

# Stateflow<sup>®</sup> 7

## Reference

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*Stateflow*® Reference

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## Function Reference

**1**

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Object Retrieval .....	1-2
Chart Creation .....	1-2
Chart Input/Output .....	1-2
GUI .....	1-2
Help .....	1-3

## Functions — Alphabetical List

**2**

## Block Reference

**3**

## Index



# Function Reference

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Object Retrieval (p. 1-2)

Get objects in Stateflow<sup>®</sup> hierarchy

Chart Creation (p. 1-2)

Create Stateflow charts and truth tables

Chart Input/Output (p. 1-2)

Read and write Stateflow charts

GUI (p. 1-2)

Launch tools for defining and debugging Stateflow objects

Help (p. 1-3)

Get help on using Stateflow software

## Object Retrieval

<code>sfclipboard</code>	Stateflow clipboard object
<code>sfgco</code>	Recently selected objects in chart
<code>sfroot</code>	Root object

## Chart Creation

<code>sfnew</code>	Create model containing empty Stateflow block
<code>stateflow</code>	Create empty chart

## Chart Input/Output

<code>sfclose</code>	Close chart
<code>sfopen</code>	Open existing model
<code>sfprint</code>	Print graphical view of charts
<code>sfsave</code>	Save chart in current folder

## GUI

<code>sfdebugger</code>	Open Stateflow Debugger
<code>sfexplr</code>	Open Model Explorer
<code>sflib</code>	Open Stateflow library window



## Help

sfhelp

[Open Stateflow online help](#)



# Functions — Alphabetical List

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# sfclipboard

---

<b>Purpose</b>	Stateflow clipboard object
<b>Syntax</b>	<code>object = sfclipboard</code>
<b>Description</b>	<code>object = sfclipboard</code> 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`

**Tutorials**

- “Copying Objects”
- “Quick Start for the Stateflow API”

**How To**

- “Getting a Handle on Stateflow API Objects”
- “Accessing the Chart Object”

**Purpose** 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 string.

**See Also** sfnew | sfoopen | stateflow

# sfdebugger

---

<b>Purpose</b>	Open Stateflow Debugger
<b>Syntax</b>	<code>sfdebugger</code> <code>sfdebugger('model_name')</code>
<b>Description</b>	<code>sfdebugger</code> opens the Stateflow Debugger for the current model. <code>sfdebugger('model_name')</code> opens the debugger for the Simulink® model called ' <i>model_name</i> '. Use this input argument to specify which model to debug when you have multiple models open.
<b>See Also</b>	<code>sfexplr</code>   <code>sfhelp</code>   <code>sflib</code>
<b>How To</b>	<ul style="list-style-type: none"><li>• “Using the Stateflow Debugger”</li></ul>

<b>Purpose</b>	Open Model Explorer
<b>Syntax</b>	<code>sfexplr</code>
<b>Description</b>	<code>sfexplr</code> opens the Model Explorer. A model does not need to be open.
<b>See Also</b>	<code>sfdebugger</code>   <code>sfhelp</code>   <code>sflib</code>
<b>How To</b>	<ul style="list-style-type: none"><li>• “Using the Model Explorer with Stateflow Objects”</li></ul>

<b>Purpose</b>	Recently selected objects in chart
<b>Syntax</b>	<code>object = sfgco</code>
<b>Description</b>	<code>object = sfgco</code> returns a handle or vector of handles to the most recently selected objects in a chart.
<b>Output Arguments</b>	<code>object</code> 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`

**Tutorials**              • “Quick Start for the Stateflow API”



**How To**

- “Getting a Handle on Stateflow API Objects”
- “Zooming a Chart Object Using the Stateflow API”

# sfhelp

---

<b>Purpose</b>	Open Stateflow online help
<b>Syntax</b>	<code>sfhelp</code>
<b>Description</b>	<code>sfhelp</code> opens the Stateflow online help in the MATLAB® Help browser.
<b>See Also</b>	<code>sfdebugger</code>   <code>sfexplr</code>   <code>sfnew</code>   <code>stateflow</code>

**Purpose** Open Stateflow library window

**Syntax** `sflib`

**Description** `sflib` opens the Stateflow library window. From this window, you can drag Chart and Truth Table blocks into Simulink models and access the Stateflow Examples Library.

**See Also** `sfdebugger` | `sfexplr` | `sfhelp` | `sfnew`

**Purpose** 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 that supports full semantics.

`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 that supports full semantics.

`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:

- |          |  |
|----------|--|
| -Classic | Use full chart semantics               |
| -Mealy   | Use only Mealy state machine semantics |
| -Moore   | Use only Moore state machine semantics |
| -TT      | Use a truth table                      |

`model_name`

Name of the model.

**Examples** 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` | `sfrout` | `sfsave` | `stateflow`

## How To

- “Creating a Stateflow Chart”
- “Creating Mealy and Moore Charts”
- “Building a Model with a Stateflow Truth Table”

# sfopen

---

<b>Purpose</b>	Open existing model
<b>Syntax</b>	<code>sfopen</code>
<b>Description</b>	<code>sfopen</code> prompts you for an <code>.mdl</code> file and opens the model that you select from your file system.
<b>See Also</b>	<code>sfclose</code>   <code>sfdebugger</code>   <code>sfexplr</code>   <code>sflib</code>   <code>sfnew</code>   <code>stateflow</code>

<b>Purpose</b>	Print graphical view of charts						
<b>Syntax</b>	<pre>sfprint sfprint(<i>objects</i>) sfprint(<i>objects</i>,<i>format</i>) sfprint(<i>objects</i>,<i>format</i>,<i>output_option</i>) sfprint(<i>objects</i>,<i>format</i>,<i>output_option</i>,<i>print_entire_chart</i>)</pre>						
<b>Description</b>	<p>sfprint prints the current chart to a default printer.</p> <p>sfprint(<i>objects</i>) prints all charts in <i>objects</i> to a default printer.</p> <p>sfprint(<i>objects</i>,<i>format</i>) prints all charts in <i>objects</i> in the specified <i>format</i> to a default printer.</p> <p>sfprint(<i>objects</i>,<i>format</i>,<i>output_option</i>) prints all charts in <i>objects</i> in the specified <i>format</i> to the file or printer specified in <i>output_option</i>.</p> <p>sfprint(<i>objects</i>,<i>format</i>,<i>output_option</i>,<i>print_entire_chart</i>) prints all charts in <i>objects</i> in the specified <i>format</i> to the file or printer specified in <i>output_option</i>. Prints a complete or current view of charts as specified in <i>print_entire_chart</i>.</p> <p>If the <i>format</i> argument is absent, sfprint generates a PostScript file to the default printer. If the <i>output_option</i> argument is absent, the name of the chart in the current folder becomes the output file name.</p>						
<b>Input Arguments</b>	<p><i>objects</i></p> <p>Objects containing charts to print:</p> <table border="0" style="margin-left: 40px;"> <tr> <td style="padding-right: 20px;"><i>'literal_string'</i></td> <td>Path name of a chart, model, subsystem, or block</td> </tr> <tr> <td style="padding-right: 20px;">gcb</td> <td>Command that specifies the current block of the model</td> </tr> <tr> <td style="padding-right: 20px;">gcs</td> <td>Command that specifies the current system of the model</td> </tr> </table>	<i>'literal_string'</i>	Path name of a chart, model, subsystem, or block	gcb	Command that specifies the current block of the model	gcs	Command that specifies the current system of the model
<i>'literal_string'</i>	Path name of a chart, model, subsystem, or block						
gcb	Command that specifies the current block of the model						
gcs	Command that specifies the current system of the model						

## format

Format of the image to print:

'bitmap'	Save the chart image to the clipboard as a bitmap (for Windows® operating systems only)
'default'	Print image to your default printer
'eps'	Generate an encapsulated PostScript file
'eps'	Generate a color encapsulated PostScript file
'jpg'	Generate a JPEG file
'meta'	Save the chart image to the clipboard as a metafile (for Windows operating systems only)
'png'	Generate a PNG file
'ps'	Generate a PostScript file
'psc'	Generate a color PostScript file
'tif'	Generate a TIFF file

