# Dials & Gauges Blockset

**For Use with Simulink®**

**Modeling**

**Simulation**

**Implementation**

User's Guide

*Version 1*

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| `comp.soft-sys.matlab` | Newsgroup |

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| `info@mathworks.com` | Sales, pricing, and general information |

508-647-7000 Phone

508-647-7001 Fax

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

For contact information about worldwide offices, see the MathWorks Web site.

*Dials & Gauges Blockset User's Guide*





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## 4 Placing ActiveX Controls in a Different Window



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# 1

# Getting Started

This chapter provides a brief overview of the Dials & Gauges Blockset and helps you start exploring the blockset. The sections are as follows.

# What Is the Dials & Gauges Blockset?

The Dials & Gauges Blockset is a collection of blocks that provides graphical instrumentation for monitoring and controlling signals and parameters in Simulink® models. Using the Dials & Gauges Blockset, you can set up realistic-looking instruments that are custom-designed for your Simulink model and visually representative of the environment that you are modeling.

Typical applications of the Dials & Gauges Blockset include

- Automobile dashboard prototyping
- Airplane cockpit prototyping
- Control room and process instrumentation
- Communications and power system simulation
- Prototyping of control, communications, and medical instrumentation

The Dials & Gauges Blockset requires MATLAB® and Simulink. It uses Component Object Model (COM) technology and runs only on Microsoft Windows platforms.

# Related Products

The MathWorks provides several products that are especially relevant to the kinds of tasks you can perform with the Dials & Gauges Blockset. In particular, the Dials & Gauges Blockset requires these products:

- MATLAB
- Simulink

For more information about any of these products, see either

- The online documentation for that product if it is installed or if you are reading the documentation from the CD
- The MathWorks Web site, at `http://www.mathworks.com`; see the "products" section

The toolboxes listed below all include functions that extend the capabilities of MATLAB. The blocksets all include blocks that extend the capabilities of Simulink.

| Product | Description |
|---|---|
| Aerospace Blockset | Model, analyze, integrate, and simulate aircraft, spacecraft, missile, weapon, and propulsion systems |
| DSP Blockset | Design and simulate DSP systems |
| Fixed-Point Blockset | Design and simulate fixed-point systems |
| Real-Time Windows Target | Run Simulink and Stateflow models on a PC in real time |
| Real-Time Workshop | Generate C code from Simulink models |
| SimMechanics | Model and simulate mechanical systems |
| SimPowerSystems | Model and simulate electrical power systems |
| Simulink | Design and simulate continuous- and discrete-time systems |

| Product (Continued) | Description (Continued) |
|---|---|
| Stateflow | Design and simulate event-driven systems |
| Virtual Reality Toolbox | Create and manipulate virtual reality worlds from within MATLAB and Simulink |
| xPC Target | Perform real-time rapid prototyping using PC hardware |

## External Mode Support

The Dials & Gauges Blockset support for external mode allows you to incorporate dials and gauges into any target that you can connect to through external mode (such as the xPC Target and Real-Time Windows Target environments; see the documentation for those products for details).

For more information about external mode, see the external mode section of the Real-Time Workshop documentation.

## Real-Time Workshop Support

You can use Real-Time Workshop® 4.0 or later to generate code from models that include Dials & Gauges Blockset blocks.

For dials, the code you generate contains static values (that is, the value specified at the time of code generation). Gauges are ignored during code generation, except through the use of external mode (see above). If you want to manipulate dials and view the gauges, you can do so through the external mode in Real-Time Workshop.

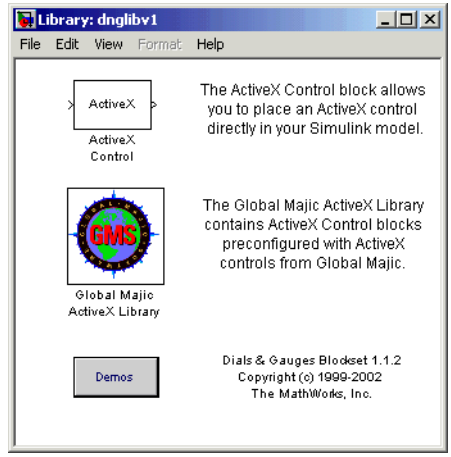
# Accessing the Preconfigured Blocks

The Dials & Gauges Blockset contains many preconfigured blocks, via the Global Majic ActiveX Library. To access these blocks, follow the procedures described in one of these two sections:

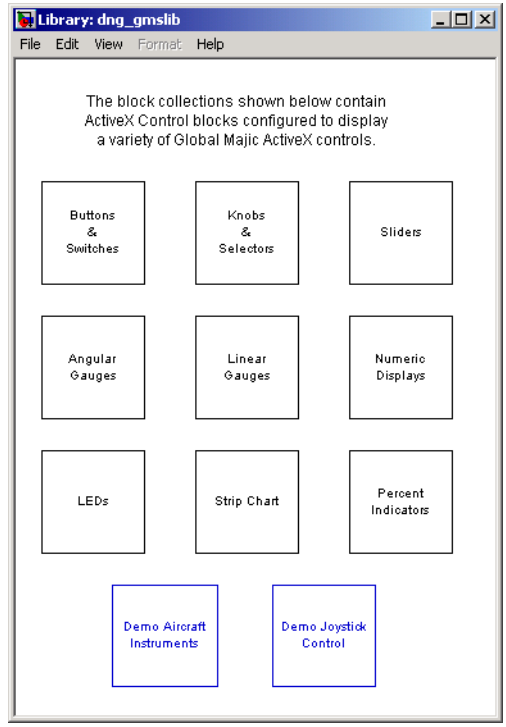
- "Using the dnglib Command in MATLAB"
- "Using the Simulink Library Browser" on page 1-6

## Using the dnglib Command in MATLAB

1 Enter the `dnglib` command in the MATLAB Command Window, which causes the following window to appear.




2 Double-click on the Global Majic ActiveX Library icon to access the libraries it contains.

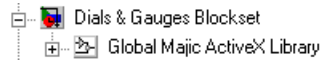



Each icon represents a different library of blocks. Double-click on an icon to access the blocks in the library. If they all say “ActiveX” and do not look like graphical instruments, then follow the instructions in “Configuring the Dials & Gauges Blockset” on page 1-8. Each library also includes a question-mark block that provides access to online help for the ActiveX controls in that library.

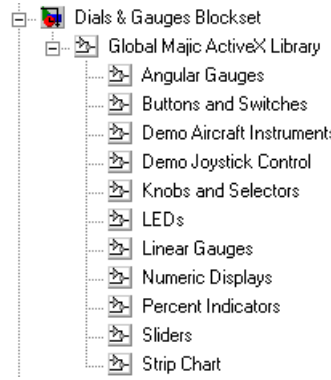
## Using the Simulink Library Browser

As an alternative to the `dnglib` command, you can use the Simulink Library Browser to access the preconfigured blocks:

1 Open the Dials & Gauges Blockset by clicking on the plus sign to the left of the blockset name. This displays the listing for the Global Majic ActiveX Library.



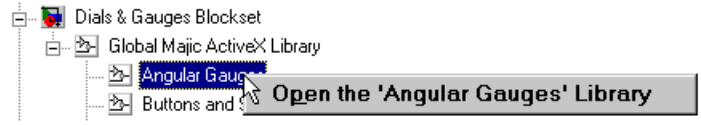

**2** Open the Global Majic ActiveX Library to display its libraries of blocks.



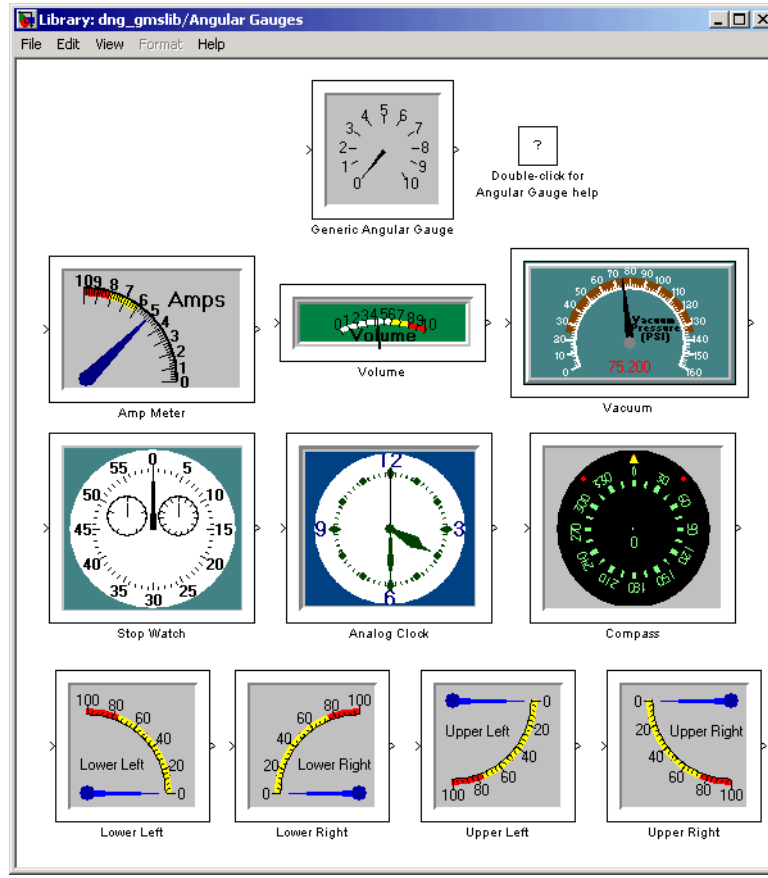

If you click on the name of a library, then the right pane of the Simulink Library Browser displays the library's contents.

## Opening a Library Window From the Simulink Library Browser

You can also view the blocks as instruments in a library window by right-clicking on the library name, and then selecting the option that appears. For example, the figure below shows the context menu that appears when you right-click on the Angular Gauges listing.




The next figure shows the Angular Gauges library contents as instruments in a library window. If the window you see does not look like the figure, then follow the instructions in "Configuring the Dials & Gauges Blockset" on page 1-8.




## Configuring the Dials & Gauges Blockset

Normally, the installation process automatically registers the ActiveX controls associated with the Dials & Gauges Blockset. However, in exceptional cases you might see an error message referring to an `.ocx` component, similar to the following message:

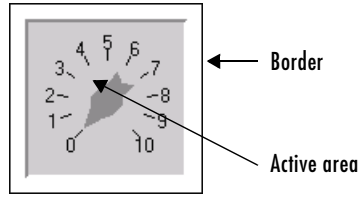
```
Copying Dials & Gauges Blockset files
ads.ocx self registering file did not register
```

If you see such a message, or if the graphical instruments do not appear on the blocks in this blockset, then try one of the following:

- Enter `dng_register_ocx` in the MATLAB Command Window.
- See Solution Number 24876 in the Support area of the MathWorks Web site (`http://www.mathworks.com/support`).

# Moving and Selecting Blocks

The way you move and select blocks from the Dials & Gauges Blockset differs from how you move and select a Simulink block. Dials & Gauges Blockset blocks consist of an "active" area containing the actual ActiveX control, and a border surrounding the active area. The border gives you a way to manipulate the block as a Simulink entity, without affecting the ActiveX control.




Dials & Gauges Blockset blocks are active even when a simulation is not running; that is, dragging the cursor anywhere within the active area is interpreted as attempting to change the value of the control. The table below describes how to manipulate a Dials & Gauges Blockset block.

| Task | Mouse Action |
|---|---|
| Add block to model | From the Simulink Library Browser, drag the block by its icon in the right pane. |
| | From the library window (displaying blocks as instruments), drag the block by its border. |
| Move block | Drag the block's border. You can do this only if the border is visible. |
| Select block | Click on the block's border. Or "rubber-band select" the block. |
| Resize block | Select the block, and then drag one of the selection handles (as you would resize a Simulink block). |

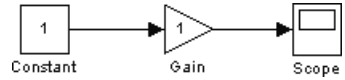
# Building a Simple Model

This section illustrates how to build and use a simple system, first using Simulink blocks alone, and then using blocks from the Dials & Gauges Blockset. By building the latter model, you can practice finding and using blocks from the Dials & Gauges Blockset. By comparing the two models, you can get a better sense of how graphical instruments might enhance the look, feel, and usability of your own models. This section includes



## The Original Simulink Model

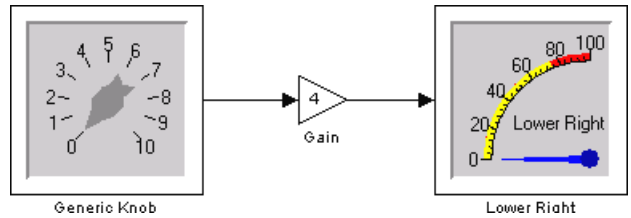
Consider a system in which a Constant block feeds into a Gain block, while a Scope block displays the output from the Gain block. All three of these blocks are part of Simulink.




If you simulate this system and double-click on the Scope block, then the Scope traces the value of its input signal over time. To change the value of the signal that feeds into the Gain block, you double-click on the Constant block, type a different number in the **Constant value** parameter field, and click on the **OK** or **Apply** button in the dialog box.

## Replacing Simulink Blocks with Instrumentation

Using the Dials & Gauges Blockset, you can replace the Constant and Scope blocks from Simulink with instrument-like input and output. For example, a Generic Knob block can provide variable input to the Gain block, which passes its signal to a Lower Right display block.



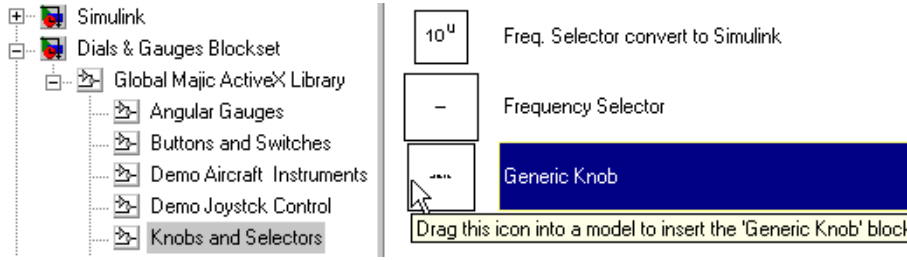

When you simulate this system, the Lower Right block displays the value of the signal at that instant. To change the value of the signal that feeds into the Gain block, you use your mouse to adjust the needle on the Generic Knob block.

## Building the Model

To build the model described earlier, follow the steps below. Alternatively, type `dng_simple` in MATLAB to open a completed copy of the model.

1 Open the Simulink Library Browser and create a new model window.

2 From the Knobs and Selectors library, drag the Generic Knob block into the model. To do this, select Knobs and Selectors in the left pane of the Simulink Library Browser, and then drag the Generic Knob block from the right pane into the model.




3 From the Simulink Math library, drag the Gain block into the model window.

4 Double-click on the Gain block and change the **Gain** parameter to `4`.

5 From the Angular Gauges Library, drag the Lower Right block into the model.

6 Draw connection lines from the Generic Knob block to the Gain block, and from the Gain block to the Lower Right block.

7 From the model window's **Simulation** menu, choose **Simulation parameters**. Set the **Stop time** parameter to `Inf`.

Now you can run the model and watch how adjustments to the Generic Knob block affect the needle on the Lower Right block.

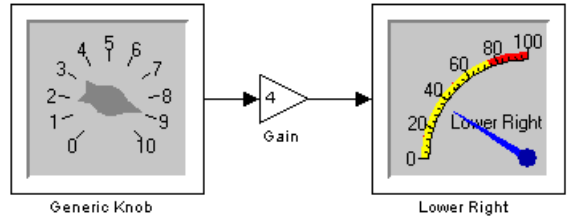
# Working with a Model

This section indicates how you can perform common tasks involving the model you built in the section "Building the Model" on page 1-12. This section includes

- "Running the Simulation"
- "Saving the Model"
- "Printing the Model" on page 1-15

## Running the Simulation

Run the simulation by choosing **Start** from the model window's **Simulation** menu. While the simulation is running, you can manipulate the needle of the Generic Knob block and observe results on the Lower Right gauge block. This figure shows the model after the needle of the Generic Knob block is moved from its default position.




To stop the simulation, choose **Stop** from the model window's **Simulation** menu.

## Saving the Model

Save the model by choosing **Save** from the model window's **File** menu. When you save a model that contains blocks from the Dials & Gauges Blockset, MATLAB automatically saves additional files that describe each Dials & Gauges Blockset block. For example, if you save the model described in this chapter with the name `sample`, then MATLAB saves the following files.

```
sample.mdl
sample@Generic_Knob.ax
sample@Lower_Right.ax
```

The files with the `.ax` extension describe the Dials & Gauges Blockset blocks. Note that these files are not text files. They save the current state of the ActiveX control that is embedded in the block. If you delete the `.ax` files, then the corresponding blocks reinitialize themselves to the exact state in which they are stored in the library.

---

**Note** The easiest way to rename a model is to open it in Simulink and use the **Save As** menu option. If, alternatively, you simply rename the `.mdl` file from your operating system, then remember to rename the associated `.ax` files.

