Using the Dual Measurement Functionality and Dual Measurement Display on the Keithley Model 2110 5½-Digit Dual-Display Digital Multimeter

The Keithley Model 2110 5½-Digit Dual-Display Digital Multimeter (DMM) is equipped with dual measurement functionality and a dual measurement LCD display to simplify making measurements and enhance viewing capability for many industrial and research applications. For example, engineers can now examine motor performance by monitoring both the voltage and the temperature simultaneously using the Model 2110.
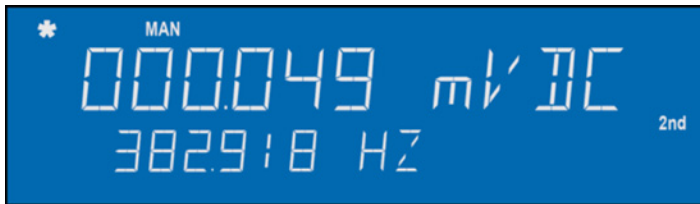

Figure 1. Example of dual measurement display.

As shown in *Figure 1*, the Keithley Model 2110 display consists of a primary display (upper row) and a secondary display (lower row). The primary display has a larger font size and an 11-character field to accommodate principal measurement needs. The secondary can display up to 16 characters in a smaller font size. It is configurable to display the range of the primary display measurement, buffer statistics, customized text, or a secondary measurement, as shown in *Figure 1*.

The dual measurement feature allows a user to configure the DMM for two different measurement functions. *Figure 2* captures all the possible combinations available on the Model 2110. When enabled, the secondary measurement function is denoted as 2ND on the front display. The two measurements are taken sequentially and the results are displayed simultaneously.

Figure 2. Available 2ND Measurements.

The secondary measurement function can be easily configured on the front panel by pressing SHIFT+ENTER to enter 2ND submenu and using the ◁ or ▷ button to locate a desired 2ND measurement.

For example, the AC voltage (primary) and the AC frequency (secondary) measurement functions can be activated on the front panel using the following steps:

-Set up the primary measurement
    1. Press ACV.

-Set up the secondary measurement
    2. Press SHIFT+ENTER.
    3. Use ▷ button to locate FREQ.
    4. Press ENTER to select it.

-Configure the secondary measurement
    5. Use ◁ or ▷ button to configure FREQ's APERTURE or RANGE settings.
    6. For example, to change FREQ's RANGE, press ENTER to select the RANGE setting.
    7. Use ◁ or ▷ button to select a RANGE number. For example, 1VAC
    8. Press ENTER to finish.

Figure 3. Example front panel operations.

Now the display should show the AC voltage reading in the primary display and the frequency reading in the secondary display. See *Figure 4*.
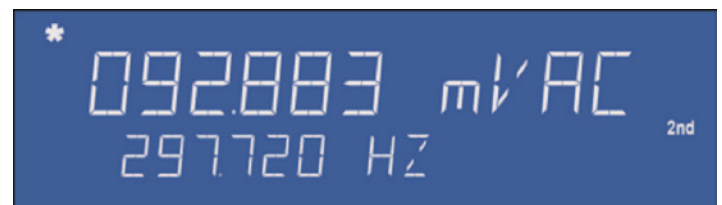

Figure 4. Dual display showing AC voltage and frequency.

You can set up a similar operation through the remote interface. The 2ND measurement function follows the SCPI (Standard Commands for Programmable Instruments) command syntax:

```
[SENSe:]FUNCtion[1|2]  "<function>"
```

where

    [1|2]   Designates the primary and secondary function, respectively

    <function> Can be replaced by "VOLTage:DC", "VOLTage:AC", "CURRent:DC", "CURRent:AC", "FREQuency", "PERiod", etc.

The combinations of primary and secondary functions must follow the rules as indicated in *Figure 2*. You will receive SCPI errors for forbidden combinations , and your program will terminate.

The following SCPI command sequence mirrors the front panel operation demonstrated earlier.

```
1. SENS:FUNC1 "VOLT:AC"
2. SENS:FUNC2 "FREQ:VOLT"
3. SENS:FREQ:VOLT:RANG 1
```

As can be seen on line 3 of the above code, the source signal range setting for the 2ND measurement is set in a similar method as the primary functions.

In addition to displaying the 2ND measurement, the secondary display can also show math-related statistical information such as average (arithmetic mean), minimum (MIN), maximum (MAX), and count. These four data values are bundled into a single function called Average. When the Average function is enabled, the Model 2110 calculates the average, MIN, MAX, and count values of all the readings performed since enabling the function. These values are stored in a volatile memory and displayed on the secondary display. The volatile memory clears when the meter is turned off, the math function is turned off, the average function is run again, or the remote interface is reset. *Figure 5* is a sample display showing the DC voltage in the primary display and the average of previously read DC voltages in the secondary display.
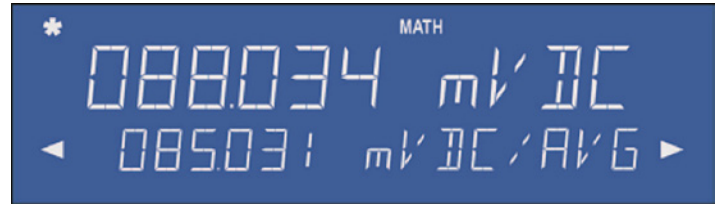

Figure 5. Dual display showing math function average.

The Keithley Model 2110 5½-Digit Dual-Display Digital Multimeter features rich capabilities, high accuracy, and high speed for a broad range of applications from production to laboratory research. Combined with a value price, the Model 2110 is unbeatable in today's digital multimeter market.

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