## output\_option

Name of the file or printer:

' <i>output_file_name</i> '	Send output to a file called <i>output_file_name</i>
'clipboard'	Copy output to the clipboard



'file'	Send output to a default file with the name <i>path_to_chart.file_extension</i> , such as <code>sf_pool_Init.jpg</code>
'promptForFile'	Prompt for file name interactively
'printer'	Send output to the default printer (use only with 'default', 'ps', or 'eps' formats)
 <code>print_entire_chart</code>	
View of charts to print:	
1	Print complete charts (default)
0	Print current view of charts

## Examples

Print all charts in the current system as a PostScript file to your default printer:

```
sfprint(gcs)
```

---

Print the complete chart whose path is 'sf\_pool/Pool' in JPEG format:

```
sfprint('sf_pool/Pool','jpg')
```

---

Print the complete chart whose path is 'sf\_car/shift\_logic' in TIFF format using the name myFile:

```
sfprint('sf_car/shift_logic','tif','myFile')
```

# sfprint

---

---

Print the current view of all charts in the current system in PNG format using default file names:

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

## See Also

gcb | gcs | sfhelp | sfnew | sfsave | stateflow

## How To

- “Printing Stateflow Charts”

---

<b>Purpose</b>	Root object
<b>Syntax</b>	<code>object = sfroot</code>
<b>Description</b>	<code>object = sfroot</code> 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.
<b>Examples</b>	<p>Zoom in on a state in your chart:</p> <pre>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;</pre>
<b>See Also</b>	<code>sfclipboard</code>   <code>sfgco</code>
<b>Tutorials</b>	<ul style="list-style-type: none"><li>• “Quick Start for the Stateflow API”</li></ul>
<b>How To</b>	<ul style="list-style-type: none"><li>• “Getting a Handle on Stateflow API Objects”</li><li>• “Accessing the Chart Object”</li></ul>

# sfsave

---

**Purpose** 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. 'Defaults' is a literal string.

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;

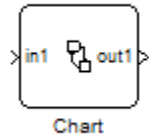
% Add a default transition to state A
dtA = Stateflow.Transition(chart1);
dtA.Destination = sA;
dtA.DestinationOClock = 0;
x = sA.Position(1)+sA.Position(3)/2;
y = sA.Position(2)-30;
dtA.SourceEndPoint = [x y];

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

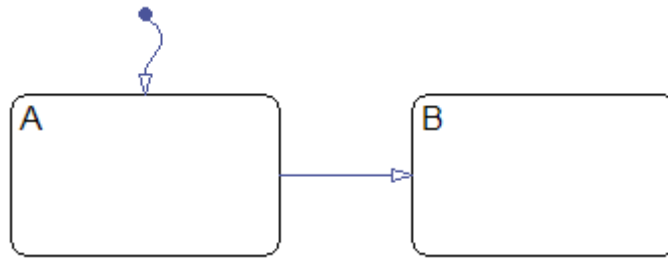
% Add an output out1
d2 = Stateflow.Data(chart1);
d2.Scope = 'Output';
d2.Name = 'out1';

% 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

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

## Tutorials

- “Quick Start for the Stateflow API”

## How To

- “Creating a MATLAB Script of API Commands”

**Purpose** Create empty chart

**Syntax** `stateflow`

**Description** `stateflow` creates an untitled model that contains an empty chart. The function also opens the Stateflow library window. From this window, you can drag Chart and Truth Table blocks into models or access the Stateflow Examples Library.

**See Also** `sflib` | `sfnew`

**How To**

- “Creating a Stateflow Chart”





# Block Reference

---

# Stateflow Chart

---

**Purpose** Implement finite state machine for controlling physical plant

**Library** Stateflow

**Description**



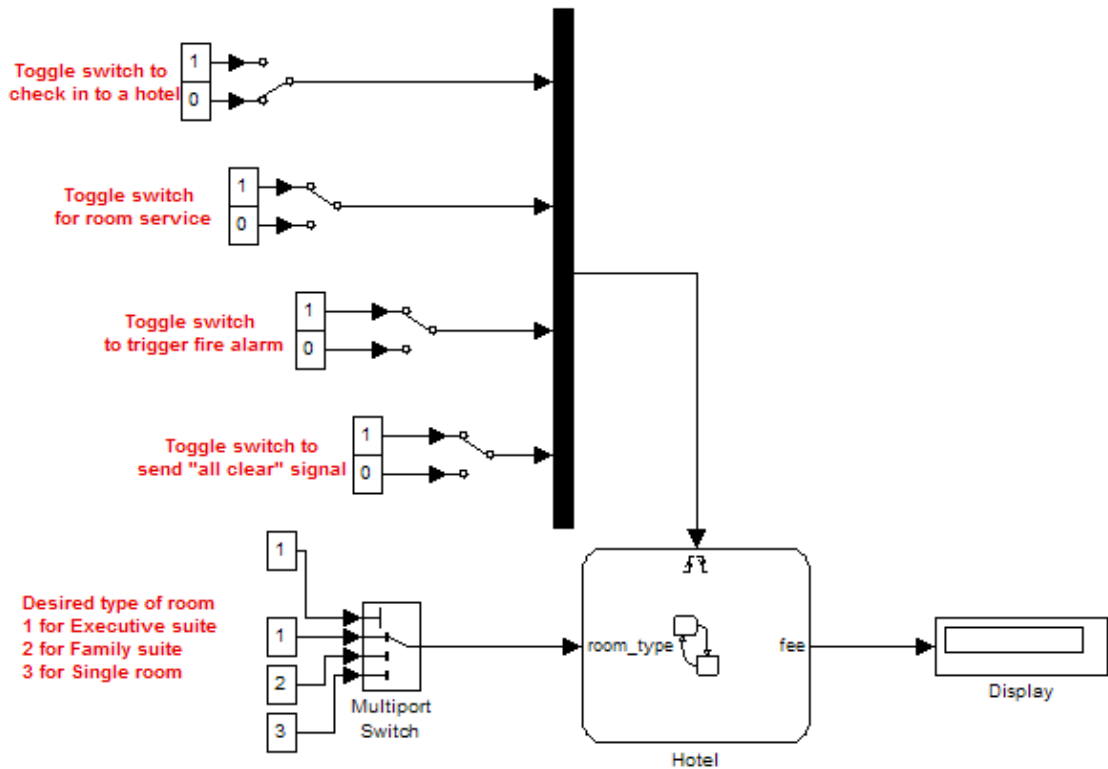
Chart

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

A Stateflow chart is a graphical representation of a finite state machine, where *states* and *transitions* form the basic building blocks of the system. You can also represent stateless flow graphs. To add your control logic to a Simulink model, use a Stateflow block.

You can use Stateflow charts to control a physical plant in response to events such as a temperature or pressure sensor, or clock or user-driven events. For example, you can 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.

The following block diagram contains a Stateflow block named Hotel that responds to inputs from several Manual Switch blocks.





For an introduction to using Stateflow charts in your model, see the *Stateflow Getting Started Guide*.

