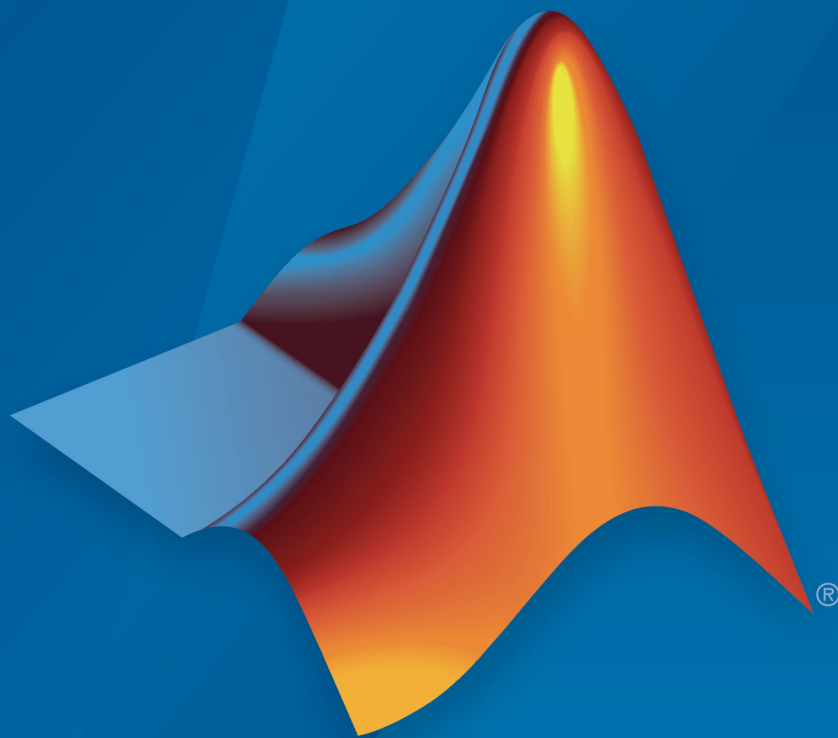


Stateflow<sup>®</sup>  
Reference



MATLAB<sup>®</sup>&SIMULINK<sup>®</sup>

R2017b



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*Stateflow® Reference*

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March 2017	Online only	Revised for Version 8.9 (Release 2017a)
September 2017	Online only	Revised for Version 9.0 (Release 2017b)



**1** | Functions — Alphabetical List

**2** | Block Reference



# Functions — Alphabetical List

---

## sfclipboard

Stateflow clipboard object

### Syntax

```
object = sfclipboard
```

### Description

*object* = sfclipboard returns a handle to the Stateflow clipboard object, which you use to copy objects from one chart or state to another.

### Examples

Copy the init function from the Init chart to the Pool chart in the sf\_pool model:

```
sf_pool;
% Get handle to the root object
rt = sfroot;
% Get handle to 'init' function in Init chart
f1 = rt.find('-isa','Stateflow.EMFunction','Name','init');
% Get handle to Pool chart
chP = rt.find('-isa','Stateflow.Chart','Name','Pool');
% Get handle to the clipboard object
cb = sfclipboard;
% Copy 'init' function to the clipboard
cb.copy(f1);
% Paste 'init' function to the Pool chart
cb.pasteTo(chP);
% Get handle to newly pasted function
f2 = chP.find('-isa','Stateflow.EMFunction','Name','init');
% Reset position of new function in the Pool chart
f2.Position = [90 180 90 60];
```



## See Also

`sfgco` | `sfnew` | `sfroot` | `stateflow`

## Topics

“Copy Objects”

“Create and Access Charts Using the Stateflow API”

“Getting a Handle on Stateflow API Objects”

“Access the Chart Object”

**Introduced before R2006a**

## sfclose

Close chart

### Syntax

```
sfclose  
sfclose('chart_name')  
sfclose('all')
```

### Description

`sfclose` closes the current chart.

`sfclose('chart_name')` closes the chart called '`chart_name`'.

`sfclose('all')` closes all open or minimized charts. 'all' is a literal character vector.

### See Also

`sfnew` | `sfopen` | `stateflow`

**Introduced in R2006a**

# sfdebugger

Open Stateflow Debugger

## Syntax

```
sfdebugger  
sfdebugger('model_name')
```

## Description

`sfdebugger` opens the Stateflow Debugger for the current model.

`sfdebugger('model_name')` opens the debugger for the Simulink® model called '*model\_name*'. Use this input argument to specify which model to debug when you have multiple models open.

## See Also

`sfexplr` | `sfhelp` | `sflib`

## Topics

“Debug Run-Time Errors in a Chart”

**Introduced in R2006a**

## sfexplr

Open Model Explorer

### Syntax

```
sfexplr
```

### Description

`sfexplr` opens the Model Explorer. A model does not need to be open.

### See Also

`sfdebugger` | `sfhelp` | `sflib`

### Topics

“Use the Model Explorer with Stateflow Objects”

**Introduced in R2006a**

## sfgco

Recently selected objects in chart

## Syntax

```
object = sfgco
```

## Description

*object* = sfgco returns a handle or vector of handles to the most recently selected objects in a chart.

## Output Arguments

### **object**

Handle or vector of handles to the most recently selected objects in a chart

Empty matrix

No charts are open, or you have no edited charts.

Handle to the chart most recently clicked

You clicked in a chart, but did not select any objects.

Handle to the selected object

You selected one object in a chart.

Vector of handles to the selected objects

You selected multiple objects in a chart.

Vector of handles to the most recently selected objects in the most recently selected chart

You selected multiple objects in multiple charts.

## Examples

Zoom in on a state after clicking it:

```
myState = sfgco;  
% Zoom in on the selected state  
myState.fitToView;
```

## See Also

`sfnew` | `sfroot` | `stateflow`

## Topics

“Create and Access Charts Using the Stateflow API”

“Getting a Handle on Stateflow API Objects”

“Zoom a Chart Object Using the API”

**Introduced before R2006a**

# sfhelp

Open Stateflow online help

## Syntax

```
sfhelp
```

## Description

`sfhelp` opens the Stateflow online help in the MATLAB® Help browser.

