References

DS2210BIT_OUT16_Bx....28
DS2210DIO_SETUP_Bx....23
simState (RTI and RTI-MP Implementation Reference 🕮)
Stop RTP (ControlDesk Platform Management 🕮)

DS2210BIT_IN_Bx_Cy

Purpose

To read from a single bit of the digital input.

Where to go from here

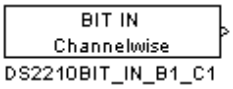
Information in this section

Block Description (DS2210BIT_IN_Bx_Cy)....31
To describe the purpose and function of the block.

Unit Page (DS2210BIT_IN_Bx_Cy)....32
To specify the board number and the channel number.

Block Description (DS2210BIT_IN_Bx_Cy)

Illustration



Purpose

To read from a single bit of the digital input.

Note

- Use DS2210BIT_IN16_Bx to access all 16 bits of the input port at the same time.
- Use DS2210DIO_SETUP_Bx to set the threshold level for digital inputs. If you do not include this block in your model the default threshold level of 2.5 V is valid.

I/O mapping

For information on the I/O mapping, refer to Bit I/O Unit (DS2210 Features 🕮).

I/O characteristics

This table shows the relationship between the digital input and the output variable (binary representation related to one channel) of the block:

Digital Input	Simulink Output
High	1
Low	0

The following table shows the characteristics of the block output:

Characteristic	Value
Datatype	Boolean
Range	0, 1

Dialog pages

The dialog settings can be specified on the **Unit Page** (refer to Unit Page (DS2210BIT_IN_Bx_Cy) on page 32).

Related RTLib functions

`ds2210_bit_io_in`

Related topics

References

Bit I/O Unit (DS2210 Features 🕮)

Unit Page (DS2210BIT_IN_Bx_Cy)

Purpose

To specify the board number and the channel number.

Dialog settings

Board number Lets you select the DS2210 board number within the range of 1 … 16.

Channel number Lets you select a channel (bit) within the range of 1 … 16.

Related topics

References

DS2210BIT_IN_Bx_Cy.....31

DS2210BIT_OUT_Bx_Cy

Purpose

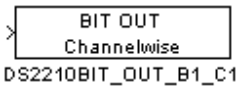
To write to a single bit of the digital output.

Where to go from here

Information in this section

Block Description (DS2210BIT_OUT_Bx_Cy)

Illustration



Purpose

To write to a single bit of the digital output.

Note

- Use DS2210BIT_OUT16_Bx to access all 16 bits of the output port at the same time.
- Use DS2210DIO_SETUP_Bx to enable or disable the termination mode for all digital outputs.

I/O mapping

For information on the I/O mapping, refer to Bit I/O Unit (DS2210 Features 🕮).

I/O characteristics

This table shows the relationship between the block input and block output:

Simulink Input	Digital Output
1	High
0	Low

The following table shows the characteristics of the block input:

Characteristic	Value
Datatype	Boolean
Range	0, 1

Dialog pages

The dialog settings can be specified on the **Unit Page** (refer to Unit Page (DS2210BIT_OUT_Bx_Cy) on page 34).

Related RTLib functions

`ds2210_bit_io_set`, `ds2210_bit_io_clear`

Related topics

References

Bit I/O Unit (DS2210 Features 🕮)

Unit Page (DS2210BIT_OUT_Bx_Cy)

Purpose

To specify the board number, the initialization and the termination.

Description

Initialization During the model initialization phase the initial digital output state specified with **Initial output state** is written to each channel (bit) to ensure a defined output during this simulation phase. 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.

Termination When the simulation terminates, all channels hold their last digital output state by default. With the **Termination output state** you can specify an output state on termination and use this setting to drive your external hardware into a safe final condition. Use **DS2210DIO_SETUP_Bx** to enable or disable the termination mode for all digital outputs.

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 you stop the real-time application by using ControlDesk's **Stop RTP** command, the processor resets immediately without executing termination functions. The current values of the I/O channels are kept and the specified termination values are not set.

Dialog settings

Board number Lets you select the DS2210 board number within the range of 1 … 16.

Channel number Lets you select a channel (bit) within the range of 1 … 16.

Initial output state Lets you select the output state "low" or "high" at the start of the simulation.

Termination mode Lets you set the output state specified by Termination output state or keep the current output state when the simulation terminates.

Termination output state Lets you select the output state "low" or "high" at the end of the simulation.

Related topics

References

DS2210BIT_OUT_Bx_Cy....33
DS2210DIO_SETUP_Bx....23
simState (RTI and RTI-MP Implementation Reference 🕮)
Stop RTP (ControlDesk Platform Management 🕮)

D/R Converter

Introduction

To access the resistor outputs.

DS2210RES_Bx_Cy

Purpose

To set a single resistance output.

Where to go from here

Information in this section

Block Description (DS2210RES_Bx_Cy)

Illustration

Purpose

To set a single resistance output.

I/O mapping

For information on the I/O mapping, refer to D/R Converter (DS2210 Features 🕮).

Description

The resistance value can only be set to the discrete values 1 MΩ / x (x within the range of 1 … 65535) or to infinity. If you specify a resistance that does not match one of these discrete values the next matching value will be set.

Note

Resolution decreases with growing resistance due to the reciprocal relationship between the output code and resistance.

I/O characteristics

The following table shows the characteristics of the block input:

Characteristic	Value
Datatype	Double
Range	15.26 Ω … 1 MΩ, infinity

Dialog pages

The dialog settings can be specified on the **Unit Page** (refer to Unit Page (DS2210RES_Bx_Cy) on page 37).

Related RTLib functions

`ds2210_resistance_out`

Related topics

References

D/R Converter (DS2210 Features 🕮)

Unit Page (DS2210RES_Bx_Cy)

Purpose

To specify the board number, the channel number, the initialization and the termination.

Description

Initialization During the model initialization phase the initial resistance specified with **Initial resistance** is adjusted for each channel to ensure a defined output during this simulation phase. 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.

Termination When the simulation terminates, all channels hold their last resistance by default. With the **Termination resistance**, you can specify an output resistance on termination and use this setting to drive your external hardware into a safe final condition.

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 you stop the real-time application by using ControlDesk's **Stop RTP** command,

the processor resets immediately without executing termination functions. The current values of the I/O channels are kept and the specified termination values are not set.

Dialog settings

Board number Lets you select the DS2210 board number within the range of 1 … 16.

Channel number Lets you select a resistor channel within the range of 1 … 6.

Initial resistance Lets you enter the initial resistance value at the start of the simulation. The value must remain within the range of 15.26 … 1000000 Ω. If you enter values greater than 1 MΩ the resistance will be set to infinity.

Termination mode Lets you set the output resistance specified by Termination resistance or keep the current output resistance when the simulation terminates.

Termination resistance Lets you enter the termination resistance value at the end of the simulation. The value must remain within the range of 15.26 … 1000000 Ω. If you enter values greater than 1 MΩ the resistance will be set to infinity.

Related topics

References

DS2210RES_Bx_Cy..... 36
simState (RTI and RTI-MP Implementation Reference 🕮)
Stop RTP (ControlDesk Platform Management 🕮)

PWM Signal Measurement

Introduction

To capture pulse width modulation (PWM) type signals.

DS2210PWM2D_Bx_Cy

Purpose

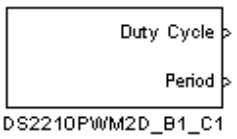
To measure the period and duty cycle of the specified PWM input signal.

Where to go from here

Information in this section

Block Description (DS2210PWM2D_Bx_Cy)

Illustration



Purpose

To measure the period and duty cycle of the specified PWM input signal.

I/O mapping

For information on the I/O mapping, refer to PWM Signal Measurement (DS2210 Features 🕮).

Note

- With extended functionality PWM signal measurement works with 16-bit resolution else with 14-bit resolution. To check whether your board has extended functionality, refer to **DS2210 Board Revision**.
- Use **DS2210DIO_SETUP_Bx** to set the threshold level for digital inputs. If you do not include this block in your model, the default threshold level of 2.5 V is valid.
- It is not possible to use the same channels for frequency and PWM signal measurement.

I/O characteristics

- This table shows the scaling between the duty cycle of the measured signal and the output of the block:

Duty Cycle	Simulink Output
0 … 100%	0 … 1

- The following table shows the characteristics of the block output:

Variable	Characteristic	Value
Duty Cycle	Datatype	Double
	Range	0 … 1
Period	Datatype	Double
	Range	Depends on the selected period

- The period of the measured signal is given in seconds.
- The period of the input signal should remain within the specified range, otherwise the measured values will not be correct.

Dialog pages

The dialog settings can be specified on the **Unit Page** (refer to Unit Page (DS2210PWM2D_Bx_Cy) on page 41).

Related RTLib functions

`ds2210_timing_in_mode_set`, `ds2210_pwm_in`

Related topics

References

PWM Signal Measurement (DS2210 Features 🕮)

Unit Page (DS2210PWM2D_Bx_Cy)

Purpose

To specify the board number, the channel number and the range of period.

Dialog settings

Board number Lets you select the DS2210 board number within the range of 1 … 16.

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

Range of period Lets you select the period range. Note that the resolution depends on the selected period range. For further information, refer to PWM Signal Measurement (DS2210 Features 🕮).

Note

- The displayed period ranges are valid for 16-bit resolution. The corresponding period values for 14-bit resolution are displayed in brackets.
- To optimize the resolution of the measurement, you should always choose the period range with the lowest possible range number. For example, if your desired period is 10 ms, you should use period range 3 (50 µs … 13.1 ms) rather than period range 4 (50 µs … 26.2 ms), refer to Quantization Effects (DS2210 Features 🕮).

Related topics

References

DS2210PWM2D_Bx_Cy..... 39

PWM Signal Generation

Introduction

To generate pulse width modulation (PWM) signals.

Note

Before operating the digital outputs of PWM signal generation, an external power supply (V_{Bat}) must be connected.

DS2210PWM_Bx_Cy

Purpose

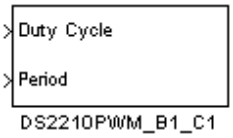
To generate a square-wave signal with the variable period and variable duty cycle adjustable during run time.

Where to go from here

Information in this section

Block Description (DS2210PWM_Bx_Cy)

Illustration



Purpose

To generate a square-wave signal with the variable period and variable duty cycle adjustable during run time.

I/O mapping

For information on the I/O mapping, refer to PWM Signal Generation (DS2210 Features 🕮).

Note

- With extended functionality PWM signal generation works with 16-bit resolution else with 14 bit. To check whether your board has extended functionality, refer to DS2210 Board Revision (DS2210 Features 🕮).
- Use **DS2210DIO_SETUP_Bx** to enable or disable the termination mode for all digital outputs.
- It is not possible to use the same channels for square-wave and PWM signal generation.

I/O characteristics

- The block inputs – Period and Duty Cycle – can be changed during run time. The Period input values should remain within the specified range. The Duty Cycle input values become effective immediately.
- The block input Period is given in seconds.
- This table shows the scaling between the duty cycle and the input of the block:

Simulink Input	Duty Cycle
0 … 1	0 … 100%

The following table shows the characteristics of the block input:

Variable	Characteristic	Value
Duty Cycle	Datatype	Double
	Range	0 … 1
Period	Datatype	Double
	Range	Depends on the selected period

Dialog pages

The dialog settings can be specified on the following dialog pages:

- **Unit Page** (refer to Unit Page (DS2210PWM_Bx_Cy) on page 44)
- **Initialization Page** (refer to Initialization Page (DS2210PWM_Bx_Cy) on page 44)
- **Termination Page** (refer to Termination Page (DS2210PWM_Bx_Cy) on page 45)

Related RTLib functions `ds2210_timing_out_mode_set`, `ds2210_pwm_out`

Related topics References

PWM Signal Generation (DS2210 Features 🕮)

Unit Page (DS2210PWM_Bx_Cy)

Purpose To specify the board number, the channel number and the range of period.

Dialog settings

Board number Lets you select the DS2210 board number within the range of 1 … 16.

Channel number Lets you select the output channel within the range of 1 … 6.

Range Lets you select the period range for the PWM signal to be generated. Note that the resolution depends on the selected period range. For further information, refer to PWM Signal Generation (DS2210 Features 🕮).

Note

The displayed period ranges are valid for 16-bit resolution. The corresponding period values for 14-bit resolution are displayed in brackets.

Initialization Page (DS2210PWM_Bx_Cy)

Purpose To specify the initialization values to be set.

Dialog settings

Initial duty cycle Lets you enter the duty cycle at the start of the simulation within the range of 0 … 1 (by default: 0)

Initial period Lets you enter the period at the start of the simulation within the range of 50 µs … 107.3 s (by default: 50 µs). The value should remain within the selected period range and must be given in seconds.

Note

If your DS2210 board has not extended functionality, only 14-bit resolution are supported. The initial period range is then 50 µs … 26.8 s.

Termination Page (DS2210PWM_Bx_Cy)

Purpose

To specify the termination values to be set.

Description

Initialization During the model initialization phase, the output signal is either generated with an initial period or is set to zero. This is especially useful if a channel is used in a triggered or enabled subsystem that is not executed at the start of the simulation. With **Initial period** and **Initial duty cycle**, the channel has a defined output during this simulation phase.

Termination When the simulation terminates, the signal generation is continued with the last period and duty cycle by default. If you want to stop signal generation during this simulation phase, set the duty cycle to 0. Otherwise, select one above the lower range limit. Use these settings to drive your external hardware into a safe final condition. Use **DS2210DIO_SETUP_Bx** to enable or disable the termination mode for all digital outputs.

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 you stop the real-time application by using ControlDesk's **Stop RTP** command, the processor resets immediately without executing termination functions. The current values of the I/O channels are kept and the specified termination values are not set.

Dialog settings

Termination Lets you set the values specified by **Duty cycle on termination** and **Period on termination** or keep the current duty cycle and period when the simulation terminates.

Duty cycle on termination Lets you enter the duty cycle at the end of the simulation within the range of 0 … 1.

Period on termination Lets you enter the period at the end of the simulation within the range of 50 µs … 107.3 s. The values should remain within the selected period range and must be given in seconds.

Note

For 14-bit resolution the period range on termination is 50 µs … 26.8 s.

Related topics

References

DS2210DIO_SETUP_Bx..... 23
simState (RTI and RTI-MP Implementation Reference 🕮)
Stop RTP (ControlDesk Platform Management 🕮)

Square-Wave Signal Generation

Introduction

To generate square-wave signals.

DS2210D2F_Bx_Cy

Purpose

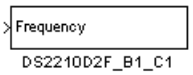
To generate a square-wave signal for the specified output channel. For square-wave signal generation, 6 independent channels are available.

Where to go from here

Information in this section

Block Description (DS2210D2F_Bx_Cy)

Illustration



Purpose

To generate a square-wave signal for the specified output channel. For square-wave signal generation, 6 independent channels are available.

Description

Note

- It is not possible to use the same channels for square-wave and PWM signal generation.
- Square-wave signal generation is supported only for DS2210 boards with extended functionality. To check whether your board has extended functionality, refer to DS2210 Board Revision (DS2210 Features 🕮).
- Before operating the digital outputs of the D2F unit, you must connect an external power supply (V_{Bat}).

I/O mapping

For information on the I/O mapping, refer to Square-Wave Signal Generation (DS2210 Features 🕮).

I/O characteristics

The frequency of the output signal specified in Hz corresponds to the input of the block.

- If the frequency is higher than the upper limit, the frequency saturates to f_{max}.
- If the frequency is less than the lower limit, the output voltage level is set to the value specified by **Set output channel**.

Dialog pages

The dialog settings can be specified on the following dialog pages:

- **Unit Page** (refer to Unit Page (DS2210D2F_Bx_Cy) on page 48)
- **Initialization Page** (refer to Initialization Page (DS2210D2F_Bx_Cy) on page 49)
- **Termination Page** (refer to Termination Page (DS2210D2F_Bx_Cy) on page 50)

Related RTLib functions

`ds2210_init`, `ds2210_digout_mode_set`, `ds2210_timing_out_mode_set`, `ds2210_d2f`

Related topics

References

Square-Wave Signal Generation (DS2210 Features 🕮)

Unit Page (DS2210D2F_Bx_Cy)

Purpose

To specify the board number, the channel number and the range of frequency.

Dialog settings

Board number Lets you select the DS2210 board number within the range of 1 … 16.

Channel number Lets you select the output channel within the range of 1 … 6.

Range of frequency Lets you select the frequency range and the resolution.

Note

To optimize the resolution of the generated square-wave signal, you should always choose 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 … 20 kHz) rather than frequency range 2 (4.77 Hz … 20 kHz).

Resolution of frequency Displays the resolution of the selected frequency range (read-only).

Set output channel Lets you select the behavior of the output if the output 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 keeps the current signal level (low or high).

Initialization Page (DS2210D2F_Bx_Cy)

Purpose

To specify the initialization values to be set.