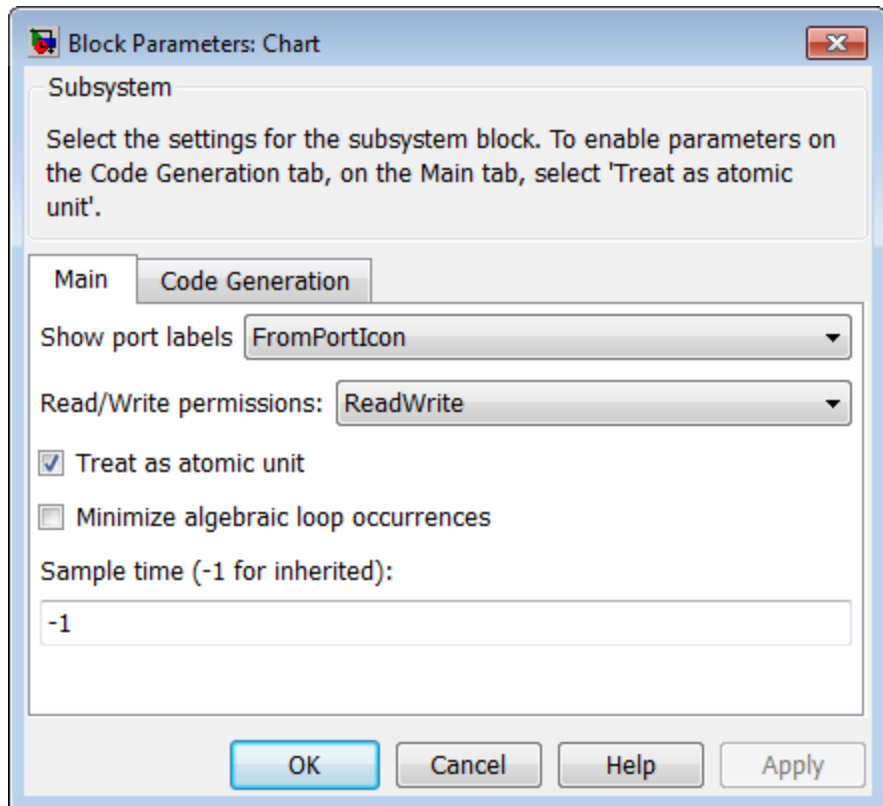
## Data Type Support

The Stateflow block accepts inputs of any type including two-dimensional matrices, fixed-point data, and enumerated data. Floating-point inputs pass through the block unchanged. Boolean inputs are treated as uint8 signals.

You can declare local data of any type or size.

## Parameters and Dialog Box

Right-click a Chart block and select **Subsystem Parameters**.



# Stateflow Chart

---

For a description of the block parameters, see the Subsystem block reference page in the Simulink documentation.

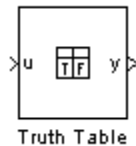
## Characteristics

Direct Feedthrough	Yes
Sample Time	Specified in the <b>Sample time</b> parameter
Scalar Expansion	N/A
Dimensionalized	Yes
Zero-Crossing Detection	Yes, if enabled for continuous-time systems  For more information, see “Modeling Continuous-Time Systems in Stateflow Charts” in the Stateflow documentation.

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

**Library** Stateflow

**Description**



The Truth Table block is a truth table function that uses only MATLAB action language. Use this block when you want to use truth table logic directly in a Simulink model. This block requires a Stateflow license.

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, especially if your model requires only a single truth table.
- You can define truth table inputs and outputs to have 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. For more information, see “Debugging a MATLAB Function in a Chart”.

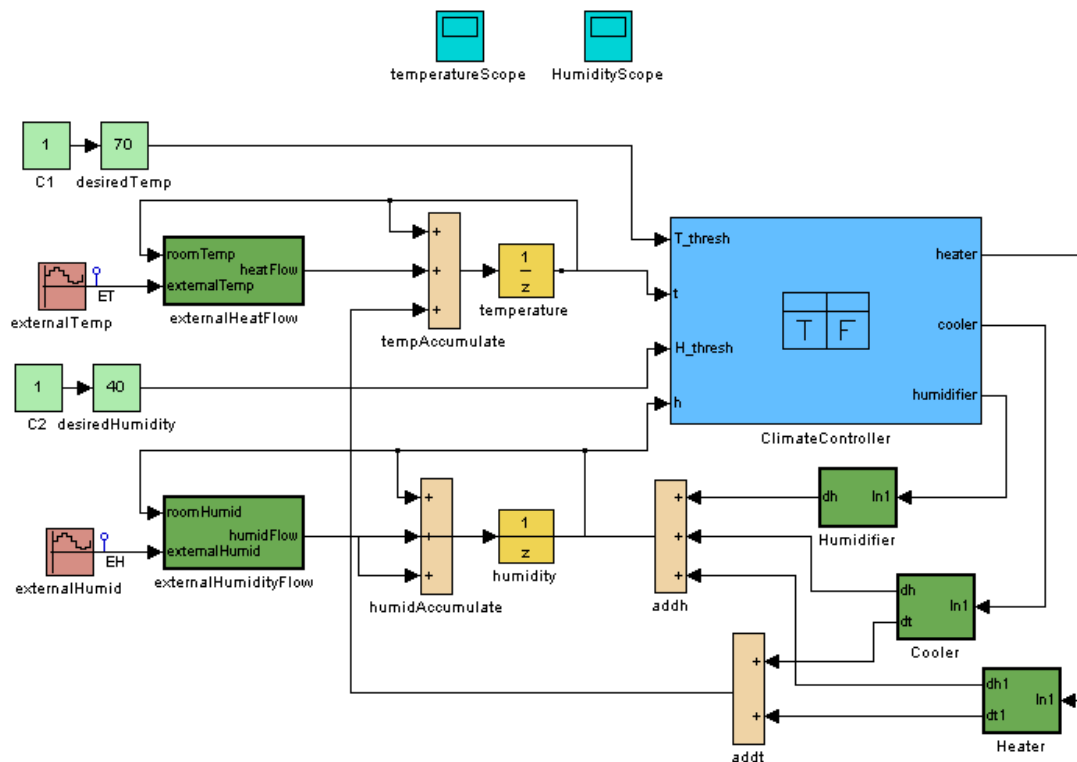
For purely logical behavior, truth tables are easier to program and maintain than graphical functions. Truth tables also provide diagnostics that indicate whether you have too few (underspecified) or too many (overspecified) decisions for the conditions you specify. For an introduction to truth tables, see “Truth Table Functions”.