## See Also

```
sfdebugger | sfexplr | sfnew | stateflow
```

**Introduced before R2006a**

## **sflib**

Open Stateflow library window

### **Syntax**

```
sflib
```

### **Description**

`sflib` opens the Stateflow block library. From this library, you can drag Stateflow blocks into Simulink models and access the Stateflow Examples Library.

### **See Also**

```
sfdebugger | sfexplr | sfhelp | sfnew
```

**Introduced in R2006a**



## sfnew

Create model containing empty Stateflow block

### Syntax

```
sfnew
sfnew('chart_type')
sfnew('model_name')
sfnew('chart_type','model_name')
```

### Description

`sfnew` creates an untitled model with an empty chart. Stateflow sets the default action language for new charts to MATLAB. To change the default action language to C, use the command `sfpref('ActionLanguage','C')`. For more information, see “Modify the Action Language for a Chart”.

`sfnew('chart_type')` creates an untitled model that contains an empty block of type `chart_type`.

`sfnew('model_name')` creates a model called `model_name` with an empty chart with the default action language.

`sfnew('chart_type','model_name')` creates a model called `model_name` with an empty block of type `chart_type`.

### Input Arguments

#### **chart\_type**

Empty block to add to an empty model:

-MATLAB

Use a chart that supports MATLAB expressions in Stateflow actions

-C	Use a chart that supports C expressions in Stateflow actions
-Mealy	Use a chart that supports only Mealy state machine semantics
-Moore	Use a chart that supports only Moore state machine semantics
-TT	Use a truth table
-STT	Use a state transition table

## **model\_name**

Name of the model.

## Examples

Create a untitled model with an empty chart that uses MATLAB as the action language:

```
sfnew()
```

Create a model called `MyModel` with an empty chart that uses only Mealy semantics:

```
sfnew('-Mealy', 'MyModel')
```

Create a model called `MyModel` with an empty chart that uses only Moore semantics:

```
sfnew('-Moore', 'MyModel')
```

## See Also

`sfhelp` | `sfprint` | `sfroot` | `sfsave` | `stateflow`

## Topics

- “Model Event-Driven System”
- “Create Mealy and Moore Charts”
- “Build Model with Stateflow Truth Table”
- “Syntax for States and Transitions”

**Introduced before R2006a**

## sfopen

Open existing model

### Syntax

```
sfopen
```

### Description

`sfopen` prompts you for a model file and opens the model that you select from your file system.

### See Also

```
sfclose | sfdebugger | sfexplr | sflib | sfnew | stateflow
```

**Introduced in R2006a**

# sfprint

Print graphical view of charts

## Syntax

```
sfprint
sfprint(objects)
sfprint(objects,format)
sfprint(objects,format,outputOption)
sfprint(objects,format,outputOption,wholeChart)
```

## Description

`sfprint` prints the current chart to the default printer.

`sfprint(objects)` prints all charts specified by `objects` to the default printer.

`sfprint(objects,format)` prints all charts specified by `objects` in the specified `format` to output files. Each output file matches the name of the chart and the file extension matches the `format`.

`sfprint(objects,format,outputOption)` prints all charts specified by `objects` in the specified `format` to the file or printer specified in `outputOption`.

`sfprint(objects,format,outputOption,wholeChart)` prints all charts specified by `objects` in the specified `format` to the file or printer specified in `outputOption`. As specified in `wholeChart`, prints either a complete or current view.

## Examples

### Print open chart

```
sfprint
```

Prints current chart to the default printer.

### Print all charts specified in path

```
sfprint('sf_car/shift_logic');
```

Prints the chart with the path 'sf\_car/shift\_logic' to the default printer.

### Print chart specified in path to a JPG file format.

```
sfprint('sf_car/shift_logic', 'jpg')
```

Prints a copy of the chart 'sf\_car/shift\_logic' in JPG format to the file 'sf\_car\_shift\_logic.jpg'.

### Print chart in TIFF format to the clipboard.

```
sfprint(gcs, 'tiff', 'clipboard')
```

Prints the chart in the current system to the clipboard in TIFF format.

### Print the current view of a chart.

```
sfprint('sf_car/shift_logic', 'png', 'file', 0)
```

Prints the current view of 'sf\_car/shift\_logic' in a PNG format to the file 'sf\_car\_shift\_logic.png'.

## Input Arguments

**objects** — Identifier of charts to print

gcb (default) | gcs | character vector

Identifier of charts to print. Use:

- `gcb` to specify the current block of the model.
- `gcs` to specify the current system of the model.
- a character vector to specify the path of a chart, model, subsystem, or block.

Example: `sfprint(gcs)`

Prints all the charts in the current system to the default printer.

Example: `sfprint('sf_pool/Pool')`

Prints the complete chart with the path `'sf_pool/Pool'` to the default printer.

### **format** — Output format of printed charts

`'bitmap' | 'jpg' | 'meta' | 'pdf' | 'png' | 'svg' | 'tiff'`

Output format of the printed charts specified as one of these values:

<code>'bitmap'</code>	Save the chart image to the clipboard as a bitmap (for Windows® operating systems only)
<code>'jpg'</code>	Generate a JPEG file
<code>'meta'</code>	Save the chart image to the clipboard as a metafile (for Windows operating systems only)
<code>'pdf'</code>	Generate a PDF file
<code>'png'</code>	Generate a PNG file
<code>'svg'</code>	Generate an SVG file
<code>'tiff'</code>	Generate a TIFF file

Example: `sfprint('sf_car/shift_logic','jpg')`

Prints the complete chart with the path `'sf_car/shift_logic'` in a JPEG format to a file in the current folder named `'sf_car_shift_logic.jpg'`.

Data Types: `char`

### **outputOption** — Name of the printer or output file

`'file' (default) | character vector | 'clipboard' | 'promptForFile' | 'printer'`

Name of the output file or printer specified as one of these values:

'file'	Send output to a default file with the name <i>chart_name.file_extension</i> . The file name is the name of the chart, with an extension that matches the output format.
character vector	Specify the name of the output file with a character vector.
'clipboard'	Copy output to the clipboard
'promptForFile'	Prompts the user interactively for path and file name.
'printer'	Send output to the default printer (use only with 'ps', or 'eps' formats)

Example: `sfprint('sf_car/shift_logic','png','myFile')`

Prints the complete chart whose path is 'sf\_car/shift\_logic' in the PNG format to a file in the current folder with the name 'myFile'.png.

Example: `sfprint('sf_car/shift_logic','pdf','promptForFile')`

Prints all charts in the current block of the model in PDF format. A dialog box opens for each chart to prompt you for the path and name of the output file.

Data Types: char

## **wholeChart — View of charts to print**

1 (default) | 0

View of charts to print specified as a integer of value 0 or 1. A value of 1 prints the complete views of all the charts, whereas a value of 0 prints the current views of all the charts.

Example: `sfprint(gcs,'png','file',0)`

Prints the current view of all charts in the current system in PNG format using default file names.

## **See Also**

`gcb` | `gcs` | `sfhelp` | `sfnew` | `sfsave` | `stateflow`



**Introduced before R2006a**

## sfroot

Root object

## Syntax

```
object = sfroot
```

## Description

*object* = `sfroot` returns a handle to the top-level object in the Stateflow hierarchy of objects. Use the root object to access all other objects in your charts when using the API.

## Examples

Zoom in on a state in your chart:

```
old_sf_car;  
% Get handle to the root object  
rt = sfroot;  
% Find the state with the name 'first'  
myState = rt.find('-isa', 'Stateflow.State', 'Name', 'first');  
% Zoom in on that state in the chart  
myState.fitToView;
```

## See Also

`sfclipboard` | `sfgco`

## Topics

“Create and Access Charts Using the Stateflow API”

“Getting a Handle on Stateflow API Objects”

“Access the Chart Object”

**Introduced before R2006a**

## sfsave

Save chart in current folder

### Syntax

```
sfsave
sfsave('model_name')
sfsave('model_name','new_model_name')
sfsave('Defaults')
```

### Description

sfsave saves the chart in the current model.

sfsave('model\_name') saves the chart in the model called 'model\_name'.

sfsave('model\_name','new\_model\_name') saves the chart in 'model\_name' to 'new\_model\_name'.

sfsave('Defaults') saves the settings of the current model as defaults.

The model must be open and the current folder must be writable.

### Examples

Develop a script to create a baseline chart and save it in a new model:

```
bdclose('all');

% Create an empty chart in a new model
sfnew;

% Get root object
rt = sfroot;
```

```
% Get model
m = rt.find('-isa','Simulink.BlockDiagram');

% Get chart
chart1 = m.find('-isa','Stateflow.Chart');

% Create two states, A and B, in the chart
sA = Stateflow.State(chart1);
sA.Name = 'A';
sA.Position = [50 50 100 60];
sB = Stateflow.State(chart1);
sB.Name = 'B';
sB.Position = [200 50 100 60];

% Add a transition from state A to state B
tAB = Stateflow.Transition(chart1);
tAB.Source = sA;
tAB.Destination = sB;
tAB.SourceOClock = 3;
tAB.DestinationOClock = 9;

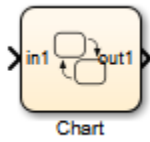
% Add a default transition to state A
dtA = Stateflow.Transition(chart1);
dtA.Destination = sA;
dtA.DestinationOClock = 0;
x = sA.Position(1)+sA.Position(3)/2;
y = sA.Position(2)-30;
dtA.SourceEndPoint = [x y];

% Add an input in1
d1 = Stateflow.Data(chart1);
d1.Scope = 'Input';
d1.Name = 'in1';

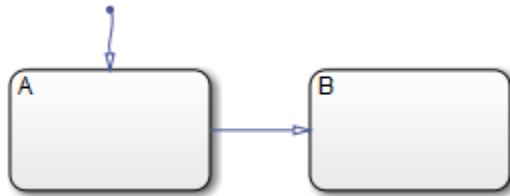
% Add an output out1
d2 = Stateflow.Data(chart1);
d2.Scope = 'Output';
d2.Name = 'out1';

% Save the chart in a model called "NewModel"
% in current folder
sfsave('untitled','NewModel');
```

Here is the resulting model:



Here is the resulting chart:



## See Also

`find` | `sfclose` | `sfnew` | `sfopen` | `sfroot`

## Topics

“Create and Access Charts Using the Stateflow API”

“Create a MATLAB Script of API Commands”

**Introduced before R2006a**

# stateflow

Create empty chart

## Syntax

```
stateflow
```

## Description

`stateflow` creates an untitled model that contains an empty chart. The function also opens the Stateflow block library. From this library, you can drag Stateflow blocks into models or access the Stateflow Examples Library.

## See Also

`sflib` | `sfnew`

Introduced before R2006a





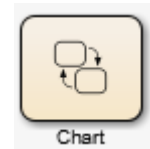
# Block Reference

---

## Chart

Implement control logic with finite state machine

**Library:** Stateflow



## Description

A *finite state machine* is a representation of an event-driven (reactive) system. In an event-driven system, the system responds to an event by making a transition from one state (mode) to another. This transition occurs if the condition defining the change is true.

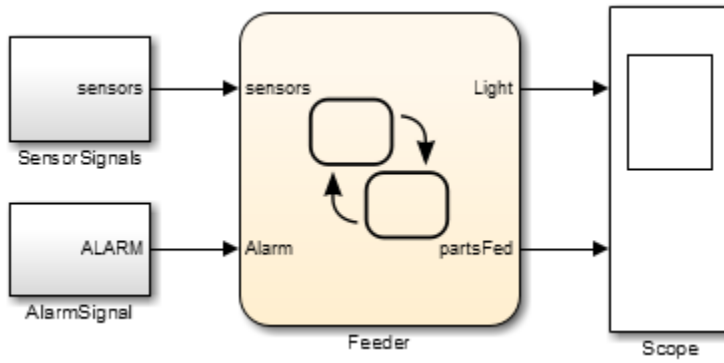
A Stateflow chart is a graphical representation of a finite state machine. *States* and *transitions* form the basic elements of the system. You can also represent stateless flow charts.

For example, you can use Stateflow charts to control a physical plant in response to events such as a temperature and pressure sensors, clocks, and user-driven events.

