B&K PRECISION®

Product Application Brief

Verify a ratio between two DC Voltage measurements with Pass/Fail conditions


5490C Series 5 ½ and 6 ½ Digit Multimeters

Objective:

After reading this application brief you will understand: how the 5490C Series' DC V Ratio function works, how it might be useful in your application, and how to setup/enable the DC V Ratio Function with pass/fail limit conditions.

Introduction:

The 5490C Series 5 ½ and 6 ½ digit bench multimeters have 12 primary measurement functions including a DCV Ratio function. This function enables the multimeter to acquire two DC Voltage measurements and display the ratio between them in real-time. The ratio is calculated by dividing the input voltage (DCV1) by the reference voltage (DCV2) as shown in the following figure.
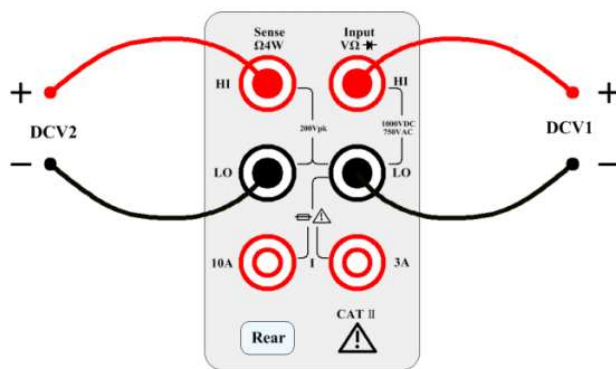
$$DC\ V\ Ratio = \frac{DCV1}{DCV2}$$

Pass/Fail Measurement Verification

The DC V Ratio function combined with the 5490C Series' configurable limits provide Pass/Fail verification to quickly determine if the ratio is within a specified lower and upper limit. This is also useful to help verify the ratio stays within the specified range for an extended period of time or under various test conditions. *Note: When the DC V Ratio function is enabled the reference voltage (DCV2) measurement range is limited to ± 12 V.*

Application Areas:

Bench DMMs like the 5490C Series are often used in manufacturing and production applications. In these environments, the added capability of the DC V Ratio function offers increased throughput by eliminating the need to make two separate measurements. Specifically, this function can be used to evaluate DC-DC converters by displaying the ratio of input and output voltage.

Example: Setup and Results

In this example, we will verify a 1:3 ratio between the input and output voltage of two DC-DC converters using the DCV Ratio function. The limit math function will be enabled to ensure the ratio is within a range of 2.90 to 3.10.
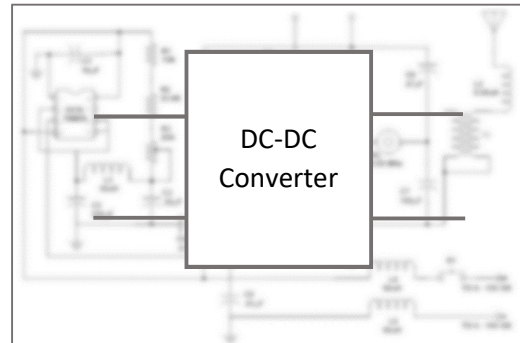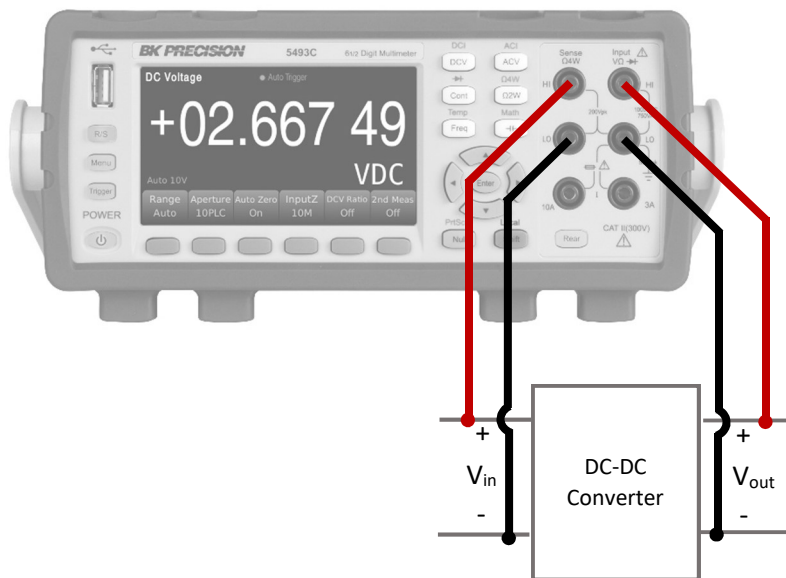

Setup

1. With the multimeter powered on press the DCV button on the front panel.

2. Select the 'DC V Ratio' softkey to enable the DC V Ratio function:

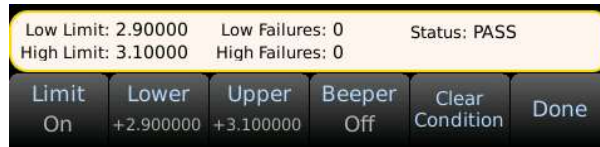 | Range | Aperture | Auto Zero | InputZ | DCV Ratio | 2nd Meas |
   |-------|----------|-----------|--------|-----------|----------|
   | Auto | 10PLC | On | 10M | Off | Off |

3. Connect the test leads to the input and output of the DC-DC converter as illustrated in the following figure.

4. To enable limit mode for pass/fail verification press Shift then press ⊣⊢ on the front panel.

Use the softkeys to select 'Limit' then select 'Limit On' to enable. In this example, the lower limit is set to 2.90 and the upper limit is set to 3.10 using the directional keypad:
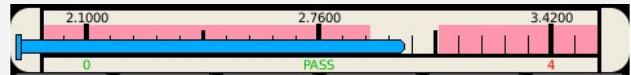
Low Limit: 2.90000	Low Failures: 0	Status: PASS			
High Limit: 3.10000	High Failures: 0				
Limit On	Lower +2.900000	Upper +3.100000	Beeper Off	Clear Condition	Done

Results: DC-DC Converter 1

The ratio of $\frac{V_{out}}{V_{in}}$ for DC-DC converter 1 is displayed below and is within the specified limits:

Tip: Use the bar meter display mode, for a visual representation of the resulting measurement:

The areas shaded in red indicate the specified limits. Pass/Fail status is displayed below the bar meter with the amount of times the lower or upper limit has been exceeded.

Results: DC-DC Converter 2

Applying the same ratio measurement, it is clear the second DC-DC converter is outside the specified limits indicated by the red screen: