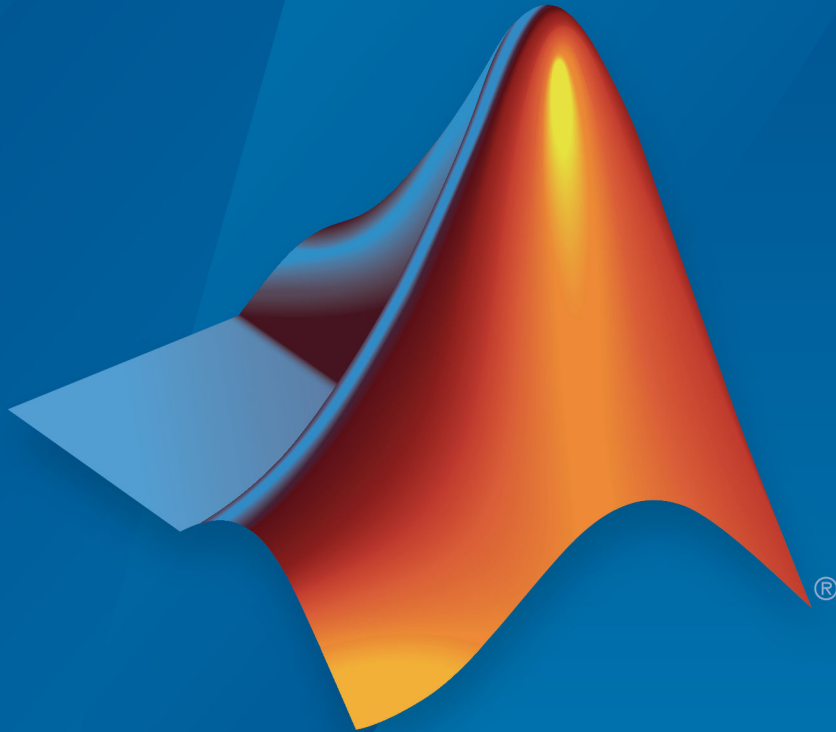


Simulink® Desktop Real-Time™  
Reference



MATLAB®

R2017b



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The MathWorks, Inc.  
3 Apple Hill Drive  
Natick, MA 01760-2098

*Simulink® Desktop Real-Time™ Reference*

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# Function Reference

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## rtwho

Display information about development computer status

## Syntax

```
rtwho
```

## Description

`rtwho` displays information about the Simulink Desktop Real-Time development computer status. For example:

- Simulink Desktop Real-Time version
- Computer type
- Timers (ID, period, and status)
- Hardware drivers (ID, device type, and address)

## Examples

### Get Development Computer Information

Get information about a development computer with a HUMUSOFT® MF624 board installed.

```
rtwho
```

```
Simulink Desktop Real-Time version 5.0.0 (C) The MathWorks, Inc.  
1994-2014 Running on 64-bit computer.
```

```
TIMERS:  Period      Running  
         0.001      Yes  
         0.001      Yes
```



DRIVERS:	Address	Name
	0	Humusoft MF624

## See Also

sldrtkernel

**Introduced before R2006a**

## sldrtconfigset

Attach and activate default Simulink Desktop Real-Time configuration set

### Syntax

```
sldrtconfigset model
sldrtconfigset model 'ERT'

configset = sldrtconfigset
configset = sldrtconfigset('','ERT')
```

### Description

`sldrtconfigset model` attaches the default Simulink Desktop Real-Time configuration set `SimulinkDesktopRealTime` to the model, and then activates the configuration set. This set specifies various simulation and code generation parameter values that are useful when working with a Simulink Desktop Real-Time model.

`sldrtconfigset model 'ERT'` attaches the default Simulink Desktop Real-Time configuration set `SimulinkDesktopRealTime_ERT` for Embedded Coder® software to the model, and then activates the configuration set. This set specifies simulation and code generation parameter values that are useful when working with a Simulink Desktop Real-Time model in the Embedded Coder environment.

`configset = sldrtconfigset` returns the default Simulink Desktop Real-Time configuration set object. Later, you can attach this configuration set to a model.

`configset = sldrtconfigset('','ERT')` returns the default Simulink Desktop Real-Time configuration set object for the Embedded Coder software. Later, you can attach this configuration set to a model.

### Examples

## Set and Get Default Configuration Set

Set model `sldrtex_vdp` to the default configuration set. Read the configuration set into a variable.

```
open_system('sldrtex_vdp')
sldrtconfigset('sldrtex_vdp')

configset = sldrtconfigset;
configset.Name

ans =

SimulinkDesktopRealTime
```

## Set and Get Default ERT Configuration Set

Open model `sldrtex_vdp` and set `gcs` to the default Embedded Coder configuration set. Read the configuration set into a variable.

```
open_system('sldrtex_vdp')
sldrtconfigset('gcs', 'ERT')

configset = sldrtconfigset('gcs', 'ERT');
configset.Name

ans =

SimulinkDesktopRealTime_ERT
```

# Input Arguments

### **model** — Model to associate with default configuration set

character vector

The model to which you attach the default Simulink Desktop Real-Time configuration set.

Example: `sldrtex_vdp`

## Output Arguments

**configset** — Default configuration set  
structure

The default Simulink Desktop Real-Time configuration set, which later you can attach to a model.

## See Also

### Topics

“Configure a Model”

“Manage a Configuration Set” (Simulink)

“Manage a Configuration Reference” (Simulink)

**Introduced in R2015a**

# sldrtkernel

Install and remove Simulink Desktop Real-Time kernel

## Syntax

```
sldrtkernel -install  
sldrtkernel -uninstall  
sldrtkernel -version  
sldrtkernel -setup
```

## Description

`sldrtkernel -install` installs the Simulink Desktop Real-Time kernel on your system.

On Windows® systems, installing or uninstalling the kernel can require you to authorize requests from User Account Control (UAC). On Mac OS systems, installing or uninstalling the kernel can require you to enter an `osascript` password.

`sldrtkernel -uninstall` removes the Simulink Desktop Real-Time kernel from your system.

`sldrtkernel -version` displays the Simulink Desktop Real-Time version installed on your system.

`sldrtkernel -setup` installs the Simulink Desktop Real-Time kernel on your system.

## Examples

### Update Kernel Version

Checking the version of the kernel, uninstalling the kernel, and installing a new version

Check the kernel version.

```
sldrtkernel -version
```

```
The installed version of the Simulink Desktop Real-Time kernel  
is 5.0.0.
```

Uninstall the kernel. At the command prompt, type `y`.

```
sldrtkernel -uninstall
```

```
You are going to uninstall the Simulink Desktop Real-Time kernel.  
Do you want to proceed? [y] : y  
The Simulink Desktop Real-Time kernel has been successfully  
uninstalled.
```

Reinstall the kernel. At the command prompt, type `y`.

```
sldrtkernel -install
```

```
You are going to install the Simulink Desktop Real-Time kernel.  
Do you want to proceed? [y] : y  
The Simulink Desktop Real-Time kernel has been successfully  
installed.
```

## See Also

rtwho

**Introduced in R2015a**

## Blocks — Alphabetical List

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## Analog Input

Read from one or multiple analog input channels

### Description

Connect to and read from specific analog input channels from your Simulink model. After you add an Analog Input block to your model, you can enter the parameters for its I/O driver.

### Ports

#### Output

**Analog Data** — Analog-to-digital converter data read from input channels

vector

Result of A/D conversion of an analog signal. The data type and range of the output value depend on the capabilities of the board.

Data Types: `double` | `single` | `int8` | `uint8` | `int16` | `uint16` | `int32` | `uint32`

**Missed Ticks** — Missed tick count (optional)

double

In normal or accelerator modes, returns the number of timer ticks that your model lags behind the real-time kernel. When the model lags by more than **Maximum missed ticks**, the software reports an error and simulation stops.

#### Dependency

When you select **Show “Missed Ticks” port**, this port is visible.

Data Types: `double`



## Parameters

### **Install new board — Register a board**

< no board selected > (default)

When you click **Install new board**, the software displays a list of manufacturers of supported boards. When you select a manufacturer, the software displays a list of boards available from that manufacturer. When you select a board, the software adds the board to the list of registered boards and makes that board the current board.

By default, the initial selection in the list of registered boards is < no board selected >.

#### **Dependency**

When you select a board in the list of registered boards, the **Delete current board** and **Board setup** buttons are available.

### **Delete current board — Delete the current board**

(button)

To delete the current board, click this button. The initial selection of the list of registered boards changes to < no board selected >.

#### **Dependency**

To activate this parameter, select a board in the list of registered boards.

When you delete the current board, the **Delete current board** and **Board setup** buttons are no longer available.

### **Board setup — Set up the board**

(button)

To set up the board, click this button.

A board-specific dialog box opens to set up the board. For more information, see the board manufacturer documentation.

#### **Dependency**

To activate this parameter, select a board in the list of registered boards.

To deactivate this parameter, click **Delete current board**.

### **Sample time — Sample time of block**

0.1 (default) | double

Enter a value, in seconds, that represents how frequently you want the block to execute and interact with the I/O hardware. The block synchronizes your model with the real-time clock at this sample rate.

If you are using a fixed-step solver, enter the value that you entered as the **Fixed step size** configuration parameter or an integer multiple of that value.

### **Maximum missed ticks — Number of timer ticks by which your model can trail the kernel**

10 (default) | integer

In normal or accelerator modes, enter the number of timer ticks that your model can lag behind the real-time kernel. When the model lags behind by this number or fewer timer ticks, the software assumes that the lag is temporary. It allows the model to catch up, even if the model misses some ticks. When the model lags by more than this number, the software reports an error and simulation stops.

In external mode, the software ignores this value.

### **Show "Missed Ticks" port — Send number of missed ticks to port Missed Ticks**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to send the number of missed ticks to output port Missed Ticks.

In external mode, the Missed Ticks port is zero.

### **Yield CPU when waiting — Yield CPU while kernel waits for hardware**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to grant other programs more CPU time while the kernel waits for a response from the hardware.

In external mode, the software ignores this value.

### **Input channels — Select analog input channels**

1 (default) | vector

Enter a channel vector that selects the analog input channels that you are using on this board. The vector can be any valid MATLAB® vector form. For example, to select eight contiguous analog input channels, enter:

```
[1,2,3,4,5,6,7,8]
```

or

```
[1:8]
```

To select the first three analog input channels, enter:

```
[1,2,3]
```

#### **Input range — Input range of analog inputs**

board dependent

From the list, select the input range for the analog input channels that you entered for the **Input channels** parameter. For example, if the board has an input range of  $\pm 5$  V, select -5 to 5 V.

If you want a different input range for different analog channels, add an I/O block for each different input range. The valid values depend upon the capabilities of the board.

#### **Block output signal — Value type returned from block**

Volts (default) | Normalized bipolar | Normalized unipolar | Raw

From the list, select from the following options:

- **Volts** — Returns a value equal to the analog voltage.
- **Normalized bipolar** — Returns a full range value of -1 to +1 regardless of the input voltage range.
- **Normalized unipolar** — Returns a full range value of 0 to +1 regardless of the input voltage range. For example, analog input ranges of 0 volts to +5 volts and of -5 volts to +5 volts are converted to 0 to +1.
- **Raw** — Returns a value from 0 through  $2^n - 1$ . For example, a 12-bit A/D converter returns values from 0 through  $2^{12} - 1$  (0 to 4095). The advantage of this method is that the returned value is an integer with no round-off errors.

#### **Output data type — Data type of block output**

double (default) | single | int8 | uint8 | int16 | uint16 | int32 | uint32

From the list, select the type of data that the block outputs to the model. The valid values depend on the capabilities of the board.

## **Model Examples**

### **See Also**

Analog Output

**Introduced before R2006a**

# Analog Output

Write to one or multiple analog output channels

## Description

Connect to and write to specific analog output channels from your Simulink model. After you add an Analog Output block to your model, you can enter the parameters for its I/O driver.

## Ports

### Input

**Analog Data** — Digital-to-analog converter data to write to output channels

vector

Source data provided as input to D/A conversion. The data type and range of the input value depend upon the capabilities of the board.