---

### Dials & Gauges Blockset Blocks Within Subsystems

If you save a model that contains a Dials & Gauges Blockset block within a subsystem, then the subsystem's name is also included in the name of the `.ax` file. For example, if the model contains a Generic Knob block inside a subsystem named `SubSystem`, then the following file is saved.

```
sample@SubSystem@Generic_Knob.ax
```

## Printing the Model

You can print the structure of the model by choosing **Print** from the model window's **File** menu. Note that the printing functionality in Simulink does not print the active areas of Dials & Gauges Blockset blocks. Instead, it shows only the outline of those blocks.

To capture the exact appearance of a model that contains Dials & Gauges Blockset blocks, you can create a `.bmp` file that represents the model by entering either of these commands in the MATLAB Command Window.

```
print -smodelname -dbitmap filename
```

```
print(['-s','modelname'],'-dbitmap','filename')
```

Here, `modelname` and `filename` list the names of the Simulink model and the bitmap file, respectively. For example, if the open model is called `sample`, then this command saves it in a file called `samplepic.bmp`.

```
print -ssample -dbitmap samplepic
```

After MATLAB creates the bitmap file, you can insert it into an application that can print it.

# Modifying Properties of Blocks

This section describes how to view and modify properties of a preconfigured Dials & Gauges Blockset block using a dialog box. This section includes

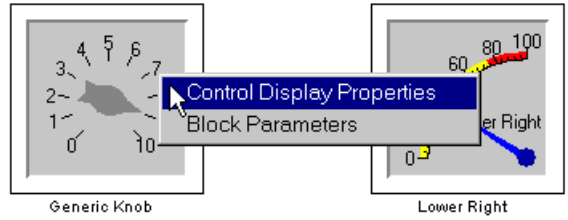


## Accessing the Properties

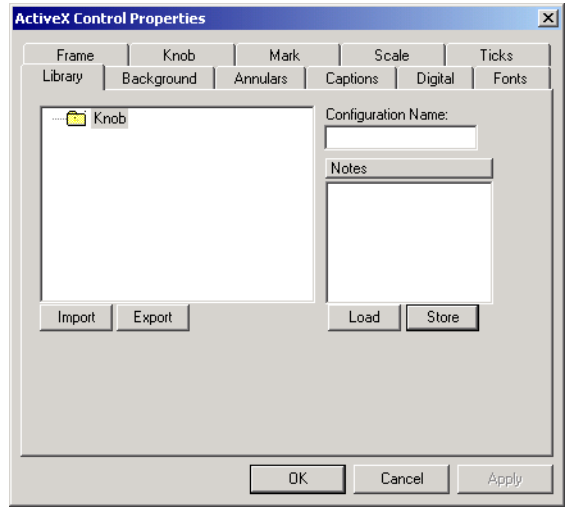
You can view ActiveX control properties by using one of these procedures:

- Double-click on the active area of the block that contains the control.
- Right-click on the active area of the block and select the **Control Display Properties** option.

This figure shows the context menu that appears when you right-click on the Generic Knob block.




After you select the **Control Display Properties** option, the **ActiveX Control Properties** dialog box appears. This dialog box allows you to modify ActiveX control properties. The next figure shows the dialog box for the Generic Knob block.




If you modify any values in this dialog box, then the block is visually updated immediately. However, the changes are not permanent until you choose **OK** or **Apply**; if you choose **Cancel**, then the changes will be undone.

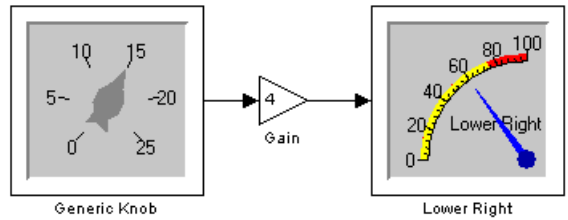
## Example of Modifying Properties

Returning to the model that you built in the section "Building a Simple Model" on page 1-11, you can modify the range of possible input values by modifying the properties of the Generic Knob block. For example, the instructions below change the maximum knob value from 10 to 25 so that the maximum value on the knob corresponds to the maximum value on the Lower Right gauge block.

1. Open the **ActiveX Control Properties** dialog box by double-clicking on the active area of the Generic Knob block.
2. Display the panel that controls the scaling of values by clicking on the **Scale** tab.
3. Set the **Max** parameter to 25.
4. Display the panel that controls tick marks by clicking on the **Ticks** tab.
5. Set the **StopValue** parameter to 25.

6 Set the **DeltaValue** parameter to 5. This prevents the knob block from looking too crowded.

The figure shows the resulting model. Notice that the knob can now register values between 0 and 25, and that it displays values in increments of 5.




## Learning More About Properties

Dials & Gauges Blockset blocks have many properties. Changing the appearance of a block might require changing several properties and can be quite complex. “Modifying ActiveX Control Properties” on page 2-3 discusses how to make some common changes, such as changing the range of values displayed on a block.

For information about specific properties, consult the ActiveX control’s help by double-clicking on the question-mark block that appears in each library of the Dials & Gauges Blockset. Some libraries provide more than one question-mark block when the blocks contained in the library are significantly different from each other. Once in the Help window, use the **Properties** link to display information about block properties.

2

# Using Instrumentation in a Model

This chapter discusses tasks involved in using instrumentation in a model. The sections are as follows.

| | |
|---|---|
| Connecting Blocks in a Model (p. 2-2) | How to determine which types of connections a block can have |
| Modifying ActiveX Control Properties (p. 2-3) | How to change various properties of a block using the **ActiveX Control Properties** dialog box |
| Controlling Multiple Graphical Elements (p. 2-18) | How to make a multiple-component gauge display multiple input values simultaneously |
| Saving and Reusing a Customized Control (p. 2-29) | How to store your customized block properties for later use or to share with other users |

# Connecting Blocks in a Model

Before you connect a Dials & Gauges Blockset block with other blocks, you should know whether it is meant to be an input device (with an output connection), or an output device (with an input connection). Dials & Gauges Blockset blocks are initially drawn with both an inport and an outport, but Simulink removes unused ports when the simulation starts running or when you update the block diagram.

To determine whether a Dials & Gauges Blockset block is meant to be used as an input or output device, right-click on the block and select the **Block Parameters** option.

---

**Note** If you built your own ActiveX control by customizing the generic ActiveX Control block, then another way to display the custom block's **Block Parameters** dialog box is to double-click on the border of the block.

---

In the **Block Parameters** dialog box, the **Connections** field determines the type of connection the block currently uses:

- `Input` indicates that the block has an inport and receives a signal. The **Input property** parameter indicates the block's property whose value is changed by the input.
- `Output` indicates that the block has an outport and outputs a signal. The **Output property** parameter indicates the block's property whose value is output.
- `Both` indicates that the block has an inport and an outport and receives and outputs a signal.
- `Neither` indicates that the block has neither an inport nor an outport.

To specify a connection different from the block's default setup, change the block's **Connection** setting and make sure that the **Input property** and **Output property** fields are filled in with the appropriate property name. See "Summary of Dialog Box Fields and Check Boxes" on page 3-29 for information about the other fields and check boxes. You can also use the **Help** button to find out about other parameters.

# Modifying ActiveX Control Properties

You can modify many properties of a preconfigured Dials & Gauges Blockset block using its **ActiveX Control Properties** dialog box, introduced in "Accessing the Properties" on page 1-17. This section discusses some of the more complicated tasks and concepts associated with the modification of properties, in these subsections:

- "Using Multiple Styles Within One Block"
- "Understanding ID Properties" on page 2-6
- "Displaying Text on a Block" on page 2-8
- "Controlling Values with the Mouse" on page 2-10
- "Modifying the Displayed Range" on page 2-11
- "Modifying Multiple Tick Marks" on page 2-14

For more information about individual properties of the preconfigured blocks, see the online help for the corresponding ActiveX controls. To access such help, open the library window and double-click on the question-mark block. The online help summarizes the functionality and contains links to information about properties, events, and methods.

## Using Multiple Styles Within One Block

Some ActiveX control properties let you use more than one style for a given component or characteristic, in the same block. For example, you might use multiple styles to create

- Different font characteristics for text in different places
- Multiple colors within a graphical element such as an annular region or a divided pie chart
- Multiple sets of ticks, each with its own size or labeling characteristics
- Multiple components, such as LEDs or needles, each with its own characteristics

These sections discuss the use of multiple styles in preconfigured Dials & Gauges Blockset blocks:

- "Blocks that Use Multiple Styles by Default" on page 2-4
- "Determining When Multiple Styles Are Allowed" on page 2-4

### Blocks that Use Multiple Styles by Default

Many Dials & Gauges blocks include multiple styles by default:

- The Vacuum block in the Angular Gauges library uses three text styles: one for the tick labels, one for the number at the bottom of the gauge, and one for the text near the center of the gauge.
- The Volume block in the Angular Gauges library uses three adjacent annular regions, each with a different color.
- The Thermometer block in the Sliders library uses two styles for ticks: one for numbered ticks every 10 degrees and another for unnumbered ticks every 2 degrees.
- The Circle Meter block in the LEDs library applies one of three LED styles to each of 10 LEDs. The three styles differ in their colors.

### Determining When Multiple Styles Are Allowed

If a component supports multiple styles, then its property dialog box has properties that allow you to set the number of styles and refer to the styles by number. As an example, the figure below shows how a dialog box supports multiple font styles. The **Fonts** property indicates the number of font styles, while the **FontID** property refers to a given style by number.


To determine whether a component supports multiple styles, look in the block's property dialog box for a pair of properties whose names are

- A plural noun describing the component, such as **Fonts** or **Scales**
- A word that combines the noun and the letters "ID," such as **FontID** or **ScaleID**

If the dialog box has no such properties for the component, then you cannot create multiple styles for that component. For example, in the **Background** panel of a block's dialog box, you can define the color of an outline, but you cannot create multiple concentric outlines of different colors.

### Creating Styles

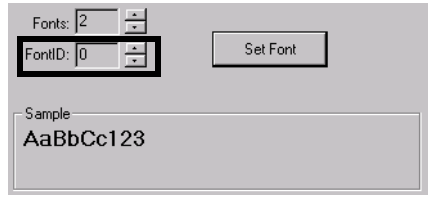
After locating the style-identifying pair of properties for the component you are interested in, follow these steps to create an additional style:

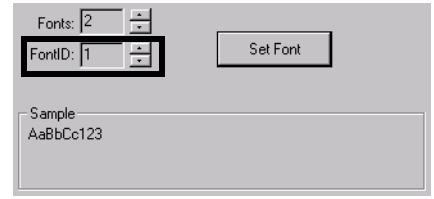
1. Click once on the up arrow next to the value of the first property in the pair (**Fonts** in the figure). This value is the number of defined styles. If N styles are defined, then each is associated with an integer between 0 and N-1. The corresponding ID property (**FontID** in the figure) can assume values between 0 and N-1.

2. Click repeatedly on the up arrow next to the ID property to set it to its maximum value. This causes the dialog box panel to reflect the attributes of that particular style instead of the other defined styles.

3. Configure other properties in the dialog box panel to match the attributes that you want that particular style to have. In the figure, the **Set Font** button allows you to set font attributes and the **Sample** box displays text using those attributes. In many cases, all properties in the panel except the original style-identifying pair are attributes of the style. In a few cases, only part of the panel contains attributes of the style and others are global attributes that apply to all styles.

To view attributes of an existing style, set the ID property to the integer associated with that style. Then, properties on the dialog box panel other than the style-identifying pair reflect attributes of that style. For example, the figure below shows how the **Sample** portion of the **Fonts** panel of a dialog box displays either a large bold font or a font of medium size and weight, depending on whether the **FontID** value is set to `0` or `1`.

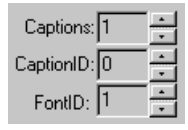



### Applying Styles

In some cases, creating a style implicitly causes the block to apply it. For example, creating an additional style for tick marks automatically creates an additional set of tick marks on the block. In other cases, creating a style does not implicitly cause the block to apply it. For example, even after you create an additional font style, you will not see its effect on the block until you indicate which text should use that style. This section describes how to apply styles that the block does not apply immediately after you create them.

To determine where you can apply a style you have created, look for the corresponding ID property on a panel of the dialog box *other than* the panel where you defined the style. For example, the figure below shows part of a **Captions** panel containing the **FontID** property. The fact that the **FontID** property is not preceded by a **Fonts** property indicates that this is a panel that allows you to apply font styles but not define them.




Once you have located a part of the dialog box where you can apply a style you previously created, set the ID property to match the ID property of that style. For example, the figure above shows that the block has exactly one caption, and that the caption's font style is the one whose ID is 1. If you change the **FontID** value in the **Captions** panel to a different number, then you will probably notice a change in some text on the block.

## Understanding ID Properties

Many blocks have properties whose names end with **ID**, such as **FontID**, **ScaleID**, and **NeedleID**. Such properties allow you to use more than one style

in the same block, as in the situations listed in "Using Multiple Styles Within One Block" on page 2-3. This section describes how to interpret ID property settings. For an example that examines ID property settings among a block's default settings, see "Modifying Multiple Tick Marks" on page 2-14.

The value of an ID property refers to a style by number. To determine the purpose of the ID property, first see whether the property directly above it is a plural noun similar to the ID property's name. (For example, see whether the property directly above **FontID** is **Fonts**.) Then,

- If the property directly above the ID property is a plural noun similar to the ID property's name, then this panel of the dialog box *defines* a set of styles. The ID property associates a number with each style. Other properties in the dialog box panel reflect the definition of the style whose number is the current value of the ID property. By changing the value of the ID property, you can view the definition of a different style.

  For example, in the **Fonts** panel of the Volume block, the **FontID** property occurs directly underneath a **Fonts** property. This panel of the dialog box defines font styles, and the **Sample** box displays text using the font style whose number is the current value of the **FontID** property.

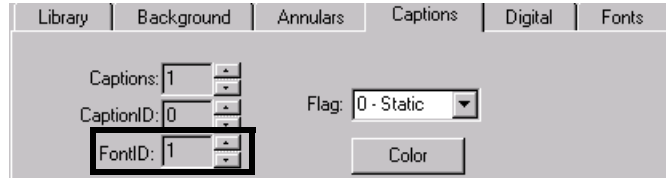
---

**Caution** If you decrease the value of the property named by the plural noun (for example, the **Fonts** property), then the style corresponding to the highest ID value is removed. To replace that style, you have to add a new style and recreate the settings of the deleted style from the default settings.

---

- If the property directly above the ID property is *not* a plural noun similar to the ID property's name, then the ID property *applies* a style that was previously defined in another panel of the dialog box. Other properties in the dialog box panel indicate the context in which the style is applied. By changing the value of the ID property, you can select a different style to apply.

  For example, in the **Captions** panel of the Volume block, the **FontID** property does not occur directly underneath a **Fonts** property. The purpose of the **FontID** property in this case is to reference previously defined font styles and apply them to captions. (The font styles are defined on the **Fonts** panel of the dialog box.)




Sometimes, multiple styles are combined so seamlessly that it is not obvious why multiple styles are needed or which parts of the block correspond to which style definitions. You can often adjust the definition of the style to make the style usage more apparent. For example, if you change the colors of different annular regions and then look for the corresponding change in the block, then you should be able to determine how the design is split among multiple annular regions.

## Displaying Text on a Block

Many blocks allow you to include text on the block. Such text might describe the quantity being measured, the units of measurement, or other information. The table below lists some types of text that are associated with a specific part of the block, as well as the part of the **ActiveX Control Properties** dialog box panel that defines the text. Some types of text apply only to certain blocks.

| Type of Text | Part of Dialog Box That Defines or Enables Text |
|---|---|
| Title appearing in block's outline | **Title** property on **Background** panel |
| Numerical labels near tick marks | **Labels** area on **Ticks** panel. On Strip Chart block, **Labels** properties on **Tracks** and **X Axis** panels. |
| Numerical labels near pointer, needle, or knob | **Digital** panel |
| Captions appearing anywhere on block | **Captions** panel |

## Using the Captions Panel to Display Text

When it is present, the **Captions** panel of the **ActiveX Control Properties** dialog box allows you to place text anywhere on the block. Blocks that use text captions by default include Mixer Scale, Tank, Thermometer, Amp Meter, and Volume. This section describes how to add, remove, and change characteristics of text captions using the **Captions** panel.

**Adding Text Captions.** To create a new text caption, follow these steps:

1. Increase the value of the **Captions** property by one.
2. Set **CaptionID** to its maximum value. This is the index that corresponds to the newest text caption.
3. Type the desired text in the **Caption** edit field.

**Removing Text Captions.** To remove the most recently added text caption (that is, the one with the largest **CaptionID** value), decrease the value of the **Captions** property by one. Note that this removes all characteristics of that text caption.

**Changing Fonts and Other Characteristics of Text Captions.** To change the font of an existing text caption, you must create a numbered font style and then apply that style to the caption. Follow these steps:

1. Open the **Fonts** panel of the dialog box.
2. Allocate space for a new font style by increasing the value of the **Fonts** property by one.
3. Set **FontID** to its maximum value. This is the index that corresponds to the newest font style.
4. Use the **Set Font** button to select font characteristics.
5. Open the **Captions** panel of the dialog box.
6. Set **CaptionID** to the index that corresponds to the text caption whose font you want to change.
7. Apply the font style to the caption by setting **FontID** to the font style's index.

To change other characteristics of an existing text caption, first set the **CaptionID** property on the **Captions** panel to the value that corresponds to the text caption you want to change. Then use other properties on the dialog box panel, *except* the **Captions** counter, to configure the text caption accordingly.

---

**Note** For text captions, the color choice on the **Captions** dialog box panel overrides the color choice on the **Fonts** dialog box panel.

---

## Controlling Values with the Mouse

A key benefit of using a source block, such as a knob or slider, from the Dials & Gauges Blockset is the ability to adjust the value of the control by clicking or dragging the mouse over the control. Except for toggle elements, most mouse-controllable values in this blockset offer three modes of mouse response: `None`, `Relative`, and `Snap To`. This section describes the mouse-reponse modes and explains how to choose a mouse-response mode.

### Description of Mouse-Response Modes

The table below describes how a control's value responds to mouse events under different mouse-response modes.

| Mode | Behavior |
|---|---|
| `None` | The control's value does not respond to mouse events. |
| `Relative` | The change in the control's value depends on the change in the mouse position when the mouse pointer is dragged. |
| `Snap To` | The control's value becomes that of the current mouse position when the mouse button is released. |

**Note** Some mouse-controllable blocks do not offer these options. Blocks in the Buttons & Switches library always respond to mouse clicks. If the Odometer block has a reset button, then it always responds to mouse clicks.

For example, if a vertical slider block uses the `Snap To` mode, then you can set the block's value to `12` by clicking on the value `12` on the block. If the same block uses the `Relative` mode and has a current value of `20`, then you can set the block's value to `12` by dragging the mouse pointer downward until the slider knob corresponds to `12`. When you drag, the mouse pointer must be within the bounds of the slider control, but does not need to be on or near the value `12`.

### Choosing a Mouse-Response Mode

The mouse-response modes described above correspond to settings of the **MouseControl** property in a block's **ActiveX Control Properties** dialog box. The table below indicates which categories of blocks and which dialog box panels have a **MouseControl** property.

| Category of Block | Panel in Dialog Box with MouseControl Property |
|---|---|
| Angular Gauges | Needles |
| Knobs & Selectors | Knob |
| Linear Gauges | Pointers |
| Percent Indicators | Portions |
| Sliders | Knob |

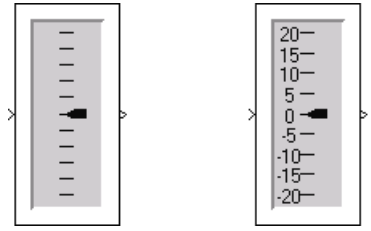
In typical Simulink models, blocks acting as sources use the `Relative` or `Snap To` mode to enable mouse control, while blocks acting as sinks use the `None` mode to disable mouse control.

## Modifying the Displayed Range

Changing the range of values displayed on a block involves adjusting these properties:

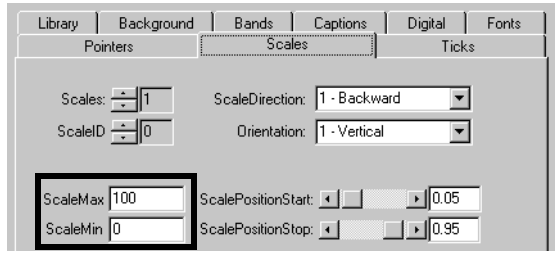
- Scale properties define the extent of the units displayed by the block, the location of the block's center, and the block's start and stop positions.
- Tick mark properties define tick marks on the block, including start and stop values, the interval between tick marks, and label positions.
- Needle or pointer properties indicate the value.

To illustrate how to use these properties to adjust the range of values displayed on a block, this example changes the Generic Linear Gauge to display values from -20 to 20, sets the interval between tick marks to 5, and shows the tick mark labels. This figure shows the Generic Linear Gauge with its default settings (left) and with modified settings (right).




## Changing the Scale

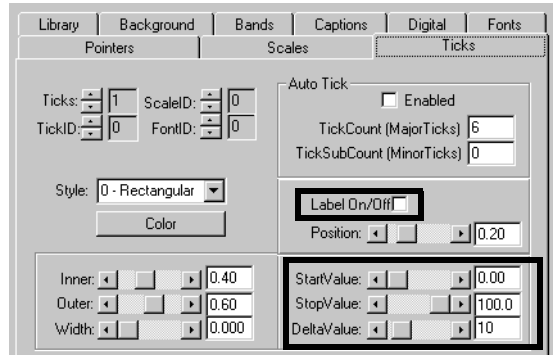
Click on the **Scales** tab to display the scales properties page. This figure shows the default scale properties for the Generic Linear Gauge.




To modify the scale range, change **ScaleMax** to 20 and **ScaleMin** to -20.

## Displaying Labels Next to Tick Marks

Click on the **Ticks** tab to display the tick mark properties page. This figure shows the default tick mark properties.

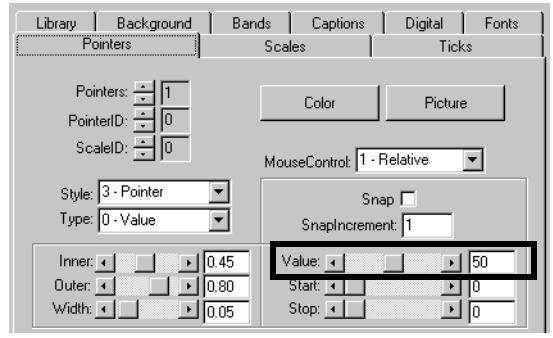



To show tick mark labels, check the **Label On/Off** check box.

To set the starting and ending tick marks so they mark the minimum and maximum scale settings, set **StartValue** to `-20` and **StopValue** to `20`. Change the **DeltaValue** property, which sets the spacing between tick marks. A value of `5` is reasonable for default block size.

## Setting the Current Pointer Value

Click on the **Pointers** tab to display the pointer properties page. This figure shows the default pointer properties.



The **Value** property indicates the current pointer value. Set the initial value to `0`, halfway between the maximum and minimum scale values. Click on **OK** to accept the changes and close the dialog box.

## Modifying Multiple Tick Marks

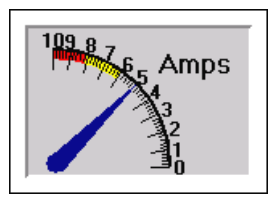
This example illustrates the use of multiple tick marks and the use of the ID property to manage them. Instead of modifying a block, this example examines the default settings for a particular block.

---

**Note** This release of the Dials & Gauges Blockset does not support the use of multiple needles or pointers to display more than one value. Passing a vector signal to a Dials & Gauges Blockset block displays only the first element of the vector. The Strip Chart block, however, is an exception to this because it *does* support vector input.

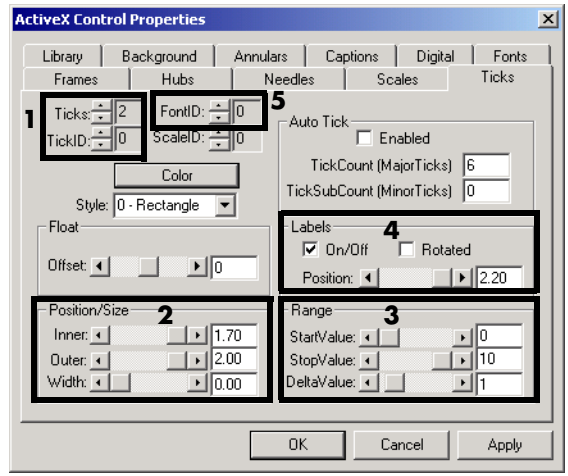
---

This figure shows the Amp Meter block. Notice that the tick marks have two different lengths. These are created by defining two sets of tick marks.




The first set consists of 11 longer tick marks, each positioned at one of the label values, positioned at increments of 1.0. The second set consists of five shorter tick marks for each integer change in the scale, positioned at increments of 0.2.

To examine how these tick marks have been created, double-click on the Amp Meter block to display its properties dialog box. Select the **Ticks** tab.




The **Ticks** and **TickID** properties, in the box labeled **1**, are defined as follows:

- The **Ticks** property specifies how many sets of tick marks are used by the block. For this block, this property is set to **2**.
- The **TickID** property indicates which set of tick marks is defined by the other properties on this page. When specifying the characteristics of a set of tick marks, you set the **TickID** property, and then define the property values for that set of tick marks. In the dialog box page above, the settings for all the properties on the page apply to the first set, identified as **TickID** 0.

---

**Note** When you define multiple components, the first instance is identified by an ID of 0. In this example, the two sets of tick marks have IDs of 0 and 1.

---

The **Position/Size** properties, in the box labeled **2**, are defined as follows:

- The **Inner** property defines the edge of the tick mark closest to the needle center and the **Outer** property defines the edge of the tick mark farthest from the needle center. To see where the tick marks are located relative to the needle length, examine the needle length by selecting the **Needles** page. The needle length is `2.0`. The **Inner** position is `1.70` and the **Outer** position is `2.00`. These tick marks are `0.3` units long.
- The **Width** property of the tick marks is `0.00`, the narrowest width.

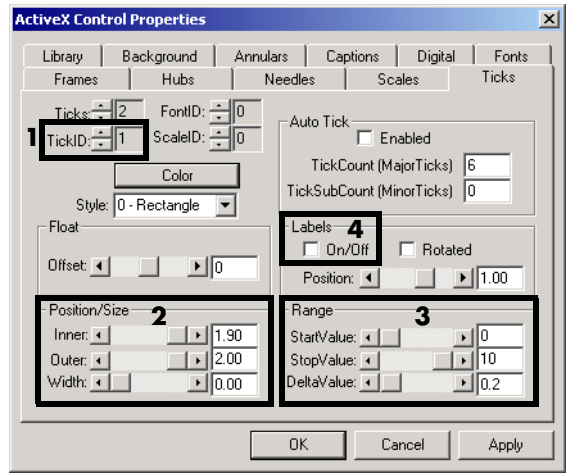
The **Range** properties, in the box labeled **3**, are defined as follows:

- **StartValue** determines at which scale value the first tick mark is displayed. For these tick marks, the value is `0`.
- **StopValue** determines at which scale value the last tick mark is displayed. For these tick marks, the value is `10`.
- **DeltaValue** determines the interval between tick marks. For these tick marks, the value is `1`.

The **Labels** properties **On/Off** check box, in the box labeled **4**, determines whether the labels are displayed. For the first set of tick marks, the labels are displayed.

The **FontID** property, in the box labeled **5**, determines which of multiple fonts defined for this block is used for the label. In this case, two font sets are defined. The first (**FontID** `0`) is for the tick marks, while the second (**FontID** `1`) is for the caption, “Amps.”

To examine the second set of tick marks, change the **TickID** property value to `1` by clicking on the up arrow to the left of the value. The **Ticks** page looks like this.




The **Position/Size** properties, in the box labeled **2**, are defined as follows:

- The **Inner** position is `1.90` and the **Outer** position is `2.00`. These tick marks are `0.10` units long, one-third the length of the longer tick marks.
- The **Width** property of the tick marks is `0.00`, the same as the longer tick marks.

The **Range** properties, in the box labeled **3**, are defined as follows.

- **StartValue** for these tick marks is `0`. The first short tick mark and the first long tick mark appear in the same place.
- **StopValue** for these tick marks is `10`. The last short tick mark and the last long tick mark appear in the same place.
- **DeltaValue** determines the interval between tick marks. For these tick marks, the value is `0.2`.

The **Labels** properties **On/Off** check box determines whether labels appear next to the tick marks. No labels appear next to this set of tick marks.

If you decrease the **Ticks** property, then the tick mark settings corresponding to the highest **TickID** value is removed. To replace that set of tick marks, you will have to recreate the settings from the defaults.

# Controlling Multiple Graphical Elements

This section describes how you can display multiple input values simultaneously and dynamically on a gauge block that includes multiple graphical elements. Examples of multiple-component gauge blocks include these preconfigured blocks:

- Multiple Scales in the Linear Gauges library
- Pie Chart and Dynamic Pie in the Percent Indicators library
- Analog Clock and Stop Watch in the Angular Gauges library

Example models in this section describe different techniques for controlling multiple components simultaneously during a simulation. The S-function technique is more complicated but also more flexible and powerful.

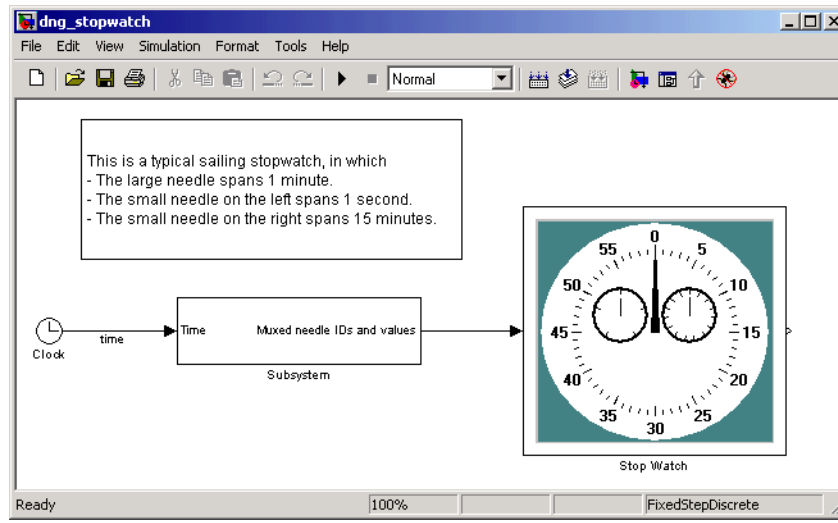
| Section | Technique |
|---|---|
| "Simulating a Multiple-Needle Stopwatch" on page 2-18 | Using the **Input property** parameter in the block's dialog box |
| "Updating Multiple Portions of a Pie Chart" on page 2-23 | Using an S-function to drive a block |

## Simulating a Multiple-Needle Stopwatch

This example model simulates a typical sailing stopwatch. The model uses the Stop Watch block, which displays three needles on individual angular scales. The needles mark simulation time simultaneously, as follows:

- The large needle spans 1 minute.
- The small needle on the left spans 1 second.
- The small needle on the right spans 15 minutes.

To open this example, enter `dng_stopwatch` in the MATLAB Command Window. Run the simulation and watch how the three needles move.




These sections describe how the model works:

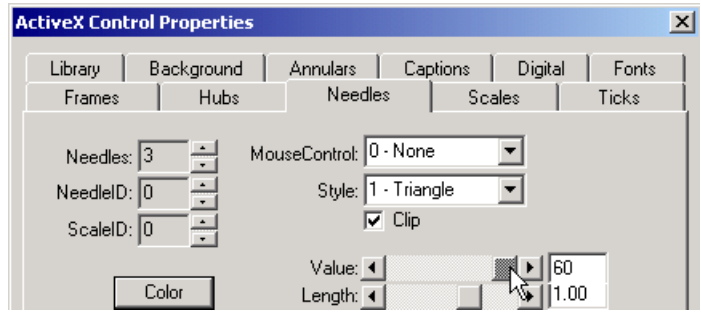
- "How NeedleID Values Correspond to Needles"
- "Configuration of the Stop Watch Block" on page 2-21
- "Preparing the Input Signal for the Stop Watch Block" on page 2-22

## How NeedleID Values Correspond to Needles

To explain how the model controls three needles, this section first explains how the block makes its needles accessible to you. Each needle on the block has an associated pair of **NeedleID** and **Value** parameters, where

- **NeedleID** is a number that distinguishes that needle from other needles on the block.
- **Value** is the numerical value for that needle along its angular scale.

You can view or control these parameters via the **Needles** panel of the block's **ActiveX Control Properties** dialog box.




To find out which needle and range of values correspond to a given ID number, use this procedure:

1. Right-click on the Stop Watch block and choose **Control Display Properties**.
2. Click on the **Needles** tab.
3. Set **NeedleID** to the ID number you want to investigate: 0, 1, or 2 in this case.
4. Change the **Value** parameter while watching which needle on the block moves. By dragging the **Value** slider to its extremes, you can also find out the minimum and maximum values for the needle with that **NeedleID** number.

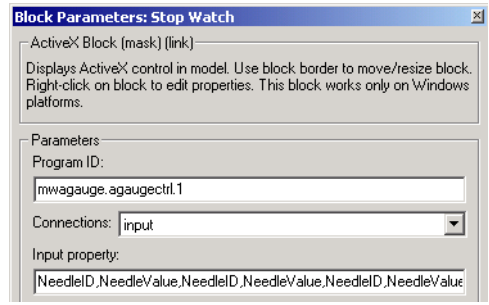
The table below summarizes what the procedure reveals.

| NeedleID | Needle on Block | Range of Values |
|---|---|---|
| 0 | Large needle | [0, 60] seconds |
| 1 | Small needle on right | [0, 15] minutes |
| 2 | Small needle on left | [0, 5] fifths of a second |

For more information about ID properties, see “Understanding ID Properties” on page 2-6.

## Configuration of the Stop Watch Block

After you run the model, the number `6` appears near the connector line that represents the input to the Stop Watch block. This indicates that the signal on that line is a vector of length 6. To understand why, first right-click on the Stop Watch block and choose **Block Parameters**.




