Keysight Technologies
Using Source/Measure Unit as a Voltmeter

B2900A Precision Source/Measure Unit

Demo Guide

KEYSIGHT TECHNOLOGIES

Unlocking Measurement Insights

Introduction

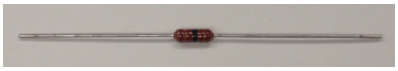
The Keysight B2900A Series Precision Source/Measure Unit (SMU) is a compact and cost-effective bench-top SMU with the capability to output and measure both voltage and current. The B2900A Series SMU enables you to make a wide range of current versus voltage (IV) measurements more accurately and quickly than ever before. In addition, the B2900A Series SMU comes with an intuitive graphical user interface (GUI) and free PC-based application software that make it easy for you to begin making productive measurements immediately.

This demonstration guide shows how easily you can use the Keysight B2900A Series SMU as a voltmeter.

Required Instrument and Accessories

All All of the accessories required to perform the demos described in this demonstration guide are provided in a demo kit that is included with Keysight B2902A/12A demo units. The kit includes items such as a banana cable, a 1.1 kΩ resistor, etc.

Keysight B2902A/12A
Precision Source/Measure Unit



1.1 kΩ Resistor

11059A Kelvin Probe Set

U8201A Combo Test Lead Kit

Concept

Figure 1 illustrates the connection diagram used in the demo to use the Keysight B2900A Series SMU as a voltmeter. Since the low terminal of the channels in the B2900A Series SMU is grounded internally in the initial state, you need to configure it floating.

In this demo, a 1.1 kΩ resistor combined with a current source is used as a DUT and measure voltage across the resistor. The channel 2 of the B2902A/12A is used as a current source. However, you can also use your own current source for it

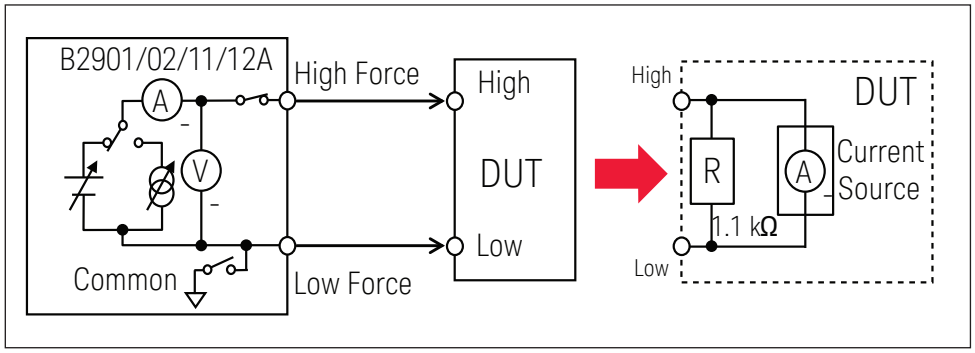
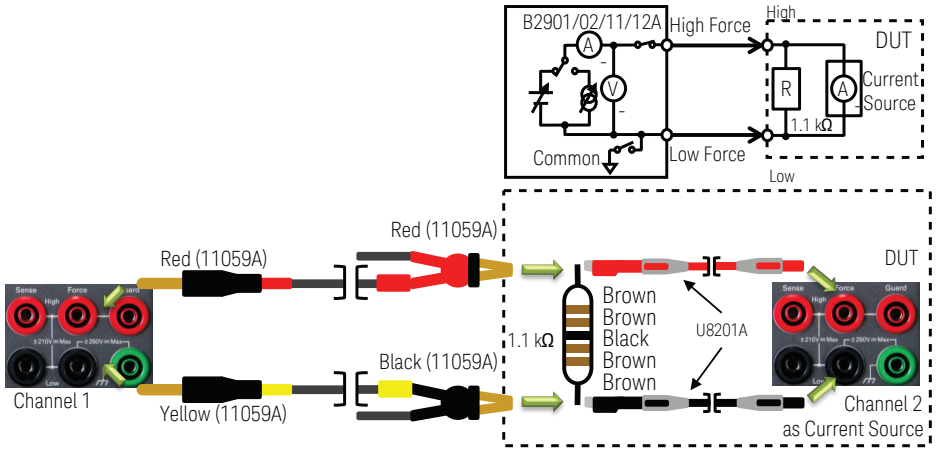


Figure 1. Connection diagram and basic condition

Setup

1. Connect the **yellow banana plug** of the 11059A to the **Ch1 Low Force** Terminal.
2. Connect the **red banana plug** of the 11059A to the **Ch1 High Force** Terminal.
3. Connect the **black banana cable** of the U8201A to the **Ch2 Low Force** Terminal.
4. Connect the **red banana cable** of the U8201A to the **Ch2 High Force** Terminal.
5. Clip the **end of the 1.1 kΩ** resistor with the **black alligator clip** of the U8201A.
6. Clip the **same end** with the **black gold-plated tweezers** of the 11059A.
7. Clip the **other end of the 1.1 kΩ** resistor with the **red alligator clip** of the U8201A
8. Clip the **same end of 1.1 kΩ** resistor which the red alligator clip is clipped with the **red gold-plated tweezers** of the 11059A.