Dialog settings

Initial frequency Lets you enter the initial frequency at the start of the simulation. The values of the initial frequency must remain within the selected range. If a frequency below the lower limit is chosen, the signal generation starts with frequency 0.

Termination Page (DS2210D2F_Bx_Cy)

Purpose

To specify the termination values to be set.

Description

Initialization During the model initialization phase, the output signal is either generated with an initial frequency or is set to zero. This is especially useful if a channel is used in a triggered or enabled subsystem that is not executed at the start of the simulation. With **Initial frequency**, the channel has a defined output during this simulation phase.

Termination When the simulation terminates, the signal generation continues with the last frequency by default. If you want to stop signal generation during this simulation phase, specify a frequency below the lower limit. The frequency is set to 0 Hz, but the signal voltage level may not be 0 V (if **Set output channel** is set to **High**). Otherwise, select a frequency above the lower limit. Use these settings to drive your external hardware into a safe final condition. Use **DS2210DIO_SETUP_Bx** to enable or disable the termination mode for all digital outputs.

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 you stop the real-time application by using ControlDesk's **Stop RTP** command, the processor resets immediately without executing termination functions. The current values of the I/O channels are kept and the specified termination values are not set.

Dialog settings

Termination Lets you set the values specified by **Frequency on termination** or keep the frequency when the simulation terminates. Values must remain within the selected range. If a frequency below the lower limit is chosen, the frequency is set to 0 Hz, but the signal voltage level may not be 0 V (if **Set output channel** is set to **High**).

Related topics

References

DS2210DIO_SETUP_Bx..... 23
simState (RTI and RTI-MP Implementation Reference 🕮)
Stop RTP (ControlDesk Platform Management 🕮)

Frequency Measurement

Introduction

To measure the frequency of square-wave signals.

Note

Frequency measurement is supported only for DS2210 boards with extended functionality. To check whether your board has extended functionality, refer to DS2210 Board Revision (DS2210 Features 🕮).

DS2210F2D_Bx_Cy

Purpose

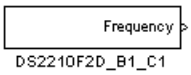
To measure the frequency of a square-wave input signal. For frequency measurement, 8 independent channels are available.

Where to go from here

Information in this section

Block Description (DS2210F2D_Bx_Cy)

Illustration



Purpose

To measure the frequency of a square-wave input signal. For frequency measurement, 8 independent channels are available.

I/O mapping

For information on the I/O mapping, refer to Frequency Measurement (DS2210 Features 🕮).

Description

Note

- It is not possible to use the same channels for frequency and PWM signal measurement.
- Frequency measurement is supported only for DS2210 boards with extended functionality. To check whether your I/O board has extended functionality, refer to DS2210 Board Revision (DS2210 Features 🕮).

I/O characteristics

The frequency of the input signal specified in Hz corresponds to the output of the block.

- 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 faulty due to quanitization effects.

Dialog pages

The dialog settings can be specified on the Unit Page (refer to Unit Page (DS2210F2D_Bx_Cy) on page 52).

Related RTLib functions

`ds2210_init`, `ds2210_timing_in_mode_set`, `ds2210_f2d`

Related topics

References

Frequency Measurement (DS2210 Features 🕮)

Unit Page (DS2210F2D_Bx_Cy)

Purpose

To specify the board number, the channel number and the range of frequency.

Dialog settings

Board number Lets you select the DS2210 board number within the range of 1 … 16.

Channel number Lets you select the input channel within the range of 1 … 8.

Range of frequency Lets you select the frequency range and the resolution.

Note

To optimize the resolution of the measurement, you should always choose 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 … 20 kHz) rather than frequency range 2 (4.77 Hz … 20 kHz).

Resolution of frequency Displays the resolution of the selected frequency range (read-only).

Wheel Speed Sensor Simulation

Introduction

To generate wheel speed sensor signals.

DS2210SL_WSSG_Bx_Cy

Purpose

To generate wheel speed sensor signals.

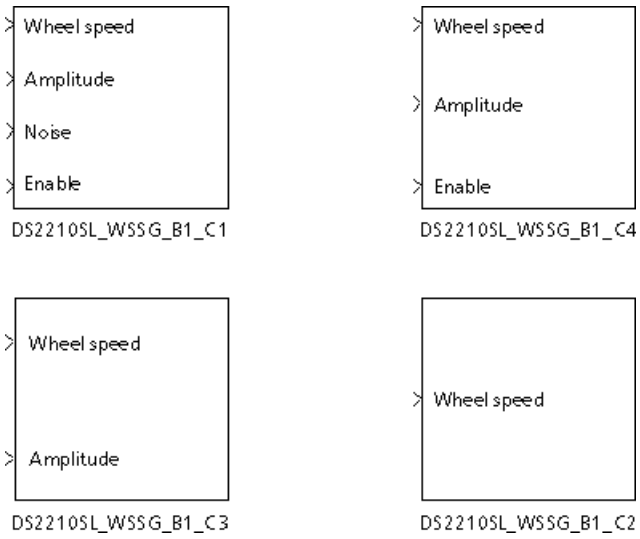
Where to go from here

Information in this section

Block Description (DS2210SL_WSSG_BxCy)

Illustration

The block's different representations depend on how you configure the tunable parameters of the block.



I/O mapping

For information on the I/O mapping, refer to Wheel Speed Sensor Simulation (DS2210 Features 🕮).

Purpose

To generate wheel speed sensor signals.

Note

The block uses tunable parameters. These parameters can be updated *either* by their block input *or* by block parameters that are accessible by experiment software, for example, ControlDesk. The different representations of the block depend on your selection. Tunable parameters that are defined as block parameters will be removed from the RTI block layout. For detailed information, refer to Model Parameter Configuration Dialog (RTI and RTI-MP Implementation Reference 🕮).

I/O characteristics

- The *Wheel speed* input must be given in revolutions per minute (rpm).
- The *Amplitude* input is available if **input port** is selected in the **Set amplitude** parameter. The value must be given within the range of 0 … 40 V_{PP}.
- The *Noise* input is available if input port is selected in the **Set noise** parameter. The value must be given within the range of 0 … 40 V_{PP}.

- The *Enable* input is available if input port is selected by the **Enable channel** parameter. The value must be given as follows.

Simulink Input	Purpose
0	To disable the wheel speed signal.
1	To enable the wheel speed signal.

- The following table shows the characteristics of the block inputs:

Variable	Characteristic	Value
Wheel speed	Datatype	Double
	Range	(1/60) · Wheel speed · Number of wheel teeth < (1/2) · 50.000
Amplitude	Datatype	Double
	Range	0 … 40
Noise	Datatype	Double
	Range	0 … 40
Enable	Datatype	Boolean
	Range	0, 1

Dialog pages

The dialog settings can be specified on the following dialog pages:

- **Unit Page** (refer to Unit Page (DS2210SL_WSSG_Bx_Cy) on page 56)
- **Parameters Page** (refer to Parameters Page (DS2210SL_WSSG_Bx_Cy) on page 57)

Related RTLib functions

`ds2210_slave_dsp_signal_enable`, `ds2210_slave_dsp_channel_enable`, `ds2210_slave_dsp_wheel_init`, `ds2210_slave_dsp_wheel_update`

Unit Page (DS2210SL_WSSG_Bx_Cy)

Purpose

To specify the board number, the channel number and the sample time.

Dialog settings

Board number Lets you select the DS2210 board number within the range of 1 … 16.

Channel number Lets you select a channel within the range of 1 … 4.

Sample time Lets you enter the sample time of the WSSG block in seconds. Enter –1 to keep the model's base sample time (inherited).

Parameters Page (DS2210SL_WSSG_Bx_Cy)

Purpose

To specify the wheel and the signal parameters.

Dialog settings

Number of wheel teeth Lets you enter the number of wheel teeth within the range of 0 … 2^{31}–1. You have to take care of the following relation:

(1/60) · Wheel speed · Number of wheel teeth < (1/2) · 50.000

Set amplitude This is a tunable parameter. Select the radio button by input port to set the amplitude value of the wheel speed signal by the block input port or enter the initial amplitude within the range of 0 … 40 V_{PP}.

Set noise This is a tunable parameter. Select the radio button by input port to set the noise value of the wheel speed signal by the block input port or enter the noise value within the range of 0 … 40 V_{PP}.

Enable channel This is a tunable parameter. Select the radio button by input port to enable the wheel speed signal by the block input port or select "enable" in the by block parameter selection list.

Digital Capture of Event Capture Input

Introduction

To read the digital capture input channelwise.

DS2210CAP_IN_Bx_Cy

Purpose

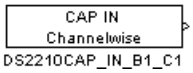
To read the digital capture input channelwise.

Where to go from here

Information in this section

Block Description (DS2210CAP_IN_Bx_Cy)

Illustration



Purpose

To read the digital capture input channelwise.

I/O mapping

For information on the I/O mapping, refer to Spark Event Capture (DS2210 Features 🕮) and Injection Pulse Position and Fuel Amount Measurement (DS2210 Features 🕮).

Note

- The threshold can be adjusted within the range of 1 … 7 V via the DS2210DIO_SETUP_Bx block.
- DS2210CAP_IN_Bx_Cy needs no other block to run within a Simulink model. If you do not use the DS2210_SETUP_Bx block, the threshold is set to 2.5 V.
- The block is also linked to the DS2210apulib.

Note

The channels INJ7 (PWM7) and INJ8 (PWM8) are only supported on DS2210 boards with extended functionality. To check whether your board has extended functionality, refer to DS2210 Board Revision (DS2210 Features 🕮).

I/O characteristics

- The digital signal (high/low) of the binary signal is defined by a threshold that can be configured via DS2210DIO_SETUP_Bx. If no setup block is selected, the default threshold (1.4 V) is valid.
- You can set only one threshold for all digital inputs of the DS2210.

Dialog page

The dialog settings can be specified on the Unit Page (refer to Unit Page (DS2210F2D_Bx_Cy) on page 52).

Related RTLib functions

`ds2210_init`, `ds2210_ignition status_read`, `ds2210_injection status_read`

Related topics

References

DS2210DIO_SETUP_Bx 23

Unit Page (DS2210CAP_IN_Bx_Cy)

Purpose

To specify the board number and the channel-wise read access to the capture input.

Dialog settings

Board number Lets you select the DS2210 board number within the range of 1 … 16.

Capture input Lets you select the capture input channel. You can use the channels to capture either ignition or injection data. The following channels can be selected:

Channel Number	Signal
1	IGN1
2	IGN2
3	IGN3
4	IGN4
5	IGN5
6	IGN6
7	AUX1
8	AUX2
9	INJ1
10	INJ2
11	INJ3
12	INJ4
13	INJ5
14	INJ6
15	INJ7 (PWM7)
16	INJ8 (PWM8)

Angular Processing Unit

Where to go from here

Information in this section

Overview of the Angular Processing Unit

Overview of the Angular Processing Unit

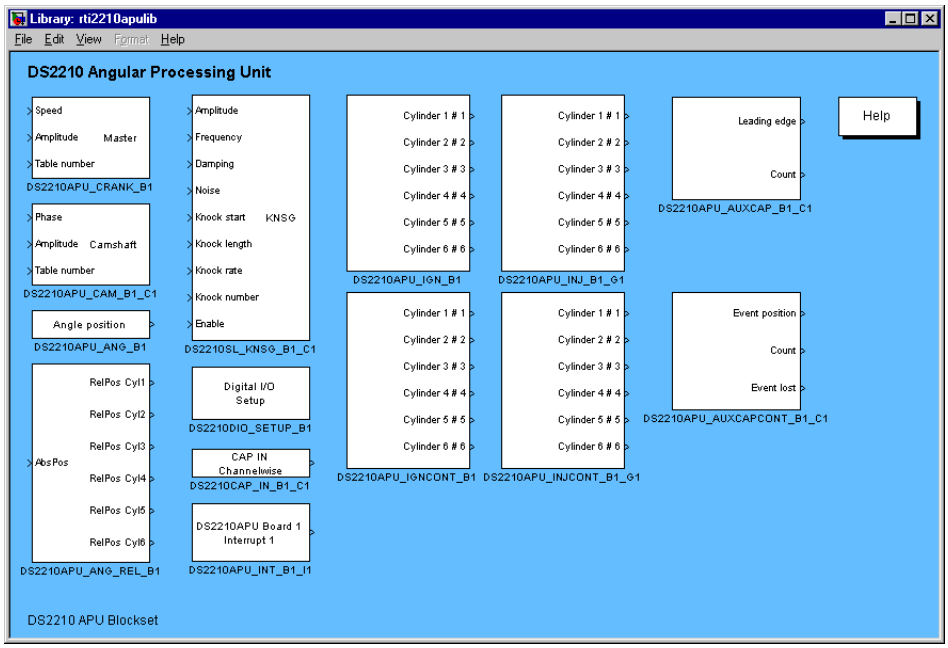
Introduction

The angular processing unit (APU) is designed to simulate core engine processing functions, for example, crankshaft signal generation, or capturing spark events.

The Library: rti2210apulib provides access to the angular processing unit (APU).

Access

If you click the APU button in the Library: rti2210lib window, the Library: rti2210apulib window opens.



Library components

The library contains the following components:

- DS2210APU_CRANK_Bx on page 65
- DS2210APU_CAM_Bx_Cy on page 72
- DS2210APU_ANG_Bx on page 76
- DS2210APU_ANG_REL_Bx on page 78
- DS2210APU_IGN_Bx on page 81
- DS2210APU_IGNCONT_Bx on page 87
- DS2210APU_INJ_Bx_Gy on page 94
- DS2210APU_INJCONT_Bx_Gy on page 102

- DS2210APU_AUXCAP_Bx_Cy on page 111
- DS2210APU_AUXCAPCONT_Bx_Cy on page 116
- DS2210APU_INT_Bx_Iy on page 121
- DS2210SL_KNSG_Bx_Cy on page 124
- Digital I/O Set Up on page 23

Related topics

Basics

Angular Processing Unit (DS2210 Features 🕮)

DS2210APU_CRANK_Bx

Purpose

To set up the angular processing unit, generate the engine position information, and define the crankshaft output signal.

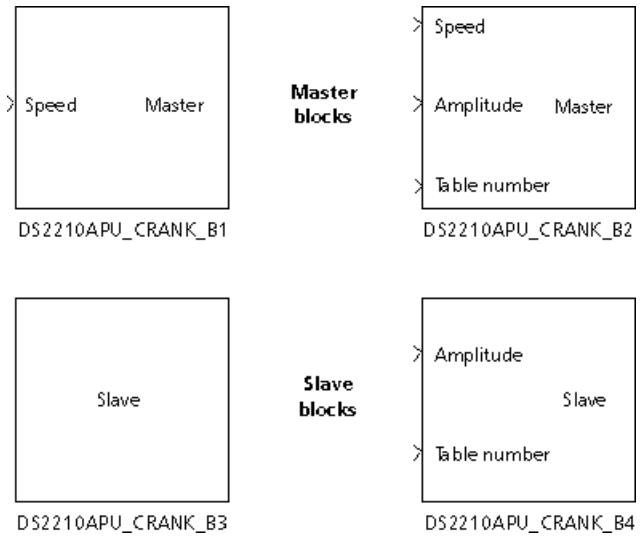
Where to go from here

Information in this section

Block Description (DS2210APU_CRANK_Bx)

Illustration

The block's different representations depend on your settings.



Purpose

To set up the angular processing unit, generate the engine position information, and define the crankshaft output signal.

I/O mapping

For information on the I/O mapping, refer to Crankshaft Sensor Signal Generation (DS2210 Features 🕮).

Note

If several DS2210 boards are connected to different PHS buses of a multiprocessor system, identical board numbers are assigned to these boards. For the moment, RTI-MP does not allow you to configure a multiprocessor system using identical board numbers on different processors. If you encounter this problem, contact dSPACE Support (www.dspace.com/go/supportrequest).

Description

The block input ports are specified in I/O characteristics on page 67.

For each DS2210 master or slave board you need an own DS2210APU_CRANK_Bx block. You have to define the DS2210 master board first (refer to Master/Slave selection on page 68).

If another board is configured as master, for example, a DS5203, you have to reconfigure the DS2210 master manually via the following source code. You cannot reconfigure the master in the RTI block because a slave configuration requires a master configuration in the model.

1. Start a build process for your model to generate the `<ModelName>_usr.c` file.
2. Add the following lines to the file.

```
static void usr_initialize(void)
{
   2210ds_mode_set(DS2210_1_BASE, DS2210_SLAVE_MODE);
}
...
static void usr_terminate(void)
{
   ds2210_apu_stop(DS2210_1_BASE);
}
```

3. Restart the build process.
4. Load the model to your real-time hardware.

The engine position is derived from the Speed input. For cascaded DS2210 boards, only the master board gets a Speed input port to generate the engine position. The slave boards get the engine position information from the master board via the time-base bus connector.