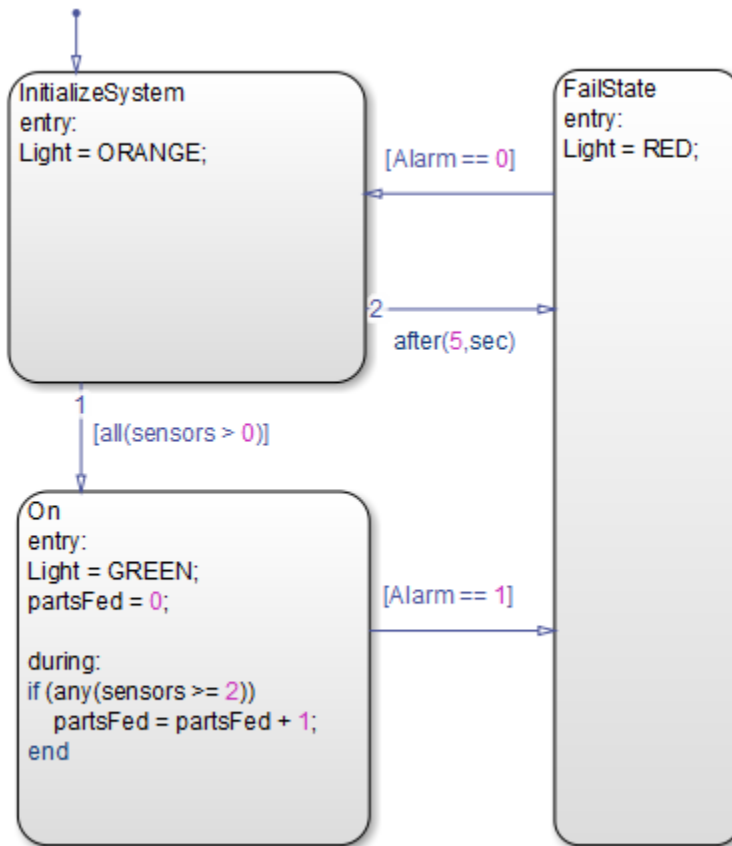
You can also use a state machine to represent the automatic transmission of a car. The transmission has these operating states: park, reverse, neutral, drive, and low. As the driver shifts from one position to another, the system makes a transition from one state to another, for example, from park to reverse.

A Stateflow chart can use MATLAB or C as the action language to implement control logic.

This block diagram represents a machine on an assembly line that feeds raw material to other parts of the line. It contains a chart, `Feeder`, with MATLAB as the action language.



To open the chart, double-click the `Feeder` block in the model.



For a tutorial on this model, see “Model Event-Driven System”.

## Ports

### Input

**port\_1** — Input port  
 scalar | vector | matrix

When you create input data in the Symbols window, Stateflow creates input ports. The input data that you create has a corresponding input port that appears once you create data.

Data Types: `single` | `double` | `int8` | `int16` | `int32` | `uint8` | `uint16` | `uint32` | `Boolean` | `fixed point` | `enumerated` | `bus`

## Output

### **Port\_1 — Output port**

`scalar` | `vector` | `matrix`

When you create output data in the Symbols window, Stateflow creates output ports. The output data that you create has a corresponding output port that appears once you create data.

Data Types: `single` | `double` | `int8` | `int16` | `int32` | `uint8` | `uint16` | `uint32` | `Boolean` | `fixed point` | `enumerated` | `bus`

## Parameters

Parameters on the Code Generation tab require Simulink Coder™ or Embedded Coder®.

## Main

### **Show port labels — Select how to display port labels**

`FromPortIcon` (default) | `FromPortBlockName` | `SignalName`

Select how to display port labels on the Chart block icon.

`none`

Do not display port labels.

`FromPortIcon`

If the corresponding port icon displays a signal name, display the signal name on the Chart block. Otherwise, display the port block name.

`FromPortBlockName`

Display the name of the corresponding port block on the Chart block.

SignalName

If a signal name exists, display the name of the signal connected to the port on the Chart block. Otherwise, display the name of the corresponding port block.

### Programmatic Use

**Parameter:** ShowPortLabels

**Type:** character vector

**Value:** 'FromPortIcon' | 'FromPortBlockName' | 'SignalName'

**Default:** 'FromPortIcon'

### Read/Write permissions — Select access to contents of chart

ReadWrite (default) | ReadOnly | NoReadOrWrite

Control user access to the contents of the chart.

ReadWrite

Enable opening and modification of chart contents.

ReadOnly

Enable opening but not modification of the chart. If the chart resides in a block library, you can create and open links to the chart and can make and modify local copies of the chart but you cannot change the permissions or modify the contents of the original library instance.

NoReadOrWrite

Disable opening or modification of chart. If the chart resides in a library, you can create links to the chart in a model but you cannot open, modify, change permissions, or create local copies of the chart.

### Programmatic Use

**Parameter:** Permissions

**Type:** character vector

**Value:** 'ReadWrite' | 'ReadOnly' | 'NoReadOrWrite'

**Default:** 'ReadWrite'

### Treat as atomic unit — Control execution of a subsystem as one unit

off (default) | on

When determining the execution order of block methods, causes Simulink to treat the chart as a unit.

off

When determining block method execution order, treat all blocks in the chart as being at the same level in the model hierarchy as the chart. This hierarchy treatment can cause the execution of methods of blocks in the chart to be interleaved with the execution of methods of blocks outside the chart.

on

When determining the execution order of block methods, treat the chart as a unit. For example, when Simulink needs to compute the output of the chart, Simulink invokes the output methods of all the blocks in the chart before invoking the output methods of other blocks at the same level as the chart block.

### Dependency

If you select this parameter, you enable the **Minimize algebraic loop occurrences**, **Sample time**, and **Function packaging** parameters. **Function packaging** requires the Simulink Coder software.

### Programmatic Use

**Parameter:** `TreatAsAtomicUnit`

**Type:** character vector

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

**Default:** 'off'

### See also

- “Generate Reusable Code for Atomic Subcharts”

### Minimize algebraic loop occurrences — Control elimination of algebraic loops

off (default) | on

Try to eliminate any artificial algebraic loops that include the atomic subchart

See also “Eliminate Artificial Algebraic Loops Caused by Atomic Subsystems” (Simulink).

off

Do not try to eliminate any artificial algebraic loops that include the atomic subchart.

on

Try to eliminate any artificial algebraic loops that include the atomic subchart.

### Dependency

To enable this parameter, select the **Treat as atomic unit** parameter.

