# LabVIEW™ Custom Controls, Indicators, and Type Definitions

## Introduction

This application note explains how to use the Control Editor to create and use custom controls, indicators, and type definitions.

Use custom controls and indicators to extend the available set of front panel objects. You can create custom user-interface components suited for your application that vary cosmetically from standard LabVIEW controls and indicators.

You can save a custom control or indicator you created in a directory or VI library and use the custom control or indicator on other front panels. You also can create an icon for the custom control or indicator and add it to the **Controls** palette.

Use type definitions and strict type definitions to link all the instances of a custom control or indicator to a master definition so you can make changes to all instances by editing only the master definition, which is valuable if you require the same custom control or indicator in several VIs.

## Creating Custom Controls and Indicators

The Control Editor window looks like a front panel, but you use it only for editing and saving a single control or indicator. The Control Editor has no block diagram and cannot run.

The Control Editor toolbar indicates whether you are in edit mode or in customize mode. The Control Editor opens in edit mode. You can change the size or color of a control or indicator and select options from its shortcut menu just as you do in edit mode of any front panel. In customize mode, you can change the parts of a control or indicator individually. Refer to the *Customize Mode* section of this document for more information about making extensive changes to a control or indicator.

Complete the following steps to create a custom control or indicator.

1. Select **File»New** to display the **New** dialog box. You also can display the **New** dialog box by selecting **New** from the **New** pull-down menu of the **LabVIEW** dialog box.

2. Select **Other Document Types»Custom Control** in the **Create new** list.

3. Click the **OK** button. The **Control Editor** window appears.

4. Place a control or indicator most like the one you want to create in the **Control Editor** window and make the changes you want.

5. Select **File»Save as** to save the custom control or indicator to use it on other front panels. Save the control or indicator in a directory or in a VI library. If you close the **Control Editor** window without saving the changes to the control or indicator, the **Save Changes?** dialog box prompts you to save.

# Editing Custom Controls and Indicators

Use the Control Editor to change the size, color, and relative position of a control or indicator and to change images in the control or indicator. Complete the following steps to edit a custom control or indicator.

1.  With the Positioning tool, select the custom control or indicator you want to edit. You can edit only one control or indicator at a time. The **Control Editor** window appears.

2.  Select **Edit»Customize Control**. This menu item is available only when you select a custom control or indicator.

3.  Select a resizing handle or circle on the control or indicator and reposition or resize the control or indicator.

4.  With the Coloring tool, select the control or indicator whose color you want to change.

5.  Select a color from **Set Color** on the **Tools** palette to change the color of the control or indicator.

6.  Right-click the control or indicator and select **Import Picture** from the shortcut menu to select an image.

7.  Select **File»Apply Changes** in the **Control Editor** window to replace the original front panel control or indicator with the new custom control or indicator. The **Apply Changes** menu item is available only after you make changes to the original control or indicator.

8.  If the original front panel is the only place you use the custom control or indicator, you can close the **Control Editor** window without saving the control or indicator. If you want to use the new control or indicator on other front panels, save it before you exit the Control Editor. Save the original VI with the custom control or indicator in place.

## Valid Custom Controls

The Control Editor can contain only one control or indicator, although the control or indicator can be a cluster of other controls or indicators.

The **Invalid Control** button  appears on the Control Editor toolbar temporarily while you move controls or indicators in and out of a cluster or array. Click the **Invalid Control** button for an explanation of the error.

# Using Custom Controls and Indicators

Complete the following steps to place a custom control or indicator on a front panel.

1.  Select **Select a Control** to use a custom control or indicator on other front panels. The **Choose a custom control to open** dialog box appears.

2.  Select the control or indicator you want and place it on the front panel.

3.  Save the VI with the custom control or indicator in place.

Complete the following steps to place a custom control or indicator on a block diagram.

1.  Select **Select a VI** to use a custom control or indicator on block diagrams. The **Choose the VI to open** dialog box appears.

2.  Select the control or indicator you want and place it on the block diagram. If you use a custom control or indicator on a block diagram, you create a constant with the same data type as the custom control or indicator.

3.  Save the VI with the custom control or indicator in place.

You also can add custom controls and indicators to the **Controls** and **Functions** palettes. Refer to the *LabVIEW Help* for more information about adding custom controls and indicators to the **Controls** and **Functions** palettes.

When you place a custom control or indicator in a VI, LabVIEW eliminates the connection between the file that created the custom control or indicator and the control or indicator in the VI. Only type definitions contain instances that link to its definition.

# Differences Between Independent and Linked Custom Controls and Indicators

Select **File»Open** to open any custom control or indicator you saved. A custom control or indicator always opens in the **Control Editor** window.

Changes you make to a custom control or indicator when you open it do not affect VIs already using that control or indicator. When you use a custom control or indicator on a front panel, no connection exists between that instance of the custom control or indicator and the file or VI library where you saved the custom control or indicator unless the control or indicator is a type definition. Each instance of a custom control or indicator is a separate, independent copy.

A type definition is a custom control or indicator whose instances are linked to its definition. Save the custom control or indicator as a type definition to create a connection among control or indicator instances on various VI front panels or block diagrams and the master copy of the control or indicator. Any data type changes you make to the master copy affect all instances of the control or indicator in all the VIs that use it. If you save the custom control or indicator as a strict type definition, cosmetic changes to the master copy also affect all instances of the custom control or indicator. Refer to the *Type Definitions* section of this document for more information about type definitions.

# Customize Mode

Use the customize mode of the Control Editor to make extensive changes to controls or indicators. Switch between edit mode and customize mode by clicking the **Mode** button on the Control Editor toolbar or by selecting **Operate»Change to Customize Mode** or **Change to Edit Mode** in the **Control Editor** window.

## Independent Parts of Controls or Indicators

All controls or indicators are built from smaller parts. For example, a slide control consists of a scale, a housing, a slider, the increment and decrement arrows, a digital display, a unit label, and a name label, as shown in the following illustration.
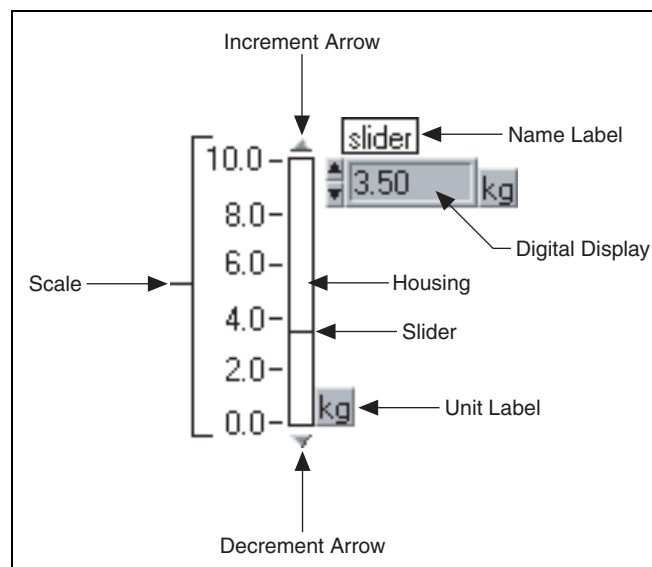


**Figure 1.** A Slide Control

When you switch to customize mode in the Control Editor, the parts of the control or indicator become independent. You can make changes to each part without affecting any other part. Customize mode shows all parts of the control or indicator, including any parts that are hidden in edit mode, such as the name label or the radix on a digital control. Because the parts of the control or indicator are detached from each other, you cannot operate or change the value of the control or indicator while in customize mode.

Complete the following steps to select, align, or distribute parts of the control or indicator in the **Control Editor** window.

1. With the Positioning tool, select the parts of the control or indicator you want to align or distribute.
2. Select the **Align Objects** pull-down menu or the **Distribute Objects** pull-down menu on the toolbar to align or distribute the parts you selected.
3. Select the **Reorder** pull-down menu on the toolbar to change the layering order of the parts you selected.
4. Save the custom control or indicator.

## Control Editor Parts Window

Select **Window»Show Parts Window** in the **Control Editor** window to help size and position control or indicator parts. The **Control Parts** window appears and identifies the parts of the control or indicator and shows the exact position and size of each part in pixels.

The **Current Part** display in the **Control Parts** window contains a graphic and the name of the part you selected in the **Control Editor** window. Click the **Current Part** display to see all the parts of the control or indicator. Click the **Current Part** display increment or decrement arrows to scroll through the parts of the control or indicator.

When you move or resize a part in the Control Editor, LabVIEW updates the position and size in the **Current Parts** display. You also can enter the position and size values directly in the **Control Parts** window to move or resize the part in the Control Editor, which is useful when you must make two parts exactly the same size or align one part with another.

## Customize Mode Shortcut Menus for Different Parts

In customize mode, a shortcut menu for each part replaces the shortcut menu for the control or indicator as a whole. Different parts have different shortcut menus, and available menu items vary in edit mode and in customize mode. Use the shortcut menus to customize the following types of parts:

- Cosmetic parts, such as a slide housing, slider, and the increment and decrement arrows
- Text parts, such as the name label
- Controls or indicators as parts, such as the numeric control used for the slide digital display. Knobs, meters, and charts also use a numeric control for a digital display. Some controls are more complicated. For example, the graph uses an array of clusters for its cursor display part.

# Cosmetic Parts

A cosmetic part has no dynamic user interaction. You must be in customize mode to right-click a cosmetic part. Right-click the part itself in the Control Editor, not the graphic of the part in the **Control Parts** window.

The following list describes items in the cosmetic parts shortcut menu:

- **Copy to Clipboard** – Places a copy of the graphic of the part on the clipboard. Select **Edit»Paste** to paste the clipboard graphic on any front panel. Right-click the part and select **Import Picture** from the shortcut menu to import the graphic to another part.

  When you require simple shapes, such as the housing rectangle for other parts, there are several advantages to copying them from other parts instead of making them in a paint program. Graphics taken from existing parts or decorations resize better than graphics made in a paint program. For example, when you resize a rectangle drawn in a paint program, it grows only uniformly, enlarging its area and also making its border thicker. When you resize a rectangle copied from a part, it keeps the same thin border.

  Another advantage of copying built-in parts is that they appear basically the same on color monitors and on black-and-white monitors. In addition, you can use the Coloring tool to add color to graphics you copy from parts or decorations. Graphics you import from another source keep the colors they had when you imported them because those colors are a part of the definition of that graphic.

- **Import Picture** – Replaces the current graphic of a cosmetic part with the graphic currently on the clipboard. For example, you can import graphics of an open and closed valve for a Boolean switch. The **Import Picture** menu item is dimmed if the clipboard does not contain a graphic.

- **Import at Same Size** – Replaces the current graphic and keeps the original size of the part, shrinking or enlarging the clipboard graphic to fit. The **Import at Same Size** menu item is dimmed if the clipboard does not contain a graphic.

- **Revert** – Restores the part to its original appearance. Selecting **Revert** from the shortcut menu does not change the position of the part. If you open the **Control Editor** window by selecting **Edit»Edit Control** from a front panel and use the **Revert** menu item, the part returns to the way it looks on the front panel. If you open the **Control Editor** window by selecting **File»Open**, the **Revert** menu item is dimmed.

- **Original Size** – Sets the graphic of a part to its original size, which is useful for graphics you import from other applications and then resize. Some of these graphics do not look as good as the original when you resize it, and you might want to restore the original size. The **Original Size** menu item is dimmed if you do not import a graphic.

# Importing Graphics

Complete the following steps to use the Control Editor to import graphics into a Boolean control and to import different graphics for the transition states.

1. In the Control Editor, select **Edit»Import Picture from File** and navigate to the graphic to load it into memory.

2. When you are in edit mode, right-click the Boolean control and select **Import Picture** and select **False**, **True**, or **Decal** from the shortcut menu. Repeat this step as necessary for each case. The decal does not change with the state of the Boolean control.

3. LabVIEW imports the graphic into the normal state and into the corresponding transition state. Refer to the *Cosmetic Parts with More than One Graphic* section of this document for more information about transition states.

4. Complete the following steps to use graphics for other elements of the control.

   a. Right-click the Boolean control and select **Picture Item** from the shortcut menu.

   b. Copy a graphic on the clipboard.

   c. With the graphic on the clipboard, right-click the control again and select **Import Picture**. You also can select **Import at Same Size** from the shortcut menu to import the graphic at the same size as the element.

## Cosmetic Parts with More than One Graphic

Some cosmetic parts have more than one graphic to display at different times. The different graphics are the same size and use the same colors. When you move or resize the current graphic of the cosmetic part, its other graphics also move the same amount or change size proportionally. For example, a Boolean switch has four different graphics. The first shows the False state, the second shows the True state, and the third and fourth show the Switch When Released or Latch When Released state. Refer to the *LabVIEW Help* for more information about setting the mechanical action of Boolean controls.

Until you release the mouse button, the value of the Boolean control does not change with these two mechanical actions. Between the time you click the mouse button and the time you release the mouse button, the Boolean control shows the third or fourth graphic as a transition state. The third graphic is for the True to False transition state, and the fourth is for the False to True transition state.

**Picture Item** is available on the shortcut menu of a cosmetic part with more than one graphic. Selecting **Picture Item** from the shortcut menu displays all the graphics that belong to a cosmetic part. The current graphic item has a dark border around it. When you import a graphic, you change only the current graphic item. To import a graphic for one of the other graphic items, first select that graphic item, then import the new graphic.

## Cosmetic Parts with Independent Graphics

A cosmetic part with more than one graphic can have graphics of different sizes that each use different colors. For example, the slide uses two graphics of different sizes to show which slider is active on a multivalue slide.

**Independent Sizes** is available on the shortcut menu of a cosmetic part that can have graphics of different sizes. In customize mode, select **Independent Sizes** from the shortcut menu to place a checkmark by this menu item and move and resize each graphic individually without changing the other graphics of the cosmetic part.

## Text Parts

A text part is a graphic with text. The shortcut menu for a text part in the Control Editor is similar to the cosmetic part shortcut menu. The other items on this menu are the same as the shortcut menu for text elements in front panel edit mode. The **Controls Part** window shows only the background graphic for the text part, not the text itself. You can customize the background graphic, not the text.

## Controls and Indicators as Parts

A control or indicator can include other controls or indicators as parts, such as the digital display on a slide, knob, meter, or chart. The digital display of a numeric control or indicator is no different from a digital display used on its own.

The digital display also is made up of parts. When you edit the original control or indicator in the Control Editor, the digital display behaves as a single part so you cannot change or move its parts individually. However, you can open the Control Editor for the digital display and customize it. You do not have to be in customize mode to open a nested **Control Editor** window unless you are unable to select the control or indicator part in edit mode.

You can open the **Control Editor** window for the part directly from the original front panel if you can select it separately from the main control or indicator in edit mode on the front panel. You always can open the **Control Editor** window for the part from the **Control Editor** window of the main control or indicator in customize mode.

Complete the following steps to customize a control or indicator that is part of another control or indicator.

1. Open the Control Editor for a control or indicator that is part of another control or indicator to customize it.
2. Select the part in the Control Editor. For example, you can select the digital display separately from the slide control.
3. Select **Edit»Customize Control**.

You can nest **Control Editor** windows in this way indefinitely, but most controls or indicators use other controls or indicators as parts only at the top level. An exception is the graph, which uses complicated controls as parts that in turn use other controls as parts.

## Adding Cosmetic Parts to Custom Controls and Indicators

When you use the Control Editor to create a custom control or indicator, you can add cosmetic or text parts to it in edit mode or in customize mode.

If you paste a graphic or text from the clipboard, create a label with the Labeling tool, or select a graphic from the **Decorations** palette, that graphic or text becomes a part of the new control or indicator and appears with the control or indicator when you place it on a front panel. You can move, resize, or change the layering order of the new part. The addition appears as a decoration part in the **Control Parts** window in customize mode. You also can delete decoration parts in the Control Editor.

When you use a custom control or indicator on front panels, you can change the size of any decoration parts you add, but you cannot move them.

## Custom Control Caveats

Consider the following issues when you make custom controls or indicators:

- Graphics you create on one platform look slightly different when you load them on another platform. For example, a graphic with an irregular shape or a transparent background might have a solid white background on another platform. Refer to the *Picture Differences* section in the *Porting and Localizing LabVIEW VIs* Application Note for more information about differences among platforms.
- The Control Editor changes only the appearance of a control or indicator. It cannot change the behavior of a control or indicator. You cannot change the way a control or indicator displays data, and you cannot change the way a control or indicator behaves when you edit it, especially when you resize it. For example, when you make a ring control taller, the increment and decrement arrows also increase in height. If you move the increment and decrement arrows so they are side by side at the bottom of a ring control, the buttons become taller when the ring control becomes taller.
- Custom controls or indicators often look correct, but they occasionally behave oddly. If you like the appearance of a custom control or indicator but are not pleased with its irregular editing behavior, use a strict type definition. Refer to the *Type Definitions* section of this document for more information about editing restrictions.

# Type Definitions

Use the Control Editor to create a type definition, which is a master copy of a control or indicator. LabVIEW ensures that the data type of the control or indicator is the same everywhere you use a type definition. Type definitions are useful when you use the same control or indicator in many VIs. Save the control or indicator as a type definition and use that type definition in other VIs so if you need to change that control or indicator, you can update data type values in the single type definition file instead of updating the control or indicator in every VI that uses it.

You can set a type definition instance to not update automatically. Refer to the *Updating Type Definitions* section of this document for more information about how to update type definitions.

As long as the data type matches the master copy, a type definition can have a different name, description, default value, size, color, or style of control or indicator, such as a knob instead of a slide.

The type definitions identify the correct type for each instance of a custom control or indicator. When the type definition data type changes, the instances update. However, because type definitions identify only the data type, only the values that are part of the type update.