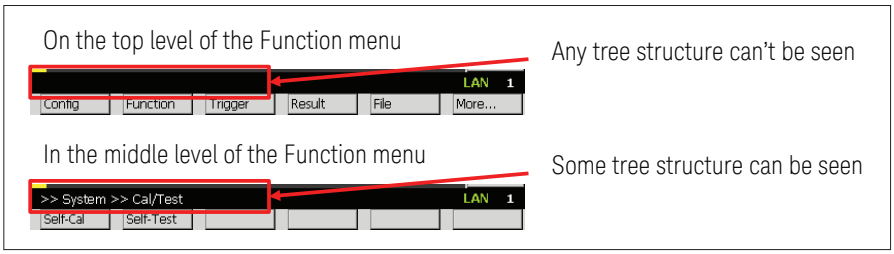
LAB1: Use Source/Measure Unit as an Voltmeter

Demonstration

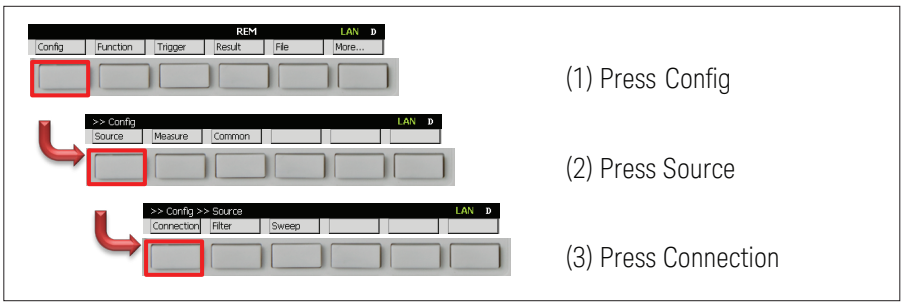
In the default setting, the low terminal of the channels in the Keysight B2900A Series SMU is grounded internally. However, the low terminal can be disconnected from the ground and kept floating. Configuring the low terminal state to FLOATING, which enables you to connect the low terminal to any potential up to ±250 V, and measuring voltage with sourcing 0 A from the channel, which makes it possible to use the channel as a voltmeter.

1. Configure the low terminal state to FLOATING

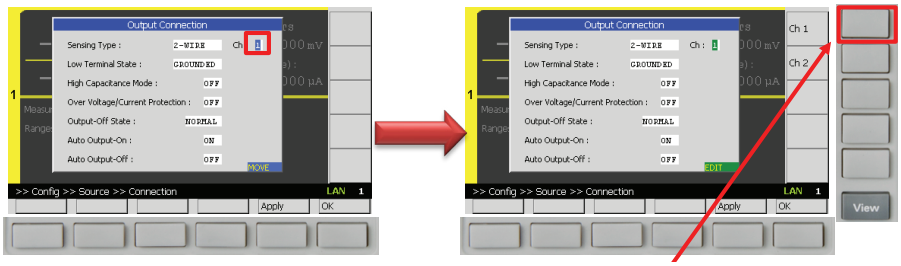
1) If you aren't on the top of the Function menu, press Cancel Local repeatedly to return to the top level.



2) Press Config, Source, and then press Connection to open the **Output Connection dialogue.**



3) Press and select Ch 1 to specify the channel which the **Low terminal state** is configured for.



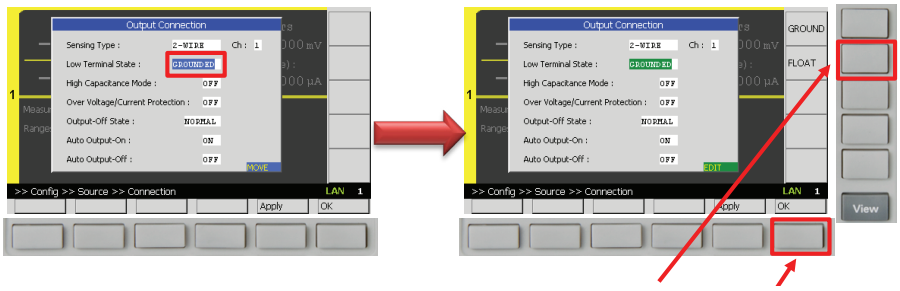
Objective

This demo illustrates the voltage measurement function as a voltmeter by sourcing almost 0 A current and measuring the voltage across the resistor biased by a current source using a Source/Measure Unit.