Note

- The DS2210APU_CRANK_Bx block must always be in your model if you want to use any of the other APU blocks.
- Use DS2210DIO_SETUP_Bx to enable or disable the termination mode for digital outputs.
- The block uses tunable parameters. These parameters can be updated *either* by their block input *or* by block parameters that are accessible by experiment software, for example, ControlDesk. The different representations of the block depend on your selection. Tunable parameters that are defined as block parameters will be removed from the RTI block layout. For detailed information, refer to Model Parameter Configuration Dialog (RTI and RTI-MP Implementation Reference 🕮).

I/O characteristics

- The *Speed* input is only available for the master block and must be given in revolutions per minute (rpm).
- The *Amplitude* input is available if **input port** is selected in the **Set amplitude** parameter.
- The *Table number* input is available if **input port** is selected in the **Set table number** parameter.
- The following table shows the characteristics of the block inputs:

Variable	Characteristic	Value
Speed	Datatype	Double
	Range	–29297 … 29297
Amplitude	Datatype	Double
	Range	0 … 40 V_{pp}
Table number	Datatype	UInt8
	Range	1 … 8

Dialog pages

The following pages are available:

- **Unit Page** (refer to Unit Page (DS2210APU_CRANK_Bx) on page 68) for master/slave selection
- **TDC Page** (refer to TDC Page (DS2210APU_CRANK_Bx) on page 69) only for the master board's engine setup
- **Parameters Page** (refer to Parameters Page (DS2210APU_CRANK_Bx) on page 70) for crankshaft signal definition and to define the digital output mode of crankshaft and camshaft signals
- **Wave Tables Page** (refer to Wave Tables Page (DS2210APU_CRANK_Bx) on page 70) for wavetable assignment

Related RTLib functions

`ds2210_mode_set`, `ds2210_digout_mode_set`, `ds2210_digwform_mode_set`, `ds2210_apu_transformer_mode_set`, `ds2210_apu_position_write`, `ds2210_apu_start`, `ds2210_apu_stop`,

`ds2210_apu_velocity_write`, `ds2210_crank_output_ampl_set`, `ds2210_crank_table_load`, `ds2210_crank_table_select`

Related topics

References

DS2210DIO_SETUP_Bx 23

Unit Page (DS2210APU_CRANK_Bx)

Purpose

To specify the board number and select master/slave mode.

Dialog settings

Board number Lets you select the DS2210 board number within the range of 1 … 16.

Master/Slave selection Lets you define the board as the master or the slave board. If you choose **Master** you can specify the **Initial position** at the start of the simulation within the engine cycle range of 0 … <720° with a resolution of 0.088°. If you choose **Slave**, you have to select the board number of the already defined master board within the range of 1 … 16.

For information on the board installation, refer to Setting Up I/O Boards (DS1006 Hardware Installation and Configuration Guide 🕮) or Setting Up I/O Boards (DS1007 Hardware Installation and Configuration Guide 🕮).

Related topics

Basics

Setting Up I/O Boards (DS1006 Hardware Installation and Configuration Guide 🕮)
Setting Up I/O Boards (DS1007 Hardware Installation and Configuration Guide 🕮)

References

DS2210APU_CRANK_Bx 65

TDC Page (DS2210APU_CRANK_Bx)

Purpose

To specify the top dead center (TDC).

Dialog settings

The TDC page is enabled only if you chose Master in the MasterSlave selection. Use this page to set up the engine to be simulated, that is the TDC positions for the selected number of cylinders. The TDC page provides the following parameters:

Number of cylinders Lets you select the number of cylinders of the engine to be simulated within the range of 1 … 18. The I/O blocks (for example, DS2210APU_IGN_Bx on page 81, DS2210APU_INJ_Bx_Gy on page 94 and DS2210SL_KNSG_Bx_Cy on page 124) allow you to use up to 8 of the defined cylinders.

Cylinder sequence Lets you edit the ignition sequence, for example: [1 3 2 4]. This setting affects ignition and injection capturing as well as knock signal generation.

First TDC Lets you enter the TDC for the first cylinder of the sequence you have specified above. The engine position has to be given within the range of 0 … <720° with a resolution of 0.088°.

Example

The following table shows how the TDC values are calculated for the cylinder sequence [1 3 2 4]:

Cylinder	TDC
1	First TDC
3	First TDC + 720° / Number of cylinders
2	First TDC + (2 · 720°) / Number of cylinders
4	First TDC + (3 · 720°) / Number of cylinders

Related topics

References

DS2210APU_CRANK_Bx....65

Parameters Page (DS2210APU_CRANK_Bx)

Purpose

To specify the digital output and the signal parameters.

Dialog settings

Digital output mode Clears automatically the digital crankshaft and camshaft outputs (CRANK_DIG, CAM1_DIG and CAM2_DIG) when the angular processing unit is stopped or when the Speed input becomes 0.

Set amplitude This is a tunable parameter. Select the radio button **by input port** to set the amplitude of the analog crankshaft output by the block input port or select **by block parameter amplitude** and enter the initial amplitude value within the range of 0 … 40 V_{PP}. This parameter allows you to scale the values defined in your wavetable.

Set table number This is a tunable parameter. Select the radio button **by input port** to update the wavetable to be used by the block input port or select **by block parameter table number** and an initial wavetable in the list. For the wavetable numbering, refer to the Wave Tables Page (DS2210APU_CAM_Bx_Cy) on page 75Wave Tables Page (DS2210APU_CRANK_Bx) on page 70.

Related topics

References

DS2210APU_CRANK_Bx..... 65

Wave Tables Page (DS2210APU_CRANK_Bx)

Purpose

To assign MAT wavetable files to up to eight crankshaft wave tables.

Description

Each MAT wave table file defines a single wave table. For information on wave tables, refer to Wave Table Basics (DS2210 Features 🕮).

Use the **Add** button to browse through the file system and collect up to eight MAT wave table files in the selection list. Use the **Remove** button to remove a wave table file from the selection list. The files in the selection list are internally numbered consecutively, starting with 1 at the top. These numbers identify the wave tables.

You can modify the sequence with the **Up** and **Down** buttons.

Dialog settings

Model directory Displays the directory of your model. If you copy the model to another directory while the **Wave tables** page is still open, click the **Refresh** button to display the current model directory.

Use path relative to the model directory Displays the file names with a path relative to the current model directory.

Related topics

References

DS2210APU_CRANK_Bx..... 65

DS2210APU_CAM_Bx_Cy

Purpose

To define the amplitude, phase and wavetable of the selected camshaft output signal.

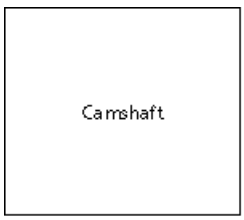
Where to go from here

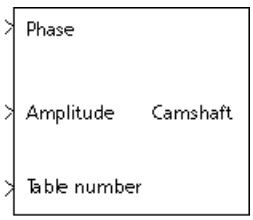
Information in this section

Block Description (DS2210APU_CAM_Bx_Cy)

Illustration

The block's different representations depend on how you configure the tunable parameters of the block.





Purpose

To define the amplitude, phase and wavetable of the selected camshaft output signal.

The block input ports are specified in I/O characteristics on page 73.

Use **DS2210APU_CRANK_Bx** to set the digital output mode for the digital camshaft outputs.

I/O mapping

For information on the I/O mapping, refer to Camshaft Sensor Signal Generation (DS2210 Features 🕮).

Note

- The DS2210APU_CRANK_Bx block must be in your model.
- Use DS2210DIO_SETUP_Bx to enable or disable the termination mode for digital outputs.
- The block uses tunable parameters. These parameters can be updated *either* by their block input *or* by block parameters that are accessible by experiment software, for example, ControlDesk. The different representations of the block depend on your selection. Tunable parameters that are defined as block parameters will be removed from the RTI block layout. For detailed information, refer to Model Parameter Configuration Dialog (RTI and RTI-MP Implementation Reference 🕮).

I/O characteristics

- The *Phase* input, which sets the phase between the crankshaft and the camshaft signal, is available if **by input port** is selected in the **Set phase** parameter. A positive angle leads to a shift to the left of the camshaft signal in relation to the crankshaft signal. The value must be given within the range of -720° … <720° with a resolution of 0.088°.
- The *Amplitude* input is available if **by input port** is selected in the **Set amplitude** parameter.
- The *Table number* input is available if **by input port** is selected in the **Set table number** parameter. The value must be given within the range of 1 … 8.
- The following table shows the characteristics of the block inputs:

Variable	Characteristic	Value
Phase	Datatype	double
	Range	–720 … <720°
Amplitude	Datatype	double
	Range	0 … 40 V_{PP}
Table number	Datatype	uint8
	Range	1 … 8

Dialog pages

The following pages are available:

- Unit Page (DS2210APU_CAM_Bx_Cy) for camshaft output channel selection
- Parameters Page (DS2210APU_CAM_Bx_Cy) for camshaft signal definition
- Wave Tables Page (DS2210APU_CAM_Bx_Cy) for wavetable assignment

Related RTLib functions

`ds2210_cam_phase_write`, `ds2210_cam_output_ampl_set`, `ds2210_cam_table_load`, `ds2210_cam_table_select`

Related topics

References

DS2210APU_CRANK_Bx....65
DS2210DIO_SETUP_Bx....23

Unit Page (DS2210APU_CAM_Bx_Cy)

Purpose

To specify the board and channel number.

Dialog settings

Board number Lets you select the DS2210 board number of the board to be defined by this block within the range of 1 … 16. This board may be the master board itself.

Channel number Lets you select the camshaft output channel number within the range of 1 … 2.

Related topics

References

DS2210APU_CAM_Bx_Cy....72

Parameters Page (DS2210APU_CAM_Bx_Cy)

Purpose

To specify the phase between crankshaft and camshaft signal and set the signal parameters.

Dialog settings

Set phase This is a tunable parameter. Either select the radio button by input port to set the phase between crankshaft and camshaft signal by the block input port or enter the initial phase value within the engine cycle range of –720 … <720° with a resolution of 0.088°. A positive angle leads to a shift to the left of the camshaft signal in relation to the crankshaft signal.

Set amplitude This is a tunable parameter. Select the radio button by input port to set the amplitude by the block input port or select by block parameter

amplitude and enter the initial amplitude value within the range of 0 … 40 V_{PP}. This parameter allows you to scale the values defined in your wavetable.

Set table number This is a tunable parameter. Either select the radio button by input port to update the wavetable to be used by the block input port or select by block parameter table number and an initial wavetable in the list. For the wavetable numbering, refer to the Wave Tables Page (DS2210APU_CAM_Bx_Cy) on page 75.

Related topics

References

DS2210APU_CAM_Bx_Cy 72

Wave Tables Page (DS2210APU_CAM_Bx_Cy)

Purpose

To assign MAT wave table files to up to eight camshaft wave tables.

Description

Each MAT wave table file defines a single wavetable. For information on wave tables, refer to Wave Table Basics (DS2210 Features 🕮).

Use the Add button to browse through the file system and collect up to eight MAT wave table files in the selection list. Use the Remove button to remove a wavetable file from the selection list. The files in the selection list are internally numbered consecutively, starting with 1 at the top. These numbers identify the wave tables.

You can modify the sequence with the Up and Down buttons.

Dialog settings

Model directory Displays the directory of your model. If you copy the model to another directory while the Wave tables page is still open, click the Refresh button to display the current model directory.

Use path relative to the model directory Displays the file names with a path relative to the current model directory.

Related topics

References

DS2210APU_CAM_Bx_Cy 72

DS2210APU_ANG_Bx

Purpose

To read the current engine position (angle) of the angular processing unit.

Where to go from here

Information in this section

Block Description (DS2210APU_ANG_Bx)

Illustration

For information on angle position (engine position) processing, refer to Engine Position Phase Accumulator (DS2210 Features 🕮).

Purpose

To read the current engine position (angle) of the angular processing unit.

Note

- The DS2210APU_CRANK_Bx block must be in your model.
- If you use more than one DS2210APU_ANG_Bx block for cascaded DS2210 master and slave boards within the same timer task, the engine positions may differ from one another. It is recommended to use only one DS2210APU_ANG_Bx block in a DS2210 master/slave system.

I/O characteristics

- The Angle position output is given within the range of –720 … <720° with a resolution of 0.088°.
- The following table shows the characteristics of the block output:

Variable	Datatype	Range
Angle position	Double	0 … 719.91°

Dialog pages	The dialog settings can be specified on the **Unit Page**.
Related RTLib functions	`ds2210_apu_position_read`
Related topics	References DS2210APU_CRANK_Bx 65

Unit Page (DS2210APU_ANG_Bx)

Purpose	To select the board number.
Dialog settings	**Board number** Lets you select the DS2210 board number of the board to be defined by this block within the range of 1 … 16. This board may be the master board itself.
Related topics	References DS2210APU_ANG_Bx 76

DS2210APU_ANG_REL_Bx

Purpose

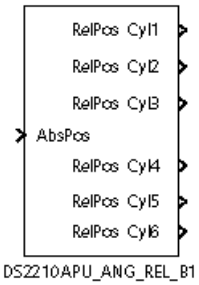
To convert the absolute angle position of the APU to a relative angle related to the top-dead-center of the selected cylinder or related to a specified reference position.

Where to go from here

Information in this section

Block Description (DS2210APU_ANG_REL_Bx)

Illustration



For information on angle position (engine position) processing, refer to Engine Position Phase Accumulator (DS2210 Features 🕮).

Purpose

To convert the absolute angle position of the APU to a relative angle related to the top-dead-center of the selected cylinder or related to a specified reference position.

Note

- The DS2210APU_CRANK_Bx block must be in your model.
- The input value must be an absolute angle position as output by DS2210APU_ANG_Bx, for example.

I/O characteristics

- The relative *Angle position* output depends on the absolute angle's value that was input and on the specified reference angle.
- The following table shows the characteristics of the block output:

Output Variable	Datatype	Range
RelPos Cyl x	Double	–719.91 … 719.91

Dialog pages

The following pages are available:

- Unit Page
- Parameter Page

Related topics

References

DS2210APU_ANG_Bx....76
DS2210APU_CRANK_Bx....65

Unit Page (DS2210APU_ANG_REL_Bx)

Purpose

To specify the board number.

Dialog settings

Board number Lets you select the DS2210 board number of the board to be defined by this block within the range of 1 … 16. This board may be the master board itself.

Parameter Page (DS2210APU_ANG_REL_Bx)

Purpose

To specify the number and secquence of the cylinders to be used.

Dialog settings

Number of selected cylinders Lets you select the number of cylinders within the range 1 … 8. The parameter defines the size of the Selected cylinders vector.

Selected cylinders Lets you enter the cylinder sequence for which the angles should be converted within the range of 1 … 18. You input an array that specifies the cylinders, for example [1,3,6].

Set reference Lets you select the reference the absolute angles are related to. The table shows the possibilities:

Setting	Meaning
from master crank block	The angle positions are related to the TDCs defined in the DS2210APU_CRANK_Bx block.
by block parameter	If you select this option the input field is enabled. Enter the reference position for each selected cylinder into the vector, for example, [0 120 240 360 480 600].

Note

The number of angle positions to be specified in the vector must be equal to the number of selected cylinders.

Related topics

References

DS2210APU_CRANK_Bx 65

DS2210APU_IGN_Bx

Purpose

To read the positions of the ignition pulses that occurred in the last event capture window.

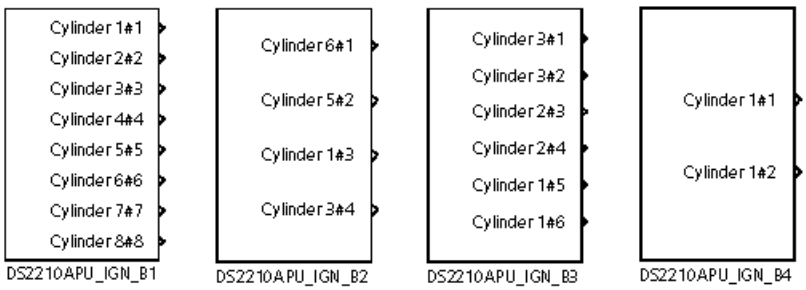
Where to go from here

Information in this section

Block Description (DS2210APU_IGN_Bx)

Illustration

The block's different representations depend on the selected cylinders.



Purpose

To read the positions of the ignition pulses that occurred in the last event capture window.

Description

You can define event capture windows for up to eight cylinders. Two additional auxiliary channels are integrated to evaluate the relative position for up to 8 cylinders.

The block output ports are specified in I/O characteristics on page 82.

I/O mapping

For information on the I/O mapping, refer to Spark Event Capture (DS2210 Features 🕮).

Port description

The ports are named Cylinder X # Y. X is the number of the selected cylinder and Y the port number that corresponds to the appropriate ignition input line.

Note

This block cannot be used together with the following blocks:
- DS2210APU_INJ_Bx_G2
- DS2210APU_INJCONT_Bx_G2
- DS221APU_AUXCAPCONT_Bx_Cx
- DS2210APU_IGNCONT_Bx

If the block is expanded to 8 cylinders, the following restrictions are also valid:
- DS2210APU_AUXCAP_Bx_C1 cannot be used if channel 7 of the DS2210APU_IGN_Bx is selected.
- DS2210APU_AUXCAP_Bx_C2 cannot be used if channel 8 of the DS2210APU_IGN_Bx is selected.

This blocks has the following dependencies to other blocks:
- The DS2210APU_CRANK_Bx block must be in your model.
- Use DS2210DIO_SETUP_Bx to set the threshold level for digital inputs. If you do not include this block in your model the default threshold level of 2.5 V is valid.

I/O characteristics

The format of the *Cylinder 1 … Cylinder 18* block outputs depends on the capture mode. Position values are given relative to the TDC within the range of –720 … 720° with a resolution of 0.088°. The position values are output as an array of data type Double that is defined as following:

Port Name	Capture Mode	Array Size	Array Index	Parameter
Variable, cylinder (1 … 18) # (1 … 8)	Single mode	2	1	Leading edge
			2	Edge count
	Multi mode	(2 · No of sparks) +2	1 … No of sparks	Leading edge
			No of sparks + 1… 2 · No of sparks	Trailing edge
			2 · No of sparks + 1	Pulse count
			2 · No of sparks + 2	Pulse state

- In *single event capture mode*, a position value and an edge count will be output for each event capture window.
  - The position of the first *leading edge* is given in degrees.

    If no leading edge was detected in the last event capture window the old value will remain.

Before the first leading edge after the start of the simulation was captured, the output is 999.

- The *edge count* is defined as follows:

Edge Count	Meaning
0	No ignition pulse captured within the last event capture window.
1	At least one pulse captured within the last event capture window.

- In *multiple event capture mode*, the positions of leading edges, positions of trailing edges, a pulse count and a pulse state will be output for each event capture window.
  - The positions of up to eight *leading edges* are given in degrees. The number of position values is defined by the number of expected sparks as specified on the Capture page.

    If the number of measured leading edges is smaller than the number of expected sparks the missing position values are set to 999.

    If no leading edge was detected in the last event capture window the old values will remain.

    If the leading edge of the first pulse occurred before the event capture window the position value is set to the start position of the event capture window.

    Before the first leading edge after the start of the simulation was captured, the output is 999.
  - The positions of up to eight *trailing edges* are given in degrees. The number of position values is defined by the number of expected events as specified on the Capture page.

    If the number of measured trailing edges is smaller than the number of expected events the missing position values are set to 999.

    If no trailing edge was detected in the last event capture window the old values will remain.

    If the trailing edge of the last pulse occurs after the event capture window the position value is set to the end position of the event capture window.

    Before the first leading edge after the start of the simulation was captured, the output is 999.
  - The *pulse count* specifies the number of actually captured pulses within the range of 0, 1, … 255.
  - The *pulse state* is defined as follows:

Pulse State	Meaning
0	All pulses occurred within the event capture window.
1	The leading edge of the first pulse occurred before the event capture window.
2	The trailing edge of the last pulse occurred after the event capture window.

Pulse State	Meaning
3	The leading edge of the first pulse occurred before the event capture window and the trailing edge of the last pulse occurred after the event capture window.

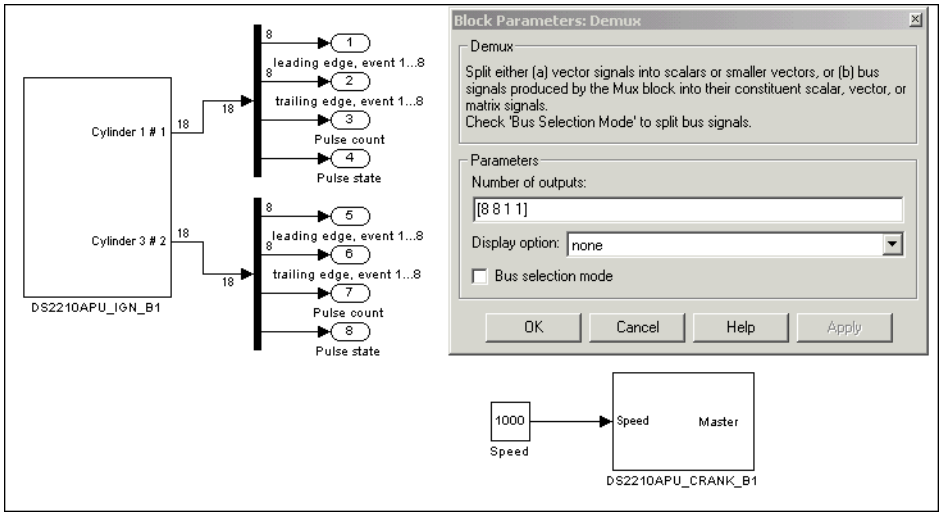
Dialog pages

The following pages are available:

- Unit Page for board selection
- Capture Page for capture mode setting
- Parameters Page for cylinder selection and definition of event capture windows

Example

The following illustration shows the relationship between the block outputs and the captured values for 8 pulses in the multiple event capture mode.



Related RTLib functions

`ds2210_event_window_set`, `ds2210_ign_capture_mode_set`, `ds2210_ignition_capture_read`

Related topics

References

DS2210APU_CRANK_Bx....65
DS2210DIO_SETUP_Bx....23

Unit Page (DS2210APU_IGN_Bx)

Purpose

To specify the board number.

Dialog settings

Board number Lets you select the DS2210 board number of the board to be defined by this block within the range of 1 … 16. This board may be the master board itself.

Capture Page (DS2210APU_IGN_Bx)

Purpose

To specify the trigger and capture mode.

Dialog settings

Trigger mode Lets you select whether ignition pulses are active high or active low.

Capture mode Lets you select the capture mode. In single event capture mode, the position of the leading edge of the first input pulse within the event capture window is captured. In multiple event capture mode, the positions of all leading and trailing edges of up to eight pulses are captured. For more detailed information, see the I/O characteristics on page 82.

Number of expected sparks Lets you select the number of expected pulses within a event capture window (available only if multiple event capture mode is selected). This parameter defines the number of position values given in the block's output. You cannot differentiate between the cylinders, the same number is valid for each of them. For more detailed information, see the I/O characteristics on page 82.

Parameters Page (DS2210APU_IGN_Bx)

Purpose

To specify the number of cylinders and the event capture window to be used.

Dialog settings

Number of selected cylinders Lets you select the number of cylinders for which ignition pulses will be captured within the range of 1 … 8. This number can be smaller than the number of cylinders simulated by the specified DS2210 board.

Selected cylinders Lets you enter the cylinders for which ignition pulses will be captured.

Note

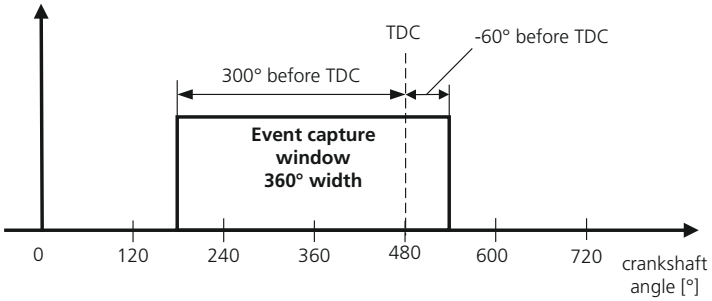
The cylinder sequence in this field determines the I/O mapping of the ignition input lines. The first cylinder is mapped to the I/O signal IGN1, the second one to IGN2, and so on. For example, if you specify [8 12 10], cylinder 8 is mapped to IGN1, cylinder 12 to IGN2, and cylinder 10 to IGN3.

Start position Lets you enter the start positions of the event capture windows within the range of –720 … 720° (719.82°) with a resolution of 0.088°. Note that the maximum size of the defined event capture window is 720° (719.82°). The values are assigned to the cylinders following the sequence you specified for the **Selected cylinders** parameter. The start positions are defined relative to the TDCs, which are specified by the **First TDC** parameter of the DS2210APU_CRANK_Bx block of the DS2210 master board.

End position Lets you enter the end positions of the event capture windows within the range of –720 … 720° (719.82°) with a resolution of 0.088°. Note that the maximum size of the defined event capture window is 720° (719.82°). The values are assigned to the cylinders following the same sequence that you have specified for the **Selected cylinders** parameter. The end positions are defined relative to the TDCs, which are specified by the **First TDC** parameter of the DS2210APU_CRANK_Bx block of the DS2210 master board.

Before TDC

Angles before TDC are positive values. Thus, the Start position is always greater than the End position. The following illustration shows an event capture window (width 360°, Start position = +300°, End position = –60°):



Related topics

References

DS2210APU_CRANK_Bx.....65

DS2210APU_IGNCONT_Bx

Purpose

To read continuously the positions of the ignition pulses.

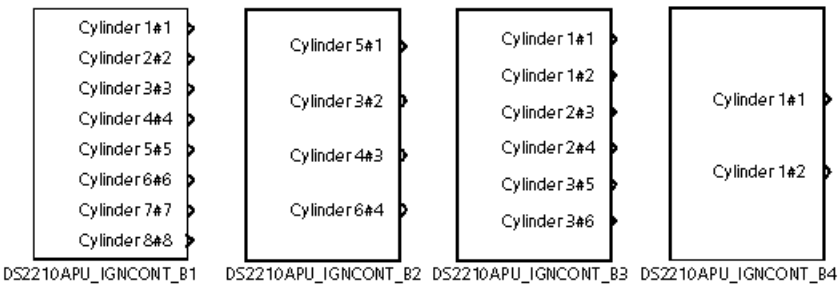
Where to go from here

Information in this section

Block Description (DS2210APU_IGNCONT_Bx)

Illustration

The block's different representations depend on the selected cylinders.



Purpose

To read continuously the positions of the ignition pulses.

Description

You can define event capture windows for up to eight cylinders.

The block output ports are specified in I/O characteristics.

I/O mapping

For information on the I/O mapping, refer to Spark Event Capture (DS2210 Features 🕮).

Port description

The ports are named Cylinder X # Y. X is the number of the selected cylinder and Y the port number that corresponds to the appropriate ignition input line.

Note

This block cannot be used together with the following blocks:
- DS2210APU_AUX_Bx_Cx
- DS2210APU_IGN_Bx
- DS2210APU_INJ_Bx_G2
- DS2210APU_INJCONT_Bx_G2

If the block is expanded to 8 cylinders, the following restrictions are also valid:
- DS2210APU_AUXCAPCONT_Bx_C1 cannot be used if channel 7 of the DS2210APU_IGNCONT_Bx is selected.
- DS2210APU_AUXCAPCONT_Bx_C2 cannot be used if channel 8 of the DS2210APU_IGNCONT_Bx is selected.

This blocks has the following dependencies to other blocks:
- The DS2210APU_CRANK_Bx block must be in your model.
- Use DS2210DIO_SETUP_Bx to set the threshold level for digital inputs. If you do not include this block in your model, the default threshold level of 2.5 V is valid.

I/O characteristics

The format of the *Cylinder 1 … Cylinder 18* block outputs depends on the capture mode. Position values are given relative to the TDC within the range of -720 … 720° with a resolution of 0.088°. The position values are output as an array of data type Double that is defined as following:

Port Name	Capture Mode	Array Size	Array Index	Parameter
Variable, cylinder (1 … 18) # (1 … 8)	Single event	No of events + 2	1 … No of events	Value (leading edge)
			No of events + 1	Event count
			No of events + 2	Lost events
	Multi event	(2 · No of events) +2	1 … No of events	Value (leading / trailing edge
			No of events + 1… 2 · No of events	State
			2 · No of events + 1	Event count
			2 · No of events + 2	Lost events

- In *single event capture mode*, the position of the leading edge of the first pulse within each capture window and the last sample hit is output together with the number of captured events and lost events during the last sample hit.
  - The position of the first *leading edge* is given in degrees.

    If no leading edge was detected in the last sample hit, the old value are kept.

In front of the first leading edge after the start of the simulation was captured, the output is 999.

- The *event count* specifies the number of actually captured events within the range of 0, 1, … 32.
- Up to 32 pulses are stored in a temporary internal buffer (FIFO). Pulses that are not read remain in the FIFO. If they are not read fast enough, a buffer overflow with a loss of pulses occurs. The *lost events* parameter specifies whether data is lost or all events are read.

Lost Events	Meaning
0	No event is lost or left in the FIFO
1 … 32	Number of events left in the FIFO
–1	A FIFO overflow occurred, one or more events are lost.

- In *multiple event capture mode*, the positions of leading edges, positions of trailing edges, a pulse count, a pulse state and the lost events are output for each event capture window and within the last sample hit.
  - The positions of the captured events are given in degrees. The number of position values is defined by the number of expected events as specified on the **Capture** page.

    You can capture either the positions of leading (state = 1) or trailing edges (state = 0).

    If the number of measured events is less than the number of expected events, the missing position values are set to 999.

    If no event was detected during the last sample hit, the old values are kept.

    In front of the first event after the start of the simulation was captured, the output is 999.
  - The *event count* specifies the number of actually captured pulses within the range of 0 … 32.
  - The *event state* is defined as follows:

Event State	Meaning
0	The captured positions are trailing edges.
1	The captured positions are leading edges.

  - Up to 32 pulses are stored in a temporary internal buffer (FIFO). Pulses that are not read remain in the FIFO. If they are not read fast enough, a buffer overflow with a loss of pulses occurs. The *lost events* parameter specifies whether data is lost or all events are read.

Lost Events	Meaning
0	No event is lost or left in the FIFO
1 … 32	Number of events left in the FIFO
–1	A FIFO overflow occurred, one or more events are lost.

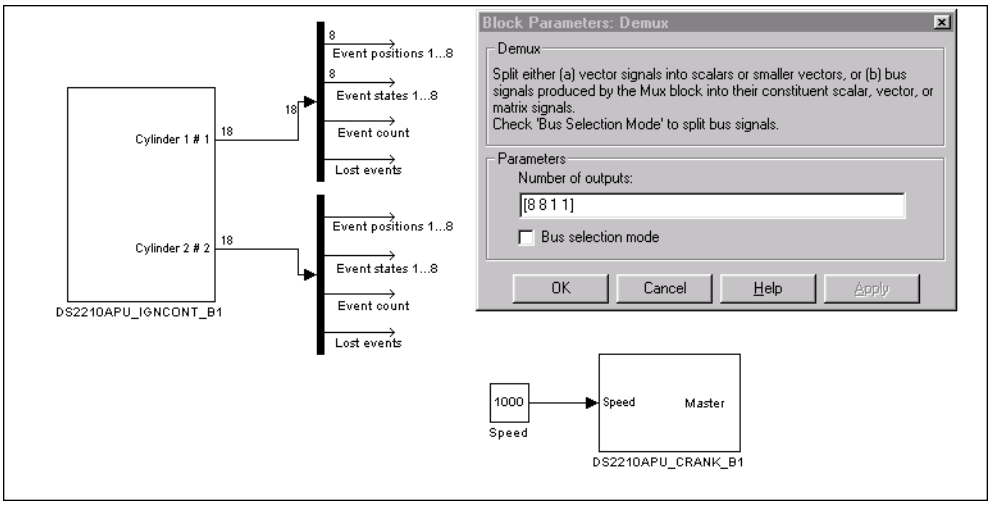
Dialog pages

The following pages are available:

- Unit Page for board selection
- Capture Page for capture mode setting
- Parameters Page for cylinder selection and definition of event capture windows

Example

The following illustration shows the relationship between the block outputs and the captured values for 8 pulses in the multiple event capture mode.



Related RTLib functions

`ds2210_init`, `ds2210_ignition_fifo_read`, `ds2210_event_window_set`, `ds2210_ign_capture_mode_set`

Related topics

References

DS2210APU_CRANK_Bx....65
DS2210DIO_SETUP_Bx....23

Unit Page (DS2210APU_IGNCONT_Bx)

Purpose

To specify the board number.

Dialog settings

Board number Lets you select the DS2210 board number of the board to be defined by this block within the range of 1 … 16. This board may be the master board itself.

Capture Page (DS2210APU_IGNCONT_Bx)

Purpose

To specify the trigger and capture mode.

Dialog settings

Trigger mode Lets you select whether ignition pulses are active high or active low.

Capture mode Lets you select the capture mode. In single event capture mode, only the position of the leading edge of the first input pulse within the sample hit is captured.

In multiple event capture mode, within each sample hit up to 32 position values of all leading and trailing edges can be captured. For more detailed information, see the I/O characteristics on page 82.

Number of expected events Lets you select the number of expected events within one sample hit. You cannot differentiate between the cylinders, the same number is valid for each of them.

Note

It is possible to capture multiple events in single event capture mode, for example, if the sample time is greater than the turnaround time of the engine cycle.

Parameters Page (DS2210APU_IGNCONT_Bx)

Purpose

To specify the number of cylinders and the event capture window to be used.