The following model, `sf_climate_control`, shows a home environment controller that attempts to maintain a selected temperature and humidity. The model has a Truth Table block, `ClimateController`,

# Truth Table

that responds to changes in room temperature (input  $t$ ) and humidity (input  $h$ ).

Home climate (temperature and humidity) controller using Truth Table



## Truth Table Editor

If you double-click the Truth Table block in `sf_climate_control`, the Truth Table Editor opens to display its conditions, actions, and decisions. Here is the display for the Truth Table block named `ClimateController`.



**Condition Table**

	Description	Condition	D1	D2	D3	D4
1	Hot	$t > T\_thresh$	T	T	-	-
2	Dry	$h < H\_thresh$	T	-	T	-
		Actions: Specify a row from the Action Table	CoolOn, HumidOn	CoolOn	HeatOn, HumidOn	HeatOn

**Action Table**

#	Description	Action
1	Turn On Cooling (This implicitly reduces humidity)	CoolOn: cooler = 1; heater = 0; humidifier = 0;
2	Turn On Heater (This implicitly reduces humidity)	HeatOn: heater = 1; cooler = 0; humidifier = 0;
3	Turn On Humidifier	HumidOn: humidifier = 1;

The inputs  $t$  and  $h$  define the conditions, and the outputs  $heater$ ,  $cooler$ , and  $humidifier$  define the actions for this Truth Table block. For more details, refer to the demo description for this model.

Using the Truth Table Editor, you can:

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

# Truth Table



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


## Ports and Data Manager

If you want to add or edit data in a Truth Table block, open the Ports and Data Manager by clicking the **Edit Data/Ports** button in the Truth Table Editor toolbar:



Using the Ports and Data Manager, you can add these elements to a Truth Table block.

Element	Tool	Description
Data		You can add these types of data: <ul style="list-style-type: none"><li>• Local</li><li>• Constant</li><li>• Parameter</li><li>• Data store memory</li></ul>
Input trigger		An <i>input trigger</i> causes a Truth Table block to execute when a Simulink control signal changes or through a Simulink block that outputs function-call events. You can use one of these input triggers: <ul style="list-style-type: none"><li>• Rising edge</li><li>• Falling edge</li><li>• Either rising or falling edge</li><li>• Function call</li></ul>

Element	Tool	Description
		For more information, see “Defining Events”.
Function-call output		A <i>function-call output</i> triggers a function call to a subsystem. For more information, see “Function-Call Subsystems” in the Simulink documentation.