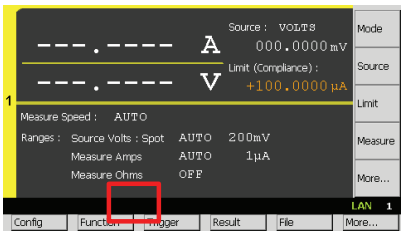
Procedure

1. Configure the low terminal state to FLOATING
2. Measure voltage using the SMU (Channel 1) as a voltmeter
3. Enable the DUT
4. Confirm measured voltage
5. (Optional) Configuring the measurement speed
6. (Optional) Configuring the measurement range operation

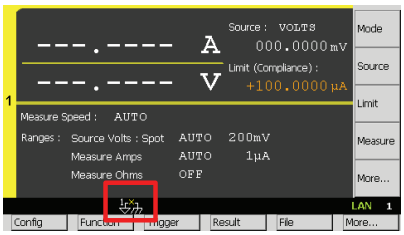
4) Press  and select FLOAT , and then press OK to configure the **Low terminal state** to **FLOATING**.



If the low terminal state of the channel is set to FLOATING, you can see the status indicator on the GUI as below, although no indicator can be seen on being set to GROUNDED.



GROUNDED



FLOATING

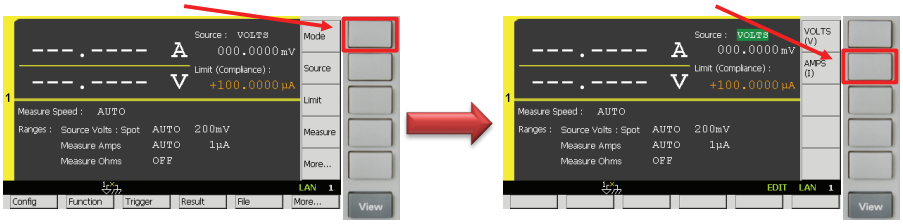
2. Measure voltage using the SMU (Channel 1) as a voltmeter

2-1. Change View mode to Ch1 Single View

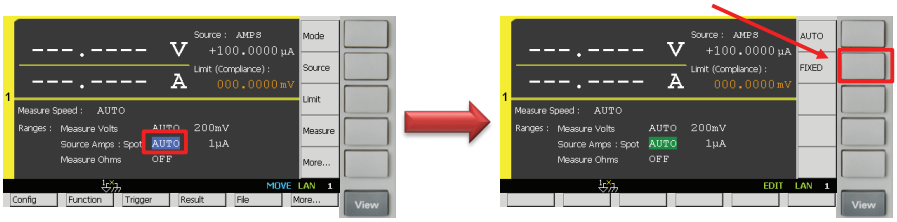
1) Press View repeatedly until the Channel 1 **Single View** is displayed

2-2. Configure the condition to source and measure

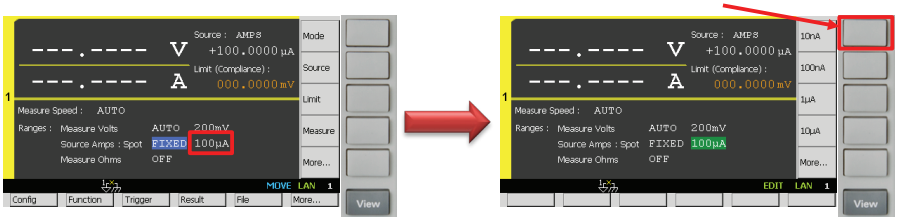
1) Press Mode to edit the **Source function**, and then select AMPS (I) to set the **Source function** to **Current source**.



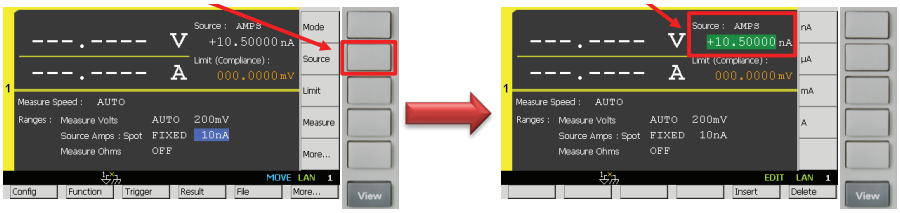
2) Rotate and press  to edit the **Current source range operation**. Then Select FIXED to set the **Current source range operation** to **FIXED**.



