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# LabVIEW™ Custom Controls, Indicators, and Type Definitions

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

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.



For example, you can create a Boolean switch that shows a closed valve when the switch is off and an open valve when the switch is on, or a slide control with its scale on the right side instead of the left.

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

Use type definitions and strict type definitions to link all the instances of a custom object to a master definition so you can make changes to all instances by editing just the master. This 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 customize mode . The Control Editor opens in edit mode. You can change the size or color of a control 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 individually. Refer to the Customize Mode section 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**. The **New** dialog box appears.
2. Select **Control** from the **Create new** listbox.
3. Click **OK**. The **Control Editor** window appears.
4. Place a control or indicator most like the one you want to create on the Control Editor panel and make the changes you want. For example, to create a slide with its scale on the right, start by placing a vertical slide on the Control Editor panel.
5. Select **File»Save** as to save the custom control or indicator to use it on other front panels. Save a control or indicator the same way you save a VI – in a directory or in a VI library. If you close the Control Editor window without saving your 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 from a front panel. 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 grow handle, such as a corner, of a control or indicator and click the mouse button to 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 **Picture Item** 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. 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. If you want to use the new control or indicator in 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, although the control can be a cluster of other controls.



The **not-OK** button appears in the Control Editor toolbar temporarily while you move controls in and out of a cluster or array. Click the **not-OK** 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 **Controls>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 **Functions>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 on a block diagram, you create a constant with the same data type as the custom control.
3. Save the VI with the custom control or indicator in place to preserve your work.

Instead of using the dialog box to navigate to your custom controls, you can add custom controls to the **Controls** and **Functions** palettes. Refer to the *LabVIEW User Manual* for more information about adding a custom control to the **Controls** and **Functions** palettes.

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

## Making Icons


If you plan to add the custom control to the **Controls** palette, or if the control is a type definition, make an icon that represents the control before you save it. The icon represents the custom control in the **Controls** palette. If the control is a type definition, the icon appears in the Hierarchy window.

Complete the following steps to create an icon:


1. Right-click the icon square in the top right corner of the Control Editor window.
2. Select **Edit Icon** from the shortcut menu to create an icon for the control.
3. Use the tools on the left of the **Icon Dialog** dialog box to create the icon design. An image of the actual icon size appears in one of the boxes to the right of the editing area.
4. Depending on the type of monitor you are using, design a separate icon for monochrome, 16-color, and 256-color mode. Design and save each icon version separately. To switch modes, click the icon for other color options.
5. Click **OK** to save your icon or click **Cancel** to exit the **Icon Dialog** dialog box without saving changes.

## Adding Custom Controls and Indicators to Palettes

Complete the following steps to add custom controls and indicators to the **Controls** palette:

1. Select **Options** button  on the Controls palette.
2. Select **Edit Palettes**.
3. Select **new setup** in the **Palette Set** ring control. The **Submenu Name** dialog box appears.
4. Enter a name for the new palette and select **Save Changes** to save your work or **Undo All Changes** without saving changes.

Complete the following steps to add custom controls and indicators to the **Functions** palette on the block diagram:

1. Select **Options**  button on the **Functions** palette.
2. Select **Edit Palettes**.
3. Select **new setup** in the **Palette Set** ring control. The **Submenu Name** dialog box appears.
4. Create a name for the new palette and select **Save Changes** to save your work or **Undo All Changes** without saving changes.

## Differences Between Independent and Linked Custom Controls

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. Unless it is a type definition, when you use a custom control or indicator on a front panel, there is no connection between that instance of the custom control and the file or VI library where it is saved. Each instance of a custom control is a separate, independent copy.

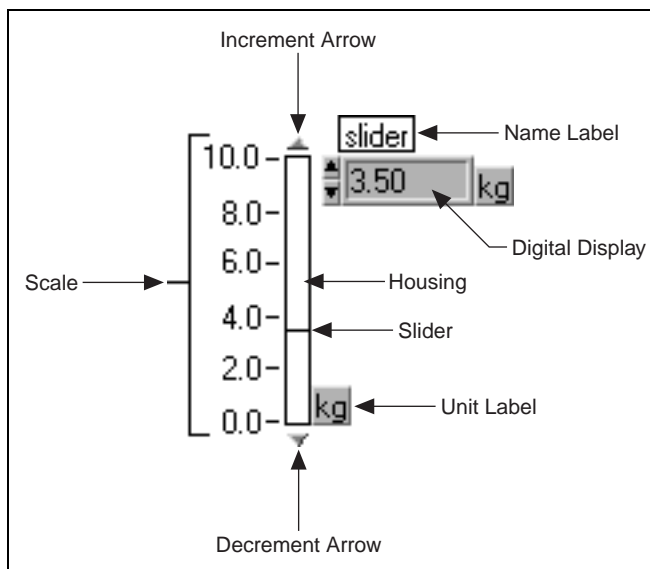
A custom control whose instances are linked to its definition is called a type definition. Save the custom control or indicator as a type definition to create a connection between control instances on various VI front panels or block diagrams and the master copy of the control. Any data type changes you make to the master copy affect all instances of the control 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 will affect all instances of the custom control. Refer to the Type Definitions section for more information about type definitions.