Data Types: `single` | `double` | `int8` | `uint8` | `int16` | `uint16` | `int32` | `uint32`

### Output

**Missed Ticks** — Missed tick count (optional)

double

In normal or accelerator modes, returns the number of timer ticks that your model lags behind the real-time kernel. When the model lags by more than **Maximum missed ticks**, the software reports an error and simulation stops.

### Dependency

When you select **Show “Missed Ticks” port**, this port is visible.

Data Types: `double`

## Parameters

### **Install new board — Register a board**

< no board selected > (default)

When you click **Install new board**, the software displays a list of manufacturers of supported boards. When you select a manufacturer, the software displays a list of boards available from that manufacturer. When you select a board, the software adds the board to the list of registered boards and makes that board the current board.

By default, the initial selection in the list of registered boards is < no board selected >.

#### **Dependency**

When you select a board in the list of registered boards, the **Delete current board** and **Board setup** buttons are available.

### **Delete current board — Delete the current board**

(button)

To delete the current board, click this button. The initial selection of the list of registered boards changes to < no board selected >.

#### **Dependency**

To activate this parameter, select a board in the list of registered boards.

When you delete the current board, the **Delete current board** and **Board setup** buttons are no longer available.

### **Board setup — Set up the board**

(button)

To set up the board, click this button.

A board-specific dialog box opens to set up the board. For more information, see the board manufacturer documentation.

#### **Dependency**

To activate this parameter, select a board in the list of registered boards.

To deactivate this parameter, click **Delete current board**.

**Sample time — Sample time of block**

0.1 (default) | double

Enter a value, in seconds, that represents how frequently you want the block to execute and interact with the I/O hardware. The block synchronizes your model with the real-time clock at this sample rate.

If you are using a fixed-step solver, enter the value that you entered as the **Fixed step size** configuration parameter or an integer multiple of that value.

**Maximum missed ticks — Number of timer ticks by which your model can trail the kernel**

10 (default) | integer

In normal or accelerator modes, enter the number of timer ticks that your model can lag behind the real-time kernel. When the model lags behind by this number or fewer timer ticks, the software assumes that the lag is temporary. It allows the model to catch up, even if the model misses some ticks. When the model lags by more than this number, the software reports an error and simulation stops.

In external mode, the software ignores this value.

**Show "Missed Ticks" port — Send number of missed ticks to port Missed Ticks**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to send the number of missed ticks to output port Missed Ticks.

In external mode, the Missed Ticks port is zero.

**Yield CPU when waiting — Yield CPU while kernel waits for hardware**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to grant other programs more CPU time while the kernel waits for a response from the hardware.

In external mode, the software ignores this value.

**Output channels — Channel vector that selects output channels**

1 (default) | vector

Enter a channel vector that selects the analog output channels that you are using on this board. The vector can be any valid MATLAB vector form. For example, to select the first two analog output channels, enter:

```
[1,2]
```

or

```
[1:2]
```

### **Output range — Select output range for analog outputs**

board dependent

From the list, select the output range for the analog output channels that you entered for the **Output channels** parameter. For example, if the board has an output range of  $\pm 5$  V, select `-5 to 5 V`.

If you want the output range to be different for different analog channels, add an I/O block for each different output range.

### **Block input signal — Value type sent into block**

Volts (default) | Normalized bipolar | Normalized unipolar | Raw

From the list, select from the following options:

- `Volts` — Expects a value equal to the analog output voltage.
- `Normalized bipolar` — Expects a value between  $-1$  and  $+1$  that is converted to the full range of the output voltage regardless of the output voltage range.
- `Normalized unipolar` — Expects a value between  $0$  and  $+1$  that is converted to the full range of the output voltage regardless of the output voltage range. For example, analog output ranges of  $0$  volts to  $+5$  volts and of  $-5$  volts to  $+5$  volts are converted from values between  $0$  and  $+1$ .
- `Raw` — Expects a value from  $0$  through  $2^n - 1$ . For example, a 12-bit A/D converter expects a value between  $0$  and  $2^{12} - 1$  ( $0$  to  $4095$ ). The advantage of this method is that the expected value is an integer with no round-off errors.

### **Initial value — Initial value for output channels**

vector



Enter the initial value for each analog output channel that you entered for the **Output channels** parameter. For example, if you entered [1, 2], and you want initial values of 0 Volts, enter [0, 0].

**Final value — Final value for output channels**

vector

Enter a final value for each analog channel that you entered for the **Output channels** parameter. For example, if you entered [1, 2], and you want final values of 0 Volts, enter [0, 0].

## Model Examples

### See Also

Analog Input

Introduced before R2006a

## Counter Input

Read from one or multiple counter-input channels

### Description

Connect to and read from specific counter-input channels into your Simulink model. After you have added a Counter Input block to your model, you can enter the parameters for its I/O driver.

### Ports

#### Output

**Counter Data** — Counter data read from input channels

vector

Data representing the state of a counter. The data type of the output values depends upon the capabilities of the board.

Data Types: `single` | `double` | `int8` | `uint8` | `int16` | `uint16` | `int32` | `uint32`

**Missed Ticks** — Missed tick count (optional)

double

In normal or accelerator modes, returns the number of timer ticks that your model lags behind the real-time kernel. When the model lags by more than **Maximum missed ticks**, the software reports an error and simulation stops.

#### Dependency

When you select **Show “Missed Ticks” port**, this port is visible.

Data Types: `double`

## Parameters

### **Install new board — Register a board**

< no board selected > (default)

When you click **Install new board**, the software displays a list of manufacturers of supported boards. When you select a manufacturer, the software displays a list of boards available from that manufacturer. When you select a board, the software adds the board to the list of registered boards and makes that board the current board.

By default, the initial selection in the list of registered boards is < no board selected >.

### **Dependency**

When you select a board in the list of registered boards, the **Delete current board** and **Board setup** buttons are available.

### **Delete current board — Delete the current board**

(button)

To delete the current board, click this button. The initial selection of the list of registered boards changes to < no board selected >.

### **Dependency**

To activate this parameter, select a board in the list of registered boards.

When you delete the current board, the **Delete current board** and **Board setup** buttons are no longer available.

### **Board setup — Set up the board**

(button)

To set up the board, click this button.

A board-specific dialog box opens to set up the board. For more information, see the board manufacturer documentation.

### **Dependency**

To activate this parameter, select a board in the list of registered boards.

To deactivate this parameter, click **Delete current board**.

### **Sample time — Sample time of block**

0.1 (default) | double

Enter a value, in seconds, that represents how frequently you want the block to execute and interact with the I/O hardware. The block synchronizes your model with the real-time clock at this sample rate.

If you are using a fixed-step solver, enter the value that you entered as the **Fixed step size** configuration parameter or an integer multiple of that value.

### **Maximum missed ticks — Number of timer ticks by which your model can trail the kernel**

10 (default) | integer

In normal or accelerator modes, enter the number of timer ticks that your model can lag behind the real-time kernel. When the model lags behind by this number or fewer timer ticks, the software assumes that the lag is temporary. It allows the model to catch up, even if the model misses some ticks. When the model lags by more than this number, the software reports an error and simulation stops.

In external mode, the software ignores this value.

### **Show "Missed Ticks" port — Send number of missed ticks to port Missed Ticks**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to send the number of missed ticks to output port Missed Ticks.

In external mode, the Missed Ticks port is zero.

### **Yield CPU when waiting — Yield CPU while kernel waits for hardware**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to grant other programs more CPU time while the kernel waits for a response from the hardware.

In external mode, the software ignores this value.

### **Input channels — Select counter-input channels**

1 (default) | vector

Enter a channel vector that selects the counter input channels you are using on this board. The vector can be any valid MATLAB vector form.

For example, to select the first four counter-input channels on the board, enter:

```
[1,2,3,4]
```

or

```
[1:4]
```

#### **Reset after read — Counter-reset policy**

```
never (default) | always | level | rising edge | falling edge | either edge
```

Determines whether the software resets the counter to zero after reading its value. From the list, select one of the following options:

- `never` — Do not reset after reading.
- `always` — Always reset after reading.
- `level` — Reset after reading if the block input is nonzero. Adds an input to the Counter Input block.
- `rising edge` — Reset after reading if the block input changes from zero to nonzero between the last two successive readings. Adds an input to the Counter Input block.
- `falling edge` — Reset after reading if the block input changes from nonzero to zero between last two successive readings. Adds an input to the Counter Input block.
- `either edge` — Reset after reading if the block input changes either from zero to nonzero or from nonzero to zero between the last two successive readings. Adds an input to the Counter Input block.

#### **Clock input source — Clock input that increments counter**

```
input pin rising edge (default) | input pin falling edge | internal clock
```

Determines the clock input source to increment the counter. From the list, select:

- `input pin rising edge` — Clock edge low-to-high transitions
- `input pin falling edge` — Clock edge high-to-low transitions
- `internal clock` — Internal time base

If you set the **Gate input functionality** parameter to `enable when high, latch & reset on edge`, or `enable when low, latch & reset on edge`, you can

measure positive or negative pulse lengths in units of the internal time base. You can use this combination with National Instruments® drivers for pulse width measurement.

Not all counter chips support selecting the input edge. In this case, only supported options appear in the list.

### **Gate input functionality — Action of counter-gate input pin**

`none (default) | enable when high | enable when low | start on rising edge | start on falling edge | reset on rising edge | reset on falling edge | latch on rising edge | latch on falling edge | latch & reset on rising edge | latch & reset on falling edge | enable when high, latch & reset on edge | enable when low, latch & reset on edge`

Defines the action of the counter gate input pin. From the list, select:

- `none` — Enable counting unconditionally, ignoring gate input.
- `enable when high` — Disable counting when gate input is low and enable counting when gate input is high.
- `enable when low` — Disable counting when gate input is high and enable counting when gate input is low.
- `start on rising edge` — Disable counting until low-to-high gate transition occurs.
- `start on falling edge` — Disable counting until high-to-low gate transition occurs.
- `reset on rising edge` — Reset counter to zero when low-to-high gate transition occurs.
- `reset on falling edge` — Reset counter to zero when high-to-low gate transition occurs.
- `latch on rising edge` — Store count in register when low-to-high gate transition occurs. Return contents of register.
- `latch on falling edge` — Store count in register when high-to-low gate transition occurs. Return contents of register.
- `latch & reset on rising edge` — Store count in register, and then reset counter to zero when low-to-high gate transition occurs. Return contents of register.
- `latch & reset on falling edge` — Store count in register, and then reset counter to zero when high-to-low gate transition occurs. Return contents of register.

- enable when high, latch & reset on edge — Disable counting while gate input is low. Start counting when low-to-high gate transition occurs. Count while gate input is high. Store count in register, and then reset counter to zero when high-to-low gate transition occurs. Return contents of register.

If you set the **Clock input source** parameter to `internal clock`, you can measure positive pulse lengths in units of the internal time base. You can use this combination with most National Instruments drivers for pulse width measurement.

- enable when low, latch & reset on edge — Disable counting while gate input is high. Start counting when high-to-low gate transition occurs. Count while gate input is low. Store count in register, and then reset counter to zero when low-to-high gate transition occurs. Return contents of register.

If you set the **Clock input source** parameter to `internal clock`, you can measure negative pulse lengths in units of the internal time base. You can use this combination with National Instruments drivers for pulse width measurement.

Not all counter chips support all gate input modes. Only supported modes appear in the list.

#### **Output data type — Data type of block output**

`double` (default) | `single` | `int8` | `uint8` | `int16` | `uint16` | `int32` | `uint32`

From the list, select the type of data that the block outputs to the model. The valid values depend on the capabilities of the board.

## Model Examples

## See Also

Introduced before R2006a

## Digital Input

Read from one or multiple digital input channels

### Description

Connect to and read from specific digital lines or channels into your Simulink model. After you have added a Digital Input block to your model, you can enter the parameters for its I/O driver.

### Ports

#### Output

**Digital Data** — Digital data read from input channels

vector

The data type and range of the output values depend upon the capabilities of the board.

Data Types: `single` | `double` | `int8` | `uint8` | `int16` | `uint16` | `int32` | `uint32`

**Missed Ticks** — Missed tick count (optional)

double

In normal or accelerator modes, returns the number of timer ticks that your model lags behind the real-time kernel. When the model lags by more than **Maximum missed ticks**, the software reports an error and simulation stops.

#### Dependency

When you select **Show “Missed Ticks” port**, this port is visible.

Data Types: `double`



## Parameters

### **Install new board — Register a board**

< no board selected > (default)

When you click **Install new board**, the software displays a list of manufacturers of supported boards. When you select a manufacturer, the software displays a list of boards available from that manufacturer. When you select a board, the software adds the board to the list of registered boards and makes that board the current board.

By default, the initial selection in the list of registered boards is < no board selected >.

### **Dependency**

When you select a board in the list of registered boards, the **Delete current board** and **Board setup** buttons are available.

### **Delete current board — Delete the current board**

(button)

To delete the current board, click this button. The initial selection of the list of registered boards changes to < no board selected >.

### **Dependency**

To activate this parameter, select a board in the list of registered boards.

When you delete the current board, the **Delete current board** and **Board setup** buttons are no longer available.

### **Board setup — Set up the board**

(button)

To set up the board, click this button.

A board-specific dialog box opens to set up the board. For more information, see the board manufacturer documentation.

### **Dependency**

To activate this parameter, select a board in the list of registered boards.

To deactivate this parameter, click **Delete current board**.

**Sample time — Sample time of block**

0.1 (default) | double

Enter a value, in seconds, that represents how frequently you want the block to execute and interact with the I/O hardware. The block synchronizes your model with the real-time clock at this sample rate.

If you are using a fixed-step solver, enter the value that you entered as the **Fixed step size** configuration parameter or an integer multiple of that value.

**Maximum missed ticks — Number of timer ticks by which your model can trail the kernel**

10 (default) | integer

In normal or accelerator modes, enter the number of timer ticks that your model can lag behind the real-time kernel. When the model lags behind by this number or fewer timer ticks, the software assumes that the lag is temporary. It allows the model to catch up, even if the model misses some ticks. When the model lags by more than this number, the software reports an error and simulation stops.

In external mode, the software ignores this value.

**Show "Missed Ticks" port — Send number of missed ticks to port Missed Ticks**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to send the number of missed ticks to output port Missed Ticks.

In external mode, the Missed Ticks port is zero.

**Yield CPU when waiting — Yield CPU while kernel waits for hardware**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to grant other programs more CPU time while the kernel waits for a response from the hardware.

In external mode, the software ignores this value.

**Input channels — Select digital input channels**

1 (default) | vector

Enter a channel vector that selects the digital input channels you are using on this board. The vector can be any valid MATLAB vector form. For example, to select the first eight digital input channels, enter:

```
[1,2,3,4,5,6,7,8]
```

or

```
[1:8]
```

If you want to use the first four digital input lines, enter:

```
[1,2,3,4]
```

If you have one 8-bit digital channel, enter [1]. If you have two 8-bit digital channels, enter [1 9], and from the Channel mode list, select Byte.

#### **Channel mode — Mode of representing the input lines**

Bit (default) | Byte

From the list, select one of the following options:

- Bit — Returns a value of 0 or 1.
- Byte — Groups eight digital lines into one digital channel. Returns a value of 0–255.

#### **Output data type — Data type of block output**

double (default) | single | int8 | uint8 | int16 | uint16 | int32 | uint32

From the list, select the type of data that the block outputs to the model. The valid values depend on the capabilities of the board.

## See Also

Digital Output

Introduced before R2006a

## Digital Output

Write to one or multiple digital output channels

### Description

Connect to and write to specific digital lines or channels from your Simulink model. After you have added a Digital Output block to your model, you can enter the parameters for its I/O driver.

### Ports

#### Input

**Digital Data** — Digital data to write to output channels  
vector

The data type and range of the input values depend upon the capabilities of the board.

Data Types: `single` | `double` | `int8` | `uint8` | `int16` | `uint16` | `int32` | `uint32`

#### Output

**Missed Ticks** — Missed tick count (optional)  
double

In normal or accelerator modes, returns the number of timer ticks that your model lags behind the real-time kernel. When the model lags by more than **Maximum missed ticks**, the software reports an error and simulation stops.

#### Dependency

When you select **Show “Missed Ticks” port**, this port is visible.

Data Types: `double`

## Parameters

### **Install new board — Register a board**

< no board selected > (default)

When you click **Install new board**, the software displays a list of manufacturers of supported boards. When you select a manufacturer, the software displays a list of boards available from that manufacturer. When you select a board, the software adds the board to the list of registered boards and makes that board the current board.

By default, the initial selection in the list of registered boards is < no board selected >.

### **Dependency**

When you select a board in the list of registered boards, the **Delete current board** and **Board setup** buttons are available.

### **Delete current board — Delete the current board**

(button)

To delete the current board, click this button. The initial selection of the list of registered boards changes to < no board selected >.

### **Dependency**

To activate this parameter, select a board in the list of registered boards.

When you delete the current board, the **Delete current board** and **Board setup** buttons are no longer available.

### **Board setup — Set up the board**

(button)

To set up the board, click this button.

A board-specific dialog box opens to set up the board. For more information, see the board manufacturer documentation.

### **Dependency**

To activate this parameter, select a board in the list of registered boards.

To deactivate this parameter, click **Delete current board**.

**Sample time — Sample time of block**

0.1 (default) | double

Enter a value, in seconds, that represents how frequently you want the block to execute and interact with the I/O hardware. The block synchronizes your model with the real-time clock at this sample rate.

If you are using a fixed-step solver, enter the value that you entered as the **Fixed step size** configuration parameter or an integer multiple of that value.

**Maximum missed ticks — Number of timer ticks by which your model can trail the kernel**

10 (default) | integer

In normal or accelerator modes, enter the number of timer ticks that your model can lag behind the real-time kernel. When the model lags behind by this number or fewer timer ticks, the software assumes that the lag is temporary. It allows the model to catch up, even if the model misses some ticks. When the model lags by more than this number, the software reports an error and simulation stops.

In external mode, the software ignores this value.

**Show "Missed Ticks" port — Send number of missed ticks to port Missed Ticks**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to send the number of missed ticks to output port Missed Ticks.

In external mode, the Missed Ticks port is zero.

**Yield CPU when waiting — Yield CPU while kernel waits for hardware**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to grant other programs more CPU time while the kernel waits for a response from the hardware.

In external mode, the software ignores this value.

**Output channels — Select digital output channels**

vector

Enter a channel vector that selects the digital output channels you are using on this board. The vector can be any valid MATLAB vector form. For example, to select the first eight digital output channels, enter:

```
[1,2,3,4,5,6,7,8]
```

or

```
[1:8]
```

If you want to use the first four digital output lines, enter:

```
[1,2,3,4]
```

If you have one 8-bit digital channel, enter [1]. If you have two 8-bit digital channels, enter [1 9], and from the **Channel mode** list, select `Byte`.

#### **Channel mode — Mode of representing the output lines**

`Bit` (default) | `Byte`

From the list, select from one of the following:

- `Bit` — Expects a value of 0 or 1.
- `Byte` — Expects a value of 0–255 that is converted to one digital channel of eight digital lines.

#### **Initial value — Initial value for output channels**

vector

Enter the initial values for each digital output line or channel that you entered as the **Output channels** parameter. For example, if you entered [1, 2, 3, 4], and you want initial values of 0 and 1, enter:

```
[0,0,1,1]
```

If you select `Byte` from the **Channel mode** list, enter a value from 0 through 255 for each digital output channel. For example, for 1 byte (eight digital lines) with an initial value of 25, enter [25]. For 2 bytes (16 digital lines) with initial values of 25 and 50, enter [25 50].

#### **Final value — Final value for output channels**

vector

Enter a final value for each digital output channel that you entered as the **Output channels** parameter. For example, if you entered [1, 2, 3, 4], and you want final values of 0, enter:

```
[0, 0, 0, 0]
```

If you select `Byte` from the **Channel mode** list, enter a value from 0 through 255 for each digital output channel.

### See Also

Digital Input

Introduced before R2006a



# Encoder Input

Read from one or multiple incremental encoder input channels

## Description

Connect to and read from specific encoder input channels into your Simulink model. After you have added an Encoder Input block to your model, you can enter the parameters for its I/O driver.

## Ports

### Output

**Encoder Data** — Encoder data read from input channels

vector

Data representing the state of an encoder. The data type and range of the output values depend upon the capabilities of the board.

Data Types: `single` | `double` | `int8` | `uint8` | `int16` | `uint16` | `int32` | `uint32`

**Missed Ticks** — Missed tick count (optional)

double

In normal or accelerator modes, returns the number of timer ticks that your model lags behind the real-time kernel. When the model lags by more than **Maximum missed ticks**, the software reports an error and simulation stops.

### Dependency

When you select **Show “Missed Ticks” port**, this port is visible.

Data Types: `double`

## Parameters

### **Install new board — Register a board**

< no board selected > (default)

When you click **Install new board**, the software displays a list of manufacturers of supported boards. When you select a manufacturer, the software displays a list of boards available from that manufacturer. When you select a board, the software adds the board to the list of registered boards and makes that board the current board.

By default, the initial selection in the list of registered boards is < no board selected >.

#### **Dependency**

When you select a board in the list of registered boards, the **Delete current board** and **Board setup** buttons are available.

### **Delete current board — Delete the current board**

(button)

To delete the current board, click this button. The initial selection of the list of registered boards changes to < no board selected >.

#### **Dependency**

To activate this parameter, select a board in the list of registered boards.

When you delete the current board, the **Delete current board** and **Board setup** buttons are no longer available.

### **Board setup — Set up the board**

(button)

To set up the board, click this button.

A board-specific dialog box opens to set up the board. For more information, see the board manufacturer documentation.

#### **Dependency**

To activate this parameter, select a board in the list of registered boards.

To deactivate this parameter, click **Delete current board**.

**Sample time — Sample time of block**

0.1 (default) | double

Enter a value, in seconds, that represents how frequently you want the block to execute and interact with the I/O hardware. The block synchronizes your model with the real-time clock at this sample rate.

If you are using a fixed-step solver, enter the value that you entered as the **Fixed step size** configuration parameter or an integer multiple of that value.

**Maximum missed ticks — Number of timer ticks by which your model can trail the kernel**

10 (default) | integer

In normal or accelerator modes, enter the number of timer ticks that your model can lag behind the real-time kernel. When the model lags behind by this number or fewer timer ticks, the software assumes that the lag is temporary. It allows the model to catch up, even if the model misses some ticks. When the model lags by more than this number, the software reports an error and simulation stops.

In external mode, the software ignores this value.

**Show "Missed Ticks" port — Send number of missed ticks to port Missed Ticks**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to send the number of missed ticks to output port Missed Ticks.

In external mode, the Missed Ticks port is zero.

**Yield CPU when waiting — Yield CPU while kernel waits for hardware**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to grant other programs more CPU time while the kernel waits for a response from the hardware.

In external mode, the software ignores this value.

**Input channels — Select encoder input channels**

1 (default) | vector

Enter a channel vector that selects the encoder input channels that you are using on this board. The vector can be any valid MATLAB vector form. For example, to select the first four encoder input channels, enter:

```
[1,2,3,4]
```

or

```
[1:4]
```

**Quadrature mode** — To detect optically the amplitude and direction of movement, select encoder stripe edges

`quadruple` (default) | `double` | `single`

Encoders use two sets of stripes, shifted in phase, to detect optically the amplitude and direction of movement. This parameter specifies which encoder stripe edges the encoder counts. From the list, select:

- `quadruple` (default) — Counts rising and falling edges from both stripe sets.
- `double` — Counts the rising edges from both stripe sets.
- `single` — Counts the rising edges from one stripe set.

Quadruple mode yields four times more pulses per revolution than the single mode. Therefore, quadruple is more accurate. Use quadruple mode unless other parameters dictate otherwise.