#### Programmatic Use

**Parameter:** `MinAlgLoopOccurrences`

**Type:** character vector

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

**Default:** 'off'

#### Sample time — Specify time interval

-1 (default) | [`Ts` 0]

Specify whether all blocks in this chart must run at the same rate or can run at different rates.

- If the blocks in the chart can run at different rates, specify the chart sample time as inherited (-1).
- If all blocks must run at the same rate, specify the sample time corresponding to this rate as the value of the **Sample time** parameter.
- If any of the blocks in the chart specify a different sample time (other than -1 or `inf`), Simulink displays an error message when you update or simulate the model. For example, suppose all the blocks in the chart must run 5 times a second. To ensure this time, specify the sample time of the chart as 0.2. In this example, if any of the blocks in the chart specify a sample time other than 0.2, -1, or `inf`, Simulink displays an error when you update or simulate the model.

-1

Specify inherited sample time. If the blocks in the chart can run at different rates, use this sample time.

[`Ts` 0]

Specify periodic sample time.

### Dependency

To enable this parameter, select the **Treat as atomic unit** parameter.

#### Programmatic Use

**Parameter:** `SystemSampleTime`

**Type:** character vector



**Value:** '-1' | '[Ts 0]'

**Default:** '-1'

### **Treat as grouped when propagating variant conditions — Control treating subsystem as unit**

`on` (default) | `off`

When propagating variant conditions from Variant Source blocks or to Variant Sink blocks, causes Simulink to treat the chart as a unit.

on

Simulink treats the chart as a unit when propagating variant conditions from Variant Source blocks or to Variant Sink blocks. For example, when Simulink computes the variant condition of the chart, it propagates that condition to all the blocks in the chart.

off

Simulink treats all blocks in the chart as being at the same level in the model hierarchy as the chart itself when determining their variant condition.

### **Programmatic Use**

**Parameter:** `TreatAsGroupedWhenPropagatingVariantConditions`

**Type:** character vector

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

**Default:** 'on'

## **Code Generation**

### **Function packaging — Select code format**

`Auto` (default) | `Inline` | `Nonreusable function` | `Reusable function`

Select the generated code format for an atomic (nonvirtual) subchart.

`Auto`

Simulink Coder chooses the optimal format for your system based on the type and number of instances of the chart that exist in the model.

`Inline`

Simulink Coder inlines the chart unconditionally.

### Nonreusable function

Simulink Coder explicitly generates a separate function in a separate file. Charts with this setting generate functions that might have arguments depending on the “Function interface” (Simulink) parameter setting. You can name the generated function and file using parameters “Function name” (Simulink) and “File name (no extension)” (Simulink). These functions are not reentrant.

### Reusable function

Simulink Coder generates a function with arguments that allows reuse of chart code when a model includes multiple instances of the chart.

This option generates a function with arguments that allows chart code to be reused in the generated code of a model reference hierarchy that includes multiple instances of a chart across referenced models. In this case, the chart must be in a library.

### Tips

- When you want multiple instances of a chart represented as one reusable function, you can designate each one of them as `Auto` or as `Reusable function`. It is best to use one because using both creates two reusable functions, one for each designation. The outcomes of these choices differ only when reuse is not possible. Selecting `Auto` does not allow for control of the function or file name for the chart code.
- The `Reusable function` and `Auto` options both try to determine if multiple instances of a chart exist and if the code can be reused. The difference between the options' behavior is that when reuse is not possible. In this case, `Auto` yields inlined code, or if circumstances prohibit inlining, separate functions for each chart instance.
- If you select the `Reusable function` while your generated code is under source control, set **File name options** to `Use chart name`, `Use function name`, or `User specified`. Otherwise, the names of your code files change whenever you modify your model, which prevents source control on your files.

### Dependency

- This parameter requires Simulink Coder.
- To enable this parameter, select **Treat as atomic unit**.
- Setting this parameter to `Nonreusable function` or `Reusable function` enables the following parameters:
  - **Function name options**

- **File name options**
- Memory section for initialize/terminate functions (requires Embedded Coder and an ERT-based system target file)
- Memory section for execution functions (requires Embedded Coder and an ERT-based system target file)
- Setting this parameter to `Nonreusable function` enables **Function with separate data** (requires a license for Embedded Coder and an ERT-based system target file).

#### Programmatic Use

**Parameter:** `RTWSystemCode`

**Type:** character vector

**Value:** `'Auto'` | `'Inline'` | `'Nonreusable function'` | `'Reusable function'`

**Default:** `'Auto'`

## Block Characteristics

<b>Data Types</b>	<code>double<sup>a</sup></code>   <code>single<sup>a</sup></code>   <code>Boolean<sup>a</sup></code>   <code>base integer<sup>a</sup></code>   <code>fixed point<sup>a</sup></code>   <code>enumerated<sup>a</sup></code>   <code>bus<sup>a</sup></code>
<b>Multidimensional Signals</b>	<code>Yes<sup>a</sup></code>
<b>Variable-Size Signals</b>	<code>Yes<sup>a</sup></code>

a. Actual data type or capability support depends on block implementation.

## See Also

Introduced in R2013b

## Sequence Viewer

Display message or events between blocks during simulation



### Library

Stateflow, SimEvents®, Simulink Test™

### Description

The Sequence Viewer block displays messages or events between certain blocks during simulation. The blocks that you can display messages and events for are called lifeline blocks and include:

- Subsystems
- Stateflow charts
- Blocks that contain messages, for example, Stateflow charts.

### Parameters

#### History

Specify maximum number of events to keep in viewer.

**Default:** 5000

## See Also

### Topics

“Work with Sequence Viewer”

“Work with Sequence Viewer” (SimEvents)

**Introduced in R2015b**

## State Transition Table

Represent modal logic in tabular format

**Library:** Stateflow



### Description

When you want to represent modal logic in tabular format, use this block. The State Transition Table block uses only MATLAB as the action language.

Using the State Transition Table Editor, you can:

- Add states and enter state actions.
- Add hierarchy among your states.
- Enter conditions and actions for state-to-state transitions.
- Specify default transitions, inner transitions, and self-loop transitions.
- Add input or output data and events.
- Set breakpoints for debugging.
- Run diagnostics to detect parser errors.
- View autogenerated content as you edit the table.

For more information about the State Transition Table Editor, see “State Transition Table Operations”.