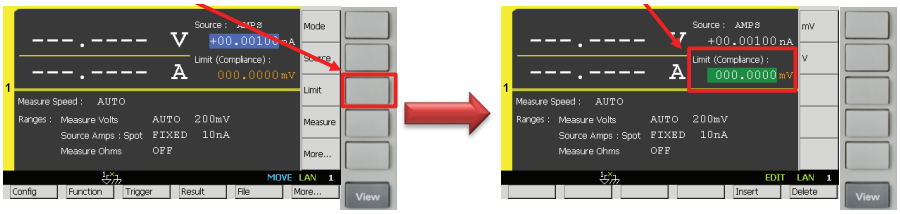
3) Rotate and press  to edit the **Current source range**, and then select 10nA to set it to **10 nA**. (If you couldn't find 10nA, select 100nA instead.)



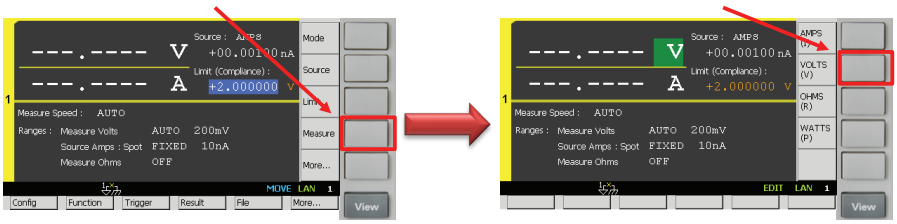
4) Press Source to edit the **Source value**, and then enter **0.001 nA (1 pA)** to set the **Source value** to **1 pA**.



5) Press Limit to edit the **Limit value**, and then enter **2 V** to set the **Limit value** to **2 V** for example.



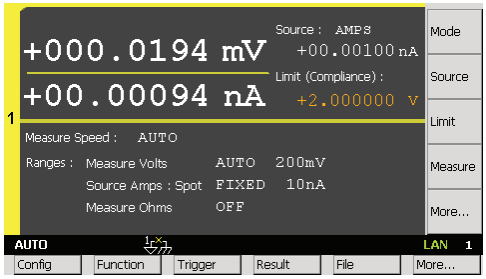
6) Press Measure to configure the **Measurement parameter**, and then select VOLTS (V) to set the **Measurement parameter** to **Voltage**.



2-3. Perform the measurement

1) Press [On/Off] for the channel 1 to switch on its output terminal.

2) Press [Auto] to perform a measurement repeatedly. Now you can see the measurement result on the GUI of the B2902/12A as below.



3. Enable the DUT

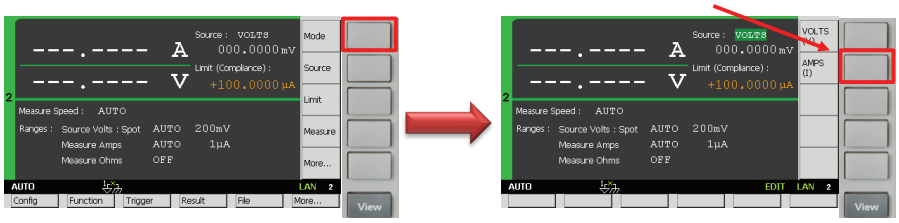
You can also use your own current source instead of the channel 2 of the B2902A/12A

3-1. Change View mode to Ch2 Single View.

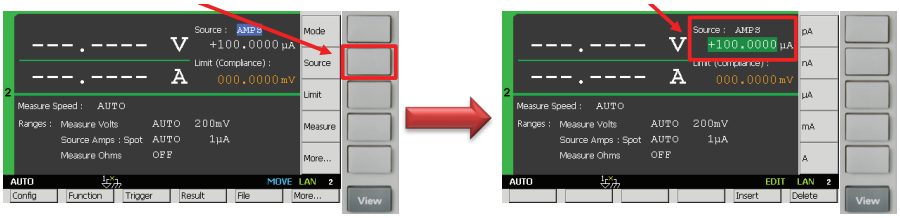
1) Press [View] repeatedly until the Channel 2 **Single View** is displayed.