# Customize Mode Option

Use the customize mode of the Control Editor to make changes to controls, such as importing graphics into controls. Import graphics in controls by copying to a clipboard, replacing the picture, and shrinking or enlarging the picture to fit. Switch between edit and customize mode by clicking the **Mode** button in the Control Editor toolbar or by selecting **Operate»Change to Customize Mode** or **Change to Edit Mode** in the Control Editor.

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

Complete the following steps to select, align, or distribute parts of the control or indicator:

1. With the Positioning tool, select the parts of the control or indicator you want to align or distribute.
2. Select **Align Objects** or **Distribute Objects** from the toolbar to align or distribute the parts you selected.
3. Select **Reorder** from 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** to help size and position control parts. The Control Parts window appears and identifies the parts of the control and shows the exact position and size of each part in pixels.

The **Current Part** display in the Control Parts window contains a picture 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. Scroll through the parts of the control by clicking the **Current Part** display increment or decrement arrows.

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. This 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 as a whole. Different parts have different shortcut menus, and available menu items vary in edit and 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 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 picture 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 picture of the part on the clipboard. You can paste the clipboard picture on any front panel by selecting **Edit»Paste**. You can import the picture to another part by right-clicking the part and selecting **Import Picture** from the shortcut menu.

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. Pictures taken from existing parts or decorations resize better than pictures made in a paint program. For example, when you resize a rectangle drawn in a paint program, it grows only uniformly, enlarging its area but also making its border thicker. When you resize a rectangle copied from a part, it keeps the same thin border.

Another advantage is built-in parts appear basically the same on both color and black-and-white monitors. In addition, you can use the Color tool to add color to pictures you copy from parts or decorations. Pictures 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 picture.

- **Import Picture** – Replaces the current picture of a cosmetic part with the picture currently on the clipboard. For example, you can import pictures of an open and closed valve for a Boolean switch. The **Import Picture** menu item is dimmed if the clipboard does not contain a picture.
- **Import at Same Size** – Replaces the current picture, and keeps the original size of the part, shrinking or enlarging the clipboard picture to fit. The **Import at Same Size** menu item is dimmed if the clipboard does not contain a picture.
- **Revert** – Restores the part to its original appearance. **Revert** 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 picture of a part to its original size. This feature is useful for pictures you import from other applications and then resize. Some of these pictures do not look as good as the original when you resize it, and you might want to restore the original size. If you do not import a picture, the **Original Size** menu item is dimmed.

# Importing Graphics

Complete the following steps to use the Control Editor for importing pictures into a Boolean control and to import different pictures for the transition states in customize mode:

1. When you are in edit mode, right-click the Boolean control and select **Import Picture»True** or **Import Picture»False** from the shortcut menu.
2. LabVIEW imports the picture into both the normal state and the corresponding transition state. Refer to *Cosmetic Parts with More than One Picture* for more information about transition states.
3. Right-click the Boolean control and select **Picture Item** from the shortcut menu to change the third picture.
4. Copy a picture on the clipboard.
5. With the picture on the clipboard, right-click the control again and select **Import Picture**.
6. Repeat these steps for the fourth (**False»True**) picture.

Complete the following steps to import the picture at the same size:

1. When you are in edit mode, right-click the control and select **Import at Same Size** from the shortcut menu.
2. LabVIEW imports the picture, keeping the original size of the part.

## Cosmetic Parts with More than One Picture

Some cosmetic parts have more than one picture to display at different times. The different pictures are the same size and use the same colors. When you move or resize the current picture of the cosmetic part, its other pictures also move the same amount or change size proportionally. For example, a Boolean switch has four different pictures – 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 *LabVIEW Help* for more information about setting the mechanical action of Boolean controls.

Until you release the mouse button, the value of the Boolean 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 shows the third or fourth picture as a transition state. The third picture 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 picture. **Picture Item** displays all the pictures that belong to a cosmetic part. The current picture item has a dark border around it. When you import a picture, you change only the current picture item. To import a picture for one of the other picture items, first select that picture item, then import the new picture.

## Cosmetic Parts with Independent Pictures

A cosmetic part with more than one picture can have pictures of different sizes that each use different colors. For example, the slide uses two pictures 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 pictures of different sizes. Select **Independent Sizes** when you are in customize mode if you want to move and resize each picture individually without changing the other pictures of the cosmetic part. By default, the **Independent Sizes** menu item is not activated.

## Text Parts

A text part is a picture 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 picture for the text part, not the text itself. You can customize the background picture, not the text.

## Controls as Parts

A control can include other controls 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 is also made up of parts. When you edit the original control 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 there. You do not have to be in customize mode to open a nested Control Editor window unless you are unable to select the control part in edit mode.