### Ports

#### Input

**Port\_1** — Input port

scalar | vector | matrix

When you create input data in the Symbols window, Stateflow creates input ports. The input data that you create has a corresponding input port that appears once you create data.

Data Types: `single` | `double` | `int8` | `int16` | `int32` | `uint8` | `uint16` | `uint32` | `Boolean` | `fixed point` | `enumerated` | `bus`

## Output

### **Port\_1 — Output port**

`scalar` | `vector` | `matrix`

When you create output data in the Symbols window, Stateflow creates output ports. The output data that you create has a corresponding output port that appears once you create data.

Data Types: `single` | `double` | `int8` | `int16` | `int32` | `uint8` | `uint16` | `uint32` | `Boolean` | `fixed point` | `enumerated` | `bus`

## Parameters

Parameters on the Code Generation tab require Simulink Coder or Embedded Coder.

## Main

### **Show port labels — Select how to display port labels**

`FromPortIcon` (default) | `FromPortBlockName` | `SignalName`

Select how to display port labels on the Chart block icon.

`none`

Do not display port labels.

`FromPortIcon`

If the corresponding port icon displays a signal name, display the signal name on the Chart block. Otherwise, display the port block name.

`FromPortBlockName`

Display the name of the corresponding port block on the Chart block.

SignalName

If a signal name exists, display the name of the signal connected to the port on the Chart block. Otherwise, display the name of the corresponding port block.

### Programmatic Use

**Parameter:** ShowPortLabels

**Type:** character vector

**Value:** 'FromPortIcon' | 'FromPortBlockName' | 'SignalName'

**Default:** 'FromPortIcon'

### Read/Write permissions — Select access to contents of chart

ReadWrite (default) | ReadOnly | NoReadOrWrite

Control user access to the contents of the chart.

ReadWrite

Enable opening and modification of chart contents.

ReadOnly

Enable opening but not modification of the chart. If the chart resides in a block library, you can create and open links to the chart and can make and modify local copies of the chart but you cannot change the permissions or modify the contents of the original library instance.

NoReadOrWrite

Disable opening or modification of chart. If the chart resides in a library, you can create links to the chart in a model but you cannot open, modify, change permissions, or create local copies of the chart.

### Programmatic Use

**Parameter:** Permissions

**Type:** character vector

**Value:** 'ReadWrite' | 'ReadOnly' | 'NoReadOrWrite'

**Default:** 'ReadWrite'

### Treat as atomic unit — Control execution of a subsystem as one unit

off (default) | on

When determining the execution order of block methods, causes Simulink to treat the chart as a unit.



off

When determining block method execution order, treat all blocks in the chart as being at the same level in the model hierarchy as the chart. This hierarchy treatment can cause the execution of methods of blocks in the chart to be interleaved with the execution of methods of blocks outside the chart.

on

When determining the execution order of block methods, treat the chart as a unit. For example, when Simulink needs to compute the output of the chart, Simulink invokes the output methods of all the blocks in the chart before invoking the output methods of other blocks at the same level as the chart block.

### Dependency

If you select this parameter, you enable the **Minimize algebraic loop occurrences**, **Sample time**, and **Function packaging** parameters. **Function packaging** requires the Simulink Coder software.

### Programmatic Use

**Parameter:** `TreatAsAtomicUnit`

**Type:** character vector

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

**Default:** 'off'

### See also

- “Generate Reusable Code for Atomic Subcharts”

### Minimize algebraic loop occurrences — Control elimination of algebraic loops

off (default) | on

Try to eliminate any artificial algebraic loops that include the atomic subchart

See also “Eliminate Artificial Algebraic Loops Caused by Atomic Subsystems” (Simulink).

off

Do not try to eliminate any artificial algebraic loops that include the atomic subchart.

on

Try to eliminate any artificial algebraic loops that include the atomic subchart.

### Dependency

To enable this parameter, select the **Treat as atomic unit** parameter.

#### Programmatic Use

**Parameter:** MinAlgLoopOccurrences

**Type:** character vector

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

**Default:** 'off'

#### Sample time — Specify time interval

-1 (default) | [Ts 0]

Specify whether all blocks in this chart must run at the same rate or can run at different rates.

- If the blocks in the chart can run at different rates, specify the chart sample time as inherited (-1).
- If all blocks must run at the same rate, specify the sample time corresponding to this rate as the value of the **Sample time** parameter.
- If any of the blocks in the chart specify a different sample time (other than -1 or `inf`), Simulink displays an error message when you update or simulate the model. For example, suppose all the blocks in the chart must run 5 times a second. To ensure this time, specify the sample time of the chart as 0.2. In this example, if any of the blocks in the chart specify a sample time other than 0.2, -1, or `inf`, Simulink displays an error when you update or simulate the model.

-1

Specify inherited sample time. If the blocks in the chart can run at different rates, use this sample time.

[Ts 0]

Specify periodic sample time.

### Dependency

To enable this parameter, select the **Treat as atomic unit** parameter.

#### Programmatic Use

**Parameter:** SystemSampleTime

**Type:** character vector

**Value:** '-1' | '[Ts 0]'

**Default:** '-1'

### **Treat as grouped when propagating variant conditions — Control treating subsystem as unit**

`on` (default) | `off`

When propagating variant conditions from Variant Source blocks or to Variant Sink blocks, causes Simulink to treat the chart as a unit.

on

Simulink treats the chart as a unit when propagating variant conditions from Variant Source blocks or to Variant Sink blocks. For example, when Simulink computes the variant condition of the chart, it propagates that condition to all the blocks in the chart.

off

Simulink treats all blocks in the chart as being at the same level in the model hierarchy as the chart itself when determining their variant condition.

#### **Programmatic Use**

**Parameter:** `TreatAsGroupedWhenPropagatingVariantConditions`

**Type:** character vector

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

**Default:** 'on'

## **Code Generation**

### **Function packaging — Select code format**

`Auto` (default) | `Inline` | `Nonreusable function` | `Reusable function`

Select the generated code format for an atomic (nonvirtual) subchart.

`Auto`

Simulink Coder chooses the optimal format for your system based on the type and number of instances of the chart that exist in the model.

`Inline`

Simulink Coder inlines the chart unconditionally.