Dialog settings

Number of selected cylinders Lets you select the number of cylinders for which ignition pulses will be captured within the range of 1 … 8. This number can be smaller than the number of cylinders simulated by the specified DS2210 board.

Selected cylinders Lets you enter the cylinders for which ignition pulses will be captured.

Note

The cylinder sequence in this field determines the I/O mapping of the ignition input lines. The first cylinder is mapped to the I/O signal IGN1, the second one to IGN2, and so on. For example, if you specify [8 12 10], cylinder 8 is mapped to IGN1, cylinder 12 to IGN2, and cylinder 10 to IGN3.

Start position Lets you enter the start positions of the event capture windows within the range of –720 … 720° with a resolution of 0.088°. Note that the maximum size of the defined event capture window is 720°. The values are assigned to the cylinders following the sequence you specified for the Selected cylinders parameter. The start positions are defined relative to the TDCs, which are specified by the First TDC parameter of the DS2210APU_CRANK_Bx block of the DS2210 master board.

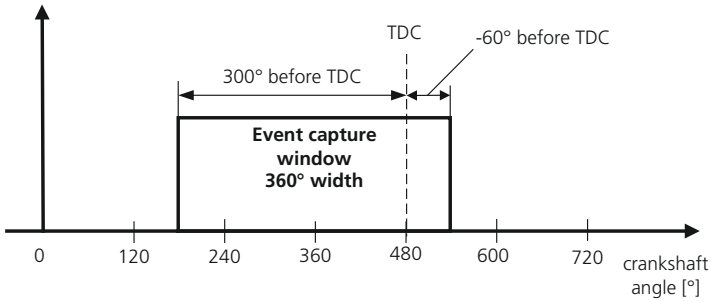
End position Lets you enter the end positions of the event capture windows within the range of –720 … 720° with a resolution of 0.088°. Note that the maximum size of the defined event capture window is 720°. The values are assigned to the cylinders following the same sequence that you have specified for the Selected cylinders parameter. The end positions are defined relative to the TDCs, which are specified by the First TDC parameter of the DS2210APU_CRANK_Bx block of the DS2210 master board.

Note

- With the DS2210APU_IGNCONT_Bx block in *multiple event capture mode* you can use the whole 720° event capture window, while DS2210APU_IGN_Bx subtracts 0.18° from 720°.
- In *single event capture mode*, the event window must not span the whole 720°. The event window must be within the range 0 … 719.82°.

Before TDC

Angles before TDC are positive values. Thus, the Start position is always greater than the End position. The following illustration shows an event capture window (width 360°, Start position = +300°, End position = –60°):



Related topics

References

DS2210APU_CRANK_Bx..... 65

DS2210APU_INJ_Bx_Gy

Purpose

To read the positions and durations of the injection pulses that occurred in the last event capture window.

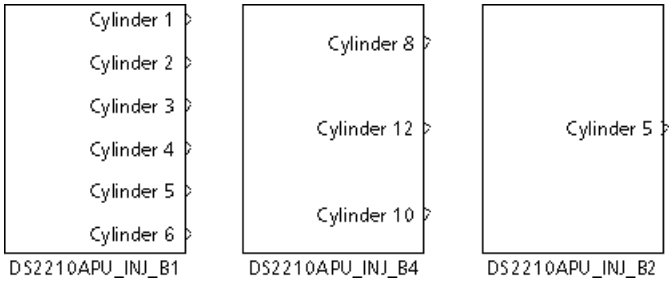
Where to go from here

Information in this section

Block Description (DS2210APU_INJ_Bx_Gy)

Illustration

The block's different representations depend on the selected cylinders.



Purpose

To read the positions and durations of the injection pulses that occurred in the last event capture window.

Description

You can define event capture windows for up to eight cylinders.

The block output ports are specified in I/O characteristics on page 95.

I/O mapping

For information on the I/O mapping, refer to Injection Pulse Position and Fuel Amount Measurement (DS2210 Features 🕮).

Port description

The ports are named Cylinder x # y. X is the number of the selected cylinder and y the port number that corresponds to the appropriate injection input line.

Note

8 cylinders are only supported, if the DS2210 hardware has extended functionality, else you can select 6 cylinders, refer to DS2210 Board Revision (DS2210 Features 🕮).

If you use this block, you must consider the following dependencies:

- DS2210APU_INJ_Bx_G1 cannot be used with DS2210APU_INJCONT_Bx_G1
- DS2210APU_INJ_Bx_G2 cannot be used with
  - DS2210APU_INJCONT_Bx_G2
  - DS2210APU_AUXCAPCONT_Bx_Cy
  - DS2210APU_IGN_Bx
  - DS2210APU_IGNCONT_Bx
- The DS2210APU_CRANK_Bx block must be in your model.
- Use DS2210DIO_SETUP_Bx to set the threshold level for digital inputs. If you do not include this block in your model, the default threshold level of 2.5 V is valid.

If the block is expanded to 8 cylinders, the following restrictions are also valid:

- DS2210APU_AUXCAP_Bx_C1 cannot be used if channel 7 of the DS2210APU_INJ_Bx_G2 is selected.
- DS2210APU_AUXCAP_Bx_C2 cannot be used if channel 8 of the DS2210APU_INJ_Bx_G2 is selected.

I/O characteristics

The format of the *Cylinder 1 … Cylinder 18* block outputs depends on the capture mode. Position values are given relative to the TDC within the range of -720 … 720° with a resolution of 0.088°. The position values are output as an array of data type Double that is defined as following:

Port Name	Capture Mode	Array Size	Array Index	Parameter
Variable, cylinder (1 … 18) # (1 … 8)	Duration	(2 · No of pulses) + 1	1 … No of pulses	Leading edge
			No of pulses + 1… 2 · No of pulses	Duration
			2 · No of pulses + 1	Pulse count
	Position	(2 · No of pulses) +1	1 … No of pulses	Leading edge
			No of pulses + 1… 2 · No of pulses	Trailing edge
			2 · No of pulses + 1	Pulse count

- In *duration mode*, the positions of the leading edges, the pulse durations and the pulse count will be output for each event capture window.
  - The positions of up to eight *leading edges* are given in degrees. The number of position values is defined by the number of expected pulses as specified on the **Capture** page.

    If the number of measured leading edges is smaller than the number of expected pulses the missing position values are set to 999.

    If no leading edge was detected in the last event capture window the old values will remain.

    If the leading edge of the first pulse occurred before the event capture window the position value is set to the start position of the event capture window.

    Before the first leading edge after the start of the simulation was captured, the output is 999.
  - The *durations* of up to eight pulses within the last event capture window are given in seconds. The number of duration values is defined by the number of expected pulses as specified on the **Capture** page.

    If the number of measured pulses is smaller than the number of expected pulses the missing duration values will be set to 999.

    If no pulse was detected in the last event capture window the old duration values will remain.

    If the leading edge of the first pulse occurred before the event capture window the duration measurement begins at the start position of the event capture window.

    If the trailing edge of the last pulse occurred after the event capture window the duration measurement ends at the end position of the event capture window.

Before the first leading edge after the start of the simulation was captured, the output is 999.

- The *pulse count* specifies the number of actually captured pulses within the range of 0, 1, … 255.

- In *position mode*, the positions of up to eight leading edges, positions of up to eight trailing edges, and a pulse count will be output for each event capture window.
  - The positions of the *leading edges* are given in degrees. The number of position values is defined by the number of expected pulses as specified on the **Capture** page.

    If the number of measured leading edges is smaller than the number of expected pulses the missing position values are set to 999.

    If no leading edge was detected in the last event capture window the old values will remain.

    If the leading edge of the first pulse occurred before the event capture window the position value is set to the start position of the event capture window.

    Before the first leading edge after the start of the simulation was captured, the output is 999.
  - The positions of *trailing edges* are given in degrees. The number of position values is defined by the number of expected pulses as specified on the **Capture** page.

    If the number of measured trailing edges is smaller than the number of expected pulses the missing position values are set to 999.

    If no trailing edge was detected in the last event capture window the old values will remain.

    If the trailing edge of the last pulse occurs after the event capture window the position value is set to the end position of the event capture window.

    Before the first leading edge after the start of the simulation was captured, the output is 999.
  - The *pulse count* specifies the number of actually captured pulses within the range of 0, 1, … 255.

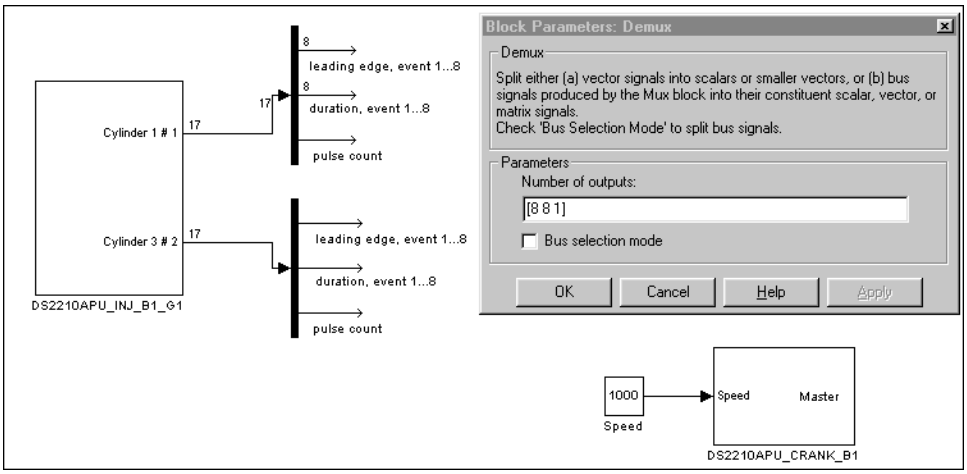
Dialog pages

The following pages are available:

- **Unit Page** (refer to Unit Page (DS2210APU_INJ_Bx_Gy) on page 98) for board selection
- **Capture Page** (refer to Capture Page (DS2210APU_INJ_Bx_Gy) on page 99) for capture mode setting
- **Parameters Page** (refer to Parameters Page (DS2210APU_INJ_Bx_Gy) on page 100) for cylinder selection and definition of event capture windows

Example

The following illustration shows the relationship between the block outputs and the captured values for 8 pulses in the duration mode.



Related RTLib functions

`ds2210_event_window_set`, `ds2210_inj_capture_mode_set`, `ds2210_injection_capture_read`

Related topics

References

DS2210APU_CRANK_Bx....65
DS2210DIO_SETUP_Bx....23

Unit Page (DS2210APU_INJ_Bx_Gy)

Purpose

To specify the board number.

Dialog settings

Board number Lets you select the DS2210 board number of the board to be defined by this block within the range of 1 … 16. This board may be the master board itself.

Group number Lets you select the group number. Group 1 can be used for injection capture on channels INJ1 ... INJ6, INJ7 (PWM7), INJ8 (PWM8) and group 2 for injection capture on channels IGN1 ... IGN6, (AUXCAP1, AUXCAP2).

Note

The usage of group 2 is only supported if the DS2210 hardware has extended functionality, refer to DS2210 Board Revision (DS2210 Features 🕮). If you want to capture ignition values, you must use DS2210APU_IGN_Bx or DS2210APU_IGNCONT_Bx.

Related topics

References

DS2210APU_IGN_Bx....81
DS2210APU_IGNCONT_Bx....87

Capture Page (DS2210APU_INJ_Bx_Gy)

Purpose

To specify the trigger and capture mode.

Dialog settings

Trigger mode Lets you select whether ignition pulses are active high or active low.

Capture mode Lets you select the capture mode. If you select **duration mode** (start position/fuel amount capture mode) the positions of the leading edges and the pulse durations of up to eight pulses within the event capture window will be measured. If you select **position mode** (start/end position capture mode) the positions of leading and trailing edges of up to eight pulses are captured. For more detailed information, see the I/O characteristics on page 95.

Resolution Lets you select the resolution of the duration measurement. The following resolutions are supported:

Resolution	Meaning
1 µs	High resolution results in a maximum duration time of 262 ms.
4 µs	Low resolution results in a maximum duration time of 1048 s.

Note

High resolution is only supported if the DS2210 hardware has extended functionality, refer to DS2210 Board Revision (DS2210 Features 🕮).

Number of expected pulses Lets you select the number of expected pulses within the event capture window. This parameter defines the number of position values given in the block's output. You cannot differentiate between the cylinders, the same number is valid for each of them. For more detailed information, see the I/O characteristics on page 95.

Parameters Page (DS2210APU_INJ_Bx_Gy)

Purpose

To specify the number of cylinders and the event capture window to be used.

Dialog settings

Number of selected cylinders Lets you select the number of cylinders for which injection pulses will be captured within the range of 1 … 8. This number can be smaller than the number of cylinders simulated by the specified DS2210 board.

Note

8 cylinders are only supported if the DS2210 hardware has extended functionality. Else you can select up to 6 cylinders, refer to DS2210 Board Revision (DS2210 Features 🕮).

Selected cylinders Lets you enter the cylinders for which injection pulses will be captured.

Note

The cylinder sequence in this field determines the I/O mapping of the injection input lines. The first cylinder is mapped to the I/O signal INJ1, the second one to INJ2, and so on. For example, if you specify [8 12 10] then cylinder 8 is mapped to INJ1, cylinder 12 to INJ2, and cylinder 10 to INJ3.

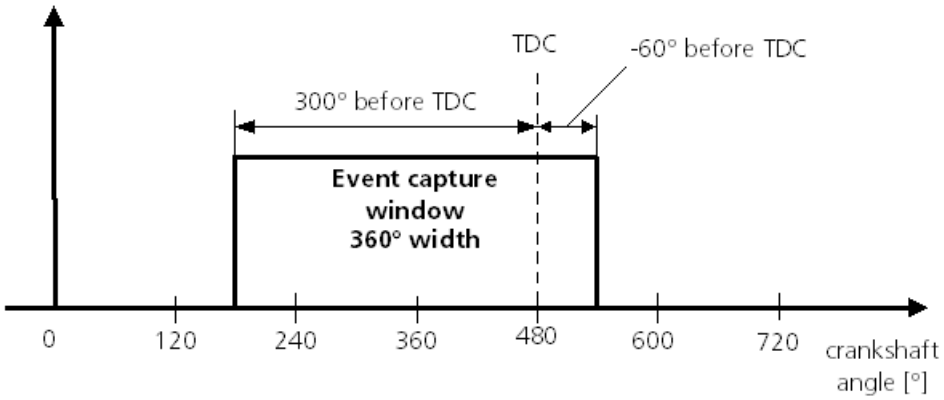
Start position Lets you enter the start positions of the event capture windows within the range of –720 … 720° (719.82°) with a resolution of 0.088°. Please note that the maximum size of the defined event capture window is 720° (719.82°). The values are assigned to the cylinders following the same sequence that you specified for the **Selected cylinders** parameter. The start

positions are defined relative to the TDCs, which are specified by the **First TDC** parameter of the **DS2210APU_CRANK_Bx** block of the DS2210 master board.

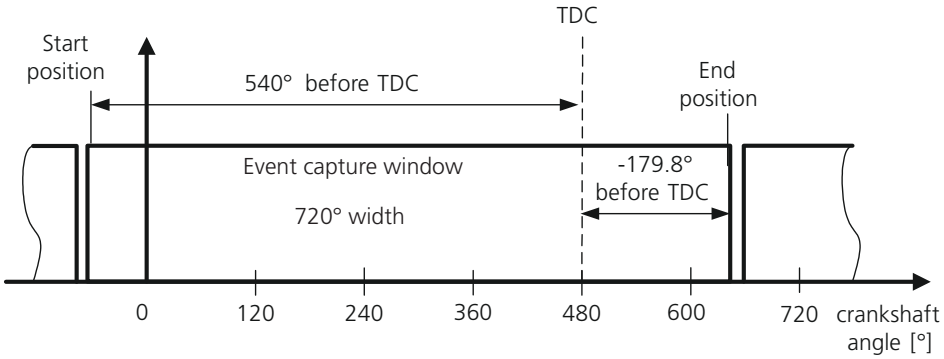
End position Lets you enter the end positions of the event capture windows within the range of –720 … 720° (719.82°) with a resolution of 0.088°. Please note that the maximum size of the defined event capture window is 720° (719.82°). The values are assigned to the cylinders following the same sequence that you specified for the **Selected cylinders** parameter. The end positions are defined relative to the TDCs, which are specified by the **First TDC** parameter of the **DS2210APU_CRANK_Bx** block of the DS2210 master board.

Before TDC

Angles before TDC are positive values. The following illustration shows an event capture window (width 360°, Start position = +300°, End position = –60°):



The following illustration shows an event capture window with the maximum width of 719.8° (Start position = +540°, End position = –179.8°). Note that the event capture window must not cover the whole engine cycle of 720° and that Start and End position have to be defined within the range of –720 … 720°.