**Reset input function** — Select mode of reset pin

`reset` (default) | `gate` | `rising edge index` | `falling edge index`

The encoder interface chip has a reset pin in addition to encoder inputs. Usually, you connect this pin to the index output of the encoder. However, you can connect it to any signal or not at all. This parameter specifies the function of this pin. From the list, select:

- `reset` (default) — Level reset of the encoder count.
- `gate` — Enables encoder counting.
- `rising edge index` — Resets the encoder count on the rising edge.
- `falling edge index` — Resets the encoder count on the falling edge.

**Input filter clock frequency** — Cutoff frequency (Hz) of low-pass filter

`Inf` (default) | `scalar`

The encoder interface chip includes a low-pass filter that filters out high frequencies, which the chip interprets as noise. This parameter is the cutoff frequency (Hz) of this filter. The cutoff frequency that you specify is rounded to the nearest frequency supported by the chip.

If the encoder is moving slowly and high-frequency noise is present, use the filter to eliminate the noise. With the filter in operation, the chip does not count the noise as encoder pulses. If the encoder is moving quickly, the filter can filter out the high-frequency pulses, including pulses that you want to count. In this case, consider disabling the filter by setting the cutoff frequency to `Inf`.

**Output data type — Data type of block output**

`double` (default) | `single` | `int8` | `uint8` | `int16` | `uint16` | `int32` | `uint32`

From the list, select the type of data that the block outputs to the model. The valid values depend on the capabilities of the board.

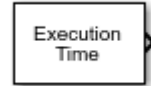
## See Also

Introduced before R2006a

## Execution Time

Output total execution time in external mode

**Library:** Target Profiling



## Description

In external mode, this block outputs the execution time.

In normal and accelerated modes, this block does not perform any action. It outputs zeros.

## Ports

### Output

**Total Exec Time** — Total execution time for the previous base rate tick  
double

Presents the total execution time as of the previous sample time.

**Task Exec Time** — Task execution times for individual sample rates (optional)  
vector of double

Presents the task execution times for individual sample rates in a multitasking model as of the previous sample time.

### Dependency

When you select **Measure task execution times**, this port is visible.

## Parameters

**Measure task execution times** — Show task execution times for individual tasks

`'off'` (default) | `'on'`

Makes visible the port `Task Exec Time`, which presents the task execution times for individual sample rates in a multitasking model as of the previous sample time.

## Model Examples

### See Also

Timestamp

Introduced in R2017a

## Frequency Output

Write to one or multiple frequency or PWM output channels

### Description

Generate and output a pulse-width-modulated square wave to an analog output.

The square wave alternates between low (0) and high (1) with a specified frequency and duty cycle.

You specify the frequency in hertz (Hz).

You specify the duty cycle as a decimal fraction from 0 through 1 inclusive. The duty cycle determines the amount of time that the output signal value is high (1).

After you have added a Frequency Output block to your model, double-click the Frequency Output block to open the Block Parameters: Frequency Output dialog box.

### Ports

#### Input

**Frequency** — Frequency of output waveform (optional)

vector

Frequency setting of waveform generator. The data type and range of the input values depend upon the capabilities of the board.

#### Dependency

When you set **Output signal frequency source** to `external`, this port is visible.

Data Types: `single` | `double` | `int8` | `uint8` | `int16` | `uint16` | `int32` | `uint32`

**Duty Cycle** — Duty cycle of output waveform (optional)

vector



Duty cycle setting of waveform generator. The data type and range of the input values depend upon the capabilities of the board.

### Dependency

When you set **Output signal duty source** to `external`, this port is visible.

Data Types: `single` | `double` | `int8` | `uint8` | `int16` | `uint16` | `int32` | `uint32`

## Output

### Missed Ticks — Missed tick count (optional)

`double`

In normal or accelerator modes, returns the number of timer ticks that your model lags behind the real-time kernel. When the model lags by more than **Maximum missed ticks**, the software reports an error and simulation stops.

### Dependency

When you select **Show “Missed Ticks” port**, this port is visible.

Data Types: `double`

## Parameters

### Install new board — Register a board

`< no board selected >` (default)

When you click **Install new board**, the software displays a list of manufacturers of supported boards. When you select a manufacturer, the software displays a list of boards available from that manufacturer. When you select a board, the software adds the board to the list of registered boards and makes that board the current board.

By default, the initial selection in the list of registered boards is `< no board selected >`.

### Dependency

When you select a board in the list of registered boards, the **Delete current board** and **Board setup** buttons are available.

### **Delete current board — Delete the current board**

(button)

To delete the current board, click this button. The initial selection of the list of registered boards changes to < no board selected >.

#### **Dependency**

To activate this parameter, select a board in the list of registered boards.

When you delete the current board, the **Delete current board** and **Board setup** buttons are no longer available.

### **Board setup — Set up the board**

(button)

To set up the board, click this button.

A board-specific dialog box opens to set up the board. For more information, see the board manufacturer documentation.

#### **Dependency**

To activate this parameter, select a board in the list of registered boards.

To deactivate this parameter, click **Delete current board**.

### **Sample time — Sample time of block**

0.1 (default) | double

Enter a value, in seconds, that represents how frequently you want the block to execute and interact with the I/O hardware. The block synchronizes your model with the real-time clock at this sample rate.

If you are using a fixed-step solver, enter the value that you entered as the **Fixed step size** configuration parameter or an integer multiple of that value.

### **Maximum missed ticks — Number of timer ticks by which your model can trail the kernel**

10 (default) | integer

In normal or accelerator modes, enter the number of timer ticks that your model can lag behind the real-time kernel. When the model lags behind by this number or fewer timer ticks, the software assumes that the lag is temporary. It allows the model to catch up,

even if the model misses some ticks. When the model lags by more than this number, the software reports an error and simulation stops.

In external mode, the software ignores this value.

**Show "Missed Ticks" port** — Send number of missed ticks to port `Missed Ticks`  
'off' (default) | 'on'

In normal or accelerator modes, select this check box to send the number of missed ticks to output port `Missed Ticks`.

In external mode, the `Missed Ticks` port is zero.

**Yield CPU when waiting** — Yield CPU while kernel waits for hardware  
'off' (default) | 'on'

In normal or accelerator modes, select this check box to grant other programs more CPU time while the kernel waits for a response from the hardware.

In external mode, the software ignores this value.

**Output channels** — Select frequency output channels  
vector

Enter a channel vector that selects the frequency output channels you are using on this board. The vector can be any valid MATLAB vector form. For example, to select the first eight digital output channels, enter:

```
[1, 2, 3, 4, 5, 6, 7, 8]
```

or

```
[1:8]
```

**Output signal frequency source** — Specify source of output frequency (Hz)  
external (default) | internal

Select the source that specifies the frequency to output, in Hz. The **Output signal frequency source** can be either of the following:

- `internal` — A tunable parameter named **Frequency** specifies the frequency.
- `external` (default) — A signal specifies the frequency. Input port `Frequency` appears on the block to accept the signal.

You can specify additional settings for **Frequency initial value** and **Frequency final value**.

### Dependency

If you specify `external` (the default), port `Frequency` and the parameters **Frequency initial value** and **Frequency final value** are visible.

If you specify `internal`, **Frequency** replaces **Frequency initial value** and **Frequency final value** is disabled.

### **Frequency** — Specify the output frequency (Hz)

scalar

This parameter replaces **Frequency initial value**.

### Dependency

To make this parameter visible, set **Output signal frequency source** to `internal`.

### **Frequency initial value** — Specify the frequency that the board generates before execution starts

scalar

Optionally specify an initial frequency in hertz. When you connect to the target, the specified frequency takes effect. It persists until simulation starts, when the value of the frequency signal takes effect. You can use this parameter to specify initial conditions and give them time to stabilize. If no value appears, connecting to the target has no effect on the frequency.

### Dependency

To make this parameter visible, set **Output signal frequency source** to `external`.

### **Frequency final value** — Specify the frequency that the board generates after execution ends

scalar

Optionally specify a final frequency in hertz. When simulation is complete, the specified frequency takes effect and persists indefinitely. Disconnecting from the target does not change the frequency. You can use this parameter to put a connected device into a neutral state after simulation. If no value appears, the frequency in effect at the end of simulation persists afterward.

### Dependency

To make this parameter visible, set **Output signal frequency source** to `external`.

### **Output signal duty source** — Specify source of output signal duty cycle

`internal` (default) | `external`

Specify the source that determines the duty cycle. The **Output signal duty source** can be either of the following:

- `internal` (default) — A tunable parameter named **Duty** specifies the duty cycle.
- `external` — A signal specifies the duty cycle. Input port `Duty Cycle` appears on the block to accept the signal.

### Dependency

If you specify `internal` (the default), **Duty** is visible. **Duty final value** is not visible.

If you specify `external`, port `Duty Cycle` appears, parameter **Duty initial value** replaces **Duty**, and parameter **Duty final value** is visible.

### **Duty** — Specify the time during which the output signal is high

`0.5` (default) | `0-1`

Specify the duty cycle as a decimal fraction from 0 through 1 inclusive. It determines the amount of time that the output signal value is high (1). For example, a duty cycle of `0.7` specifies that the output is high 70% of the time and low 30% of the time.

Two duty cycle values have special significance:

- `0` — The output signal is continuously low (0) regardless of the frequency specification currently in effect.
- `1` — The output signal is continuously high (1) regardless of the frequency specification currently in effect.

### Dependency

To make this parameter visible, set **Output signal duty source** to `internal`.

### **Duty initial value** — Specify the duty cycle of the board before execution starts

`0-1`

Optionally specify an initial duty cycle. When you connect to the target, the specified duty cycle takes effect. It persists until simulation starts. If no value appears, connecting to the target has no effect on the duty cycle. You can specify any duty cycle. Often the **Duty initial value** is 0 or 1, enforcing a continuously low or high initial output signal. Specifying 0 or 1 overrides any **Frequency initial value** setting.

### Dependency

To make this parameter visible, set **Output signal duty source** to external.

### **Duty final value** — Specify the duty cycle of the board after execution ends

0-1

Optionally specify a final duty cycle. When simulation is complete, the specified duty cycle takes effect and persists indefinitely. Disconnecting from the target does not change the duty cycle. If no value appears, the duty cycle in effect at the end of simulation persists indefinitely afterward. You can specify any duty cycle. Often the **Duty final value** is 0 or 1, enforcing a continuously low or high initial output signal. Specifying 0 or 1 overrides any **Frequency final value** setting.

### Dependency

To make this parameter visible, set **Output signal duty source** to external.

## See Also

Introduced in R2007b

# Other Input

Read from one or more input channels not handled by specific blocks

## Description

Connect to and read from hardware sources requiring specialized driver support that other Simulink Desktop Real-Time input blocks do not provide. The Other Input block is rarely used and only for a few drivers. For details, see the documentation for the driver that you intend to use.

If none of the available blocks, including Other Input, provide what you need, you can create your own I/O blocks to work with Simulink Desktop Real-Time applications. For more information, see “Custom I/O Driver Basics”.

## Ports

### Output

#### **Data** — Data read from input channels

vector

The data type and range of the output value depend on the capabilities of the board.

Data Types: `double` | `single` | `int8` | `uint8` | `int16` | `uint16` | `int32` | `uint32`

#### **Missed Ticks** — Missed tick count (optional)

double

In normal or accelerator modes, returns the number of timer ticks that your model lags behind the real-time kernel. When the model lags by more than **Maximum missed ticks**, the software reports an error and simulation stops.

#### **Dependency**

When you select **Show “Missed Ticks” port**, this port is visible.

Data Types: `double`

## Parameters

### **Install new board — Register a board**

< no board selected > (default)

When you click **Install new board**, the software displays a list of manufacturers of supported boards. When you select a manufacturer, the software displays a list of boards available from that manufacturer. When you select a board, the software adds the board to the list of registered boards and makes that board the current board.

By default, the initial selection in the list of registered boards is < no board selected >.

#### **Dependency**

When you select a board in the list of registered boards, the **Delete current board** and **Board setup** buttons are available.

### **Delete current board — Delete the current board**

(button)

To delete the current board, click this button. The initial selection of the list of registered boards changes to < no board selected >.

#### **Dependency**

To activate this parameter, select a board in the list of registered boards.

When you delete the current board, the **Delete current board** and **Board setup** buttons are no longer available.

### **Board setup — Set up the board**

(button)

To set up the board, click this button.

A board-specific dialog box opens to set up the board. For more information, see the board manufacturer documentation.

#### **Dependency**

To activate this parameter, select a board in the list of registered boards.



To deactivate this parameter, click **Delete current board**.

**Sample time — Sample time of block**

0.1 (default) | double

Enter a value, in seconds, that represents how frequently you want the block to execute and interact with the I/O hardware. The block synchronizes your model with the real-time clock at this sample rate.

If you are using a fixed-step solver, enter the value that you entered as the **Fixed step size** configuration parameter or an integer multiple of that value.

**Maximum missed ticks — Number of timer ticks by which your model can trail the kernel**

10 (default) | integer

In normal or accelerator modes, enter the number of timer ticks that your model can lag behind the real-time kernel. When the model lags behind by this number or fewer timer ticks, the software assumes that the lag is temporary. It allows the model to catch up, even if the model misses some ticks. When the model lags by more than this number, the software reports an error and simulation stops.

In external mode, the software ignores this value.

**Show "Missed Ticks" port — Send number of missed ticks to port Missed Ticks**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to send the number of missed ticks to output port Missed Ticks.

In external mode, the Missed Ticks port is zero.

**Yield CPU when waiting — Yield CPU while kernel waits for hardware**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to grant other programs more CPU time while the kernel waits for a response from the hardware.

In external mode, the software ignores this value.

**Input channels — Select other input channels**

1 (default) | vector

Enter a channel vector that selects the other input channels that you are using on this board. The vector can be any valid MATLAB vector form. For example, to select eight contiguous analog input channels, enter:

```
[1,2,3,4,5,6,7,8]
```

or

```
[1:8]
```

To select the first three input channels, enter:

```
[1,2,3]
```

### **Optional parameters — Specify optional parameters that the driver requires**

0 (default) | vector

See the manufacturer data sheet for the required values.

### **Output data type — Data type of block output**

double (default) | single | int8 | uint8 | int16 | uint16 | int32 | uint32

From the list, select the type of data that the block outputs to the model. The valid values depend on the capabilities of the board.

## See Also

Other Output

Introduced before R2006a

# Other Output

Write to one or more output channels not handled by specific blocks

## Description

Connect to and write to hardware sinks requiring specialized driver support that other Simulink Desktop Real-Time output blocks do not provide. The Other Output block is rarely used and only for a few drivers. For details, see the documentation for the driver that you intend to use.

If none of the available blocks, including Other Output, provide what you need, you can create your own I/O blocks to work with Simulink Desktop Real-Time applications. For more information, see “Custom I/O Driver Basics”.

## Ports

### Input

**Data** — Data to write to output channels

vector

The data type and range of the input value depend upon the capabilities of the board.

Data Types: `single` | `double` | `int8` | `uint8` | `int16` | `uint16` | `int32` | `uint32`

### Output

**Missed Ticks** — Missed tick count (optional)

double

In normal or accelerator modes, returns the number of timer ticks that your model lags behind the real-time kernel. When the model lags by more than **Maximum missed ticks**, the software reports an error and simulation stops.

### Dependency

When you select **Show “Missed Ticks” port**, this port is visible.

Data Types: double

## Parameters

### Install new board — Register a board

< no board selected > (default)

When you click **Install new board**, the software displays a list of manufacturers of supported boards. When you select a manufacturer, the software displays a list of boards available from that manufacturer. When you select a board, the software adds the board to the list of registered boards and makes that board the current board.

By default, the initial selection in the list of registered boards is < no board selected >.

### Dependency

When you select a board in the list of registered boards, the **Delete current board** and **Board setup** buttons are available.

### Delete current board — Delete the current board

(button)

To delete the current board, click this button. The initial selection of the list of registered boards changes to < no board selected >.

### Dependency

To activate this parameter, select a board in the list of registered boards.

When you delete the current board, the **Delete current board** and **Board setup** buttons are no longer available.

### Board setup — Set up the board

(button)

To set up the board, click this button.

A board-specific dialog box opens to set up the board. For more information, see the board manufacturer documentation.

### **Dependency**

To activate this parameter, select a board in the list of registered boards.

To deactivate this parameter, click **Delete current board**.

### **Sample time — Sample time of block**

0.1 (default) | double

Enter a value, in seconds, that represents how frequently you want the block to execute and interact with the I/O hardware. The block synchronizes your model with the real-time clock at this sample rate.

If you are using a fixed-step solver, enter the value that you entered as the **Fixed step size** configuration parameter or an integer multiple of that value.

### **Maximum missed ticks — Number of timer ticks by which your model can trail the kernel**

10 (default) | integer

In normal or accelerator modes, enter the number of timer ticks that your model can lag behind the real-time kernel. When the model lags behind by this number or fewer timer ticks, the software assumes that the lag is temporary. It allows the model to catch up, even if the model misses some ticks. When the model lags by more than this number, the software reports an error and simulation stops.

In external mode, the software ignores this value.

### **Show "Missed Ticks" port — Send number of missed ticks to port Missed Ticks**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to send the number of missed ticks to output port `Missed Ticks`.

In external mode, the `Missed Ticks` port is zero.

### **Yield CPU when waiting — Yield CPU while kernel waits for hardware**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to grant other programs more CPU time while the kernel waits for a response from the hardware.

In external mode, the software ignores this value.

**Output channels** — Channel vector that selects other output channels

1 (default) | vector

Enter a channel vector that selects the other output channels that you are using on this board. The vector can be any valid MATLAB vector form. For example, to select the first two other output channels, enter:

```
[1,2]
```

or

```
[1:2]
```

**Optional parameters** — Specify optional parameters that the driver requires

0 (default) | vector

See the manufacturer data sheet for the required values.

**Initial value** — Specify the value that the channel generates before execution starts

vector

Enter the initial value for each output channel that you entered in the **Output channels** box.

**Final value** — Specify the value that the channel generates after execution ends

vector

Enter the final value for each output channel that you entered in the **Output channels** box.

## See Also

Other Input

Introduced before R2006a

# Packet Input

Read binary data or a CAN message from a communication channel

## Description

Read unformatted binary data from a port or file. After you add a Packet Input block to your model, double-click the block to set its parameters.

The driver must be one of:

- **Standard Devices > Serial Port**
- **Standard Devices > UDP Protocol**
- **Standard Devices > File**
- **Vector > CAN Device**

When you install a UDP device, enter port addresses in decimal format in the Standard Devices UDP Protocol dialog box.

## Ports

### Output

**Output Data — Data received from communication channel**

vector

Data values that were received from the communication channel as unformatted binary data.

**Data Ready — Data ready port (optional)**

1 | 0

This port signals 1 if the block has new data available and 0 otherwise.

### Dependency

When you select **Show “Data Ready” port**, this port is visible.

### Data Error — Data error port (optional)

1 | 0

This port signals 1 if a data error occurs and 0 otherwise.

### Dependency

When you select **Show “Data Error” port**, this port is visible.

### Timestamp — Packet timestamp port (optional)

double

This port shows the timestamp for the CAN message packets.

### Dependency

When you select **Show packet timestamp port**, this port is visible.

### Missed Ticks — Missed tick count (optional)

double

In normal or accelerator modes, returns the number of timer ticks that your model lags behind the real-time kernel. When the model lags by more than **Maximum missed ticks**, the software reports an error and simulation stops.

### Dependency

When you select **Show “Missed Ticks” port**, this port is visible.

Data Types: double

## Parameters

### Install new board — Register a board

< no board selected > (default)

When you click **Install new board**, the software displays a list of manufacturers of supported boards. When you select a manufacturer, the software displays a list of boards



available from that manufacturer. When you select a board, the software adds the board to the list of registered boards and makes that board the current board.

By default, the initial selection in the list of registered boards is `< no board selected >`.

### **Dependency**

When you select a board in the list of registered boards, the **Delete current board** and **Board setup** buttons are available.

### **Delete current board — Delete the current board**

(button)

To delete the current board, click this button. The initial selection of the list of registered boards changes to `< no board selected >`.

### **Dependency**

To activate this parameter, select a board in the list of registered boards.

When you delete the current board, the **Delete current board** and **Board setup** buttons are no longer available.

### **Board setup — Set up the board**

(button)

To set up the board, click this button.

A board-specific dialog box opens to set up the board. For more information, see the board manufacturer documentation.

### **Dependency**

To activate this parameter, select a board in the list of registered boards.

To deactivate this parameter, click **Delete current board**.

### **Sample time — Sample time of block**

0.1 (default) | double

Enter a value, in seconds, that represents how frequently you want the block to execute and interact with the I/O hardware. The block synchronizes your model with the real-time clock at this sample rate.

If you are using a fixed-step solver, enter the value that you entered as the **Fixed step size** configuration parameter or an integer multiple of that value.

**Maximum missed ticks — Number of timer ticks by which your model can trail the kernel**  
10 (default) | integer

In normal or accelerator modes, enter the number of timer ticks that your model can lag behind the real-time kernel. When the model lags behind by this number or fewer timer ticks, the software assumes that the lag is temporary. It allows the model to catch up, even if the model misses some ticks. When the model lags by more than this number, the software reports an error and simulation stops.

In external mode, the software ignores this value.

**Show "Missed Ticks" port — Send number of missed ticks to port Missed Ticks**  
'off' (default) | 'on'

In normal or accelerator modes, select this check box to send the number of missed ticks to output port `Missed Ticks`.

In external mode, the `Missed Ticks` port is zero.

**Yield CPU when waiting — Yield CPU while kernel waits for hardware**  
'off' (default) | 'on'

In normal or accelerator modes, select this check box to grant other programs more CPU time while the kernel waits for a response from the hardware.

In external mode, the software ignores this value.

**Packet identifier — Identifier of the packet**  
1 (default) | vector

Enter the ID of the packet to process. If your protocol does not have packet IDs, this parameter is disabled.

**Extended identifier — Extended identifier of the packet (CAN boards only)**  
'off' (default) | 'on'

Select this check box if **Packet identifier** is an extended identifier.

**Input packet size — Number of bytes that each input packet contains**

32 (default) | integer

Enter the number of bytes expected in each input packet. This number must match the number of bytes required by the type specifications in **Block output data types**.

**Block output data types — Output type and grouping of data from the packet**

'4\*double' (default) | character vector | cell array of character vector

One or more character vectors that specify how the data in each packet is to be typed and grouped for input to the application. The Packet Input block has an output port corresponding to each character vector in **Block output data types**. Changing the number of character vectors changes the number of output ports.

Each character vector has the format  $[n*]datatype$ . The data that the character vector describes has the type specified by *datatype* and the width specified by *n*. If *n* is not specified, the width is 1. For example, 'double' means one double value, and '4\*int8' means a vector of four int8 values. You can also type 'CAN\_MESSAGE' to specify a single CAN\_MESSAGE value.

By providing a cell array of such character vectors, you can convert an input packet into the types required, packaged into vectors. For example, specifying {'int16', 'int16', 'double'} creates three ports. The first and second each output an int16 value, and the third outputs a double. Specifying {'2\*int16', 'double'} creates two ports: a vector of two int16 values, and a scalar double.

The block forces an out-of-range value to the maximum value for that data type.

**Input packet field byte order — Byte order of packet acquired from device**

Little Endian (default) | Big Endian

From the list, select:

- Little Endian (default) — Send multibyte values in little-endian format.
- Big Endian — Send multibyte values in big-endian format.

**Show "Data Ready" port — Add port Data Ready that signals 1 when data is available**

'off' (default) | 'on'

When you select this check box, the block makes visible the output port Data Ready. This port signals 1 when the block has new data available and 0 otherwise.

**Show "Data Error" port — Add port Data Error that signals 1 if error occurs**  
'off' (default) | 'on'

When you select this check box, the block makes visible the output port `Data Error`. This port signals 1 when a data error occurs and 0 otherwise.

**Show packet timestamp port — Add port Timestamp that outputs CAN message timestamps**  
'off' (default) | 'on'

When you select this check box, the block makes visible the output port `Timestamp`. This port shows the timestamps for the CAN message packets. If your protocol does not have packet timestamps, the block ignores this value.

## Model Examples

### See Also

Packet Output

Introduced in R2007b

# Packet Output

Write binary data or a CAN message to a communication channel

## Description

Connect to and write unformatted binary data to a port, file, or CAN device. After you add a Packet Output block to your model, double-click the block to set its parameters.

The driver must be one of:

- **Standard Devices > Serial Port**
- **Standard Devices > UDP Protocol**
- **Standard Devices > File**
- **Vector > CAN Device**

When you install a UDP device, enter port addresses in decimal format in the Standard Devices UDP Protocol dialog box.

Any serial output port can send data with sample rates up to 500 Hz. To enable a faster sample rate of up to 10 kHz for some output serial ports, click **Install new board**, select **Standard Devices > Serial Port**, and select **Direct port access**.

The block does not support this option with all types of serial output hardware.

## Ports

### Input

**Input Data** — Data to write to communication channel  
vector

Data values that are sent to communication channel as unformatted binary data.

Data Types: `single` | `double` | `int8` | `uint8` | `int16` | `uint16` | `int32` | `uint32`

### Output

#### **Data Ready** — Data ready port (optional)

1 | 0

This port signals 1 if the block is ready to accept new data and 0 otherwise.

#### **Dependency**

When you select **Show “Data Ready” port**, this port is visible.

#### **Data Error** — Data error port (optional)

1 | 0

This port signals 1 if a data error occurs and 0 otherwise.

#### **Dependency**

When you select **Show “Data Error” port**, this port is visible.

#### **Missed Ticks** — Missed tick count (optional)

double

In normal or accelerator modes, returns the number of timer ticks that your model lags behind the real-time kernel. When the model lags by more than **Maximum missed ticks**, the software reports an error and simulation stops.

#### **Dependency**

When you select **Show “Missed Ticks” port**, this port is visible.

Data Types: double

### Parameters

#### **Install new board** — Register a board

< no board selected > (default)

When you click **Install new board**, the software displays a list of manufacturers of supported boards. When you select a manufacturer, the software displays a list of boards available from that manufacturer. When you select a board, the software adds the board to the list of registered boards and makes that board the current board.

By default, the initial selection in the list of registered boards is `< no board selected >`.

### **Dependency**

When you select a board in the list of registered boards, the **Delete current board** and **Board setup** buttons are available.

### **Delete current board — Delete the current board**

(button)

To delete the current board, click this button. The initial selection of the list of registered boards changes to `< no board selected >`.

### **Dependency**

To activate this parameter, select a board in the list of registered boards.

When you delete the current board, the **Delete current board** and **Board setup** buttons are no longer available.

### **Board setup — Set up the board**

(button)

To set up the board, click this button.

A board-specific dialog box opens to set up the board. For more information, see the board manufacturer documentation.

### **Dependency**

To activate this parameter, select a board in the list of registered boards.

To deactivate this parameter, click **Delete current board**.

### **Sample time — Sample time of block**

0.1 (default) | double

Enter a value, in seconds, that represents how frequently you want the block to execute and interact with the I/O hardware. The block synchronizes your model with the real-time clock at this sample rate.

If you are using a fixed-step solver, enter the value that you entered as the **Fixed step size** configuration parameter or an integer multiple of that value.

**Maximum missed ticks** — Number of timer ticks by which your model can trail the kernel  
10 (default) | integer

In normal or accelerator modes, enter the number of timer ticks that your model can lag behind the real-time kernel. When the model lags behind by this number or fewer timer ticks, the software assumes that the lag is temporary. It allows the model to catch up, even if the model misses some ticks. When the model lags by more than this number, the software reports an error and simulation stops.

In external mode, the software ignores this value.

**Show "Missed Ticks" port** — Send number of missed ticks to port `Missed Ticks`  
'off' (default) | 'on'

In normal or accelerator modes, select this check box to send the number of missed ticks to output port `Missed Ticks`.

In external mode, the `Missed Ticks` port is zero.

**Yield CPU when waiting** — Yield CPU while kernel waits for hardware  
'off' (default) | 'on'

In normal or accelerator modes, select this check box to grant other programs more CPU time while the kernel waits for a response from the hardware.

In external mode, the software ignores this value.

**Packet identifier** — Identifier of the packet  
1 (default) | vector

Enter the ID of the packet to process. If your protocol does not have packet IDs, this parameter is disabled.

**Extended identifier** — Extended identifier of the packet (CAN boards only)  
'off' (default) | 'on'

Select this check box if **Packet identifier** is an extended identifier.

**Output packet size** — Number of bytes that each input packet contains  
32 (default) | integer



Enter the number of bytes expected in each input packet. This number must match the number of bytes required by the type specifications in **Output packet data types**.

**Output packet field data types — Output type and grouping of data in the packet sent to the device**

'4\*double' (default) | character vector | cell array of character vector

One or more character vectors that specify how data provided by the application is formatted into a packet. The Packet Output block has an input port corresponding to each character vector in **Output packet field data types**. Changing the number of character vectors changes the number of ports.

Each character vector has the format  $[n^*]datatype$ . The data that the character vector describes has the type specified by *datatype* and the width specified by *n*. If *n* is not specified, the width is 1. For example, 'double' means one double value, and '4\*int8' means a vector of four int8 values. You can also type 'CAN\_MESSAGE' to specify a single CAN\_MESSAGE value.

The signal input to each port of the Packet Output block can be a scalar or vector of the data type. The character vector for each port specifies the type to be used when its signal is output to the device. If the character vector for a port matches the type of the signal input to that port, the signal value appears verbatim in the output packet.

You can also perform type conversion on output. For example, assume that the input is a four-element int16 vector and the character vector is '4\*int8'. The four integers are converted to int8 before being written to the packet. The resulting data occupies 4 bytes in the output packet.

The block forces an out-of-range value to the maximum value for that data type.

**Output packet field byte order — Byte order of packet being sent to device**

Little Endian (default) | Big Endian

From the list, select:

- Little Endian (default) — Receive multibyte values in little-endian format.
- Big Endian — Receive multibyte values in big-endian format.

**Show "Data Ready" port — Add port Data Ready that signals 1 when the block can accept new data**

'off' (default) | 'on'

When you select this check box, the block makes visible the output port `Data Ready`. This output port signals 1 when the block is ready to accept new data and otherwise signals 0.

**Show "Data Error" port — Add port Data Error that signals 1 if error occurs**  
'off' (default) | 'on'

When you select this check box, the block makes visible the output port `Data Error`. This port signals 1 when a data error occurs and 0 otherwise.

**Initial value — Data to send when simulation begins**  
vector

Optional. Enter a vector that has the same number of elements as the sum of the widths of the input signals across all ports. When simulation begins, send the specified data before the other data that is sent during simulation.

**Final value — Data to send when simulation ends**  
vector

Optional. Enter a vector that has the same number of elements as the sum of the widths of the input signals across all ports. When simulation ends, after the other data that is sent during simulation, send the specified data.

## Model Examples

### See Also

Packet Input

Introduced in R2007b

# Real-Time Sync

Synchronize model execution to real time in normal mode or accelerator mode

## Description

Synchronize your Simulink model with the real-time kernel clock at Real-Time Sync block sample hits. The parameters specify only sample time and missed tick values. There are no input ports.

The Real-Time Sync block operates only in the Simulink normal and accelerator modes. It has no function in Simulink external mode.

If the normal mode or accelerator mode model contains another Simulink Desktop Real-Time block, the other block synchronizes the Simulink model with the real-time clock. Do not include the Real-Time Sync block in such a model.

## Ports

### Output

**Missed Ticks** — Missed tick count (optional)

double

In normal or accelerator modes, returns the number of timer ticks that your model lags behind the real-time kernel. When the model lags by more than **Maximum missed ticks**, the software reports an error and simulation stops.

### Dependency

When you select **Show “Missed Ticks” port**, this port is visible.

Data Types: double

## Parameters

### **Sample time — Sample time of block**

0.1 (default) | double

Enter a value, in seconds, that represents how frequently you want the block to execute and interact with the I/O hardware. The block synchronizes your model with the real-time clock at this sample rate.

If you are using a fixed-step solver, enter the value that you entered as the **Fixed step size** configuration parameter or an integer multiple of that value.

### **Maximum missed ticks — Number of timer ticks by which your model can trail the kernel**

10 (default) | integer

In normal or accelerator modes, enter the number of timer ticks that your model can lag behind the real-time kernel. When the model lags behind by this number or fewer timer ticks, the software assumes that the lag is temporary. It allows the model to catch up, even if the model misses some ticks. When the model lags by more than this number, the software reports an error and simulation stops.

In external mode, the software ignores this value.

### **Show "Missed Ticks" port — Send number of missed ticks to port Missed Ticks**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to send the number of missed ticks to output port Missed Ticks.

In external mode, the Missed Ticks port is zero.

### **Yield CPU when waiting — Yield CPU while kernel waits for hardware**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to grant other programs more CPU time while the kernel waits for a response from the hardware.

In external mode, the software ignores this value.

## Model Examples

## See Also

Introduced in R2012a

## Stream Input

Read formatted ASCII data from communication channel

### Description

Read formatted ASCII data from a port or file. After you have added a Stream Input block to your model, double-click the Stream Input block to open the Block Parameters: Stream Input dialog box.

The driver must be one of:

- **Standard Devices > Serial Port**
- **Standard Devices > File**
- **Standard Devices > UDP Protocol**

Specify parameter values as required, then click **OK** or **Apply**. When you install a UDP device, enter port addresses in decimal format in the Standard Devices UDP Protocol dialog box.

### Ports

#### Output

**Output Data** — **Data received from communication channel**  
character vector

Data values that were received from the communication channel as formatted ASCII data and decoded according to **Format string**.

**Data Ready** — **Data ready port (optional)**  
1 | 0

This port signals 1 if the block has new data available and 0 otherwise.

**Dependency**

When you select **Show “Data Ready” port**, this port is visible.

**Data Error — Data error port (optional)**

1 | 0

This port signals 1 if a data error occurs and 0 otherwise.

**Dependency**

When you select **Show “Data Error” port**, this port is visible.

**Missed Ticks — Missed tick count (optional)**

double

In normal or accelerator modes, returns the number of timer ticks that your model lags behind the real-time kernel. When the model lags by more than **Maximum missed ticks**, the software reports an error and simulation stops.

**Dependency**

When you select **Show “Missed Ticks” port**, this port is visible.

Data Types: double

## Parameters

**Install new board — Register a board**

< no board selected > (default)

When you click **Install new board**, the software displays a list of manufacturers of supported boards. When you select a manufacturer, the software displays a list of boards available from that manufacturer. When you select a board, the software adds the board to the list of registered boards and makes that board the current board.

By default, the initial selection in the list of registered boards is < no board selected >.

**Dependency**

When you select a board in the list of registered boards, the **Delete current board** and **Board setup** buttons are available.

### **Delete current board — Delete the current board**

(button)

To delete the current board, click this button. The initial selection of the list of registered boards changes to < no board selected >.

#### **Dependency**

To activate this parameter, select a board in the list of registered boards.

When you delete the current board, the **Delete current board** and **Board setup** buttons are no longer available.

### **Board setup — Set up the board**

(button)

To set up the board, click this button.

A board-specific dialog box opens to set up the board. For more information, see the board manufacturer documentation.

#### **Dependency**

To activate this parameter, select a board in the list of registered boards.

To deactivate this parameter, click **Delete current board**.

### **Sample time — Sample time of block**

0.1 (default) | double

Enter a value, in seconds, that represents how frequently you want the block to execute and interact with the I/O hardware. The block synchronizes your model with the real-time clock at this sample rate.