### Nonreusable function

Simulink Coder explicitly generates a separate function in a separate file. Charts with this setting generate functions that might have arguments depending on the “Function interface” (Simulink) parameter setting. You can name the generated function and file using parameters “Function name” (Simulink) and “File name (no extension)” (Simulink). These functions are not reentrant.

### Reusable function

Simulink Coder generates a function with arguments that allows reuse of chart code when a model includes multiple instances of the chart.

This option generates a function with arguments that allows chart code to be reused in the generated code of a model reference hierarchy that includes multiple instances of a chart across referenced models. In this case, the chart must be in a library.

### Tips

- When you want multiple instances of a chart represented as one reusable function, you can designate each one of them as `Auto` or as `Reusable function`. It is best to use one because using both creates two reusable functions, one for each designation. The outcomes of these choices differ only when reuse is not possible. Selecting `Auto` does not allow for control of the function or file name for the chart code.
- The `Reusable function` and `Auto` options both try to determine if multiple instances of a chart exist and if the code can be reused. The difference between the options' behavior is that when reuse is not possible. In this case, `Auto` yields inlined code, or if circumstances prohibit inlining, separate functions for each chart instance.
- If you select the `Reusable function` while your generated code is under source control, set **File name options** to `Use chart name`, `Use function name`, or `User specified`. Otherwise, the names of your code files change whenever you modify your model, which prevents source control on your files.

### Dependency

- This parameter requires Simulink Coder.
- To enable this parameter, select **Treat as atomic unit**.
- Setting this parameter to `Nonreusable function` or `Reusable function` enables the following parameters:
  - **Function name options**

- **File name options**
- Memory section for initialize/terminate functions (requires Embedded Coder and an ERT-based system target file)
- Memory section for execution functions (requires Embedded Coder and an ERT-based system target file)
- Setting this parameter to `Nonreusable function` enables **Function with separate data** (requires a license for Embedded Coder and an ERT-based system target file).

**Programmatic Use****Parameter:** `RTWSystemCode`**Type:** character vector**Value:** `'Auto' | 'Inline' | 'Nonreusable function' | 'Reusable function'`**Default:** `'Auto'`

## Block Characteristics

<b>Data Types</b>	<code>double<sup>a</sup>   single<sup>a</sup>   Boolean<sup>a</sup>   base integer<sup>a</sup>   fixed point<sup>a</sup>   enumerated<sup>a</sup>   bus<sup>a</sup></code>
<b>Multidimensional Signals</b>	<code>Yes<sup>a</sup></code>
<b>Variable-Size Signals</b>	<code>Yes<sup>a</sup></code>

a. Actual data type or capability support depends on block implementation.

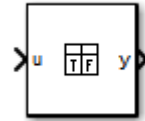
## See Also

Introduced in R2012b

## Truth Table

Represent logical decision-making behavior with conditions, decisions, and actions

**Library:** Stateflow



## Description

The Truth Table block is a truth table function that uses MATLAB as the action language. When you want to use truth table logic directly in a Simulink model, use this block. This block requires Stateflow.

When you add a Truth Table block directly to a model instead of calling truth table functions from a Stateflow chart, these advantages apply:

- It is a more direct approach than creating a truth table within a Stateflow chart, especially if your model requires only a single truth table.
- You can define truth table inputs and outputs with inherited types and sizes.

The Truth Table block works with a subset of the MATLAB language that is optimized for generating embeddable C code. This block generates content as MATLAB code. As a result, you can take advantage of other tools to debug your Truth Table block during simulation.

If you double-click the Truth Table block, the Truth Table Editor opens to display its conditions, actions, and decisions.

Using the Truth Table Editor, you can:

- Enter and edit conditions, actions, and decisions.
- Add or modify Stateflow data and ports by using the Ports and Data Manager.
- Run diagnostics to detect parser errors.
- View generated content after simulation.

For more information about the Truth Table Editor, see “Truth Table Editor Operations”.

## Ports

### Input

#### **u** — Input port

scalar | vector | matrix

When you create input data in the Symbols window, Stateflow creates input ports. The input data that you create has a corresponding input port that appears once you create data.

Data Types: single | double | int8 | int16 | int32 | uint8 | uint16 | uint32 | Boolean | fixed point | enumerated | bus

### Output

#### **y** — Output port

scalar | vector | matrix

When you create output data in the Symbols window, Stateflow creates output ports. The output data that you create has a corresponding output port that appears once you create data.

Data Types: single | double | int8 | int16 | int32 | uint8 | uint16 | uint32 | Boolean | fixed point | enumerated | bus

## Parameters

Parameters on the Code Generation tab require Simulink Coder or Embedded Coder.

### Main

#### **Show port lables** — Select how to display port labels

FromPortIcon (default) | FromPortBlockName | SignalName

Select how to display port lables on the Chart block icon.

none

Do not display port labels.

FromPortIcon

If the corresponding port icon displays a signal name, display the signal name on the Chart block. Otherwise, display the port block name.

FromPortBlockName

Display the name of the corresponding port block on the Chart block.

SignalName

If a signal name exists, display the name of the signal connected to the port on the Chart block. Otherwise, display the name of the corresponding port block.

### Programmatic Use

**Parameter:** ShowPortLabels

**Type:** character vector

**Value:** 'FromPortIcon' | 'FromPortBlockName' | 'SignalName'

**Default:** 'FromPortIcon'

### Read/Write permissions — Select access to contents of chart

ReadWrite (default) | ReadOnly | NoReadOrWrite

Control user access to the contents of the chart.

ReadWrite

Enable opening and modification of chart contents.

ReadOnly

Enable opening but not modification of the chart. If the chart resides in a block library, you can create and open links to the chart and can make and modify local copies of the chart but you cannot change the permissions or modify the contents of the original library instance.

NoReadOrWrite

Disable opening or modification of chart. If the chart resides in a library, you can create links to the chart in a model but you cannot open, modify, change permissions, or create local copies of the chart.

### Programmatic Use

**Parameter:** Permissions

**Type:** character vector



**Value:** 'ReadWrite' | 'ReadOnly' | 'NoReadOrWrite'

**Default:** 'ReadWrite'

**Treat as atomic unit — Control execution of a subsystem as one unit**

off (default) | on

When determining the execution order of block methods, causes Simulink to treat the chart as a unit.

off

When determining block method execution order, treat all blocks in the chart as being at the same level in the model hierarchy as the chart. This hierarchy treatment can cause the execution of methods of blocks in the chart to be interleaved with the execution of methods of blocks outside the chart.

on

When determining the execution order of block methods, treat the chart as a unit. For example, when Simulink needs to compute the output of the chart, Simulink invokes the output methods of all the blocks in the chart before invoking the output methods of other blocks at the same level as the chart block.