Related topics

References

DS2210APU_CRANK_Bx.....65

DS2210APU_INJCONT_Bx_Gy

Purpose

To measure continuously the injection position and fuel amount for up to 16 channels (8 channels for each group). The group number specifies the injection capture unit (group 1) and the ignition capture unit (group 2).

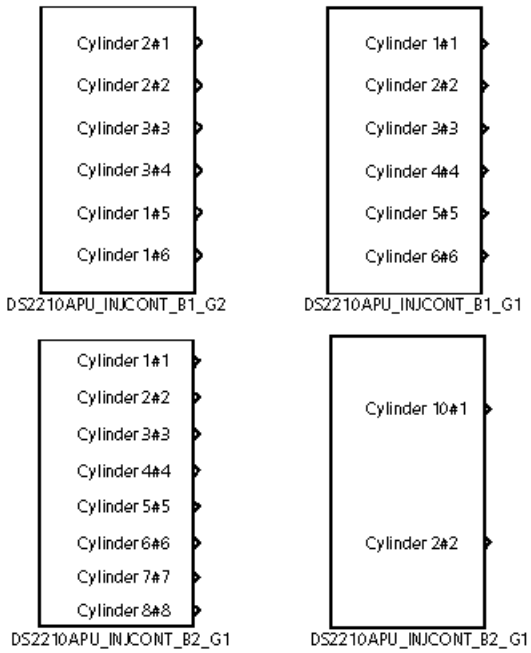
Where to go from here

Information in this section

Block Description (DS2210APU_INJCONT_Bx_Gy)

Illustration

The block's different representations depend on the selected cylinders.



Purpose

To measure continuously the injection position and fuel amount for up to 16 channels (8 channels for each group). The group number specifies the injection capture unit (group 1) and the ignition capture unit (group 2).

I/O mapping

For information on the I/O mapping, refer to Injection Pulse Position and Fuel Amount Measurement (DS2210 Features 🕮).

Port description

The ports are named Cylinder X # Y. X is the number of the selected cylinder and Y the port number that corresponds to the appropriate injection input line.

Note

The following features are supported only if your DS2210 I/O board has extended functionality:

- The use of Group 2 (ignition capture unit)
- Channel 7 and 8 in group 1
- High resolution in duration mode (1 µs)

To check whether your I/O board has extended functionality, refer to DS2210 Board Revision (DS2210 Features 🕮).

The block output ports are specified in I/O characteristics on page 104.

Note

If you use this block, you must consider the following dependencies:

- DS2210APU_INJCONT_Bx_G1 cannot be used with DS2210APU_INJ_Bx_G1
- DS2210APU_INJCONT_Bx_G2 cannot be used with
  - DS2210APU_INJ_Bx_G2
  - DS2210APU_AUXCAP_Bx_Cy
  - DS2210APU_IGN_Bx
  - DS2210APU_IGNCONT_Bx
- The DS2210APU_CRANK_Bx block must be in your model.
- Use DS2210DIO_SETUP_Bx to set the threshold level for digital inputs. If you do not include this block in your model, the default threshold level of 2.5 V is valid.

If the block is expanded to 8 cylinders, the following restrictions are also valid:

- DS2210APU_AUXCAPCONT_Bx_C1 cannot be used if channel 7 of the DS2210APU_INJCONT_Bx_G2 is selected.
- DS2210APU_AUXCAPCONT_Bx_C2 cannot be used if channel 8 of the DS2210APU_INJCONT_Bx_G2 is selected.

I/O characteristics

The format of the *Cylinder 1 … Cylinder 18* block outputs depends on the capture mode. Position values are given relative to the TDC within the range of -720 … 720° with a resolution of 0.088°. The position values are output as an array of data type Double that is defined as following:

Port Name	Capture Mode	Array Size	Array Index	Parameter
Variable, cylinder (1 … 18) # (1 … 8)	Duration	(2 · No of events) + 2	1 … No of events	Value (leading edge/duration)
			No of events + 1 … 2 · No of events	State
			2 · No of events + 1	Event count
			2 · No of events + 2	Lost events
	Position	(2 · No of events) +2	1 … No of events	Value (leading trailing edge)
			No of events + 1 … 2 · No of events	State
			2 · No of events + 1	Event count
			2 · No of events + 2	Lost events

- In *duration mode*, the position angles and the duration (proportional to fuel amount) of up to 32 events are evaluated within each capture window and

within the last sample hit. You can capture the leading edges (state = 1) or pulse durations (state = 0).

- The positions of the *events* are given in degrees. The number of position values is defined by the number of expected events as specified on the **Capture** page.

  If the number of measured events is less than the number of expected events, the missing position values are set to 999.

  If no event was detected during the last sample hit, the old values are kept.

  In front of the first event after the start of the simulation was captured, the output is 999.
- The *durations* of events within the last sample hit are given in seconds. The number of duration values is defined by the number of expected events as specified on the **Capture** page.

  If the number of measured events is less than the number of expected events, the missing state values is set to 999.

  If no event was detected in the last sample hit, the old duration values are kept.
- The *event count* specifies the number of actually captured events within the range of 0 … 32.
- The *eventstate* specifies the captured event:

Event State	Meaning
1	The positions of leading edges are captured.
0	The pulse durations are captured.

  If no event was measured, the states are kept.

  If the number of measured events is less than the number of expected events, the missing state values are set to 999.
- Up to 32 pulses are stored in a temporary internal buffer (FIFO). Pulses that are not read remain in the FIFO. If they are not read fast enough, a buffer overflow with a loss of pulses occurs. The *lost events* specifies whether data is lost or all events are read.

Lost Events	Meaning
0	No event is lost or left in the FIFO
1 … 32	Number of events left in the FIFO
–1	A FIFO overflow occurred, one or more events are lost.

- In *position mode*, the positions of up to 32 events (leading edges or trailing edges), and an event count are output for each event capture window and sample hit. You can capture the leading edges (state = 1) or trailing edges (state = 0).
  - The positions of the events are given in degrees. The number of position values is defined by the number of expected pulses as specified on the **Capture** page.

    If the number of measured events is less than the number of expected events, the missing position values are set to 999.

If no event was detected during the last sample hit, the old values are. kept

In front of the first event after the start of the simulation was captured, the output is 999.

- The *event count* specifies the number of actually captured pulses within the range of 0, 1, … 32.
- The *event state* is defined as follows:

  0: The captured positions are trailing edges.

  1: The captured positions are leading edges.
- Up to 32 pulses are stored in a temporary internal buffer (FIFO). Pulses that are not read remain in the FIFO. If they are not read fast enough, a buffer overflow with a loss of pulses occurs. The *lost events* parameter specifies whether data is lost or all events are read.

Lost Events	Meaning
0	No event is lost or left in the FIFO
1 … 32	Number of events left in the FIFO
–1	A FIFO overflow occurred, one or more events are lost.

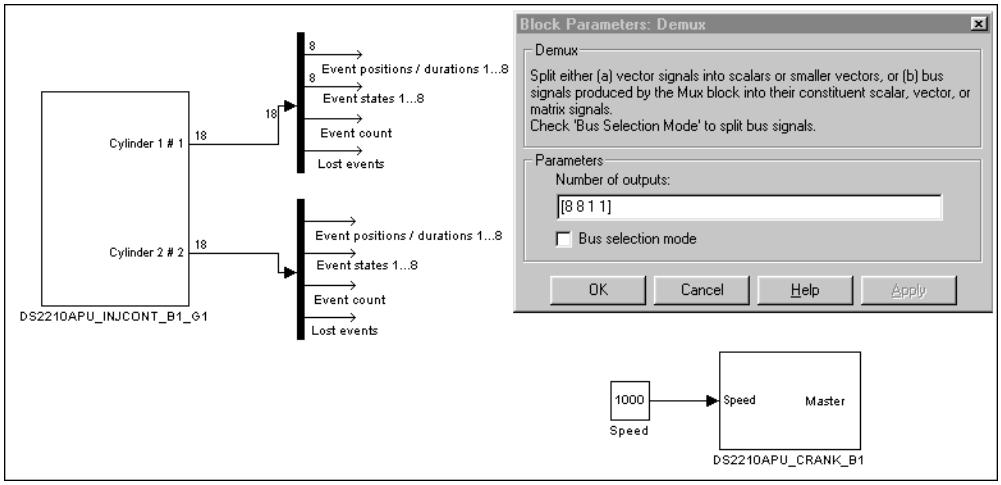
Dialog pages

The following pages are available:

- Unit Page for board selection
- Capture Page for capture mode setting
- Parameters Page for cylinder selection and definition of event capture windows

Example

The following illustration shows the relationship between the block outputs and the captured values for 8 pulses in the duration mode.



Related RTLib functions

`ds2210_event_window_set`

Group 1 `ds2210_inj_capture_mode_set`, `ds2210_injection_fifo_read`

Group 2 `ds2210_ign_capture_mode_set`, `ds2210_aux1_capture_mode_set`, `ds2210_aux2_capture_mode_set`, `ds2210_ignition_fifo_read`

Related topics

References

DS2210APU_CRANK_Bx 65
DS2210DIO_SETUP_Bx 23

Unit Page (DS2210APU_INJCONT_Bx_Gy)

Purpose

To specify the board and group number.

Dialog settings

Board number Lets you select the DS2210 board number of the board to be defined by this block within the range of 1 … 16. This board may be the master board itself.

Group number Lets you select the group number. Group 1 can be used for injection capture on channels INJ1 … INJ6, INJ7 (PWM7), INJ8 (PWM8) and group 2 for injection capture on channels IGN1 … IGN6, (AUX1, AUX2).

Note

You should group 2 only use if your DS2210 hardware has extended functionality, refer to DS2210 Board Revision (DS2210 Features 🕮). If you want to capture ignition values, you have to use DS2210APU_IGN_Bx or DS2210APU_IGNCONT_Bx.

Related topics

References

DS2210APU_IGN_Bx 81
DS2210APU_IGNCONT_Bx 87

Capture Page (DS2210APU_INJCONT_Bx_Gy)

Purpose

To specify the trigger and capture mode.

Dialog settings

Trigger mode Lets you select whether injection pulses are active high or active low.

Capture mode Lets you select the capture mode. If you select *duration mode* (start position/fuel amount capture mode), the positions of the leading edges and the pulse durations of up to 32 pulses within the last sample hit are measured. If you select *position mode* (start/end position capture mode), the positions of leading and trailing edges of up to 32 pulses are captured. For more detailed information, see the I/O characteristics on page 104.

Resolution Lets you select the resolution of the duration measurement. The following resolutions are supported:

Resolution	Meaning
1 µs	High resolution results in a maximum duration time of 262 ms.
4 µs	Low resolution results in a maximum duration time of 1048 s.

Note

High resolution is supported only if the DS2210 board has extended functionality.

Number of expected events Lets you select the number of expected events within each sample hit. This parameter defines the number of position values given in the block's output. You cannot differentiate between the cylinders, the same number is valid for each of them. For more detailed information, see the I/O characteristics on page 104.

Parameters Page (DS2210APU_INJCONT_Bx_Gy)

Purpose

To specify the number of cylinders and the event capture window to be used.

Dialog settings

Number of selected cylinders Lets you select the number of cylinders for which injection pulses will be captured within the range of 1 … 8. This number can be less than the number of cylinders simulated by the specified DS2210 board.

Selected cylinders Lets you enter the cylinders for which injection pulses will be captured.

Note

The cylinder sequence in this field determines the I/O mapping of the injection input lines. The first cylinder is mapped to the I/O signal INJ1, the second one to INJ2, and so on. For example, if you specify [8 12 10], cylinder 8 is mapped to INJ1, cylinder 12 to INJ2, and cylinder 10 to INJ3.

Start position Lets you enter the start positions of the event capture windows within the range of –720 … 720° with a resolution of 0.088°. Note that the maximum size of the defined event capture window is 720°. The values are assigned to the cylinders following the same sequence that you specified for the Selected cylinders parameter. The start positions are defined relative to the TDCs, which are specified by the First TDC parameter of the DS2210APU_CRANK_Bx block of the DS2210 master board.

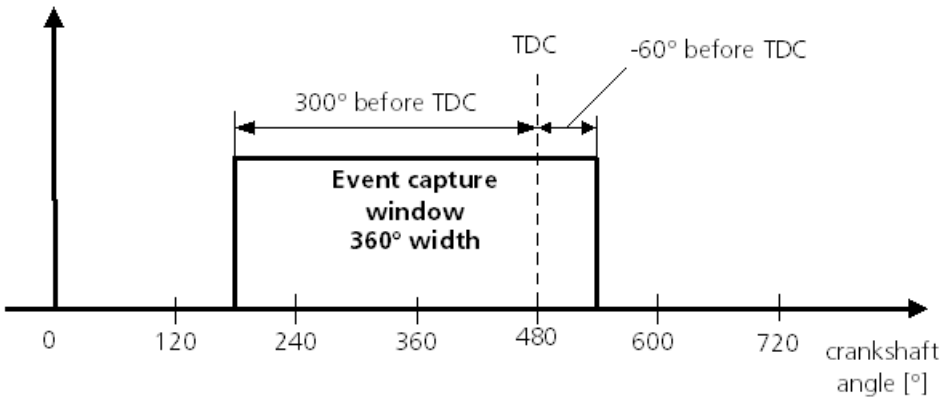
End position Lets you enter the end positions of the event capture windows within the range of –720 … 720° with a resolution of 0.088°. Note that the maximum size of the defined event capture window is 720°. The values are assigned to the cylinders following the same sequence that you specified for the Selected cylinders parameter. The end positions are defined relative to the TDCs, which are specified by the First TDC parameter of the DS2210APU_CRANK_Bx block of the DS2210 master board.

Note

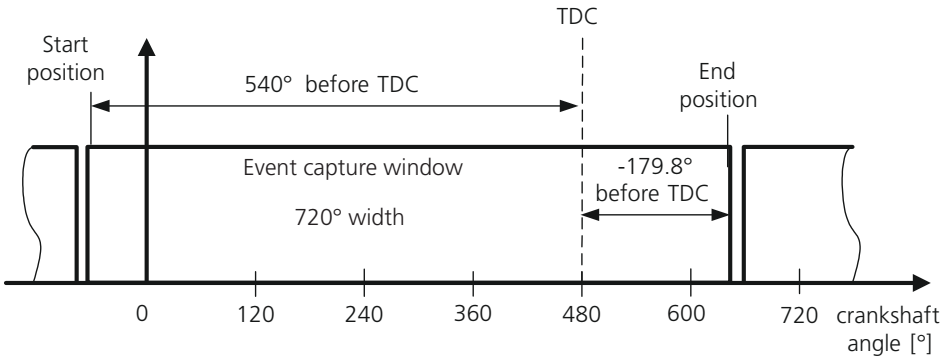
With the DS2210APU_INJCONT_Bx_Gy block you can use the whole 720° event capture window, while the DS2210APU_INJ_Bx_Gy subtract 0.18° from 720°.

Before TDC

Angles before TDC are positive values. The following illustration shows an event capture window (width 360°, Start position = +300°, End position = –60°):



The following illustration shows an event capture window with the maximum width of 719.8° (Start position = +540°, End position = –179.8°). Note that the event capture window must not cover the whole engine cycle of 720° and that Start and End position have to be defined within the range of –720 … 720°.



Related topics

References

DS2210APU_CRANK_Bx.....65

DS2210APU_AUXCAP_Bx_Cy

Purpose

To read the positions of pulses that occurred in the last event capture window of the specified auxiliary capture input.

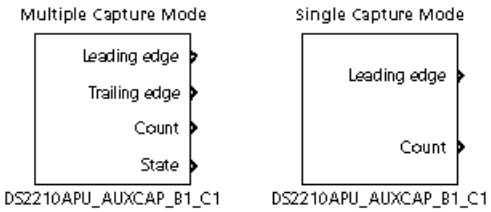
Where to go from here

Information in this section

Block Description (DS2210APU_AUXCAP_Bx_Cy)

Illustration

The block's different representations depend on the selected capture mode.



Purpose

To read the positions of pulses that occurred in the last event capture window of the specified auxiliary capture input.

The block output ports are specified in I/O characteristics on page 112.

I/O mapping

For information on the I/O mapping, refer to Spark Event Capture (DS2210 Features 🕮).

Note

- The DS2210APU_CRANK_Bx block must be in your model.
- Use the DS2210DIO_SETUP_Bx block to set the threshold level for digital inputs. If you do not include this block in your model the default threshold level of 2.5 V is valid.

I/O characteristics

The block output depends on the capture mode. Position values are given within the range of 0 … 719.91°.

- In *single event capture mode*, a position value and a count will be output for each event capture window.
  - The position of the first *leading edge* is given in degrees.

    If no leading edge was detected in the last event capture window the old value will remain.

    Before the first leading edge after the start of the simulation was captured, the output is 999.
  - The *count* is defined as follows:

Count	Meaning
0	No pulse captured within the last event capture window.
1	At least one pulse captured within the last event capture window.