If you are using a fixed-step solver, enter the value that you entered as the **Fixed step size** configuration parameter or an integer multiple of that value.

### **Maximum missed ticks — Number of timer ticks by which your model can trail the kernel**

10 (default) | integer

In normal or accelerator modes, enter the number of timer ticks that your model can lag behind the real-time kernel. When the model lags behind by this number or fewer timer ticks, the software assumes that the lag is temporary. It allows the model to catch up,



even if the model misses some ticks. When the model lags by more than this number, the software reports an error and simulation stops.

In external mode, the software ignores this value.

**Show "Missed Ticks" port** — Send number of missed ticks to port `Missed Ticks`  
'off' (default) | 'on'

In normal or accelerator modes, select this check box to send the number of missed ticks to output port `Missed Ticks`.

In external mode, the `Missed Ticks` port is zero.

**Yield CPU when waiting** — Yield CPU while kernel waits for hardware  
'off' (default) | 'on'

In normal or accelerator modes, select this check box to grant other programs more CPU time while the kernel waits for a response from the hardware.

In external mode, the software ignores this value.

**Block output data types** — Output type and grouping of data sent to the block outputs  
'double' (default) | character vector | cell array of character vector

A character vector or a cell array of character vectors. The block has as many output ports as the number of character vectors. Each vector specifies a data type by name, and optionally the number of items of that data type in an output vector. For example, 'double' means one double value, and '4\*int8' means four int8 values.

The values made available on output ports are grouped and typed according to the **Block output data types** character vectors. For example, if **Block output data types** is {'2\*int8', '3\*double'}, the block outputs:

- On output port 1 — an int8 vector of width 2
- On output port 2 — a double vector of width 3

**Format string** — Format of data items being read from the stream  
'%f' (default) | character vector

A specification in the same format used by C library I/O routines like `scanf`. The format string describes the data to be received. The number of elements in the format string must equal the number of data items specified in **Block output data types**.

For example, assume that **Block output data types** is `{'2*int8', '3*double'}` and **Format string** is `'%d %d %f %f %f'`. The block reads an ASCII representation of two integers and three doubles. The block makes the resulting values available to the application on:

- Output port 1 — an `int8` vector of width 2
- Output port 2 — a `double` vector of width 3

If the data type specified for a value in **Block output data types** differs from the type of the corresponding element in **Format string**, type conversion occurs. The block reads data as specified by **Format string**, converts the data to match the **Block output data types**, and provides the data to the application on the block output ports.

### **Message termination — Specify end of message**

`{'\r', '\n'}` (default) | character vector | cell array of character vector | integer

A character vector, cell array of character vectors, or a number. If the value is a character vector, receiving this sequence of characters terminates data input. If the value is a cell array, any character vector in the cell array terminates data input. If the value is a number, data input terminates after reading the specified number of characters.

### **Show "Data Ready" port — Add port Data Ready that signals 1 when data is available**

`'off'` (default) | `'on'`

When you select this check box, the block makes visible the output port `Data Ready`. This port signals 1 when the block has new data available and 0 otherwise.

### **Show "Data Error" port — Add port Data Error that signals 1 if error occurs**

`'off'` (default) | `'on'`

When you select this check box, the block makes visible the output port `Data Error`. This port signals 1 when a data error occurs and 0 otherwise.

## Model Examples

### See Also

Stream Output

**Introduced in R2007b**

## Stream Output

Write formatted ASCII data to communication channel

### Description

Write formatted ASCII data to a port or file. After you have added a Stream Output block to your model, double-click the Stream Output block to open the Block Parameters: Stream Output dialog box.

The driver must be one of:

- **Standard Devices > Serial Port**
- **Standard Devices > File**
- **Standard Devices > UDP Protocol**

When you install a UDP device, enter port addresses in decimal format in the Standard Devices UDP Protocol dialog box.

Any serial output port can send data with sample rates up to 500 Hz. To enable a faster sample rate of up to 10 kHz for some output serial ports, click **Install new board**, select **Standard Devices > Serial Port**, and select **Direct port access**.

The block does not support this option with all types of serial output hardware.

### Ports

#### Input

**Input Data** — **Data to write to communication channel**  
character vector

Data values that are sent to the communication channel as ASCII data, encoded according to **Format string**.

## Output

### Data Ready — Data ready port (optional)

1 | 0

This port signals 1 if the block is ready to accept new data and 0 otherwise.

#### Dependency

When you select **Show “Data Ready” port**, this port is visible.

### Data Error — Data error port (optional)

1 | 0

This port signals 1 if a data error occurs and 0 otherwise.

#### Dependency

When you select **Show “Data Error” port**, this port is visible.

### Missed Ticks — Missed tick count (optional)

double

In normal or accelerator modes, returns the number of timer ticks that your model lags behind the real-time kernel. When the model lags by more than **Maximum missed ticks**, the software reports an error and simulation stops.

#### Dependency

When you select **Show “Missed Ticks” port**, this port is visible.

Data Types: double

## Parameters

### Install new board — Register a board

< no board selected > (default)

When you click **Install new board**, the software displays a list of manufacturers of supported boards. When you select a manufacturer, the software displays a list of boards available from that manufacturer. When you select a board, the software adds the board to the list of registered boards and makes that board the current board.

By default, the initial selection in the list of registered boards is `< no board selected >`.

### **Dependency**

When you select a board in the list of registered boards, the **Delete current board** and **Board setup** buttons are available.

### **Delete current board — Delete the current board**

(button)

To delete the current board, click this button. The initial selection of the list of registered boards changes to `< no board selected >`.

### **Dependency**

To activate this parameter, select a board in the list of registered boards.

When you delete the current board, the **Delete current board** and **Board setup** buttons are no longer available.

### **Board setup — Set up the board**

(button)

To set up the board, click this button.

A board-specific dialog box opens to set up the board. For more information, see the board manufacturer documentation.

### **Dependency**

To activate this parameter, select a board in the list of registered boards.

To deactivate this parameter, click **Delete current board**.

### **Sample time — Sample time of block**

0.1 (default) | double

Enter a value, in seconds, that represents how frequently you want the block to execute and interact with the I/O hardware. The block synchronizes your model with the real-time clock at this sample rate.

If you are using a fixed-step solver, enter the value that you entered as the **Fixed step size** configuration parameter or an integer multiple of that value.

**Maximum missed ticks** — Number of timer ticks by which your model can trail the kernel  
10 (default) | integer

In normal or accelerator modes, enter the number of timer ticks that your model can lag behind the real-time kernel. When the model lags behind by this number or fewer timer ticks, the software assumes that the lag is temporary. It allows the model to catch up, even if the model misses some ticks. When the model lags by more than this number, the software reports an error and simulation stops.

In external mode, the software ignores this value.

**Show "Missed Ticks" port** — Send number of missed ticks to port `Missed Ticks`  
'off' (default) | 'on'

In normal or accelerator modes, select this check box to send the number of missed ticks to output port `Missed Ticks`.

In external mode, the `Missed Ticks` port is zero.

**Yield CPU when waiting** — Yield CPU while kernel waits for hardware  
'off' (default) | 'on'

In normal or accelerator modes, select this check box to grant other programs more CPU time while the kernel waits for a response from the hardware.

In external mode, the software ignores this value.

**Input port sizes** — Specify number and width of ports  
1 (default) | vector

Enter a port width, or vector of port widths. The number of elements determines the number of input ports. Each port has the width specified by the corresponding element. For example, specifying `[3, 1, 2]` indicates that the block has three input ports: a vector of width 3, a scalar, and a vector of width 2, for a total of six elements. You specify only the widths.

**Format string** — Format of data items being written to the stream  
'%g' (default) | character vector

Enter a specification in the same format used by C library I/O routines like `printf`. The format string describes the data to be sent. The format string must have the same number of specifiers as the sum of the elements of **Input port sizes**.

For example, assume that **Input port sizes** is [3, 1, 2]. Then a **Format string** of '%d %d %d %f %d %d' outputs ASCII representing:

- Three integers from the vector on the first input port
- One double from the scalar on the input second port
- Two integers from the vector on the third input port

If the data type specified in the **Format string** for a value differs from the type of the actual value, type conversion occurs. Converted data that conforms to the **Format string** is output as ASCII to the device.

**Show "Data Ready" port — Add port Data Ready that signals 1 when the block can accept new data**

'off' (default) | 'on'

When you select this check box, the block makes visible the output port `Data Ready`. This output port signals 1 when the block is ready to accept new data and otherwise signals 0.

**Show "Data Error" port — Add port Data Error that signals 1 if error occurs**

'off' (default) | 'on'

When you select this check box, the block makes visible the output port `Data Error`. This port signals 1 when a data error occurs and 0 otherwise.

**Initial string — Data to send when simulation begins**

character vector

Optional. Enter a character vector. When simulation begins, send the specified data before the other data that is sent during simulation.

The character vector can contain anything. You can use it to initialize a device. It is sent literally as specified, without reference to **Format string**.

**Final string — Data to send when simulation ends**

character vector

Optional. Enter a character vector. When simulation ends, after the other data that is sent during simulation, send the specified data.



The character vector can contain anything. You can use it to shut down a device. It is sent literally as specified, without reference to **Format string**

## Model Examples

### See Also

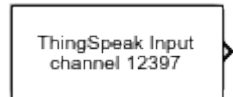
Stream Input

Introduced in R2007b

## ThingSpeak Input

Read input fields from ThingSpeak channel

**Library:** Internet of Things



### Description

The ThingSpeak Input block reads numeric data from ThingSpeak™ channels.

By default, this block uses the public ThingSpeak server, `api.thingspeak.com`. To configure the ThingSpeak channel, click **Configure channel parameters**.

To access the web page for **Channel number**, click **View channel web page**.

This block does not synchronize the ThingSpeak timestamp with the simulation time. For example, assume that the block is set to a sample time of 0.1 s and that the channel update period is 20 s. The sensor acquires new data at time  $T$  and transmits it to the ThingSpeak server, which gives the data a timestamp. If new data arrives before the 20 s update period has passed, the new data is lost. The block runs every 0.1 s and gets new data only every 20 s. The rest of the time, the block gets old data.

### Ports

#### Output

**Data** — Data read from channel

numeric

Scalar numeric data read from the ThingSpeak channel.

Example: 3.14159

#### Dependency

The setting of the **Output data type** parameter determines the port data type.

Data Types: `single` | `double` | `int8` | `int16` | `int32` | `uint8` | `uint16` | `uint32`

## Parameters

### **Channel number** — ThingSpeak channel being accessed

0 (default) | numeric

This property is read-only.

To select a channel, click the **Configure channel parameters** button. In the Network Services ThingSpeak dialog box, set the **Channel ID** parameter.

### **Configure channel parameters** — Select and configure channel to access

(button)

To configure the channel, click this button. A dialog box displays the channel parameter settings.

To accept your changes, click **OK**. To test your changes, click **Test**. To revert your settings to their previous values, click **Revert**. To exit the dialog box without changing the settings, click **Cancel**.

### **ThingSpeak server** — Server for data transfer

`api.thingspeak.com` (default) | character vector

The default value is the standard address of the public ThingSpeak server.

### **Channel ID** — Unique channel

12397 (default) | numeric

Select a unique channel among the available channels.

You cannot read and write over the same ThingSpeak channel in the same model.

### **Read API key** — Access key for reading from channel

character vector

By default, this key is the API key for the channel on the public server, `api.thingspeak.com`.

### **Update period (secs) — Read update period, in seconds**

20 (default) | numeric

Time between successive reads over the channel.

### **View channel web page — Access web page for channel**

(button)

To access the web page for **Channel number**, click **View channel web page**.

### **Sample time — Sample time of block**

0.1 (default) | double

Enter a value, in seconds, that represents how frequently you want the block to execute and interact with the I/O hardware. The block synchronizes your model with the real-time clock at this sample rate.

If you are using a fixed-step solver, enter the value that you entered as the **Fixed step size** configuration parameter or an integer multiple of that value.