Then notice that the **Input property** field in the dialog box is set to

```
NeedleID,NeedleValue,NeedleID,NeedleValue,NeedleID,NeedleValue
```

By contrast, the default value for this property is `NeedleValue`, which you can see by examining the block in the Angular Gauges library.

The comma-separated list in this example model causes the Stop Watch block to use the six values in its vector input signal to assign these parameters to the block, in sequence:

- The ID number, `0`, of the large needle
- The numerical value for the large needle
- The ID number, `2`, of the small needle on the left
- The numerical value for the small needle on the left
- The ID number, `1`, of the small needle on the right
- The numerical value for the small needle on the right

---

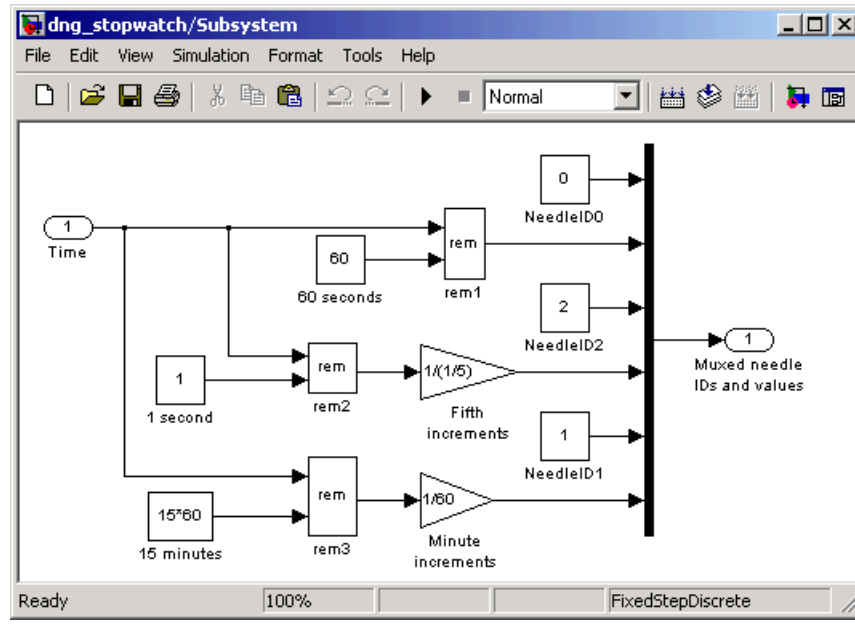
**Note** It is important that each needle's ID number precede its numerical value. Referring first to the ID number tells the block which needle to apply changes to.

---

### Preparing the Input Signal for the Stop Watch Block

The model aims to reflect the time on the Stop Watch block. However, it is necessary to process the Clock block's output somewhat to prepare it for the Stop Watch block. Double-click on the Subsystem block to open it. The subsystem accomplishes two key tasks:

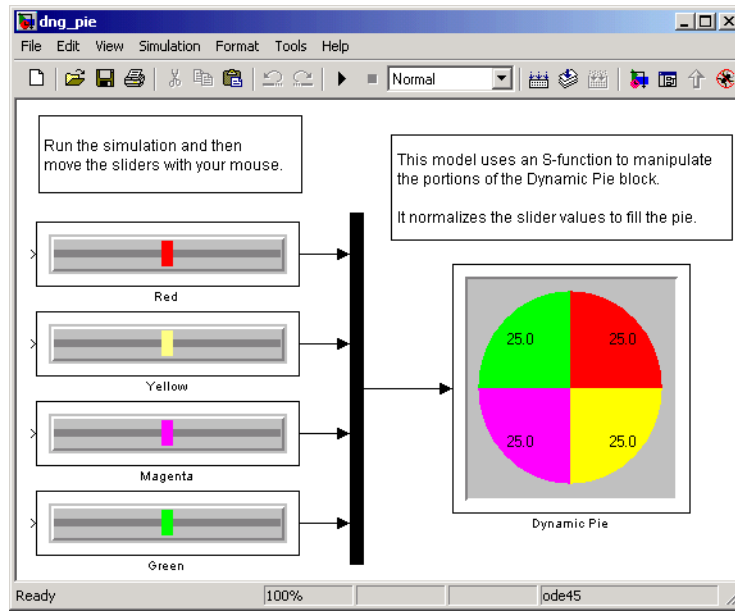
- Processing the Clock block's output value, measured in seconds, to make it an appropriate numerical value for each needle. To do this, the block performs these computations:
  - Reduces modulo 60, to get the large needle's value.
  - Reduces modulo 1 and then multiplies by 5, to get the left needle's value. Recall that values for the left needle range between 0 and 5.
  - Reduces modulo 15*60 and then divides by 60, to get the right needle's value. Recall that values for the right needle range between 0 and 15.
- Forming a six-element vector corresponding to the comma-separated list in "Configuration of the Stop Watch Block" on page 2-21. To form this vector, the subsystem uses three Constant blocks, the three processed Clock block signals, and a Mux block.



## Updating Multiple Portions of a Pie Chart

This example model allows you to control four portions of a pie chart independently using four sliders. The model uses the Dynamic Pie block and four Horizontal Slider blocks. Internally, the model uses an M-file S-function to drive the Dynamic Pie block.

To open this example, enter `dng_pie` in the MATLAB Command Window. Run the simulation and then move the sliders using your mouse.




These sections describe how the model works:

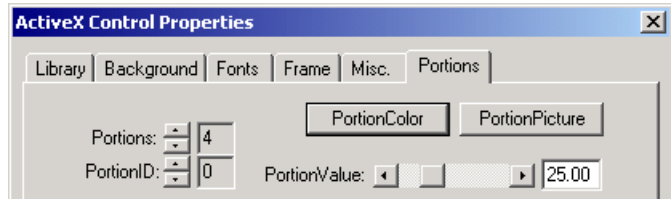
- "How PortionID Values Correspond to Portions of the Pie"
- "Configuration of the Dynamic Pie Block" on page 2-25
- "How the S-Function Updates the Pie" on page 2-27
- "Initial Portion Sizes in the Model" on page 2-28

### How PortionID Values Correspond to Portions of the Pie

To explain how the model controls four portions, this section first explains how the block makes its portions accessible to you. Each portion on the block has an associated pair of **PortionID** and **PortionValue** parameters, where

- **PortionID** is a number that distinguishes that portion from other portions on the block.
- **PortionValue** is the numerical value for that portion, as a percentage. The S-function that assigns the set of **PortionValue** parameters ensures that the percentages for all portions add up to 100.

You can view or control these parameters via the **Portions** panel of the block's **ActiveX Control Properties** dialog box.




To find out which portion corresponds to a given ID number, use this procedure:

1. Right-click on the Dynamic Pie block and choose **Control Display Properties**.
2. Click on the **Portions** tab.
3. Set **PortionID** to the ID number you want to investigate: `0`, `1`, `2`, or `3` in this case.
4. Change the **PortionValue** parameter while watching which portion on the block changes in size.

The table below summarizes what the procedure reveals.

| PortionID | Portion on Block |
|---|---|
| 0 | Red portion |
| 1 | Yellow portion |
| 2 | Magenta portion |
| 3 | Green portion |

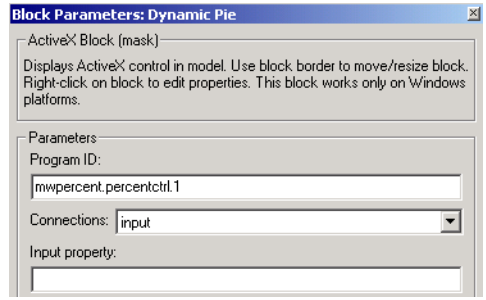
For more information about ID properties, see "Understanding ID Properties" on page 2-6.

## Configuration of the Dynamic Pie Block

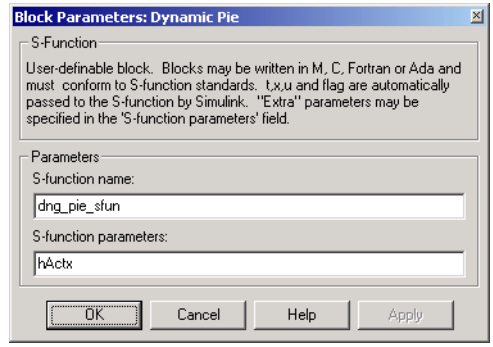
In the model, a vector containing the four slider values enters the Dynamic Pie block. While the simulation is running, an S-function called `dng_pie_sfun.m` uses the vector to make the Dynamic Pie block reflect the slider values. While the behavior of the S-function is discussed below ("How the S-Function Updates the Pie" on page 2-27), this section describes how the Dynamic Pie block is linked with the S-function.

The Dynamic Pie block in this model is a customized copy of the original one in the Percent Indicators library. The customized copy differs from the original in these ways:

- The **Input property** field in the **Block Parameters** dialog box is blank. This is because the block is being updated by an S-function that ignores the data in the **Input property** field. To see the **Input property** field, right-click on the block and choose **Block Parameters**.




- The block is driven by a customized S-function, `dng_pie_sfun.m`, rather than the S-function that drives the original library block. To see this, select the outer border of the block and choose **Edit** -> **Look under mask** from the model window's menu.




The S-function `dng_pie_sfun.m` is a customized version of `ax_strip_sfun.m`, which is an S-function designed to drive the Strip Chart block. Many parts of `dng_pie_sfun.m` are also similar to `sfuntmpl.m`, which is an M-file S-function template included in the Simulink distribution. Many features of that S-function template are not required for controlling blocks in the Dials & Gauges Blockset, which simplifies the task of writing S-functions for use with the blockset. For more information about S-functions in general, see the Writing S-Functions documentation.

If you were building this model yourself starting from the original library block, then you would have to break the library link before changing the values in the S-Function dialog box shown previously. To break the library link for a library block, use this procedure:

1 Select the outer border of the block.

2 Choose **Edit** -> **Link options** -> **Disable link**.

3 Choose **Edit** -> **Link options** -> **Break link**.

## How the S-Function Updates the Pie

While the simulation is running, the S-function `dng_pie_sfun.m` drives the Dynamic Pie block. In particular, this S-function

- Receives the vector input signal that enters the Dynamic Pie block
- Normalizes the vector so that the values add up to 100
- Updates each portion of the pie to reflect the corresponding number from the vector

**Receiving the Vector Input Signal.** During the simulation, Simulink invokes the S-function and passes it the vector that enters the Dynamic Pie block. Within the S-function, the vector is called `u`. Simulink also passes to the S-function a handle of the Dynamic Pie ActiveX control. The handle is called `hActx`.

**Normalizing the Input Vector.** The S-function uses the code below to normalize the vector `u` so that its elements add up to 100:

```
% First make sure there is no division by zero.
if sum(u)==0
   u=u+0.001;
end

% Now perform the normalization.
u = 100/sum(u).*u;
```

**Updating the Dynamic Pie Block.** After `sum(u)` is 100, the S-function updates the portions of the Dynamic Pie block by setting each one to the corresponding element of `u`. The code uses the handle `hActx` to access the **PortionID** and **PortionValue** parameters of the Dynamic Pie block.

```
% Loop through the portions and update their values.
%
if (length(u) ~= 0)
   for n=1:length(u)
      hActx.PortionID = n-1;
```

```
        hActx.PortionValue = u(n);
    end
end
```

### Initial Portion Sizes in the Model

When you first open the `dng_pie` model, the portions of the pie have equal sizes, unlike the portions in the default instance of the Dynamic Pie block in the Percent Indicators library. The equal-sized portions result from the customized `dng_pie@Dynamic_Pie.ax` file that contains the configuration information for the instance of the Dynamic Pie block in the `dng_pie` model. For more information about `.ax` files, see "Saving the Model" on page 1-14.

If you were building this model yourself starting from the original library blocks, then you would first run the model to make the portion sizes reflect the values on the slider blocks, and then save the model to make Simulink record the blocks' configurations in `.ax` files.

# Saving and Reusing a Customized Control

If you have modified settings in a block's **ActiveX Control Properties** dialog box, then you might want to store the customized version of the block for later use or to share with other users. The following subsections describe two methods:

- "Saving Customized Controls Automatically" (easier)
- "Saving Customized Controls Using the Library Panel"

## Saving Customized Controls Automatically

Saving the model causes MATLAB to save all property settings for Dials & Gauges Blockset blocks in `.ax` files (See "Saving the Model" on page 1-14.). To share your customized controls with other users, give them the `.mdl` file along with all of its associated `.ax` files. To use your customized block in a new model, copy the block from the old model, paste it into the new model, and then save the new model.

## Saving Customized Controls Using the Library Panel

Alternatively, you can use the **ActiveX Control Properties** dialog box to save property settings for later use on your own machine. However, this method does not enable you to share these customized controls with users of other machines. The steps are

1. Select the **Library** tab of the **ActiveX Control Properties** dialog box.

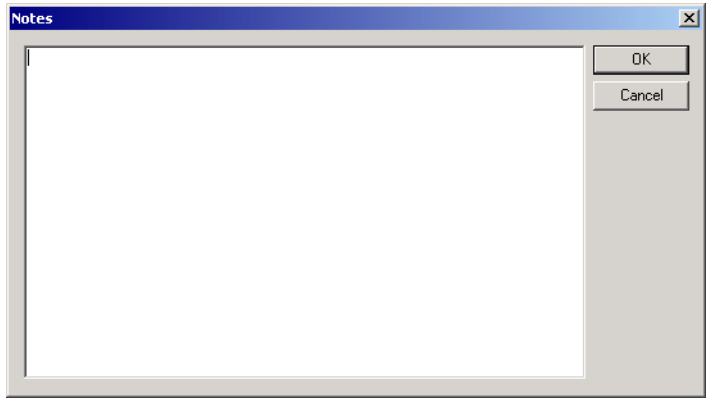
2. Assign a name to the collection of modified settings by entering a new name in the **Configuration Name** field.

---

**Note** If you leave this field blank, the new property settings write over the previous settings, which means that you cannot access the original version except by reinstalling the blockset or by registering the ActiveX controls again. To learn how to register the ActiveX controls, see "Configuring the Dials & Gauges Blockset" on page 1-8.

---

3 To provide textual information about the block, click on **Notes**. This dialog box appears.

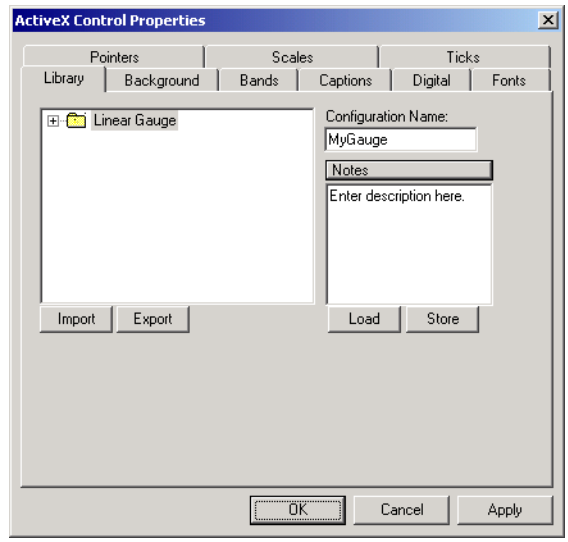



4 Enter a description in the text area and click on **OK**.

5 Select the directory in which to store the modified control by expanding the library hierarchy at the left. The new set of property settings is stored in the directory you select. Click on **Store**.

6 Click on **OK** to accept all the changes and close the dialog box.

The figure below shows the dialog box with fields filled in. The customized control is stored in the **Linear Gauge** directory.




An alternative to this procedure is to export customized controls to `.gms` files. To do this, select a directory from the left side of the panel and click on **Export**. You can later access these controls by using the **Import** button, or share the controls by sharing the `.gms` files.

3

# Categories of ActiveX Controls

This chapter discusses various categories of instrumentation that you can use in your model. Each of the sections listed below, except for the last, corresponds to a library within the Dials & Gauges Blockset.

# Angular Gauges

The Angular Gauges library contains controls that show their input value graphically along an arc of a circle. Blocks in the library differ from each other in their numerical ranges and in their use of needles, numerical labels, text captions, annular components, and tick marks.