- In *multiple event capture mode*, the positions of leading edges, positions of trailing edges, a count and a state will be output for each event capture window.
  - The positions of up to eight *leading edges* are given in degrees. The number of position values is defined by the number of expected pulses as specified on the Capture page.

    If the number of measured leading edges is smaller than the number of expected pulses the missing position values are set to 999.

    If no pulse was detected in the last event capture window the old values will remain.

    If the leading edge of the first pulse occurred before the event capture window the position value is set to the start position of the event capture window.

    Before the first leading edge after the start of the simulation was captured, the output is 999.
  - The positions of up to eight *trailing edges* are given in degrees. The number of position values is defined by the number of expected pulses as specified on the Capture page.

If the number of measured trailing edges is smaller than the number of expected pulses the missing position values are set to 999.

If no pulse was detected in the last event capture window the old values will remain.

If the trailing edge of the last pulse occurs after the event capture window the position value is set to the end position of the event capture window.

Before the first leading edge after the start of the simulation was captured, the output is 999.

- The *count* specifies the number of actually captured pulses within the range of 0, 1, … 255.
- The *state* is defined as follows:

Pulse State	Meaning
0	All pulses occurred within the event capture window.
1	The leading edge of the first pulse occurred before the event capture window.
2	The trailing edge of the last pulse occurred after the event capture window.
3	The leading edge of the first pulse occurred before the event capture window, and the trailing edge of the last pulse occurred after the event capture window.

- The following table shows the characteristics of the block outputs:

Variable	Characteristic	Value
Count	Datatype	UInt8
	Range	0 … 255
State	Datatype	UInt8
	Range	0, 1, 2, 3

Dialog pages

The following pages are available:

- Unit Page for board and channel selection
- Capture Page for capture mode setting
- Event Window Page to define the event capture window

Related RTLib functions

`ds2210_event_window_set`, `ds2210_aux1_capture_mode_set`, `ds2210_aux2_capture_mode_set`, `ds2210_ignition_capture_read`

Related topics

References

DS2210APU_CRANK_Bx 65
DS2210DIO_SETUP_Bx 23

Unit Page (DS2210APU_AUXCAP_Bx_Cy)

Purpose

To specify the board and channel number.

Dialog settings

Board number Lets you select the DS2210 board number of the board to be defined by this block within the range of 1 … 16. This board may be the master board itself.

Channel number Lets you select the auxiliary capture input to be defined by this block within the range of 1 … 2.

Capture Page (DS2210APU_AUXCAP_Bx_Cy)

Purpose

To specify the trigger and capture mode.

Dialog settings

Trigger mode Lets you select whether ignition pulses are active high or active low.

Capture mode Lets you select the capture mode. In single event capture mode, the position of the leading edge of the first input pulse within the event capture window is captured. In multiple event capture mode, the positions of all leading and trailing edges of up to eight pulses are captured. For more detailed information, see the I/O characteristics on page 112.

Number of expected sparks Lets you select the number of expected pulses within a event capture window (available only if multiple event capture mode is selected). This parameter defines the number of position values given in the block's output.You cannot differentiate between the cylinders, the same number is valid for each of them. For more detailed information, see the I/O characteristics on page 112.

Event Window Page (DS2210APU_AUXCAP_Bx_Cy)

Purpose

To specify the event window.

Dialog settings

Start position Lets you enter the start position of the event capture window within the range of 0 … <720° (719.82°) with a resolution of 0.088°. The value is not relative to the TDC.

End position Lets you enter the end position of the event capture window within the range of 0 … <720° (719.82°) with a resolution of 0.088°. The value is not relative to the TDC.

DS2210APU_AUXCAPCONT_Bx_Cy

Purpose

To read continuously the positions of pulses of the specified auxiliary capture input on up to two channels. The captured data for each channel is read within each sample hit.

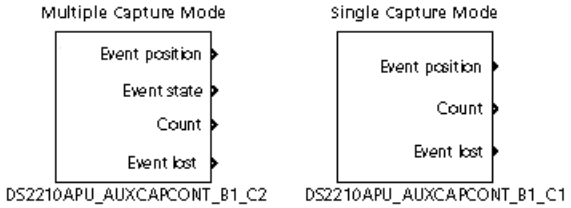
Where to go from here

Information in this section

Block Description (DS2210APU_AUXCAPCONT_Bx_Cy)

Illustration

The block's different representations depend on the selected capture mode.



Purpose

To read continuously the positions of pulses of the specified auxiliary capture input on up to two channels. The captured data for each channel is read within each sample hit.

The block output ports are specified in I/O characteristics on page 117.

I/O mapping

For information on the I/O mapping, refer to Spark Event Capture (DS2210 Features 🕮).

Note

- This block can only be used with boards that have extended functionality. To check whether your board supports has extended functionality, refer to DS2210 Board Revision (DS2210 Features 🕮).
- The block cannot be used together with the following blocks:
  - DS2210APU_AUXCAP_Bx_Cy
  - DS2210APU_INJ_BX_G2
  - DS2210APU_INJCONT_Bx_G2 (channel 7 and 8)
  - DS2210APU_IGN_Bx
  - DS2210APU_IGNCONT_Bx (channel 7 and 8)
- The block has the following depencies to other blocks:
  - The DS2210APU_CRANK_Bx block must be in your model.
  - Use DS2210DIO_SETUP_Bx to set the threshold level for digital inputs. If you do not include this block in your model, the default threshold level of 2.5 V is valid.

I/O characteristics

The block output depends on the capture mode. Position values are given within the range of 0 … 719.91°.

- In *single event capture mode*, a position value and a count are output within the last sample hit.
  - The position of the first *leading edge* is given in degrees.

    If no leading edge was detected during the last sample hit, the old value is kept.

    In front of the first leading edge after the start of the simulation was captured, the output is 999.
  - The *event count* specifies the number of actually captured events within the range of 0 … 32.
  - Up to 32 pulses are stored in a temporary internal buffer (FIFO). Pulses that are not read remain in the FIFO. If they are not read fast enough, a buffer overflow with a loss of pulses occurs. The **lost events** parameter specifies whether data is lost or all events are read.

Lost Events	Meaning
0	No event is lost or left in the FIFO
1 … 32	Number of events left in the FIFO

Lost Events	Meaning
–1	A FIFO overflow occurred, one or more events are lost.

- In *multiple event capture mode*, the positions of leading edges, positions of trailing edges, a count and a state are output for the last sample hit.
  - The positions of up to 32 events are given in degrees. The number of position values is defined by the number of expected events as specified on the Capture page.

    If the number of measured events is less than the number of expected pulses, the missing position values are set to 999.

    If no event was detected during the last sample hit, the old values are kept.
  - Up to 32 pulses can be stored in a temporary internal buffer (FIFO). Pulses that are not read remain in the FIFO. If the stored pulses are not read fast enough, a buffer overflow occurs and pulses are lost. The lost events parameter is defined as follows:

Lost Events	Meaning
0	No pulse is lost or left in the FIFO
1 … 32	Number of pulses in the FIFO
–1	FIFO overflow occurred, one or more pulses are lost.

  - The pulse state is defined as follows:

Pulse State	Meaning
1	The captured positions are leading edges.
0	The captured positions are trailing edges.

- The following table shows the characteristics of the block outputs:

Variable	Characteristic	Value
Count	Datatype	UInt8
	Range	0 … 255
State	Datatype	UInt32
	Range	0, 1

Dialog pages

The following pages are available:

- Unit Page for board and channel selection
- Capture Page for capture mode setting
- Event Window Page to define the event capture window

Related RTLib functions

`ds2210_init`, `ds2210_ignition_fifo_read`, `ds2210_event_window_set`, `ds2210_aux1_capture_mode_set`

Related topics

References

DS2210APU_CRANK_Bx....65
DS2210DIO_SETUP_Bx....23

Unit Page (DS2210APU_AUXCAPCONT_Bx_Cy)

Purpose

To specify the board and channel number.

Board number Lets you select the DS2210 board number of the board to be defined by this block within the range of 1 … 16. This board may be the master board itself.

Channel number Lets you select the auxiliary capture input to be defined by this block within the range of 1 … 2.

Related topics

References

DS2210APU_AUXCAPCONT_Bx_Cy....116

Capture Page (DS2210APU_AUXCAPCONT_Bx_Cy)

Purpose

To specify the trigger and capture mode.

Dialog settings

Trigger mode Lets you select whether ignition pulses are active high or active low.

Capture mode Lets you selectthe capture mode. In single event capture mode, the position of the leading edge of the first event within each capture window is captured. In multiple event capture mode, the positions of all leading and trailing edges of up to 32 events are captured. For more detailed information, see the I/O characteristics on page 117.

Number of expected events Lets you select the number of expected events within a sample hit (available only if multiple event capture mode is selected). This parameter defines the number of position values given in the block's output. You cannot differentiate between the cylinders, the same number is valid for

each of them. For more detailed information, see the I/O characteristics on page 117.

Related topics

References

DS2210APU_AUXCAPCONT_Bx_Cy..... 116

Event Window Page (DS2210APU_AUXCAPCONT_Bx_Cy)

Purpose

To specify the event window.

Dialog settings

Start position Lets you enter the start position of the event capture window within the range of 0 … 720° with a resolution of 0.088°. The value is not relative to the TDC.

End position Lets you enter the end position of the event capture window within the range of 0 … 720° with a resolution of 0.088°. The value is not relative to the TDC.

Note

- With the DS2210APU_AUXCAPCONT_Bx_Cy block in *multiple event capture mode* you can use the whole 720° event capture window, while the DS2210APU_AUXCAP_Bx_Cy always subtract 0.18° from 720°.
- In *single event capture mode*, the event window must not span the whole 720°. The event window must be within the range 0 … 719.82°.

Related topics

References

DS2210APU_AUXCAPCONT_Bx_Cy..... 116

DS2210APU_INT_Bx_Iy

Purpose

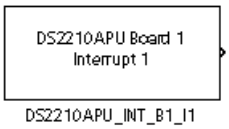
To define up to 6 angle position interrupts and make them available as trigger sources in your model.

Where to go from here

Information in this section

Block Description (DS2210APU_INT_Bx_Iy)

Illustration



Purpose

To define up to 6 angle position interrupts and make them available as trigger sources in your model.

Description

For the specified angle position interrupt, you can define up to 2048 angle positions (engine positions) for which interrupts are generated. For information on interrupt handling, refer to Interrupt Handling (DS2210 Features 🕮).

Note

The DS2210APU_CRANK_Bx block must be in your model.

Dialog pages

The following pages are available:

- Unit Page for board and interrupt selection
- Parameters Page to specify angle (engine) positions

Related topics

References

DS2210APU_CRANK_Bx.....65
Interrupt Handling (DS2210 Features 🕮)

Unit Page (DS2210APU_INT_Bx_Iy)

Purpose

To specify the board and interrupt number.

Dialog settings

Board number Lets you select the DS2210 board number of the board to be defined by this block within the range of 1 … 16. This board may be the master board itself.

Interrupt number Lets you select the angle position interrupt to be defined by this block within the range of 1 … 6.

Parameters Page (DS2210APU_INT_Bx_Iy)

Purpose

To specify the angle parameters of the interrupts to be used.

Dialog settings

Set angle position Lets you select how to define the angle positions for which interrupts will be generated. Select by automatic generation to define angular positions based on a fixed step size. Select by array field to define interrupts only for the positions given in the array.

First angle Lets you enter the angle (engine position) for which the first interrupt within each engine cycle is to be generated. The value must remain within the range of 0 … <720° with a resolution of 0.088°.

Step size Lets you enter the step size within the range of 0 … <720° with a resolution of 0.088°. Based on the first angle, the step size defines the following interrupt occurrences within an engine cycle. For example, if you specify a first angle of 270° and a step size of 200°, interrupts will be generated at the angle positions of 270°, 470° and 670°.

Number of angles Lets you enter the number of angle positions to be specified in the Angle position array within the range of 1 … 6. This number defines the length of the array.

Angle positions Lets you enter the angle positions within the array, for example: [80 210 690], meaning that interrupts will be generated at the angle

positions of 80°, 210° and 690°. The position values must remain within the range of 0 … <720° with a resolution of 0.36°.

DS2210SL_KNSG_Bx_Cy

Purpose

To generate knock signals.

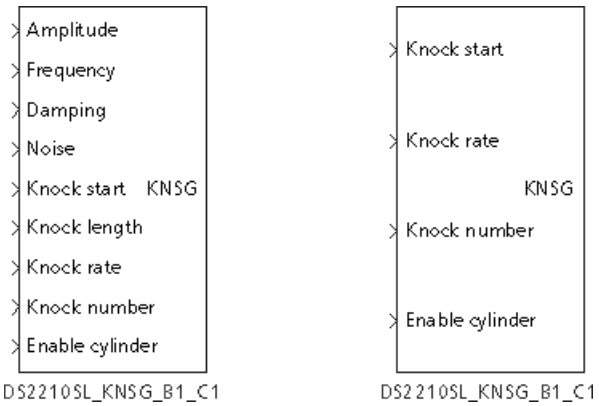
Where to go from here

Information in this section

Block Description (DS2210SL_KNSG_Bx_Cy)

Illustration

The block's different representations depend on how you configure the tunable parameters of the block.



Purpose

To generate knock signals.

I/O mapping

For information on the I/O mapping, refer to Knock Sensor Simulation (DS2210 Features 🕮).

Note

The DS2210APU_CRANK_Bx block must be in your model.

Description

The block input ports are specified in I/O characteristics on page 125.

Note

The block uses tunable parameters. These parameters can be updated *either* by their block input *or* by block parameters that are accessible by experiment software, for example, ControlDesk. The different representations of the block depend on your selection. Tunable parameters that are defined as block parameters will be removed from the RTI block layout. For detailed information, refer to Model Parameter Configuration Dialog (RTI and RTI-MP Implementation Reference 🕮).

I/O characteristics

The cylinder sequence as defined by the **Selected cylinders** parameter on the **Parameters** page determines the cylinder sequence and the length of the arrays used by the following block input parameters, except for the *Noise* parameter.

- The *Amplitude* input is available if **by input port** is selected for the **Set amplitude** parameter. The values in the array of amplitudes must be given within the range of 0 … 40 V_{PP}.
- The *Frequency* input is available if **by input port** is selected for the **Set frequency** parameter. The values in the array of frequencies must be given within the range of 0 … 12000 Hz.
- The *Damping* input is available if **by input port** is selected for the **Set damping** parameter. The values in the array of damping factors must be given within the range of 0 … 1.
- The *Noise* input is available if **by input port** is selected for the **Set noise** parameter. The noise amplitude must be given within the range of 0 … 40 V_{PP}. The noise is common for all cylinders.
- The *Knock start* input is available if **by input port** is selected for the **Set angle position of knock pulse before TDC** parameter. The values in the array of angle positions must be given within the range of –90 … 90° relative to TDC with a resolution of 0.088°.
- The *Knock length* input is available if **by input port** is selected for the **Set length of knock pulse** parameter. The values in the array of angle positions must be given within the range of 0 … 359° with a resolution of 0.088°.
- The *Knock rate* input is available if **by input port** is selected for the **Set knock rate** parameter. The values in the array of knock rates must be given within the range of 0 … 2^{31}–1.

- The *Knock number* input is available if **by input port** is selected for the **Set number of knocks** parameter. The values in the array of numbers must be given within the range of 0 … 2^{31}–1.
- The *Enable* input is available if **by input port** is selected for the **Enable cylinder** parameter. The values in the array are defined as follows.

Simulink Input	Purpose
0	To disable knock signal generation for a cylinder.
1	To enable knock signal generation for a cylinder.

- The following table shows the characteristics of the block inputs:

Variable	Characteristic	Value
Amplitude	Datatype	Double
	Range	0 … 40 V_{PP}
Frequency	Datatype	Double
	Range	0 … 12000 Hz
Damping	Datatype	Double
	Range	0 … 1
Noise	Datatype	Double
	Range	0 … 40 V_{PP}
Knock start	Datatype	double
	Range	–90 … 90°
Knock length	Datatype	double
	Range	0 … 359°
Knock rate	Datatype	int32
	Range	0 … 2^{31}–1
Knock number	Datatype	int32
	Range	0 … 2^{31}–1
Enable cylinder	Datatype	boolean
	Range	0, 1

Dialog pages

The following pages are available:

- **Unit Page** for board and channel selection
- **Parameters Page** to define the cylinders and knock signal
- **Knock Control Page** to define the knock signal

Related RTLib functions

`ds2210_slave_dsp_signal_enable`, `ds2210_slave_dsp_channel_enable`, `ds2210_slave_dsp_knock_init`, `ds2210_slave_dsp_knock_update`, `ds2210_slave_dsp_knock_noise`, `ds2210_int_position_set`

Related topics

References

DS2210APU_CRANK_Bx.....65

Unit Page (DS2210SL_KNSG_Bx_Cy)

Purpose

To specify the board number, channel number and the sample time.