You can open the Control Editor window for the part directly from the original front panel, if it can be selected separately from the main control in edit mode from the front panel. You always can open the Control Editor window for the part from the Control Editor window of the main control, if it is in customize mode.

Complete the following steps to customize a control that is part of another control:

1. Open the Control Editor for a control that is part of another control 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**.

Control Editors can be nested in this way indefinitely, but most controls use other controls 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

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

If you paste a picture or text from the clipboard, create a label with the Labeling tool, or select a picture from **Controls»Decorations**, that picture or text becomes a part of your control and appears with the control when you place it on a front panel. You can move, resize, or change the layering order of the new part, just like any other part. Your 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 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:

- Pictures created on one platform look slightly different when loaded on another platform. For example, a picture 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 *Portability and Localization Issues* application note for more information about differences among platforms.
- The Control Editor changes only the appearance of a control. It cannot change the behavior of a control. You cannot change the way a control displays its data, and you cannot change the way a control 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 the ring control, the ring control continues to make them become taller when it becomes taller.
- Custom controls often look correct, but they occasionally behave oddly. If you like the appearance of a custom control but are not pleased with its irregular editing behavior, use a strict type definition. Refer to *Type Definitions* 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. Type definitions are useful when you use the same control in many VIs. Save the control as a type definition and use that type definition in all your VIs. Then, if you change that control, you can update values that are part of the type in the single type definition file instead of updating the control in every VI that uses it. Use strict type definitions to control cosmetic properties.

LabVIEW ensures that the data type is the same everywhere you use a type definition. It also ensures everything about a strict type definition is the same in every front panel that uses it.

A type definition forces the control data type to be the same everywhere you use it. Use a type definition when you want to use a control of the same data type in many places and when you want to change that data type automatically everywhere you use it.

For example, suppose you make a type definition that is a cluster of two integers and a string, and you use that type definition in several VIs. Later, you change the type definition to a cluster of two integers and two strings. When you change the type definition, you automatically can update every VI that uses that type definition. You can set a type definition instance to not update automatically. Refer to *Using Type Definitions* for more information about how to use 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, such as a knob instead of a slide. However, strict type definitions are more restrictive, as described in the following section.

The type definitions identify the correct type for each instance of a custom control. 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 to be identical, including its size, color, and appearance. Strict type definitions also define other values, such as range checking on numeric controls and the item names on ring controls.

The only aspects of a control that can be different from the master copy of a strict type definition are the name, description, and default value. For example, suppose you make a strict type definition that is a double-precision digital control with a red frame. Like the general type definition, if you change the strict type definition to an integer, you automatically update every VI that uses it. However, unlike the general type definition, other changes to the strict type definition, such as changing the red frame color to blue, updates every VI that uses it. 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, such as Visible, Disabled, Key Focus, Blinking, Position, and Bounds.



# Type Definitions on the Block Diagram

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

Create a type definition by setting the ring control on the toolbar in the Control Editor window.

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. Set up the control the way you want it.
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 as any custom control. You cannot edit a strict type definition on the front panel except to change its name, description, or default value.

You can tell a control is a type definition because the shortcut menu includes the type definition options, or you can select **Edit»Find** to search for a control 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 its 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 in which it is saved.

Because a VI must keep a connection to each type definition, the file or VI library that contains the type definition must be available to run a VI that uses the type definition. If you open a VI and LabVIEW cannot find a type definition the VI needs, the instances of that type definition in the VI are disabled 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 or constant. You cannot re-establish the connection unless you find the type definition and replace the control with the type definition.

If you use a type definition or strict type definition that is a cluster, use the **Bundle By Name** and **Unbundle By Name** functions on the block diagram to access the elements of the cluster instead of the **Bundle** and **Unbundle** functions. **Bundle By Name** and **Unbundle By Name** reference elements of the cluster by name instead of by cluster order, and the functions are not affected when you reorder the elements or add new elements to the cluster type definition. If you delete an element you reference in **Bundle by Name** or **Unbundle By Name**, you must change the block diagram because the reference to the missing element becomes invalid. Invalid names in **Bundle by Name** or **Unbundle by Name** appear black. Click **Bundle by Name** or **Unbundle By Name** to give you a list of valid names from which to choose.

## Updating Type Definitions

You can automatically change any general type definitions or strict type definitions on your front panel.

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

1. Right-click the type definition on your front panel and turn off the **Auto-Update from Type Def.** option. Instead of automatically updating this type definition when necessary, the **Run** button appears broken in the VI, and LabVIEW disables the type definition on the front panel. The **Auto-Update from Type Def.** option is not available in the shortcut menu of a strict type definition because it always automatically updates.
2. Right-click the type definition on your front panel and select Update from Type Def. from the shortcut menu to fix the type definition or change the data type to match the type definition. You cannot run the VI until you fix 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.