**Dependency**

If you select this parameter, you enable the **Minimize algebraic loop occurrences**, **Sample time**, and **Function packaging** parameters. **Function packaging** requires the Simulink Coder software.

**Programmatic Use**

**Parameter:** TreatAsAtomicUnit

**Type:** character vector

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

**Default:** 'off'

**See also**

- “Generate Reusable Code for Atomic Subcharts”

**Minimize algebraic loop occurrences — Control elimination of algebraic loops**

off (default) | on

Try to eliminate any artificial algebraic loops that include the atomic subchart

See also “Eliminate Artificial Algebraic Loops Caused by Atomic Subsystems” (Simulink).

off

Do not try to eliminate any artificial algebraic loops that include the atomic subchart.

on

Try to eliminate any artificial algebraic loops that include the atomic subchart.

### Dependency

To enable this parameter, select the **Treat as atomic unit** parameter.

### Programmatic Use

**Parameter:** MinAlgLoopOccurrences

**Type:** character vector

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

**Default:** 'off'

### Sample time — Specify time interval

-1 (default) | [Ts 0]

Specify whether all blocks in this chart must run at the same rate or can run at different rates.

- If the blocks in the chart can run at different rates, specify the chart sample time as inherited (-1).
- If all blocks must run at the same rate, specify the sample time corresponding to this rate as the value of the **Sample time** parameter.
- If any of the blocks in the chart specify a different sample time (other than -1 or *inf*), Simulink displays an error message when you update or simulate the model. For example, suppose all the blocks in the chart must run 5 times a second. To ensure this time, specify the sample time of the chart as 0.2. In this example, if any of the blocks in the chart specify a sample time other than 0.2, -1, or *inf*, Simulink displays an error when you update or simulate the model.

-1

Specify inherited sample time. If the blocks in the chart can run at different rates, use this sample time.

[Ts 0]

Specify periodic sample time.

## Dependency

To enable this parameter, select the **Treat as atomic unit** parameter.

### Programmatic Use

**Parameter:** `SystemSampleTime`

**Type:** character vector

**Value:** `'-1'` | `'[Ts 0]'`

**Default:** `'-1'`

### Treat as grouped when propagating variant conditions — Control treating subsystem as unit

`on` (default) | `off`

When propagating variant conditions from Variant Source blocks or to Variant Sink blocks, causes Simulink to treat the chart as a unit.

`on`

Simulink treats the chart as a unit when propagating variant conditions from Variant Source blocks or to Variant Sink blocks. For example, when Simulink computes the variant condition of the chart, it propagates that condition to all the blocks in the chart.

`off`

Simulink treats all blocks in the chart as being at the same level in the model hierarchy as the chart itself when determining their variant condition.

### Programmatic Use

**Parameter:** `TreatAsGroupedWhenPropagatingVariantConditions`

**Type:** character vector

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

**Default:** `'on'`

## Code Generation

### Function packaging — Select code format

`Auto` (default) | `Inline` | `Nonreusable function` | `Reusable function`

Select the generated code format for an atomic (nonvirtual) subchart.

### Auto

Simulink Coder chooses the optimal format for your system based on the type and number of instances of the chart that exist in the model.

### Inline

Simulink Coder inlines the chart unconditionally.

### Nonreusable function

Simulink Coder explicitly generates a separate function in a separate file. Charts with this setting generate functions that might have arguments depending on the “Function interface” (Simulink) parameter setting. You can name the generated function and file using parameters “Function name” (Simulink) and “File name (no extension)” (Simulink). These functions are not reentrant.

### Reusable function

Simulink Coder generates a function with arguments that allows reuse of chart code when a model includes multiple instances of the chart.

This option generates a function with arguments that allows chart code to be reused in the generated code of a model reference hierarchy that includes multiple instances of a chart across referenced models. In this case, the chart must be in a library.

### Tips

- When you want multiple instances of a chart represented as one reusable function, you can designate each one of them as `Auto` or as `Reusable function`. It is best to use one because using both creates two reusable functions, one for each designation. The outcomes of these choices differ only when reuse is not possible. Selecting `Auto` does not allow for control of the function or file name for the chart code.
- The `Reusable function` and `Auto` options both try to determine if multiple instances of a chart exist and if the code can be reused. The difference between the options' behavior is that when reuse is not possible. In this case, `Auto` yields inlined code, or if circumstances prohibit inlining, separate functions for each chart instance.
- If you select the `Reusable function` while your generated code is under source control, set **File name options** to `Use chart name`, `Use function name`, or `User specified`. Otherwise, the names of your code files change whenever you modify your model, which prevents source control on your files.

### Dependency

- This parameter requires Simulink Coder.

- To enable this parameter, select **Treat as atomic unit**.
- Setting this parameter to `Nonreusable function` or `Reusable function` enables the following parameters:
  - **Function name options**
  - **File name options**
  - Memory section for initialize/terminate functions (requires Embedded Coder and an ERT-based system target file)
  - Memory section for execution functions (requires Embedded Coder and an ERT-based system target file)
- Setting this parameter to `Nonreusable function` enables **Function with separate data** (requires a license for Embedded Coder and an ERT-based system target file).

**Programmatic Use****Parameter:** `RTWSystemCode`**Type:** character vector**Value:** `'Auto' | 'Inline' | 'Nonreusable function' | 'Reusable function'`**Default:** `'Auto'`

## Block Characteristics

<b>Data Types</b>	<code>double<sup>a</sup>   single<sup>a</sup>   Boolean<sup>a</sup>   base integer<sup>a</sup>   fixed point<sup>a</sup>   enumerated<sup>a</sup>   bus<sup>a</sup></code>
<b>Multidimensional Signals</b>	<code>Yes<sup>a</sup></code>
<b>Variable-Size Signals</b>	<code>Yes<sup>a</sup></code>

a. Actual data type or capability support depends on block implementation.

## See Also

Introduced before R2006a