## Customizing Angular Gauges

This section describes how to customize angular gauges by making changes that are specific to the Angular Gauges library. For changes that apply to multiple categories of blocks, see these sections:

- “Using Multiple Styles Within One Block” on page 2-3
- “Displaying Text on a Block” on page 2-8
- “Modifying the Displayed Range” on page 2-11
- “Modifying Multiple Tick Marks” on page 2-14

The table below lists some common customizations involving the **ActiveX Control Properties** dialog box that are specific to blocks in the Angular Gauges library.

| Task | Description |
|---|---|
| Change the shape or size of a needle | On the **Needles** panel, set **NeedleID** to the ID of the needle you want to change (`0` if there is exactly one needle). Then use the **Style** property to choose the shape, and the **Length** and **Width** properties to determine the length and thickness. |
| Label a needle by displaying the corresponding number | On the **Digital** panel, set **NeedleID** to the ID of the needle you want to label and check the **Enabled** check box. |

| Task (Continued) | Description (Continued) |
|---|---|
| Change the appearance of a needle label | On the **Digital** panel, first set **NeedleID** to the ID of the needle whose label you want to change. Then use **Decimals** to set the number of digits after the decimal point, **Color** to set the color of the number, and **FontID** to refer to a previously defined font (on the **Fonts** panel). |
| Move a needle label | On the **Digital** panel, first set **NeedleID** to the ID of the needle whose label you want to change. Then use **X Position** and **Y Position** to set the fixed position for the label. |
| Draw an annular region along the scale | On the **Annulars** panel, increase the value of the **Annulars** property. The ID of the new region is the **Annulars** property value minus one. To specify properties of the new region, see the next task. |
| Change the appearance of an annular region | On the **Annulars** panel, first set **AnnularID** to the ID of the annular region you want to change. Use the **Radius** properties to control the annular region's thickness and radial position. Use the **Value** properties to control the portion of the scale's range that the annular region includes. Use **Color** to control the annular region's color. |
| Delete the most recently added annular region | On the **Annulars** panel, decrease the **Annulars** property. This deletes all properties associated with the region, such as its color and thickness. |

### Combining Multiple Needles in One Display

To display multiple needles on a single block, see the table below. To learn how to control multiple needles simultaneously, see “Controlling Multiple Graphical Elements” on page 2-18.

| Task | Description |
|---|---|
| Add another needle to the display | On the **Needles** panel, increase the **Needles** property. The ID of the new region is the **Needles** property value minus one. To specify properties of the new needle, set **NeedleID** to that ID and then set the remaining properties on the dialog box panel accordingly. |
| Delete the most recently added needle from the display | On the **Needles** panel, decrease the **Needles** property. This deletes all properties associated with the needle, such as its color and shape. |

# Buttons & Switches

The Buttons & Switches library contains two-state controls that change their states when you click on them. The block output is `0` when the block's state is off and `1` when the state is on. The blocks in this library differ in cosmetic ways, such as the images shown on the block and the changes in the block's appearance after you click on it. The next sections describe how to customize buttons and switches, and how to change the output values from buttons and switches.

## Customizing Buttons and Switches

The table below lists some common ways to customize a block in the Buttons & Switches library, using its **ActiveX Control Properties** dialog box.

| Task | Description |
|---|---|
| Associate an image with a state | Use the **Picture** button on the **On** or **Off** panel to select a graphics file. You cannot associate both an image and text with a state. |
| Associate text with a state | Use the **Caption** field on the **On** or **Off** panel. The **X** and **Y** values control the position of the text. The **BackColor** and **ForeColor** buttons control the colors of the background and text, respectively. You cannot associate both an image and text with a state. |
| Associate a sound with a state | On the **On** or **Off** panel, check the **Sound** check box and type the name of a `.wav` file in the **Wave file** field. You can either type the name of the sound file or browse for it using the **...** button. |
| Use beveling to make the button appear three-dimensional | Use the **BevelInner** and **BevelOuter** properties on the **Background** panel. |

| Task (Continued) | Description (Continued) |
|---|---|
| Change the way the button's beveling (if visible) responds to a mouse click | Use the **Mode** property on the **General** panel. The `SingleState` option causes the bevels to remain fixed. The `TwoState` option causes the bevels to toggle with each mouse click. The `Pressed` option causes the bevels to toggle only while you are pressing the mouse button. |
| Make the button turn off after being on for a specified length of time | Set the **OnTimer** property in the **General** panel to a nonzero value, measured in milliseconds. |

## Changing Output Values

The output values for blocks in this library are `1` and `0`. To convert these output values to other numerical values, you can send the output to a Look-Up Table block in Simulink.

# Knobs & Selectors

The Knobs & Selectors library contains two dial blocks that you can adjust using the mouse:

- The Generic Knob block assumes values in a continuum by default. You can also configure it to assume discrete values along a linear scale. For common customizations specific to this block, see "Customizing the Generic Knob Block" on page 3-8.
- The Frequency Selector block assumes only values in a discrete set. The discrete set can be labeled with alphanumeric captions of your choice, but the block's output values are nonnegative integers. For common customizations specific to this block, see these sections:
  - "Customizing the Frequency Selector Block" on page 3-9
  - "Creating a New Set of Selections" on page 3-10
  - "Changing Output Values" on page 3-12

For changes that apply to Knobs & Selectors blocks, as well as other categories of blocks in this blockset, see these sections:

- "Using Multiple Styles Within One Block" on page 2-3
- "Displaying Text on a Block" on page 2-8
- "Modifying the Displayed Range" on page 2-11
- "Modifying Multiple Tick Marks" on page 2-14

## Customizing the Generic Knob Block

The table below lists some common customizations involving the **ActiveX Control Properties** dialog box of the Generic Knob block.

| Task | Description |
|---|---|
| Change the shape or size of the selector knob | On the **Knobs** panel, use the **KnobStyle** property to choose the shape, and the **KnobRadius** property to determine the size. |
| Display a mark on the knob to indicate the selected position more precisely | On the **Mark** panel, choose a value for **MarkStyle** other than `None`. To customize the appearance of the mark, use the other properties on the **Mark** panel. |
| Remove the mark from the knob | On the **Mark** panel, set **MarkStyle** to `None`. |
| Determine whether the knob can select from a continuous or discrete range | On the **Knobs** panel, check the **KnobSnap** check box to restrict the knob to discrete values. In this case, **KnobSnapIncrement** is the distance between successive discrete values. Clear the **KnobSnap** check box to allow the knob to assume all values in the range. |
| Label the selector knob by displaying the corresponding number | On the **Digital** panel, check the **Digital** check box. |
| Change the appearance of the selector knob label | On the **Digital** panel, use **DigitalDecimals** to set the number of digits after the decimal point, **DigitalColor** to set the color of the number, and **DigitalFontID** to refer to a previously defined font (on the **Fonts** panel). |
| Move the selector knob label | On the **Digital** panel, use **DigitalX** and **DigitalY** to set the fixed position for the label. |

| Task (Continued) | Description (Continued) |
|---|---|
| Draw an annular region along the scale | On the **Annulars** panel, increase the value of the **Annulars** property. The ID of the new region is the **Annulars** property value minus one. To specify properties of the new region, see the next task. |
| Change the appearance of an annular region | On the **Annulars** panel, first set **AnnularID** to the ID of the annular region you want to change. Use the **Radius** properties to control the annular region's thickness and radial position. Use the **Value** properties to control the portion of the scale's range that the annular region includes. Use **Color** to control the annular region's color. |
| Delete the most recently added annular region | On the **Annulars** panel, decrease the **Annulars** property. This deletes all properties associated with the region, such as its color and thickness. |

## Customizing the Frequency Selector Block

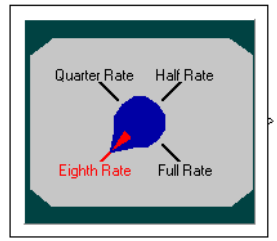
The table below lists some simple customizations involving the **ActiveX Control Properties** dialog box of the Frequency Selector block. To learn how to create an entirely new discrete set of selections, see "Creating a New Set of Selections" on page 3-10.

| Task | Description |
|---|---|
| Change the shape or size of the selector knob | On the **Knobs** panel, use the **KnobStyle** property to choose the shape, and the **KnobRadius** property to determine the size. |
| Display a mark on the knob to indicate the selected position more precisely | On the **Mark** panel, choose a value for **MarkStyle** other than `None`. To customize the appearance of the mark, use the other properties on the **Mark** panel. |
| Remove the mark from the knob | On the **Mark** panel, set **MarkStyle** to `None`. |

| Task (Continued) | Description (Continued) |
|---|---|
| Change the knob's range of motion | On the **Auto** panel, check the **AutoAngleConfine** check box and then use **AutoStartAngle** and **AutoStopAngle** to define the range of allowable angles. To allow the knob to move in a full circle, clear the **AutoAngleConfine** check box. |
| Define a new selection (that is, new possible value for the knob) | On the **Selections** panel, increase the **Selections** property. The ID of the new selection is the **Selections** property value minus one. To specify properties of the new selection, set **SelectionID** to that ID and then set the remaining properties on the dialog box panel accordingly. Note that the **Highlight Selection** and **Highlight Color** properties apply to all selections on the block. |
| Change the text label of a selection | On the **Selections** panel, first set **SelectionID** to the ID of the selection you want to change. Specify the label using the **SelectionCaption** property. |
| Change the appearance of a text label | On the **Selections** panel, first set **SelectionID** to the ID of the selection you want to change. Then use **Color** to set the color of the text, and **FontID** to refer to a previously defined font (on the **Fonts** panel). |

## Creating a New Set of Selections

To vary the selections on the Frequency Selector block, it might be easier to remove the existing selections and create a new set. This section illustrates how to create a customized version of the Frequency Selector block that looks like this:




1. Copy the Frequency Selector block from the library into a new model.
2. From the model window, open the block's **ActiveX Control Properties** dialog box. All other steps in this procedure refer to this dialog box.
3. Set up the block to configure selections and their captions automatically, by checking all the check boxes on the **Auto** panel and setting **AutoOffsetStyle** to `Vertical`. The automatic configurations are a good starting point, from which you can make manual adjustments later.
4. Define the dial's range of motion by setting **AutoStartAngle** to `225` and **AutoStopAngle** to `135`. These numbers represent degrees, starting from the top of the block and moving clockwise.
5. Remove all but one of the existing selections by setting the **Selections** property on the **Selections** panel to `1`.
6. Adjust the remaining selection by setting **SelectionCaption** to `Eighth Rate` and setting **Color** to black.
7. Add three additional selections by setting the **Selections** property to `4`.
8. Configure the additional selections one at a time. For each selection, first set **SelectionID**, and then change **SelectionCaption** according to the table below.

| SelectionID | SelectionCaption |
|---|---|
| 0 | `Eighth Rate` |
| 1 | `Quarter Rate` |

| SelectionID (Continued) | SelectionCaption (Continued) |
|---|---|
| 2 | Half Rate |
| 3 | Full Rate |

9 Change the color of the currently chosen value to red by setting **HighlightColor** to red.

### Manually Adjusting the Selections

It is generally easier to let the block determine the positions of selections and their captions. However, you can adjust the positions manually by using one or more of these techniques:

- To vary the horizontal justification of a selection caption, first clear the **AutoAlign** check box on the **Auto** panel. Then, on the **Selections** panel, set **SelectionID** to the ID of the selection you want to change and vary the **SelectionAlign** property.
- To vary the positions of the selection captions, first clear the **AutoAlign** and **AutoOffset** check boxes on the **Auto** panel, in that order. Then, on the **Selections** panel, set **SelectionID** to the ID of the selection you want to change and vary the **SelectionOffsetX**, **SelectionOffsetY**, and **SelectionRadius** properties.
- To vary the angles of a selection, first clear the **AutoAngle** check box on the **Auto** panel. Then, on the **Selections** panel, set **SelectionID** to the ID of the selection you want to change and vary the **SelectionAngle** property.

## Changing Output Values

The Frequency Selector block outputs the **SelectionID** property of the selection to which the knob points. These values are integers between 0 and one less than the value of the **Selections** property.

To convert the output values to a base-10 logarithmic scale, send the output to the block called Freq. Selector convert to Simulink, located in the Knobs & Selectors library. To convert these output values to an arbitrary set of numbers that might be useful for your application, send the output to a Look-Up Table block in Simulink.

# LEDs

The LEDs library contains controls that use graphical elements to imitate light-emitting diodes (LEDs). Each block reflects its input value by setting one or more graphical elements to an on or off state. By default, the number of LEDs in the on state is the rounded value of the block's input.

Most blocks in this library contain a single LED. These blocks differ from each other in the appearance of their LEDs. The Vertical Meter, Horizontal Meter, and Circle Meter blocks contain multiple LEDs per block.

## Customizing LEDs

The table below lists some common ways to customize a block in the LEDs library, using its **ActiveX Control Properties** dialog box.

| Task | Description |
|---|---|
| Add or remove LEDs | Change the **NumLEDs** property on the **LEDs/General** panel. |
| Change the shape or color of a particular LED | On the **LEDs/General** panel, set **LEDIndex** to the number corresponding to the LED you want to customize. To apply a previously defined style, set the **LEDStyleID** to the number corresponding to the style. To define a new style for this LED, increase the **StyleID** property on the **Styles** panel and then configure the color, picture, or shape properties accordingly. |
| Change the size or layout of a set of LEDs | On the **LEDs/General** panel, use **LEDWidth** and **LEDHeight** to control the size of each LED. Use **LEDSeparation** to control the spacing between successive LEDs. Use **Orientation** and/or **Direction** to control how multiple LEDs are arranged along a line. |

| Task (Continued) | Description (Continued) |
|---|---|
| Display a binary representation of the (rounded) input | Set the **Mode** property on the **LEDs/General** panel to `Bitwise`. The first LED corresponds to the least significant bit. |
| Display decaying maximum value of the input, in addition to the current input | Check the **MaxDecay** check box on the **LEDs/General** panel. The **DecayRate** value controls how quickly the displayed value decays from the maximum to the current input value. Larger positive values correspond to a slower decay. A value of zero causes the block to reflect its maximum value with no decay. |

# Linear Gauges

The Linear Gauges library contains controls that show their input values graphically along a linear scale. Blocks in the library differ from each other in their numerical ranges and in their use of pointers, numerical labels, text captions, and tick marks.

## Customizing Linear Gauges

This section describes how to customize linear gauges by making changes that are specific to the Linear Gauges library. For changes that apply to multiple categories of blocks, see these sections:


- "Using Multiple Styles Within One Block" on page 2-3
- "Displaying Text on a Block" on page 2-8
- "Modifying the Displayed Range" on page 2-11
- "Modifying Multiple Tick Marks" on page 2-14

The table below lists some common customizations involving the **ActiveX Control Properties** dialog box that are specific to blocks in the Linear Gauges library.

| Task | Description |
|---|---|
| Change the shape or size of a pointer | On the **Pointers** panel, set **PointerID** to the ID of the pointer you want to change (`0` if there is exactly one pointer). Then use the **Style** property to choose the shape, the **Inner** and **Outer** properties to determine the length, and the **Width** property to determine the thickness. |
| Label a pointer by displaying the corresponding number | On the **Digital** panel, set **PointerID** to the ID of the pointer you want to label and check the **PointerDigital** check box. |
| Change the appearance of a pointer label | On the **Digital** panel, first set **PointerID** to the ID of the pointer whose label you want to change. Then use **Decimals** to set the number of digits after the decimal point, **PointerDigitalColor** to set the color of the number, and **FontID** to refer to a previously defined font (on the **Fonts** panel). |
| Move a pointer label to a fixed position | On the **Digital** panel, first set **PointerID** to the ID of the pointer whose label you want to change. Clear the **PointerDigitalAttach** check box and use **PointerDigitalX** and **PointerDigitalY** to set the fixed position for the label. |
| Move a pointer label to a position relative to the pointer | On the **Digital** panel, first set **PointerID** to the ID of the pointer whose label you want to change. Check the **PointerDigitalAttach** check box. For a vertical (respectively, horizontal) linear scale, use **PointerDigitalX** (respectively, **PointerDigitalY**) to set the independent coordinate for the label. |

### Combining Multiple Pointers in One Display

To display multiple pointers on a single block, see the customizations in the table below. To learn how to control multiple pointers simultaneously, see “Controlling Multiple Graphical Elements” on page 2-18.

| Task | Description |
|---|---|
| Add another pointer to the display | On the **Pointers** panel, increase the **Pointers** property. The ID of the new region is the **Pointers** property value minus one. To specify properties of the new pointer, set **PointerID** to that ID and then set the remaining properties on the dialog box panel accordingly. |
| Delete the most recently added pointer from the display | On the **Pointers** panel, decrease the **Pointers** property. This deletes all properties associated with the pointer, such as its color and shape. |

# Numeric Displays

The Numeric Displays library contains controls that display the numerical values of their input signals. The Generic Numeric LED and PlusMinus XX.XXX blocks are probably the most useful blocks in this library. The next section describes how to customize them.

The Odometer block differs from the other blocks in this library in its appearance and dialog box. You can also customize the Odometer block.

## Customizing Numeric Displays

The table below lists some common ways to customize any block in the Numeric Displays library, *except* the Odometer block, using the **General** panel of its **ActiveX Control Properties** dialog box.

| Task | Description |
|---|---|
| Change the number of digits in the display | Set **Digits** to the total number of digits. |
| Specify the number of digits after the decimal point | Set **Decimals** to the number of digits you want after the decimal point, and check the **FixedDecimal** check box. |
| Pad the display with leading zeros | Check the **LeadingZeros** check box. |
| Display a plus or minus sign | Check the **LeadingPlusMinus** check box. |
| Change the appearance of all digits | Use the **ItalicsOffset** property to control the slanting angle of digits. Use the **Segment Width** and **Segment Separation** properties to control the width of the line segments that compose each digit and the spacing between the line segments, respectively. Use the two **Spacing** properties to control the padding around each digit. |

## Customizing the Odometer Block

The table below lists some common ways to customize the Odometer block, using the **General** panel of its **ActiveX Control Properties** dialog box.

| Task | Description |
|---|---|
| Change the number of digits in the display | Set **Digits** to the total number of digits. Set **Decimals** to the number of digits after the decimal point. The block does not display a decimal point character, but digits that represent proper fractions appear with inverted colors. |
| Make the display change gradually from old to new values, instead of registering the change instantaneously | Check the **Transition Enabled** check box. Set the **Steps** value to the number of steps in the gradual transition. Use the **Rate** value to control the speed of the transition, where larger values indicate a slower transition. |
| Introduce a mouse-controlled reset button | Check the **Enabled** check box in the **Reset Button Properties** area of the dialog box panel. By default, the reset button is a colored square to the left of the numbers. Clicking on the square sets the display to zero. |

# Percent Indicators

The Percent Indicators library contains controls that are designed to display percentages and ratios. The Generic Percent and Simple Light Blue blocks are probably the most useful blocks in this library. By default, these blocks reflect scalar input values between 0 and 100 by coloring a corresponding segment of a linear scale. By customizing the blocks, you can also have them display an input value X between m and M as the percentage 100 * ((X - m) / (M - m)).

## Customizing Percent Indicators

The table below lists some common ways to customize a block in the Percent Indicators library, using its **ActiveX Control Properties** dialog box.

| Task | Description |
|---|---|
| Use a radial percentage scale that reflects the input as a sector of a circle | On the **Misc**. panel, set **DisplayMode** to `Radial`. Use the **StartAngle** value to indicate where the sector begins; a value of 0 corresponds to a vertical radius above the circle's center, while a value of 90 corresponds to a horizontal radius to the right of the circle's center. |
| Change the direction in which a radial percentage scale increases | On the **Misc**. panel, use the **Direction** property to reverse the scale's polarity. If **Direction** is set to `Forward`, then the scale increases clockwise. |
| Use a linear percentage scale that reflects the input as a portion of a rectangle | On the **Misc.** panel, set **DisplayMode** to `Linear`. |
| Change the direction in which a linear percentage scale increases | On the **Misc.** panel, use the **Orientation** property to indicate whether the linear scale is horizontal or vertical. Use the **Direction** property to reverse the scale's polarity. If **Direction** is set to `Forward`, then a horizontal scale increases to the right and a vertical scale increases downward. |

| Task (Continued) | Description (Continued) |
|---|---|
| Specify the range to use when converting the input to a percentage | On the **Misc.** panel, use the **Min** and **Max** properties. If the input value is X, then the block displays the percentage<br>100 * ((X - **Min**) / (**Max** - **Min**)). |
| Display a number near or inside the corresponding colored area | On the **Portions** panel, set **DigitalStyle** to `Floating`. You can use the **DigitalPosition** value to vary the position along one dimension (radius in the case of a radial scale, height in the case of a horizontal scale, and horizontal coordinate in the case of a vertical scale). |
| Display a number in a fixed position | On the **Portions** panel, set **DigitalStyle** to `Fixed`. To specify the position of the number, first set **PortionID** to the ID of the portion you want to configure (`0` if you are displaying only the scalar input signal) and then use the **PortionDigitalX** and **PortionDigitalY** values to indicate the position. |

### Combining Multiple Regions in One Display

To display multiple regions on a single block, see the customizations in the table below. To learn how to control multiple regions simultaneously, see “Controlling Multiple Graphical Elements” on page 2-18.

| Task | Description |
|---|---|
| Add another region to the display | On the **Portions** panel, increase the **Portions** property. The ID of the new region is the **Portions** property value minus one. To specify properties of the new region, set **PortionID** to that ID and then set the remaining properties on the dialog box panel accordingly. Note that the **DigitalStyle** and **DigitalFormat** properties apply to all regions on the block. |
| Delete the most recently added region from the display | On the **Portions** panel, decrease the **Portions** property. This deletes all properties associated with the region, such as its color. |

# Sliders

The Sliders library contains controls that model a knob sliding along a bar and that output the numerical value corresponding to the knob's position. Blocks in the library differ from each other in their numerical ranges and in their use of numerical labels, knob appearances, text captions, and tick marks.

## Customizing Sliders

This section describes how to customize sliders by making changes that are specific to the Sliders library. For changes that apply to multiple categories of blocks, see these sections:

- "Using Multiple Styles Within One Block" on page 2-3
- "Displaying Text on a Block" on page 2-8
- "Modifying the Displayed Range" on page 2-11
- "Modifying Multiple Tick Marks" on page 2-14

The table below lists some common customizations involving the **ActiveX Control Properties** dialog box that are specific to blocks in the Sliders library.

| Task | Description |
|---|---|
| Change the range of values along the bar | On the **General** panel, use the **Min Value** and **Max Value** properties to define the range. |
| Change the orientation or direction of the bar | On the **General** panel, use **Orientation** to determine whether the slider is horizontal or vertical. Use **Direction** to determine which end of the slider corresponds to the minimum value. |

| Task (Continued) | Description (Continued) |
|---|---|
| Change the size or position of the bar | On the **Bar** panel, use the **BarInner** and **BarOuter** properties to define the width and position of the bar in the direction perpendicular to the linear scale. Use the **BarStart** and **BarStop** properties to define the length and position of the bar in the direction of the linear scale. These properties do not affect the numerical values associated with the bar, only the graphical depiction of the bar. |
| Change the colors of the portions of the bar on either side of the knob | On the **Bar** panel, use the **OnColor** and **OffColor** properties to define the colors associated with values below and above, respectively, the knob's current value along the bar. |
| Change the shape or size of the knob | On the **Knob** panel, use the **Style** property to choose the shape. Use the **Inner Value** and **Outer Value** properties to determine the thickness and position in the dimension perpendicular to the sliding scale. Use the **Width** property to determine the width along the sliding scale. |
| Label the knob by displaying the corresponding number | On the **Digital** panel, check the **Enabled** check box. |
| Change the appearance of the knob label | On the **Digital** panel, check the **Enabled** check box. Then use **Decimals** to set the number of digits after the decimal point, **Color** to set the color of the number, and **FontID** to refer to a previously defined font (on the **Fonts** panel). |

| Task (Continued) | Description (Continued) |
|---|---|
| Move the knob label to a fixed position | On the **Digital** panel, clear the **Attach** check box. Then use **X Position** and **Y Position** to set the fixed position for the label. |
| Move the knob label to a position relative to the knob | On the **Digital** panel, check the **Attach** check box. For a vertical (respectively, horizontal) linear scale, use **X Position** (respectively, **Y Position**) to set the independent coordinate for the label. |

# Strip Chart

The interface to the Strip Chart block is different from the interface to the other preconfigured blocks in the Dials & Gauges Blockset. You can configure the Strip Chart block using properties in its dialog box, just as you would for other preconfigured blocks. However, to plot data on the chart, you must invoke methods for the block. You can use the MATLAB command `invoke` to call methods of ActiveX control blocks and pass arguments to those methods.

An M-file S-function provided with the Dials & Gauges Blockset plots data on the Strip Chart block by using the `invoke` method. More generally, this S-function illustrates how to communicate with any ActiveX control from the MATLAB language through an S-function.

The file is called `ax_strip_sfun.m` and is located in the main Dials & Gauges Blockset directory. You can use the following MATLAB command to find the location of this file on your computer.

```
which ax_strip_sfun
```

During initialization, the Simulink block attributes (sample time, input width, etc.) are configured and the Strip Chart configuration is set. The infrastructure of the Dials & Gauges Blockset provides the handle of the ActiveX control (`hActX`) and is available in this S-function.

You can use this handle to set the properties of the Strip Chart through the standard dot notation. For example, the following line sets the `LastX` property of the Strip Chart to zero.

```
hActx.LastX = 0;
```

Any property of the Strip Chart can be set in this fashion.

In the outputs section of the S-function, each track of the Strip Chart is initialized to zero on the time axes and the actual plotting of the data is performed. A loop is included in this section to account for vector signals sent to the Strip Chart from Simulink.

Note that S-functions offer more options than those shown in this example. See the Writing S-Functions documentation for more details on writing your own S-functions.

# Using Your Own ActiveX Control

To use your own ActiveX control in a Simulink model, you must associate it with the generic ActiveX Control block. This section discusses how to use the ActiveX Control block, in these subsections:



## Adding the ActiveX Control Block to a Model

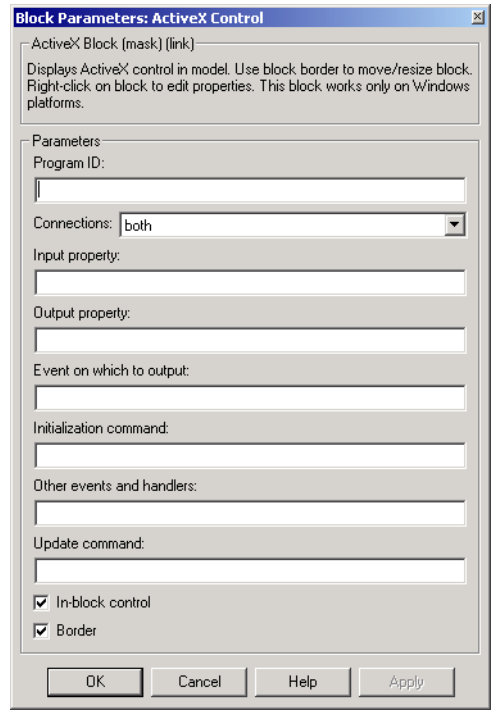
To configure the ActiveX Control block to display a specific ActiveX control, you need to know some of the programming features of the ActiveX control:

- The name under which the ActiveX control is registered on your system
- The events that cause the ActiveX control to perform an action
- The ActiveX control properties that are affected by events, by signals passed to the block, or by initialization commands

To use an ActiveX Control block in a Simulink model:

1. Drag the ActiveX Control block from the top level of the Dials & Gauges Blockset to your model. Place the block where you want the control to appear.


2. Double-click on the block to display its **Block Parameters** dialog box. Specify the appropriate values, described in subsequent sections.




**Note** Double-clicking on the border of a preconfigured block (supplied with the blockset) displays its **ActiveX Control Properties** dialog box, which lists properties in multiple tabbed panels. Double-clicking on a block that you created by customizing the generic ActiveX Control block displays its **Block Parameters** dialog box.

## Summary of Dialog Box Fields and Check Boxes

Here is a summary of the **Block Parameters** dialog box fields and check boxes. Each field and check box is described in more detail in sections following this summary.

| | |
|---|---|
| **Program ID** | Name of the ActiveX Control block |
| **Connections** | Whether the ActiveX Control block has an inport, an outport, both, or neither |
| **Input property** | Name of the property that is set when the ActiveX Control block receives a signal |
| **Output property** | Name of the property whose value is passed as the output signal |
| **Event on which to output** | Events that cause the value of the output to be updated |
| **Initialization command** | Command that sets the initial conditions for the ActiveX Control block |
| **Other events and handlers** | Events that trigger an action by the ActiveX Control block |
| **Update command** | Function that Simulink invokes when it updates the block during the simulation |
| **In-block control** | Whether the ActiveX Control block displays an ActiveX Control block or is connected to an ActiveX Control block somewhere else |
| **Border** | Whether a border appears around the control |

## Program ID

The **Program ID** parameter is the name of the ActiveX Control block displayed on the block. To determine the **Program ID** of other ActiveX Control blocks, consult the documentation for the ActiveX Control block.

## Connections

The **Connections** parameter determines whether the block has an inport, an outport, both, or neither. If the block is connected to a signal, this choice indicates whether the signal is input to the block, output from the block, passed through the block (both), or not connected directly to the block (neither).

## Input Property

The **Input property** parameter indicates the name of the block property whose value is set by the input signal. Each preconfigured Dials & Gauges Blockset block that has an input connection stores the block's current value in a property, as listed in the table below.

**Names of Input Properties**

| Library | Property Name |
|---|---|
| Angular Gauges | `NeedleValue` |
| LEDs | `Value` |
| Linear Gauges | `BandStop` (Min-Max Thermometer)<br>`PointerValue` (others) |
| Numeric Displays | `Value` (Generic Numeric LED, Odometer, PlusMinus XX.XXX)<br>`AlphaNumeric` (others) |
| Percent Indicators | `PortionValue` |

## Output Property

The **Output property** parameter is the name of the block property whose value becomes the output of the block. Each preconfigured Dials & Gauges Blockset block that has an output connection stores the block's current value in a property, as listed in the table below.

**Names of Output Properties**

| Library | Property Name |
|---|---|
| Buttons & Switches | `Value` |
| Knobs & Selectors | `KnobValue` (Generic Knob)<br>`Value` (Frequency Selector) |
| Sliders | `Value` |

## Event on Which to Output

The **Event on which to output** parameter is a comma- or space-separated list of events that indicate a change in the block's output value. After the simulation starts, the output property is only changed upon one of these events. The table below lists the events associated with the preconfigured blocks that use this parameter field.

**Events Associated With Each Block**

| Block | Associated Events |
|---|---|
| Demo Joystick Control | `JoyMove` |
| Frequency Selector | `Change` |
| Generic Knob | `Turn`, `Click` |
| Generic Slider | `Slide`, `Change` |
| Generic Toggle | `Click` |

## Initialization Command

The **Initialization command** parameter is a string that sets the initial conditions of the ActiveX Control block. The string is evaluated during the model initialization stage.

The handle of the ActiveX Control block is `hActX`.

## Other Events and Handlers

The **Other events and handlers** parameter specifies actions taken by the ActiveX Control block when you perform a defined action on the ActiveX Control block. You must enter an event as an `nx2` cell array. The first entry in each row must be the name of the ActiveX event. The second entry in each row must be the MATLAB callback to be executed.

For a list and description of supported events for an ActiveX control, consult the ActiveX control's help.

## Update Command

The **Update command** parameter is the name of the function that Simulink invokes when it updates the block during a simulation. Simulink passes these arguments to the function:

- The handle of the ActiveX control
- The current input value

The function is not invoked when you update the diagram.

## In-Block Control

The **In-block control** check box determines whether the ActiveX Control block displays an ActiveX Control block or is connected to an ActiveX Control block somewhere else. The ActiveX Control block can be in the same model window or in a different subsystem, model, or MATLAB figure.

If checked, the control whose name is specified in the **Program ID** field appears on the ActiveX Control block.

If cleared, the block is connected to the ActiveX control whose handle is specified in the **Handle location** field (this field appears when you clear the box):

- If the window is a MATLAB figure window, specify the name of a function whose return value is the figure handle. You can also specify initialization commands in the function to set the initial conditions of the ActiveX Control block.
- If the window contains a Simulink subsystem, the ActiveX Control block must be displayed on an ActiveX Control block contained in that subsystem.

Specify the path of the ActiveX Control block on which the control is to appear.

For example, if a model named `my_model` has a subsystem called `sub_disp_signals` that contains an ActiveX Control block named `signal1`, the path is `my_model/sub_disp_signals/signal1`.

Using this feature is useful in a complex model that displays signals in multiple subsystems on ActiveX Control blocks. If you feed the signals into ActiveX Control blocks but display the ActiveX Control blocks themselves in a separate system or window, it is not necessary to have the subsystems open to see the results. For more information, see "Placing ActiveX Controls in a Different Window" on page 4-1.

## Border

The **Border** check box determines whether the block displays a border around the ActiveX Control block.

---

**Note** Be careful when clearing this box, because the only way to move a block is to drag it with the border. Clearing the **Border** box renders the ActiveX Control block immovable.

---

## Notes on Third-Party ActiveX Control Blocks

This section contains additional notes about third-party ActiveX control blocks. One note is about editing ActiveX Control blocks that ignore mouse events, while another concerns the colors of ActiveX control blocks.

### Editing ActiveX Control Blocks That Ignore Mouse Events

Certain ActiveX controls do not handle typical mouse events (double-click, right-click, etc.). These ActiveX controls appear uneditable when used with the Dials & Gauges Blockset. Double-clicking or right-clicking on blocks that use these controls has no effect. To edit this type of block, you must first select the block so that it is current in the Simulink diagram. Then type the following command at the MATLAB prompt:

```
propedit(get_param(gcb,'userdata'))
```

This command opens the properties dialog box for that control. See the MATLAB COM documentation for more information on the `propedit` command and assigning event callbacks to ActiveX controls.

Additionally, you can choose an event on your control through which you want to open the property editor. For example, write an M-file function to open the property editor (or whatever you want the event to do). The function must take multiple arguments, of which the first one is the handle of the ActiveX control. For example, a simple function to open the property editor of a control looks like this:

```
function axeventhandler(varargin)
propedit(varargin{1})
```

Next enter an event with the handler you just wrote in the **Other Events and Handlers** parameter field. Assuming the `keypress` event is valid, the event and handler entry looks like this:

```
{'keypress','axeventhandler'}
```

To use the error-checking code already written for the Dials & Gauges Blockset, you can enter `ax_block_dclk` for events that should open the property editor (note that the editor does not open when the simulation is running). For example, to make a keystroke open the property editor (assuming that the `keypress` event is valid), enter the event and handler pair as follows:

```
{'keypress','ax_block_dclk'}
```

## Colors of ActiveX Control Blocks

ActiveX Control blocks that try to determine their colors by inheriting from the window in which they reside do not work properly in Simulink. More specifically, ActiveX Control blocks that send the `WM_CTLCOLOR` message to their parent have this problem. `WM_CTLCOLOR` is a Microsoft Windows message sent by an ActiveX Control block to allow the parent container to determine the color used by the control.