Dialog settings

Board number Lets you select the DS2210 board number of the board to be defined by this block within the range of 1 … 16. This board may be the master board itself.

Channel number Lets you select the output channel to be defined by this block within the range of 1 … 4.

Sample time Lets you enter the sample time for this DS2210SL_KNSG_Bx_Cy block in seconds. Enter –1 to keep the model's base sample time (inherited). The sample time determines how often the block's functions are executed. Use this parameter to minimize the execution time.

Parameters Page (DS2210SL_KNSG_Bx_Cy)

Purpose

To specify the number of cylinders and the signal parameters.

Dialog settings

Number of selected cylinders Lets you select the number of cylinders within the range of 1 … 8 for which knock signals will be generated.

Selected cylinders Lets you enter the cylinder numbers of the cylinders for which knock signals will be generated, for example: [1 3 5].

Note

- For one DS2210, the maximum number of addressed cylinders is 8.
- The cylinder sequence within this array determines the cylinder sequence within the other parameter arrays.

Set amplitude This is a tunable parameter. Either select the radio button by input port to set the amplitudes for the selected cylinders by the block input

port "Amplitude" or select by block parameter and enter the initial amplitude values for the selected cylinders within the range of 0 … 40 V_{PP}.

Set noise This is a tunable parameter. Either select the radio button by input port to set the noise by the block input port "Noise" or select by block parameter and enter the initial noise value within the range of 0 … 40 V_{PP}. The noise signal is common for all cylinders.

Set frequency This is a tunable parameter. Either select the radio button by input port to set the frequencies for the selected cylinders by the block input port "Frequency" or select by block parameter and enter the initial frequency values for the selected cylinders within the range of 0 … 12000 Hz.

Set damping coefficient This is a tunable parameter. Either select the radio button by input port to set the damping coefficients for the selected cylinders by the block input port "Damping" or select by block parameter and enter the initial damping coefficient values for the selected cylinders within the range of 0 … 1.

Knock Control Page (DS2210SL_KNSG_Bx_Cy)

Purpose

To specify the cylinders and the knock pulse parameters.

Dialog settings

Selected cylinders Displays the sequence of selected cylinder numbers as specified on the Parameters page.

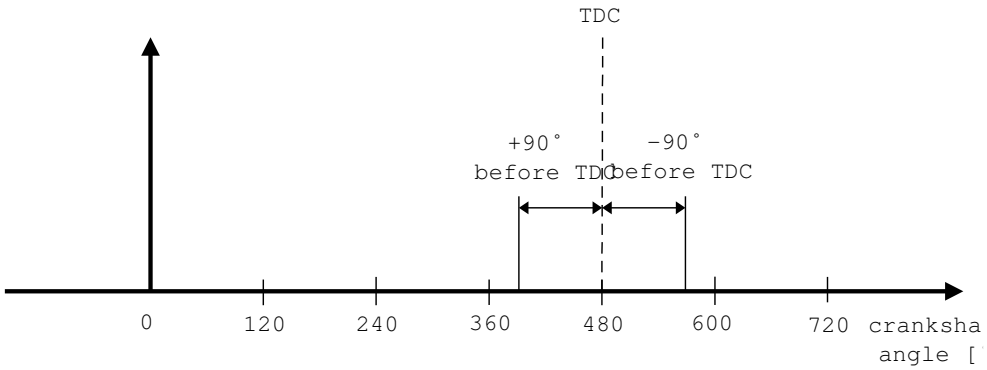
Note

The cylinder sequence within this array determines the cylinder sequence within the other parameter arrays.

Set angle position of knock pulse before TDC This is a tunable parameter. Either select the radio button by input port to set the angle positions for the selected cylinders by the Knock start block input port or select by block parameter and enter the initial angle position values for the selected cylinders within the range of –90 … 90° relative to TDC with a resolution of 0.088°.

Before TDC

Angles before TDC are positive values. The following illustration shows the allowed range relative to a TDC of 480°:



Set length of knock pulse This is a tunable parameter. Either select the radio button **by input port** to set the knock pulse lengths for the selected cylinders by the **Knock length** block input port or select **by block parameter** and enter the initial knock length values for the selected cylinders within the range of 0 … 359° with a resolution of 0.088°.

Enable cylinders This is a tunable parameter. Either select the radio button **by input port** to enable knock signal generation for the selected cylinders by the **Enable cylinder** block input port or mark the checkboxes in the **by block parameter** frame to enable knock signal generation for the selected cylinders. To disable knock signal generation for a selected cylinder do not mark the checkbox.

Set knock rate This is a tunable parameter. Either select the radio button **by input port** to set the knock rates for the selected cylinders by the **Knock rate** block input port or select **by block parameter** and enter the initial knock rate values for the selected cylinders within the range of 0 … 2^{31}–1. For information on knock signal parameters, refer to Knock Sensor Simulation (DS2210 Features 🕮).

Note

The product of (knock rate · number of knocks) must not exceed 2^{31}–1.

Set number of knocks This is a tunable parameter. Either select the radio button **by input port** to set the number of knocks for the selected cylinders by the **Knock number** block input port or select **by block parameter** and enter the initial numbers of knocks for the selected cylinders within the range of 0 … 2^{31}–1. For information on knock signal parameters, refer to Knock Sensor Simulation (DS2210 Features 🕮).

Serial Interface

Where to go from here

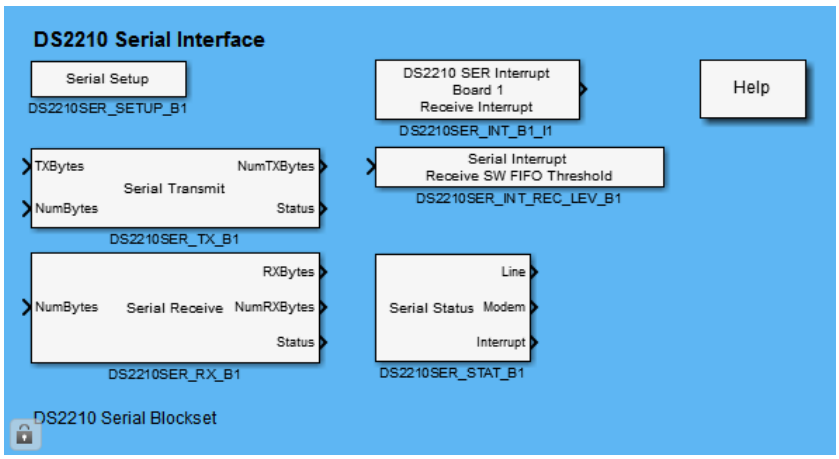
Information in this section

General Information on the Serial Interface

Overview of the Serial Interface

Introduction

After you double-click the SERIAL button in the Library: rti2210lib window, the Library: rti2210serlib is displayed.



The Serial Interface blocks can be used to implement serial communication.

Basic principles

Refer to Serial Interface (DS2210 Features 🕮).

> **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:

- DS2210SER_SETUP_Bx on page 134
- DS2210SER_STAT_Bx on page 139
- DS2210SER_TX_Bx on page 143
- DS2210SER_RX_Bx on page 147

- **DS2210SER_INT_Bx** on page 151
- **DS2210SER_INT_REC_LEV_Bx** on page 154

Related topics

Basics

Serial Interface (DS2210 Features 🕮)

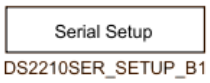
DS2210SER_SETUP_Bx

Where to go from here

Information in this section

Block Description (DS2210SER_SETUP_Bx)

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.
- If several DS2210 boards are connected to different PHS buses of a multiprocessor system, identical board numbers are assigned to these boards. For the moment, RTI-MP does not allow you to configure a multiprocessor system using identical board numbers on different processors. If you encounter this problem, contact dSPACE support.

I/O mapping

For information on the I/O mapping, refer to Serial Interface (DS2210 Features 🕮).

Dialog pages

The dialog settings can be specified on the following pages:

- **Unit Page** (refer to Unit Page (DS2210SER_SETUP_Bx) on page 135)
- **UART Page** (refer to UART Page (DS2210SER_SETUP_Bx) on page 136)
- **FIFO Page** (refer to FIFO Page (DS2210SER_SETUP_Bx) on page 137)
- **Advanced Page** (refer to Advanced Page (DS2210SER_SETUP_Bx) on page 138)

Related RTLib functions

This RTI block is implemented using the following RTLib functions:

- dsser_init
- dsser_config
- dsser_set

Related topics

References

Unit Page (DS2210SER_SETUP_Bx)

Purpose

To select the board number and channel number.

Dialog settings

Board number Lets you choose the board number in the range 1 … 16.

Related topics

References

UART Page (DS2210SER_SETUP_Bx)

Purpose

To specify the UART parameters.

Dialog settings

Transceiver Lets you select the transceiver mode:

Transceiver Mode	Meaning
RS232	RS232 mode
RS422	RS422 mode

Baud rate Lets you specify the baud rate in bits per second.

Mode	Baud Rate Range
RS232	300 … 115,200 baud
RS422	300 … 1,000,000 baud

For further information, refer to Specifying the Baud Rate of the Serial Interface (DS2210 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
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 (DS2210SER_SETUP_Bx) 138
Block Description (DS2210SER_SETUP_Bx) 134
FIFO Page (DS2210SER_SETUP_Bx) 137
Unit Page (DS2210SER_SETUP_Bx) 135

FIFO Page (DS2210SER_SETUP_Bx)

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.

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 (DS2210SER_SETUP_Bx) 138
Block Description (DS2210SER_SETUP_Bx) 134
UART Page (DS2210SER_SETUP_Bx) 136
Unit Page (DS2210SER_SETUP_Bx) 135

Advanced Page (DS2210SER_SETUP_Bx)

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

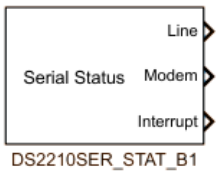
DS2210SER_STAT_Bx

Where to go from here

Information in this section

Block Description (DS2210SER_STAT_Bx)

Block



Purpose

To read the contents of the UART status register.

Note

This block can only be used in interrupt-driven subsystems (see DS2210SER_INT_Bx on page 151).

- 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 (DS2210 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 CTS
6	Complement of DSR
7	Complement of RI
8	Complement of DCD

- 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
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 (DS2210SER_STAT_Bx) on page 141)
- **Status Page** (refer to Status Page (DS2210SER_STAT_Bx) on page 142)

Related RTLib functions

This RTI block is implemented using the following RTLib function:

- dsser_status_read

Related topics

References

dsser_status_read (DS2210 RTLib Reference 🕮)
Status Page (DS2210SER_STAT_Bx)..... 142
Unit Page (DS2210SER_STAT_Bx)..... 141

Unit Page (DS2210SER_STAT_Bx)

Purpose

To specify the board number used for reading the status.

Dialog settings

Board number Lets you select the board number in the range 1 … 16.

Related topics

References

Block Description (DS2210SER_STAT_Bx)..... 139
Status Page (DS2210SER_STAT_Bx)..... 142

Status Page (DS2210SER_STAT_Bx)

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.

Enable Interrupt status port Lets you enable the interrupt status output of the UART.

Related topics

References

Block Description (DS2210SER_STAT_Bx)..... 139
Unit Page (DS2210SER_STAT_Bx)..... 141

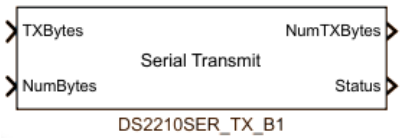
DS2210SER_TX_Bx

Where to go from here

Information in this section

Block Description (DS2210SER_TX_Bx)

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 (DS2210 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
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 DS2210SER_SETUP_Bx on page 134.

Dialog pages

The dialog settings can be specified on the following pages:

- **Unit Page** (refer to Unit Page (DS2210SER_TX_Bx) on page 145)
- **Tx Parameters Page** (refer to TX Parameters Page (DS2210SER_TX_Bx) on page 145)
- **Advanced Page** (refer to Advanced Page (DS2210SER_TX_Bx) on page 146)

Related RTLib functions

This RTI block is implemented using the following RTLib function:

- dsser_transmit

Related topics

References

Unit Page (DS2210SER_TX_Bx)

Purpose

To specify the board number used for sending data.

Dialog settings

Board number Lets you select the board number in the range 1 … 16.

Related topics

References

TX Parameters Page (DS2210SER_TX_Bx)

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 DS2210SER_SETUP_Bx on page 134).

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 (DS2210SER_TX_Bx)

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

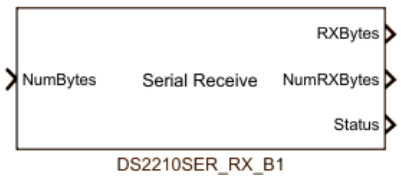
DS2210SER_RX_Bx

Where to go from here

Information in this section

Block Description (DS2210SER_RX_Bx)

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 (DS2210 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 DS2210SER_SETUP_Bx on page 134.

Dialog pages

The dialog settings can be specified on the following pages:

- **Unit Page** (refer to Unit Page (DS2210SER_RX_Bx) on page 149)
- **RX Parameters Page** (refer to RX Parameters Page (DS2210SER_RX_Bx) on page 149)
- **Advanced Page** (refer to Advanced Page (DS2210SER_RX_Bx) on page 150)

Related RTLib functions

This RTI block is implemented using the following RTLib functions:

- dsser_receive
- dsser_receive_term

Related topics

References

Advanced Page (DS2210SER_RX_Bx) 150
DS2210SER_SETUP_Bx 134
dsser_receive (DS2210 RTLib Reference 🕮)
dsser_receive_term (DS2210 RTLib Reference 🕮)
RX Parameters Page (DS2210SER_RX_Bx) 149
Unit Page (DS2210SER_RX_Bx) 149

Unit Page (DS2210SER_RX_Bx)

Purpose

To specify the board number used for reading data.

Dialog settings

Board number Lets you select the board number in the range 1 … 16.

Related topics

References

Advanced Page (DS2210SER_RX_Bx) 150
Block Description (DS2210SER_RX_Bx) 147
RX Parameters Page (DS2210SER_RX_Bx) 149

RX Parameters Page (DS2210SER_RX_Bx)

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 DS2210SER_SETUP_Bx on page 134).

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 (DS2210SER_RX_Bx)

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

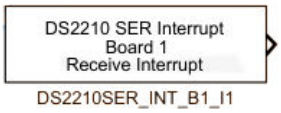
DS2210SER_INT_Bx

Where to go from here

Information in this section

Block Description (DS2210SER_INT_Bx)

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 (DS2210 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 (DS2210SER_INT_Bx) on page 152)
- Interrupt Page (refer to Interrupt Page (DS2210SER_INT_Bx) on page 152)

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 (DS2210 RTLib Reference 🕮)
dsser_subint_enable (DS2210 RTLib Reference 🕮)
dsser_subint_handler_inst (DS2210 RTLib Reference 🕮)
Interrupt Page (DS2210SER_INT_Bx) 152
Unit Page (DS2210SER_INT_Bx) 152

Unit Page (DS2210SER_INT_Bx)

Purpose

To specify the board on which an interrupt will be made available.

Dialog settings

Board number Lets you select the board number in the range 1 … 16.

Related topics

References

Block Description (DS2210SER_INT_Bx) 151
Interrupt Page (DS2210SER_INT_Bx) 152

Interrupt Page (DS2210SER_INT_Bx)

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
NOT SELECTED	For other platforms, this option represents the modem status interrupt. The DS2210 does not support the modem status interrupt, so specifying this option has no effect on the model.

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 DS2210SER_SETUP_Bx on page 134).

The RX SW FIFO threshold can be changed during run time by using the block DS2210SER_INT_REC_LEV_Bx on page 154.

Related topics

References

DS2210SER_INT_REC_LEV_Bx

Where to go from here

Information in this section

Block Description (DS2210SER_INT_REC_LEV_Bx)

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 DS2210SER_INT_Bx block (see DS2210SER_INT_Bx on page 151).

I/O mapping

For information on the I/O mapping, refer to Serial Interface (DS2210 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 DS2210SER_SETUP_Bx on page 134.

Dialog pages

The dialog settings can be specified on the following page:

- Unit page (refer to Unit Page (DS2210SER_INT_REC_LEV_Bx) on page 155)

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

DS2210SER_INT_Bx 151
DS2210SER_SETUP_Bx 134
dsser_config (DS2210 RTLib Reference 🕮)
dsser_fifo_reset (DS2210 RTLib Reference 🕮)
dsser_receive_fifo_level (DS2210 RTLib Reference 🕮)
dsser_transmit_fifo_level (DS2210 RTLib Reference 🕮)
Unit Page (DS2210SER_INT_REC_LEV_Bx) 155

Unit Page (DS2210SER_INT_REC_LEV_Bx)

Purpose

To specify the board on which the RX SW FIFO threshold will be changed.

Dialog settings

Board number Lets you select the board number in the range 1 … 16.

Related topics

References

Block Description (DS2210SER_INT_REC_LEV_Bx) 154