### **Maximum missed ticks — Number of timer ticks by which your model can trail the kernel**

10 (default) | integer

In normal or accelerator modes, enter the number of timer ticks that your model can lag behind the real-time kernel. When the model lags behind by this number or fewer timer ticks, the software assumes that the lag is temporary. It allows the model to catch up, even if the model misses some ticks. When the model lags by more than this number, the software reports an error and simulation stops.

In external mode, the software ignores this value.

### **Show "Missed Ticks" port — Send number of missed ticks to port Missed Ticks**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to send the number of missed ticks to output port `Missed Ticks`.

In external mode, the `Missed Ticks` port is zero.

### **Yield CPU when waiting — Yield CPU while kernel waits for hardware**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to grant other programs more CPU time while the kernel waits for a response from the hardware.

In external mode, the software ignores this value.

#### **Channel fields to read — Define which parts of channel to read**

`1` (default) | `[1-8]`

You can read 1-8 fields from each channel. Use this parameter to ignore implementation-specific information and receive only the fields that your application requires.

#### **Output data type — Define data type of output port**

`double` (default) | `single` | `int8` | `uint8` | `int16` | `uint16` | `int32` | `uint32` | `<data type expression>`

Define the data type of the output port.

To open the Data Type Assistant, click the `>>` button. To close the Data Type Assistant, click the `<<` button.

#### **Mode — Method of defining type**

`Built in` (default) | `Expression`

Use a built-in type, such as `double` or one defined by a data type expression.

#### **Type — Data type selector**

`double` (default) | `single` | `int8` | `uint8` | `int16` | `uint16` | `int32` | `uint32`

Set of built-in types that are available for constructing data type expressions.

#### **Data type override — Policy on a signal type mismatch**

`inherit` (default) | `off`

- `inherit` — Port inherits type of signal that it is connected to.
- `off` — Port sets signal data type to the type defined by this block.

## See Also

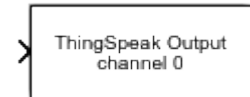
ThingSpeak Output

**Introduced in R2017b**

# ThingSpeak Output

Write output fields to ThingSpeak channel

**Library:** Internet of Things



## Description

The ThingSpeak Output block writes numeric data to 1–8 ThingSpeak channels.

By default, this block uses the public ThingSpeak server, `api.thingspeak.com`. To configure the ThingSpeak channel, click **Configure channel parameters**.

To access the web page for **Channel number**, click **View channel web page**.

This block does not synchronize the ThingSpeak timestamp with the simulation time. For example, assume that the block is set to a sample time of 0.1 s and that the channel update period is 20 s. The block transmits the data at a particular simulation time,  $T$ , but ThingSpeak writes the data and gives it a timestamp only at the 20 update period.

## Ports

### Input

**Data** — Data to write to channel

numeric

Scalar numeric data to write to the ThingSpeak channel.

Example: 3.14159

Data Types: `single` | `double` | `int8` | `int16` | `int32` | `uint8` | `uint16` | `uint32`

## Parameters

### **Channel number** — ThingSpeak channel being accessed

0 (default) | numeric

This property is read-only.

To select a channel, click the **Configure channel parameters** button. In the Network Services ThingSpeak dialog box, set the **Channel ID** parameter.

### **Configure channel parameters** — Select and configure channel to access

(button)

To configure the channel, click this button. A dialog box displays the channel parameter settings.

To accept your changes, click **OK**. To test your changes, click **Test**. To revert your settings to their previous values, click **Revert**. To exit the dialog box without changing the settings, click **Cancel**.

### **ThingSpeak server** — Server for data transfer

`api.thingspeak.com` (default) | character vector

The default value is the standard address of the public ThingSpeak server.

### **Channel ID** — Unique channel

0 (default) | numeric

Select a unique channel among the available channels.

You cannot read and write over the same ThingSpeak channel in the same model.

### **Write API key** — Access key for writing to channel

character vector

By default, this key is the API key for the channel on the public server, `api.thingspeak.com`.

### **Update period (secs)** — Read update period, in seconds

20 (default) | numeric

Time between successive reads over the channel.



**View channel web page — Access web page for channel**  
(button)

To access the web page for **Channel number**, click **View channel web page**.

**Sample time — Sample time of block**

0.1 (default) | double

Enter a value, in seconds, that represents how frequently you want the block to execute and interact with the I/O hardware. The block synchronizes your model with the real-time clock at this sample rate.

If you are using a fixed-step solver, enter the value that you entered as the **Fixed step size** configuration parameter or an integer multiple of that value.

**Maximum missed ticks — Number of timer ticks by which your model can trail the kernel**

10 (default) | integer

In normal or accelerator modes, enter the number of timer ticks that your model can lag behind the real-time kernel. When the model lags behind by this number or fewer timer ticks, the software assumes that the lag is temporary. It allows the model to catch up, even if the model misses some ticks. When the model lags by more than this number, the software reports an error and simulation stops.

In external mode, the software ignores this value.

**Show "Missed Ticks" port — Send number of missed ticks to port Missed Ticks**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to send the number of missed ticks to output port Missed Ticks.

In external mode, the Missed Ticks port is zero.

**Yield CPU when waiting — Yield CPU while kernel waits for hardware**

'off' (default) | 'on'

In normal or accelerator modes, select this check box to grant other programs more CPU time while the kernel waits for a response from the hardware.

In external mode, the software ignores this value.

### **Output fields — Define which parts of data to write**

1 (default) | [1-8]

You can write 1-8 fields to each channel. Use this parameter to ignore implementation-specific information and transmit only the fields that your application requires.

### **Initial value — First value transmitted**

[] (default) | [integer]

Transmit an initial value, for example an initial state value or an initialization command.

### **Final value — Last value transmitted**

[] (default) | [integer]

Transmit a final value, for example a final state value or a wrap-up command.

## **See Also**

ThingSpeak Input

**Introduced in R2017b**

# Timestamp

Output signal timestamp in external mode

**Library:** Target Profiling



## Description

In external mode, this block outputs the timestamp for its input signal. The timestamp is relative to model start time. The input signal can be any signal of any data type.

In normal and accelerated modes, this block does not perform any action. It outputs zeros.

## Ports

### Input

**signals** — Signals for which to capture timestamps  
vector

The actual data values are ignored.

### Output

**Timestamps** — Timestamps of signals  
vector of double

For each signal connected to `signals`, the block returns the signal timestamp measured from the beginning of model execution.

## Model Examples

### See Also

Execution Time

**Introduced in R2017a**

# Configuration Parameters

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## Simulink Desktop Real-Time Pane

Parameter	Description
“Code replacement library” on page 3-4	Specify a target-specific floating-point math library extension
“Shared code placement” on page 3-5	Specify the location for generating shared utility code
“Generate assembly listings” on page 3-6	Instruct the C compiler to generate assembly listings for the generated code.
“Rebuild all” on page 3-7	Force the object files to be rebuilt regardless of their timestamps.
“External mode” on page 3-8	Enable client/server communication between Simulink software and an application.
“Transport layer” on page 3-10	Specify the transport protocol for external mode communication.
“MEX-file arguments” on page 3-11	Specify external mode MEX arguments.

Control the code created by Simulink Coder™ code generation software for a Simulink Desktop Real-Time application.

### Configuration

The **Simulink Desktop Real-Time** node in the Configuration Parameters dialog box allows you to specify how the software generates the real-time application. To reveal the **Simulink Desktop Real-Time** node, in the **Code Generation** pane, in the **System target file** list, select one of these settings:

- `sldrt.tlc`

Generate system target code for Simulink Desktop Real-Time.

- `sldrtert.tlc`

Generate system target code for a Simulink Desktop Real-Time using the required Embedded Coder software.

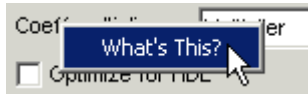
---

**Note** If you open a model that was originally saved with **System target file** set to `rtwin.tlc`, the software updates the setting to `sldrt.tlc`, and likewise with `rtwinert.tlc` and `sldrtert.tlc`. To retain the updated setting, save the updated model.

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## To get help on an option

- 1 Right-click the option text label.
- 2 From the context menu, select **What's This**.



# Code replacement library

Specify a target-specific floating-point math library extension

## Settings

**Default:** None

None

Does not use a code replacement library.

GNU C99 extensions

Generates calls to the GNU® gcc math library, which provides C99 extensions as defined by compiler option `-std=gnu99`.

## Tips

Before setting this parameter, check that your compiler supports the library you want to use. If you select a parameter value that your compiler does not support, compiler errors can occur.

## Command-Line Information

**Parameter:** CodeReplacementLibrary

**Type:** character vector

**Value:** 'None' | 'GNU99 (GNU) '

**Default:** 'None '



## Shared code placement

Specify the location for generating shared utility code

### Settings

**Default:** `Auto`

`Auto`

Operates as follows:

- When the model contains Model blocks, place utility code within the `slprj/target/_sharedutils` folder.
- When the model does not contain Model blocks, place utility code in the build folder (generally, in `model.c` or `model.cpp`).

`Shared location`

Directs code for utilities to be placed within the `slprj` folder in your working folder.

### Command-Line Information

**Parameter:** `UtilityFuncGeneration`

**Type:** character vector

**Value:** `'Auto'` | `'Shared location'`

**Default:** `'Auto'`

### Generate assembly listings

Instruct the C compiler to generate assembly listings for the generated code.

#### Settings

**Default:** off

On

Generates assembly listings.

Off

Suppresses assembly listings.

#### Command-Line Information

**Parameter:** CCListing

**Type:** Boolean

**Value:** on | off

**Default:** off

## Rebuild all

Force the object files to be rebuilt regardless of their timestamps.

### Settings

**Default:** off

On

Rebuilds the object files at every build.

Off

Rebuilds object files whose time stamps show they are outdated.

### Command-Line Information

**Parameter:** RebuildAll

**Type:** Boolean

**Value:** on | off

**Default:** off

# External mode

Enable client/server communication between Simulink software and an application.

## Settings

**Default:** on

On

Enables external mode.

Off

Disables external mode

## Tip

- This check box is selected by default and grayed out.
- Code generation is only supported in external mode.

## Dependencies

Selecting **External mode** enables:

- **Transport layer**
- **MEX-file arguments**
- **Static memory allocation**

## Command-Line Information

**Parameter:** ExtMode

**Type:** character vector

**Value:** 'on' | 'off'

**Default:** 'on'

## **See Also**

“Create a Transport Layer for External Communication” (Simulink Coder)

# Transport layer

Specify the transport protocol for external mode communication.

## Settings

**Default:** sharedmem

sharedmem

Uses a shared memory transport mechanism. The MEX-file name is `sldrtext`.

## Tips

- The MEX-file name displayed next to **Transport layer** cannot be edited in the Configuration Parameters dialog box.
- For targets provided by MathWorks®, like Simulink Desktop Real-Time, the MEX-file name is specified in:

```
matlabroot/toolbox/simulink/simulink/extmode_transports.m
```

## Dependency

This parameter is enabled by checking **External mode**.

## Command-Line Information

**Parameter:** ExtModeTransport

**Type:** integer

**Value:** 0

**Default:** 0

## See Also

- “Create a Transport Layer for External Communication” (Simulink Coder)
- “Target Interfacing” (Simulink Coder)

## MEX-file arguments

Specify external mode MEX arguments.

### Settings

**Default:** ''

For a shared memory transport, `sldrtxt` allows two optional positional arguments. If the second argument appears, the first argument must appear.

- An argument that is unused. Specify '' for this argument.
- An argument that specifies verbosity. Specify 0 for Nonverbose, or 1 for Verbose.

The default is Nonverbose mode (0). To specify Verbose mode, set **MEX-file arguments** to:

```
'' 1
```

where '' is the empty character vector and 1 specifies Verbose mode.

### Dependency

This parameter is enabled by checking **External mode**.

### Command-Line Information

**Parameter:** `ExtModeMexArgs`

**Type:** character vector followed by integer

**Value:** '' | '' 0 | '' 1

**Default:** ''

### See Also

- “Target Interfacing” (Simulink Coder)
- “Choose Communication Protocol for Client and Server” (Simulink Coder)