---

**Caution** Placing one of these controls in the ActiveX Control block causes MATLAB and Simulink to crash.

---

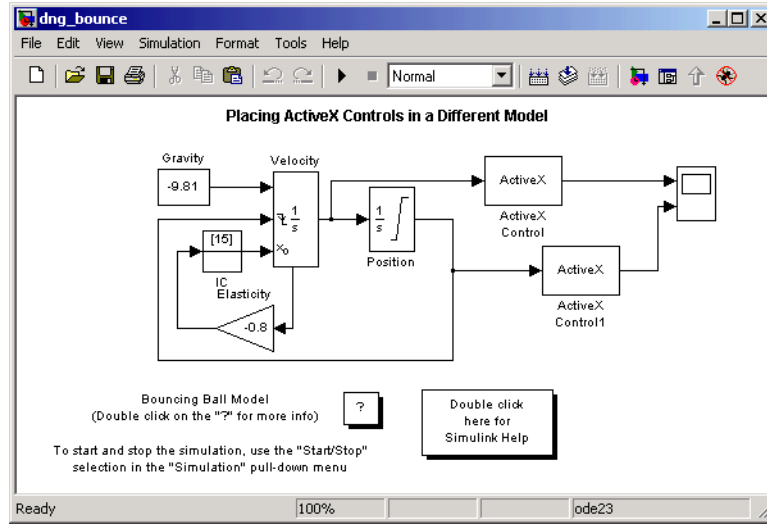
4

# Placing ActiveX Controls in a Different Window

This chapter describes how to place Dials & Gauges Blockset blocks in their own windows. By separating the controls from the computational blocks in the simulation, you can make your system look neater and more user-friendly. The sections are as follows.

# Placing ActiveX Controls in a Different Model

This sample model modifies the Simulink `bounce` demo by displaying the position and velocity signals on Dials & Gauges Blockset blocks contained in another model window. To open the original demo model, type `bounce` in MATLAB. To open the modified version, type `dng_bounce` in MATLAB. The modified version includes two ActiveX Control blocks on the signals that feed into the Scope block, as in the figure below.




The following sections describe the steps for using gauges contained in a different model:

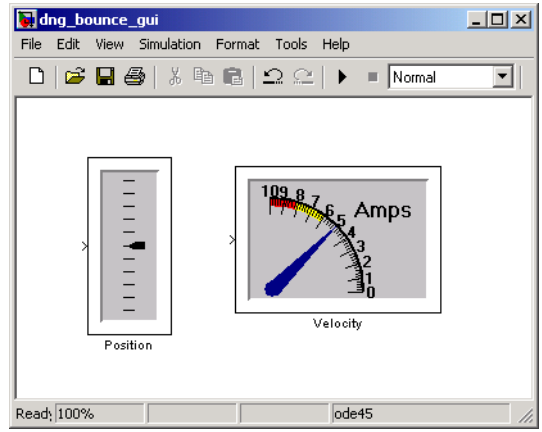
- "Creating a Model Window Containing Gauges"
- "Associating the Main Model with the Gauges" on page 4-5

## Creating a Model Window Containing Gauges

Create a new model called `dng_bounce_gui` and copy the following Dials & Gauges Blockset blocks into it:

- The Generic Linear Gauge block from the Linear Gauges library. Change the block's name to `Position`.

- The Amp Meter block from the Angular Gauges library. Change the block's name to `Velocity`.




## Customizing the Gauges

If you want to customize the gauges, particularly the range of values that they can display, then use this optional procedure:

1. Open the **ActiveX Control Properties** dialog box for the Position (Generic Linear Gauge) block.

2. From the **Scales** panel, set **ScaleMax** to `30`. This allows the gauge to display values between 0 and 30.

3. From the **Ticks** panel, set **DeltaValue** to `5`, check the **Label On/Off** check box, and set **Width** to `0.012`. This creates labeled major ticks.

4. Still on the **Ticks** panel, set **Ticks** to `2`, set **TickID** to `1`, set **DeltaValue** to `1`, set **Inner** to `0.4`, and set **Outer** to `0.75`. This creates a set of unlabeled minor ticks.

5. From the **Pointers** panel, click on **Color**, choose the color that matches the pointer on the Velocity (Amp Meter) block, and click on **OK**.

6. Click on **OK**.

7 Open the **ActiveX Control Properties** dialog box for the Velocity (Amp Meter) block.

8 From the **Captions** panel, set **Captions** to `0`. This removes the word Amps.

9 From the **Annulars** panel, set **Annulars** to `1`. This removes the colored shading of the annular region.

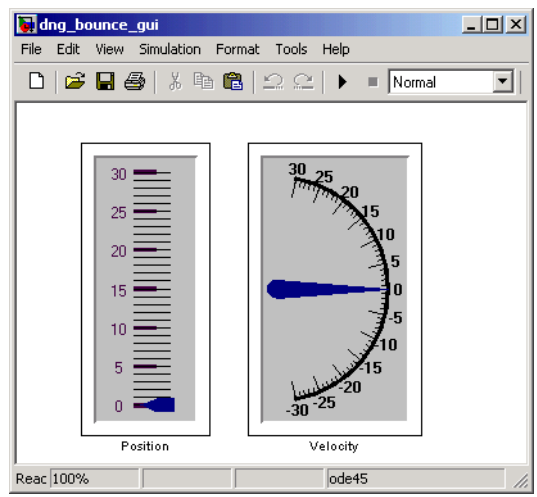
10 From the **Scales** panel, set **Min** to `-30`, set **Max** to `30`, select **Backward**, set **Start** to `10`, and set **Stop** to `170`. This causes the block to display values between `-30` and `30` along the right half of a circle.

11 From the **Ticks** panel, set **DeltaValue** to `5`. This creates labeled major ticks.

12 Still on the **Ticks** panel, set **TickID** to `1` and set **DeltaValue** to `1`. This creates unlabeled minor ticks.

13 Click on **OK**.

You might also want to enlarge the blocks. They should now look like this.



## Associating the Main Model with the Gauges

Open the original `bounce` model and save it in your working directory as `dng_bounce`. Insert two ActiveX Control blocks on the signals that feed into the Scope block. To connect the ActiveX Control blocks to the controls, make these changes in the **Block Parameters** dialog box in each of the ActiveX Control blocks:

1. Clear the **In-block control** check box, because the signal is being communicated between ActiveX Control blocks in one window and ActiveX Control blocks in another window. When you clear the **In-block control** check box, the number of fields on the dialog box changes.

2. In the **Input property** field, specify `NeedleValue` for the velocity display and `PointerValue` property for the position display. This property controls the current values of these ActiveX gauges. Doing this passes the value of the input signal to this property.

---

**Note** If you adapt this example to use the Strip Chart control instead, then set **Input property** to `Y`. For other controls in this blockset, set **Input property** to the value used in the corresponding parameter field in the library block.

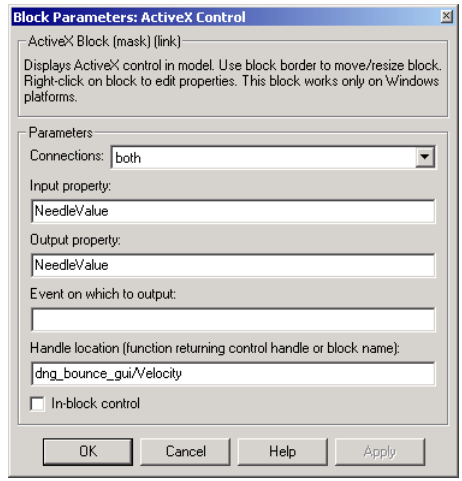
---

3. In the **Output property** field, specify the same property. Doing this passes the value of this property to the scopes.

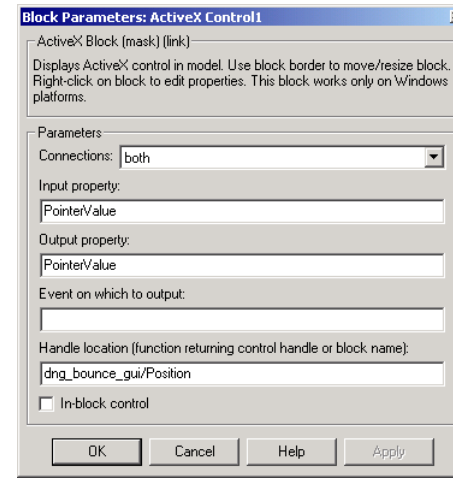
4. Specify the path of each gauge in the **Handle location** field. In this case, the new model is named `dng_bounce_gui`.

The dialog boxes should look like those in the figure below. Now, when you simulate the main model window, the gauges in the auxiliary model window reflect the velocity and position of the bouncing ball.

For displaying the velocity



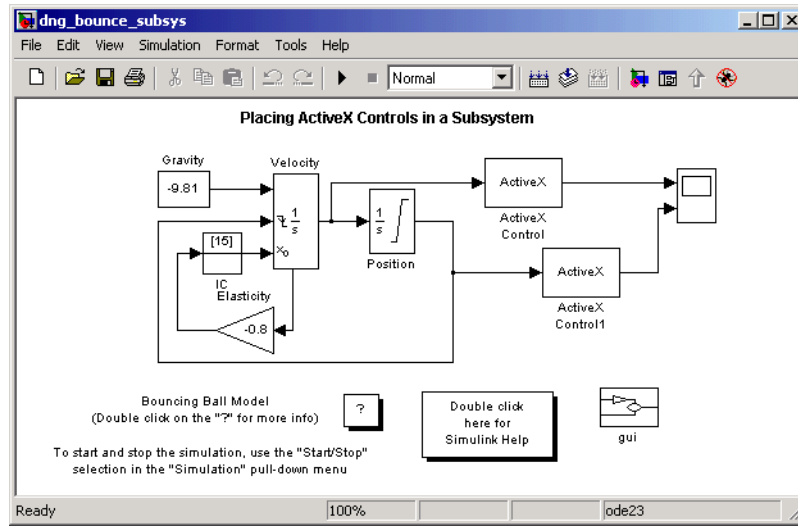

For displaying the position



# Placing ActiveX Controls in a Subsystem

This sample model builds on the one described in "Placing ActiveX Controls in a Different Model" on page 4-2, but places the Dials & Gauges Blockset blocks in a subsystem of the main model rather than a different model. This approach simplifies operations such as saving and closing the system because the system involves only a single `.mdl` file.

To open a completed version of this example, type `dng_bounce_subsys` in the MATLAB Command Window. Notice that the model includes a subsystem called `gui` in the lower right.




These sections describe the steps for using gauges contained in a subsystem:

- "Creating a Subsystem Containing Gauges"
- "Associating Top-Level Blocks with the Subsystem" on page 4-8

## Creating a Subsystem Containing Gauges

To create the subsystem, follow these steps:

**1** Open the bounce model and save it in your working directory as `dng_bounce_subsys`.

2 Copy a Subsystem block from the Simulink Signals & Systems library into the model window. Change the block's name to `gui`.

3 Double-click on the subsystem to open it.

4 Copy a Generic Linear Gauge block from the Linear Gauges library into the subsystem. Change the block's name to `Position`.

5 Copy an Amp Meter block from the Angular Gauges library into the subsystem. Change the block's name to `Velocity`.

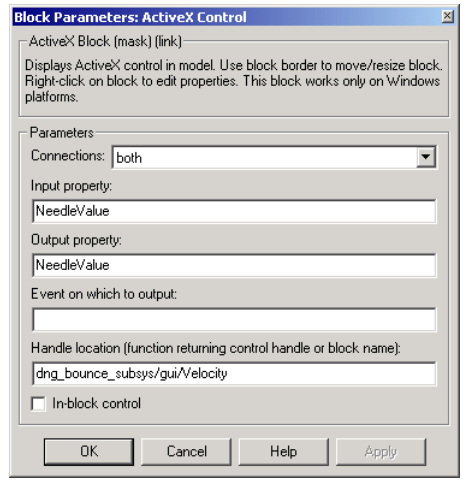
6 In the **Block Parameters** dialog box for each of the two gauge blocks, set the **Connections** parameter to `neither` and clear the **Input property** edit field.

To customize the gauge blocks, see "Customizing the Gauges" on page 4-3.

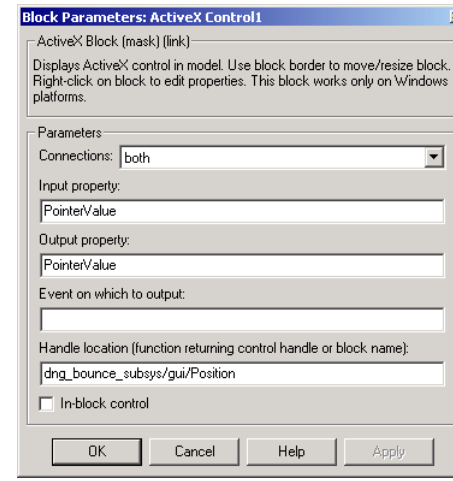
## Associating Top-Level Blocks with the Subsystem

The procedure for associating the top-level ActiveX Control blocks with the gauge blocks that are inside the subsystem is similar to the procedure described in "Associating the Main Model with the Gauges" on page 4-5. The only difference is that the **Handle location** parameters have different values for a subsystem than for a separate model. The dialog boxes should look like those in the figure below.

For displaying the velocity

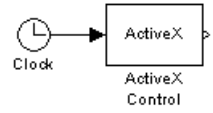



For displaying the position



# Placing ActiveX Controls in a Figure Window

In this example, a simple model displays the simulation time on an ActiveX Control block located in a figure window. You can open a completed copy of the model by typing `dng_offblock` in MATLAB, or you can follow the instructions below for building it yourself. The completed model looks like this.




1. Create and execute an M-file called `dng_gaugewindow` that consists of these statements.

   ```
   f = figure;
   h = actxcontrol('mwagauge.agaugectrl.1', [100 100 100 100], f);
   ```

   This M-file creates a figure window containing a Generic Angular Gauge, whose program ID is `mwagauge.agaugectrl.1`. The M-file also specifies the position of the ActiveX control in the figure window. For more information about `actxcontrol`, see its reference documentation.

2. Create an M-file called `dng_off_block` that consists of these statements.

   ```
   function hactx = dng_off_block
   hactx = evalin('base', 'h');
   ```

   The `dng_off_block` function returns the handle of the ActiveX Control block that is to be connected to the ActiveX Control block.

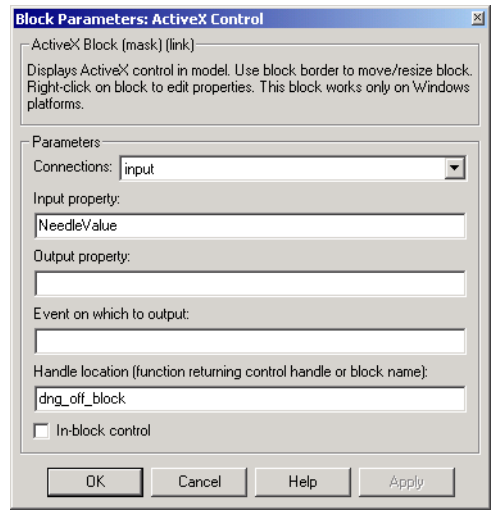
3. Open the ActiveX Control block to modify its parameters. First, clear the **In-block control** check box. When you clear the **In-block control** check box, the number of fields on the dialog box changes.

4. In the **Connections** field, select `input` to delete the outport on the ActiveX Control block.

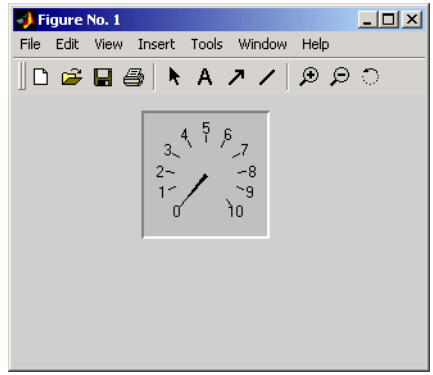
5. In the **Input property** field, enter `NeedleValue`. When a signal is received at the ActiveX Control block's inport, this property of the ActiveX Control block referenced by the ActiveX Control block (the Generic Angular Gauge) is set with the signal value.

**Note** If you adapt this example to use the Strip Chart control instead, then set **Input property** to `Y`. For other controls in this blockset, set **Input property** to the value used in the corresponding parameter field in the library block.

**6** In the **Handle location** field, enter `dng_off_block`. With the fields filled in, the **Block Parameters** dialog box looks like this.




**7** Click on **OK**. MATLAB executes the `dng_off_block` M-file, which returns the handle of the ActiveX Control block in the figure window. The figure window looks like this (resized).




8 Run the simulation. Notice that the clock time is passed to the Generic Angular Gauge.

---

**Note** If you accidentally close the figure window before you are finished exploring the model, you can recreate it by executing `dng_gaugewindow`.

---

## Saving and Reopening the Model

If you want to use this model in a different MATLAB session, then you must preserve both the model and the MATLAB commands that create the figure window and gauge. Here is an easy way to do this:

1 Save the model to give it a name.

2 If the model's name is `mymodel`, then use these commands in MATLAB to preserve the commands that create the figure window and gauge.

```
set_param('mymodel','PreLoadFcn','dng_gaugewindow');
save_system
```

Now, whenever you open `mymodel`, MATLAB automatically creates the figure that contains the gauge.

5

# Block Reference

# Blocks - By Category

This chapter contains detailed descriptions of the categories of blocks in the Dials & Gauges Blockset. Each category corresponds to a library containing blocks that share many aspects of their functionality.

| Library Name | Purpose of Blocks |
|---|---|
| Angular Gauges | Display input value on an arc |
| Buttons & Switches | Toggle between two states |
| Knobs & Selectors | Select values in a discrete or continuous set using a mouse-controlled dial |
| LEDs | Display input value using one or more two-state graphical elements |
| Linear Gauges | Display input value on a line |
| Numeric Displays | Display input value using LED digits or numbered wheels |
| Percent Indicators | Display percentages and ratios, using a linear or circular scale |
| Sliders | Select values using a mouse-controlled knob that slides along a bar |
| Strip Chart | Display streams of data in real time |

## Purpose

Display input value on an arc

## Description

Blocks in the Angular Gauges library show their input values graphically on a scale that lies along an arc of a circle. If the input value is greater than the scale's maximum or less than the scale's minimum, then the block displays the maximum or mininum value, respectively. To learn how to use and customize blocks in this library, see "Angular Gauges" on page 3-2.

---

**Note** Blocks in this library can display multiple needles. The Stop Watch and Analog Clock blocks display multiple needles by default. To learn how to control multiple needles simultaneously, see "Controlling Multiple Graphical Elements" on page 2-18.

---

### Blocks in the Library

The blocks in the Angular Gauges library are

- Amp Meter
- Analog Clock
- Compass
- Generic Angular Gauge
- Lower Left
- Lower Right
- Stop Watch
- Upper Left
- Upper Right
- Vacuum
- Volume

## Dialog Box

The **ActiveX Control Properties** dialog box governs the appearance and functionality of the ActiveX control that is embedded in the block. The table below lists the panels of the **ActiveX Control Properties** dialog box.

| Panel | Purpose |
|---|---|
| **Annulars** | Display annular regions along the block's scale |
| **Background** | Configure the background and outline of the block |
| **Captions** | Display annotations on the block |
| **Digital** | Display the numerical value corresponding to the needle |
| **Frames** | Display a border on the block |
| **Fonts** | Define text styles (The **Captions**, **Digital**, and **Ticks** panels use the **FontID** property to reference the styles defined here.) |
| **Hubs** | Embellish a needle's axis of rotation |
| **Library** | Refer to property settings as a named collection |
| **Needles** | Display one or more needles on the block (The **Digital** panel uses the **NeedleID** property to reference the needles defined here.) |
| **Scales** | Define the ranges and locations of values displayed on the block (The **Annulars**, **Hubs**, **Needles**, and **Ticks** panels use the **ScaleID** property to reference the ranges defined here.) |
| **Ticks** | Display markers and/or numbers at intervals along the scale |

The **Block Parameters** dialog box governs the interaction between Simulink and the ActiveX control embedded in the block. See "Summary of Dialog Box Fields and Check Boxes" on page 3-29 for details.

## Purpose

Toggle between two states

## Description

Blocks in the Buttons & Switches library are two-state controls that change their state when you click on them. The block output is `0` when the block's state is off and `1` when the state is on. To learn how to use and customize blocks in this library, see "Buttons & Switches" on page 3-5.

### Blocks in the Library

The blocks in the Buttons & Switches library are

- Dip Switch
- Generic Toggle
- Happy Face
- Light Bulb
- Lock
- Mailbox
- OnOff Switch
- Round Green
- Round Red
- Round Yellow
- Square Green
- Square Red
- Square Yellow

## Dialog Box

The **ActiveX Control Properties** dialog box governs the appearance and functionality of the ActiveX control that is embedded in the block. The table below lists the panels of the **ActiveX Control Properties** dialog box.

| Panel | Purpose |
|---|---|
| **Background** | Configure the background and outline of the block |
| **General** | Set timer-related behavior, and determine how the button's beveling (if visible) responds to a mouse click |
| **Library** | Refer to property settings as a named collection |

| Panel (Continued) | Purpose (Continued) |
|---|---|
| **Off** | Associate visual (text caption or image) and/or audio cues with the button's off state |
| **On** | Associate visual (text caption or image) and/or audio cues with the button's on state |

The **Block Parameters** dialog box governs the interaction between Simulink and the ActiveX control embedded in the block. See "Summary of Dialog Box Fields and Check Boxes" on page 3-29 for details.

## Purpose

Select values in a discrete or continuous set using a mouse-controlled dial

## Description

The Knobs & Selectors library contains two blocks that behave differently:

- The Generic Knob block displays a mouse-controlled dial that selects values on a continuous scale. The block's output is the value to which the dial points.
- The Frequency Selector block displays a mouse-controlled dial that selects values in a discrete set. The block's output is a nonnegative integer that depends on the value to which the dial points.

To learn how to use and customize these blocks, see "Knobs & Selectors" on page 3-7.

The Knobs & Selectors library also contains a block called Freq. Selector convert to Simulink. This block converts the output values of the Frequency Selector block to a base-10 logarithmic scale.

## Dialog Box

The **ActiveX Control Properties** dialog box governs the appearance and functionality of the ActiveX control that is embedded in the block. The table below lists the panels of the **ActiveX Control Properties** dialog box for the Generic Knob block.

| Panel | Purpose |
|---|---|
| **Annulars** | Display annular regions along the block's scale |
| **Background** | Configure the background and outline of the block |
| **Captions** | Display annotations on the block |
| **Digital** | Display the numerical value corresponding to the knob |
| **Frame** | Display a border on the block |
| **Fonts** | Define text styles (The **Captions**, **Digital**, and **Ticks** panels use the **FontID** or **DigitalFontID** property to reference the styles defined here.) |
| **Knob** | Define the appearance and behavior of the block's dial |

| Panel (Continued) | Purpose (Continued) |
|---|---|
| **Library** | Refer to property settings as a named collection |
| **Mark** | Display a dot or other mark on the dial |
| **Scale** | Define the range and locations of selectable values |
| **Ticks** | Display markers and/or numbers at intervals along the scale |

The table below lists the panels of the **ActiveX Control Properties** dialog box for the Frequency Selector block.

| Panel | Purpose |
|---|---|
| **Auto** | Define the dial's range of motion, display the lines between the dial and the annotations for the selectable values, and determine whether the block should automatically position the selectable values |
| **Background** | Configure the background and outline of the block |
| **Captions** | Display annotations on the block (These are independent of the annotations associated with the selectable values, which are defined on the **Selections** panel.) |
| **Frame** | Display a border on the block |
| **Fonts** | Define text style (The **Captions** and **Selections** panels use the **FontID** property to reference the styles defined here.) |
| **Knob** | Define the appearance of the block's dial |
| **Library** | Refer to property settings as a named collection |
| **Mark** | Display a dot or other mark on the dial |
| **Selections** | Define the number and appearance of selectable values for the block |

The **Block Parameters** dialog box governs the interaction between Simulink and the ActiveX control embedded in the block. See “Summary of Dialog Box Fields and Check Boxes” on page 3-29 for details.

# LEDs

## Purpose

Display input value using one or more two-state graphical elements

## Description

Blocks in the LEDs library use graphical elements to imitate light-emitting diodes (LEDs). Each block reflects its input value by setting one or more graphical elements to an on or off state. By default, the number of LEDs in the on state is the rounded value of the block's input. If the rounded value is nonpositive, then all LEDs are in the off state. If the rounded value exceeds the number of LEDs, then all LEDs are in the on state. To learn how to use and customize blocks in this library, see "LEDs" on page 3-13.

### Blocks in the Library

The blocks in the LEDs library are

- Circle Meter
- Generic LED
- Green Rect
- Horizontal Meter
- Rect Bitmap
- Red Rect
- Red Rectangle Plain
- Red Star
- Round Red
- Vertical Meter

## Dialog Box

The **ActiveX Control Properties** dialog box governs the appearance and functionality of the ActiveX control that is embedded in the block. The table below lists the panels of the **ActiveX Control Properties** dialog box.

| Panel | Purpose |
|---|---|
| **Background** | Configure the background and outline of the block |
| **LEDs/General** | Define the number, arrangement, and behavior of LEDs on the block |

| Panel (Continued) | Purpose (Continued) |
|---|---|
| **Library** | Refer to property settings as a named collection |
| **Style** | Define the appearance of LED graphical elements (The **LEDs/General** panel uses the **LEDStyleID** property to reference the styles defined here.) |

The **Block Parameters** dialog box governs the interaction between Simulink and the ActiveX control embedded in the block. See “Summary of Dialog Box Fields and Check Boxes” on page 3-29 for details.

# Linear Gauges

## Purpose

Display input value on a line

## Description

Blocks in the Linear Gauges library show their input value graphically on a scale that lies along a line. If the input value is greater than the scale's maximum or less than the scale's minimum, then the block displays the maximum or mininum value, respectively. To learn how to use and customize blocks in this library, see "Linear Gauges" on page 3-15.

---

**Note** Blocks in this library can display multiple pointers. The Multiple Scales block displays multiple pointers by default. To learn how to control multiple pointers simultaneously, see "Controlling Multiple Graphical Elements" on page 2-18.

---

### Blocks in the Library

The blocks in the Linear Gauges library are

- Generic Linear Gauge
- Min-Max Thermometer
- Mixer
- Mixer Scale
- Multiple Scales

## Dialog Box

The **ActiveX Control Properties** dialog box governs the appearance and functionality of the ActiveX control that is embedded in the block. The table below lists the panels of the **ActiveX Control Properties** dialog box.

| Panel | Purpose |
|---|---|
| **Background** | Configure the background and outline of the block |
| **Bands** | Display linear or rectangular regions along the block's scale |
| **Captions** | Display annotations on the block |

| Panel (Continued) | Purpose (Continued) |
|---|---|
| **Digital** | Display the numerical value corresponding to the pointer |
| **Fonts** | Define text styles (The **Captions**, **Digital**, and **Ticks** panels use the **FontID** property to reference the styles defined here.) |
| **Library** | Refer to property settings as a named collection |
| **Pointers** | Display one or more pointers on the block (The **Digital** panel uses the **PointerID** property to reference the pointers defined here.) |
| **Scales** | Define the ranges and locations of values displayed on the block (The **Bands**, **Pointers**, and **Ticks** panels use the **ScaleID** property to reference the ranges defined here.) |
| **Ticks** | Display markers and/or numbers at intervals along the scale |

The **Block Parameters** dialog box governs the interaction between Simulink and the ActiveX control embedded in the block. See “Summary of Dialog Box Fields and Check Boxes” on page 3-29 for details.

# Numeric Displays

## Purpose

Display input value using LED digits or numbered wheels

## Description

Blocks in the Numeric Displays library show the numerical values of their inputs using graphical elements that imitate either numerals composed of light-emitting diode (LED) segments, or numbered wheels.

The display of the Odometer block imitates the numbered wheels of a car's odometer. An optional reset button on the Odometer block can set the display to zero in response to a mouse click.

To learn how to use and customize blocks in this library, see "Numeric Displays" on page 3-18.

---

**Note** Blocks in this library can display alphanumeric characters if their **DisplayMode** properties are set to `AlphaNumeric`. Some blocks, such as the IRIG Format block, use this alphanumeric mode by default. However, Simulink signals are always double-precision *numeric* values. When using the alphanumeric mode, you can control the display via an M-file S-function that uses the COM support features in MATLAB. For an example of controlling a gauge using an M-file S-function, see "Updating Multiple Portions of a Pie Chart" on page 2-23.

---

### Blocks in the Library

The blocks in the Numeric Displays library are

- Generic Numeric LED
- HH:MM
- HH:MM:SS
- IRIG Format
- Odometer
- PlusMinus XX.XXX
- VCR Clock

## Dialog Box

The **ActiveX Control Properties** dialog box governs the appearance and functionality of the ActiveX control that is embedded in the block. The table below lists the panels of the **ActiveX Control Properties** dialog box.

| Panel | Purpose |
|---|---|
| **Background** | Configure the background and outline of the block |
| **General** | Define the number, appearance, and arrangement of digits on the block |
| **Library** | Refer to property settings as a named collection |

The **Block Parameters** dialog box governs the interaction between Simulink and the ActiveX control embedded in the block. See “Summary of Dialog Box Fields and Check Boxes” on page 3-29 for details.

# Percent Indicators

## Purpose

Display percentages and ratios, using a linear or circular scale

## Description

Blocks in the Percent Indicators library convert their input values to percentages or ratios. They display the percentage or ratio graphically as either a segment on a linear scale or a sector of a circle. To learn how to use and customize blocks in this library, see “Percent Indicators” on page 3-20.

---

**Note** Blocks in this library can display multiple values simultaneously using percentages or ratios. The Pie Chart block displays multiple values by default. To learn how to display multiple values simultaneously, see “Controlling Multiple Graphical Elements” on page 2-18.

---

### Blocks in the Library

The blocks in the Percent Indicators library are

- Dynamic Pie
- Generic Percent
- Pie Chart
- Simple Light Blue

## Dialog Box

The **ActiveX Control Properties** dialog box governs the appearance and functionality of the ActiveX control that is embedded in the block. The table below lists the panels of the **ActiveX Control Properties** dialog box.

| Panel | Purpose |
|---|---|
| **Background** | Configure the background and outline of the block |
| **Frames** | Display a border on the block |
| **Library** | Refer to property settings as a named collection |
| **Misc** | Define the shape, orientation, and range of the block’s scale |
| **Portions** | Define the number, appearance, and labeling style of regions that the block displays |

The **Block Parameters** dialog box governs the interaction between Simulink and the ActiveX control embedded in the block. See “Summary of Dialog Box Fields and Check Boxes” on page 3-29 for details.

# Sliders

## Purpose

Select values using a mouse-controlled knob that slides along a bar

## Description

Blocks in the Sliders library represent a knob sliding along a bar. The block output is the numerical value corresponding to the knob's position. To learn how to use and customize blocks in this library, see "Sliders" on page 3-23.

### Blocks in the Library

The blocks in the Sliders library are

- Generic Slider
- Horizontal Slider
- Reverse Sliding Scale
- Scaled Slider
- Tank
- Thermometer
- Vertical Slider

## Dialog Box

The **ActiveX Control Properties** dialog box governs the appearance and functionality of the ActiveX control that is embedded in the block. The table below lists the panels of the **ActiveX Control Properties** dialog box.

| Panel | Purpose |
|---|---|
| **Background** | Configure the background and outline of the block |
| **Bar** | Define the appearance of the bar along which the knob slides |
| **Captions** | Display annotations on the block |
| **Digital** | Display the numerical value corresponding to the knob |
| **Fonts** | Define text styles (The **Captions**, **Digital**, and **Ticks** panels use the **FontID** property to reference the styles defined here.) |
| **General** | Define the range and orientation of the block's scale |

| Panel (Continued) | Purpose (Continued) |
|---|---|
| **Knob** | Define the appearance of the sliding knob |
| **Library** | Refer to property settings as a named collection |
| **Ticks** | Display markers and/or numbers at intervals along the scale |

The **Block Parameters** dialog box governs the interaction between Simulink and the ActiveX control embedded in the block. See “Summary of Dialog Box Fields and Check Boxes” on page 3-29 for details.

# Strip Chart

## Purpose

Display streams of data in real time

## Description

The Strip Chart library contains a single block, the Strip Chart block. This block displays one or more signals while the simulation runs. It also enables you to zoom in or out. To learn how to use the Strip Chart block, see “Strip Chart” on page 3-26.

## Dialog Box

The **ActiveX Control Properties** dialog box governs the appearance and functionality of the ActiveX control that is embedded in the block. The table below lists the panels of the **ActiveX Control Properties** dialog box.

| Panel | Purpose |
|---|---|
| **Background** | Configure the background and outline of the block |
| **Captions** | Display annotations on the block |
| **Fonts** | Define text styles (The **Captions** and **Stamps** panels use the **FontID** or **Stamp FontID** property to reference the styles defined here.) |
| **General** | Define the appearance and behavior of the underlying plotting area |
| **Library** | Refer to property settings as a named collection |
| **Stamps** | Define the appearance of a symbol that you can place on the control or on an individual plot |
| **Track Bands** | Define the number of colored bands displayed on each individual plot, and the appearance of each band |
| **Tracks** | Define the number of individual plots, and the appearance of each (The **Track Bands** and **Variables** panels use the **TrackID** property to reference the tracks defined here.) |

| Panel (Continued) | Purpose (Continued) |
|---|---|
| **Variables** | Determine which variables appear in each individual plot and how each variable is displayed. |
| **X Axis** | Determine what the values along the *x*-axis represent and how they are displayed |

The **Block Parameters** dialog box governs the interaction between Simulink and the ActiveX control embedded in the block. See “Summary of Dialog Box Fields and Check Boxes” on page 3-29 for details.

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