For example, on numeric controls, the data range is not part of the type. Therefore, type definitions do not define the data range for the instances of numeric control type definitions on the front panel. Also, because the item names in ring controls do not define the type, the type definition does not define values for all their instances. Therefore, changing ring control strings does not cause the type definitions to update. However, if you change the item names in a type definition for an enumerated type, the instances update because the item names are part of the type.

## Strict Type Definitions

A strict type definition forces almost everything about the control or indicator to be identical, including cosmetic properties such as size, color, and appearance. Strict type definitions also define other values, such as range checking on numeric controls and the item names in ring controls. The only aspects of a control or indicator that can be different from the master copy of a strict type definition are the name, description, and default value. You cannot disable automatic updating for a strict type definition instance.

The only properties available for strict type definitions are those that affect the appearance of the control or indicator, such as Visible, Disabled, Key Focus, Blinking, Position, and Bounds.

## Type Definitions on Block Diagrams

When you use a type definition on a block diagram, it always appears as a constant, not a control or indicator. Therefore, an instance of a strict type definition on a block diagram acts as an instance of a general type definition. It updates automatically only when the data type of the strict type definition changes.

## Creating Type Definitions

Complete the following steps to create a type definition.

1. Select **Type Def.** from the **Type Def. Status** pull-down menu on the **Control Editor** window toolbar.
2. Customize the control or indicator.
3. Select **File»Save** in the **Control Editor** window.

Select **File»Open** to open any type definition you saved. A type definition always opens in the **Control Editor** window. Any changes you make to a type definition affect all VIs that use it.

# Using Type Definitions

Place, edit, and operate general type definitions and strict type definitions on the front panel or block diagram the same way you place, edit, and operate any custom control or indicator. You cannot edit a strict type definition on the front panel except to change its name, description, or default value.

You can recognize that a control or indicator is a type definition because the shortcut menu includes type definition options. You also can select **Edit»Find** to search for a control or indicator that is a type definition. You can recognize a strict type definition on the front panel or block diagram because you cannot edit it and most of the shortcut menu options are missing.

For each type definition you use on a front panel or block diagram, the VI keeps a connection to the file or VI library where you saved the type definition.

Because a VI must keep a connection to each type definition, the file or VI library that contains the type definition must be available for the VI that uses the type definition to run. If you open a VI and LabVIEW cannot find a type definition the VI needs, LabVIEW disables the instances of that type definition in the VI, and the **Run** button appears broken. Find and open the correct type definition or right-click the disabled instance and select **Disconnect From Type Def** from the shortcut menu. Disconnecting from the type definition removes the restrictions on the data type of the instance, making it an ordinary control, indicator, or constant. You cannot reestablish the connection unless you find the type definition and replace the control or indicator with the type definition.

If you use a type definition or strict type definition that is a cluster, use the Bundle By Name function and the Unbundle By Name function on the block diagram to access the elements of the cluster instead of using the Bundle function and the Unbundle function. The Bundle By Name function and the Unbundle By Name function reference elements of the cluster by name instead of by cluster order, and reordering the elements or adding new elements to the cluster type definition does not affect the functions. If you delete an element you reference in the Bundle by Name function or the Unbundle By Name function, you must change the block diagram because the reference to the missing element becomes invalid. Invalid names in the Bundle by Name function or the Unbundle by Name function appear black. Click the Bundle by Name function or the Unbundle By Name function to display a list of valid names from which to choose.

# Updating Type Definitions

You can automatically change any type definition or strict type definition on the front panel. When you make a change to a type definition or strict type definition, you must first save the type definition or strict type definition before LabVIEW updates the VIs that include the type definition or strict type definition.

If you edit an instance of a type definition on the front panel extensively, such as coloring and resizing it, you might not want to update all instances of the type definition with those changes. Complete the following steps to disable the automatic update feature.

1. Right-click the type definition on the front panel and remove the checkmark from the **Auto-Update from Type Def.** shortcut menu item. If you change the data type of that instance of the type definition, the **Run** button appears broken in the VI, and LabVIEW disables the type definition on the front panel.

   The **Auto-Update from Type Def.** menu item is not available on the shortcut menu of a strict type definition because strict type definitions always automatically update.

2. Right-click the type definition on the front panel and select **Update from Type Def.** from the shortcut menu to correct the type definition or change the data type to match the type definition. You cannot run the VI until you correct the type definition.

When you use a type definition, you can assign the instance a unique default value. When you change the type definition data type, LabVIEW converts the old default value to the new data type if possible. LabVIEW cannot preserve the instance default value if the data type changes to an incompatible type, such as when you replace a numeric control or indicator with a string control or indicator. In these cases, LabVIEW sets the instance default to a value such as zero or an empty string.