## Data Type Support

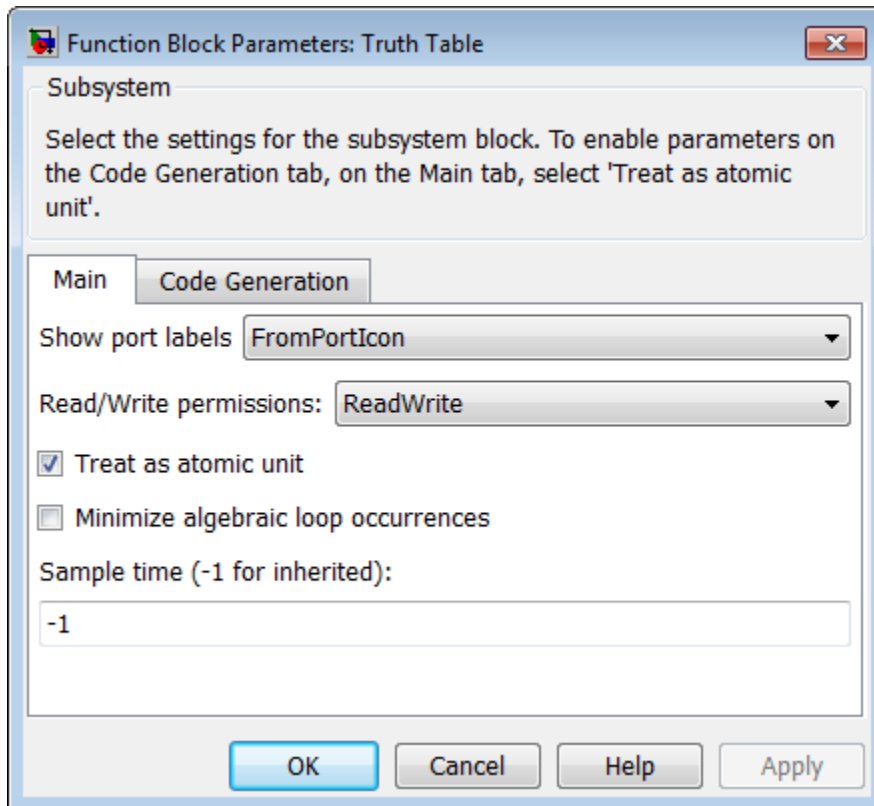
The Truth Table block accepts signals of any data type that Simulink supports, including fixed-point and enumerated data types. The block also accepts frame-based signals. Truth Table blocks work with frame-based signals in the same way as MATLAB Function blocks (see “Working with Frame-Based Signals” in the Simulink documentation).

For a discussion of data types that Simulink supports, refer to the Simulink documentation.

# Truth Table

## Parameters and Dialog Box

Right-click a Truth Table block and select **Subsystem Parameters**.



For a description of the block parameters, see the Subsystem block reference page in the Simulink documentation.

## Characteristics

Direct Feedthrough	Yes
Sample Time	Specified in the <b>Sample time</b> parameter

## Truth Table

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Scalar Expansion	N/A
Dimensionalized	Yes
Zero-Crossing Detection	No

# Truth Table

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## F

### functions

- sfclipboard 2-2
- sfclose 2-3
- sfdebugger 2-4
- sfexplr 2-5
- sfgco 2-6
- sfhelp 2-8
- sflib 2-9
- sfnew 2-10
- sfopen 2-12
- sfprint 2-13
- sfroot 2-17
- sfsave 2-18
- stateflow 2-21

## P

Ports and Data Manager 3-10

## S

- sfclipboard function
  - reference 2-2
- sfclose function
  - reference 2-3
- sfdebugger function
  - reference 2-4

- sfexplr function
  - reference 2-5
- sfgco function
  - reference 2-6
- sfhelp function
  - reference 2-8
- sflib function
  - reference 2-9
- sfnew function
  - reference 2-10
- sfopen function
  - reference 2-12
- sfprint function
  - reference 2-13
- sfroot function
  - reference 2-17
- sfsave function
  - reference 2-18
- stateflow function
  - reference 2-21

## T

- Truth Table block
  - Ports and Data Manager 3-10
  - Truth Table Editor 3-8
- Truth Table Editor 3-8