LabVIEW Day 4: The Case Structure and Rings

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The case structure allows selective execution of code depending on an input. The simplest example of a Case is an If (condition) ...Then...Else.

1 Binary case structure

Let’s program a vi to convert between Fahrenheit and Celsius. There will be an input temperature, an output temperature, and a Boolean Control that selects which conversion to do.

1.1 Basic code

(a) Place a Structures→Case Structure on a block diagram. You will see two parts to the Case, a Case Selector with a ? on the left, and a Selector Label at the top.

By default the Case Selector is green, or Boolean, and the Selector label is either True or False.

(b) On the front panel place a Modern→Numeric Control for the input temperature, a Modern→Numeric Indicator for the output temperature, and a Modern→Boolean→Vertical Toggle Switch.

(c) Switch to the block diagram. Place the Numeric Control and Vertical Toggle Switch icons to the left of the Case Structure, and the Numeric Indicator to the right of the Case Structure.

Connect the switch output to the ? on the case structure. Connect the numeric control to a tunnel (non-indexed) on the Case.

(d) Define the switch-up position as a Celsius input. Go to the Properties of the switch, uncheck Label Visible, check Show Boolean Text, Enter the On and Off texts (Celsius and Fahrenheit).

On the front panel drag the Boolean Label to the left of the switch.
2 Increasing the number of cases

(e) Two sets of code will need to be written for the two cases. For the True case, use icons from Numeric or use a Structures→Formula Node to do the conversion. Wire the converted temperature to a tunnel and then to the Indicator.

Switch to the False case and repeat the process, this time converting from Fahrenheit to Celsius. Run the program to see if it works. (You may want to use the Run Continuously, or to wrap the entire code in a While Loop so you can change values and switch positions while the program runs.)

1.2 Improving the looks of the program

(a) Go to the properties of the switch, and choose different colors for the two states of the switch (e.g. cyan for Celsius, fuchsia for Fahrenheit). Once you are used to the colors, you can glance at the screen and without reading see the state.

(b) Add a Modern→Boolean→Round LED to the front panel and place near the numeric indicator. Go to its properties, uncheck Label Visible, check Show Boolean Text, enter the On and Off texts (Fahrenheit and Celsius), reversing the order relative to the switch. Make the ON and OFF colors appropriate. Wire the switch to the LED.

(c) Finally right click on the Numeric Control and the Numeric Indicator, and adjust the Display Format to have two digits after the decimal point and to show trailing zeros.

2 Increasing the number of cases

Often 0. 0 . will have to deal with more than two cases. We will add cases to the Case Structure, and select them by using a Ring Control. Let’s build a vi that will input an angle (in degrees) and compute a trig function, sine, cosine, or tangent.

(a) Place a case structure on a new vi. Switch to the front panel and place a Modern→Ring & Enum→Text Ring and a Numeric Control.

On the block diagram you will see that the ring is blue, or integer. Its output will be an integer chosen by words in the ring. Let’s prepare the ring first. Click on a blank place on the block diagram and add a comment, “0. Sine 1. Cosine 2. Tangent.”

Open Ring Properties→Edit Items. Type “Tangent” for the item, then Insert to get a new ring item, “Sine”, then insert the third item, “Cosine”. Move items up or down so that they match the numbers in your comment box.

(b) Wire the ring to the ? input of the Case Structure. It may be hard to see, but the color will switch from the Boolean green to the Integer blue.
Your ring has 3 values, but your Case has only two. with the 1. case displayed, right click on the case boundary and Add case after so that you will have three cases numbered 0, 1 and 2.

(c) Trig functions like radians, so convert the angle into radians. Hint: on the numeric palette you can find constants like \( \pi \).

Trig functions are found on Mathematics → Elementary and Special Functions → Trig Functions. Place the appropriate one for each of the three cases. Wire the output of a trig function to the boundary, then Create an indicator. You will need to wire the tunnels for each case. Run the vi and check it.

(d) To increase the usability, let’s add a string that tells which trig function is being done\(^1\).

In each case create a String Constant with the appropriate name. Connect to a tunnel, and Create an Indicator. Arrange the front panel so that the ring appears, along with the Stop, as is shown in Figure 1. (You don’t need to have a while loop if you use Run Continuously.)

Fig. 1: Built with a Case structure controlled by a 3 value ring. The last row has a string indicator (tangent), the numeric control, a comment on the front panel (=), and another numeric indicator.

Variations on the Ring that you have just used include Menu Rings and Pict Rings.

3 State Machines—Briefly

An important control structure is a state machine. Based on the values of several inputs (coolant level, temperature, etc.) the controlling vi will go to one of several states (add coolant, increase flow, etc.) In LabVIEW a state machine is created by placing a Case Structure inside a While Loop. More on this another day.

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\(^1\) This could be done just with a Ring also. Make another Ring Control, change it from a control to an indicator and using the first ring as input.