3-2. Configure the condition of the current source (Channel 2)

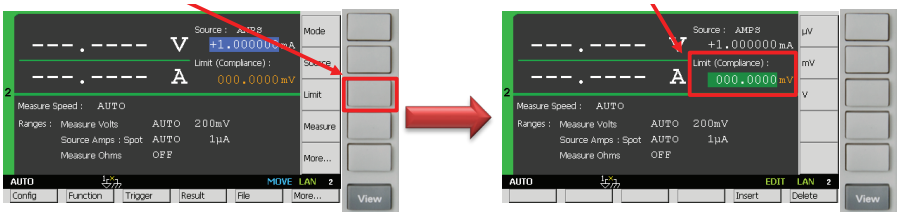
1) Press [Mode] to edit the **Source function**, and then select [AMPS (I)] to set the **Source function** to **Current source.**



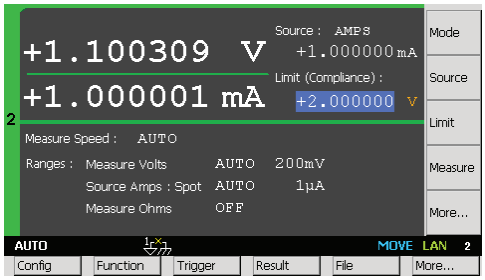
2) Press [Source] to edit the **Source value**, and then enter **1 mA** to set the **Source value** to **1 mA** for example.



3) Press [Limit] to edit the **Limit value**, and then enter **2 V** to set the **Limit value** to **2 V** for example.



4) Press On/Off for the channel 2 to switch on its output terminal and enable the DUT.

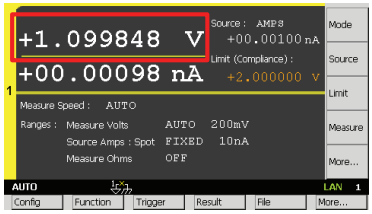


4. Confirm measured voltage

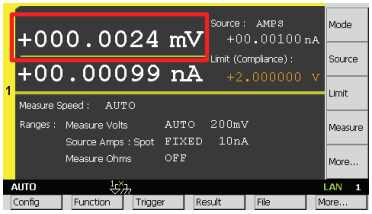
4-1. Change View mode to Ch1 Single View.

1) Press View repeatedly until Channel 1 **Single View** is displayed.

You can see about 1.1 V as measured value, since 1 mA is sourced to a 1.1 kΩ resistor. If you press On/Off for the channel 2 to switch it off, you can see only the offset voltage because the DUT is disabled.



Current Source enabled



Current Source disabled

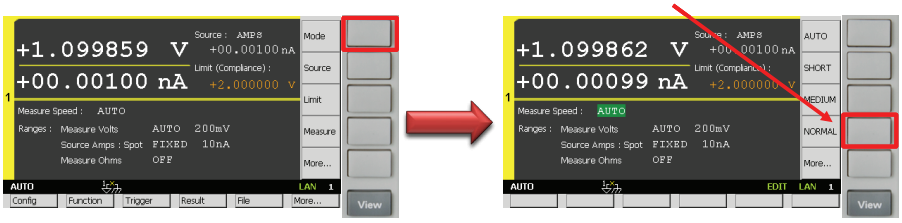
Theoretically speaking, the measured voltage should be 1.1 V since 1mA is sourced to a 1.1 kΩ resistor. However, it may be varied because the resistor has some error on its value actually.

5. (Optional) Configuring the measurement speed

In the default setting, the instrument selects the appropriate measurement speed and range automatically to get the fine accuracy. However, you can also specify these parameters on the GUI of the B2900A Series SMU to meet a variety of the requirement to the measurement conditions.

For example, let's try to change the measurement speed to NORMAL to make a measurement more carefully. If you select NORMAL, the aperture time is set to 1 PLC. Here, PLC stands for power line cycle and the specified number of power line cycles is used per a measurement.

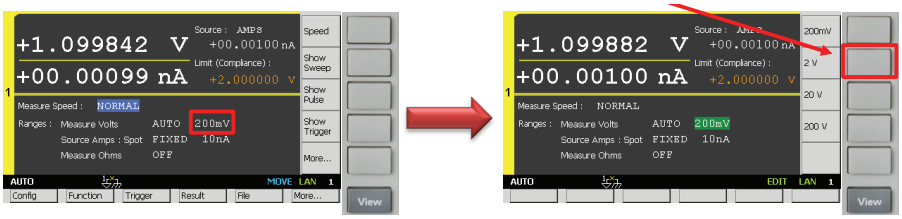
1) Press Speed to edit the **Measurement speed**, and then select NORMAL to set the **Measurement speed** to **NORMAL**. (If you can't see Speed in Assist keys, press More... to change the keys shown in Assist keys.)



6. (Optional) Configuring the measurement range operation

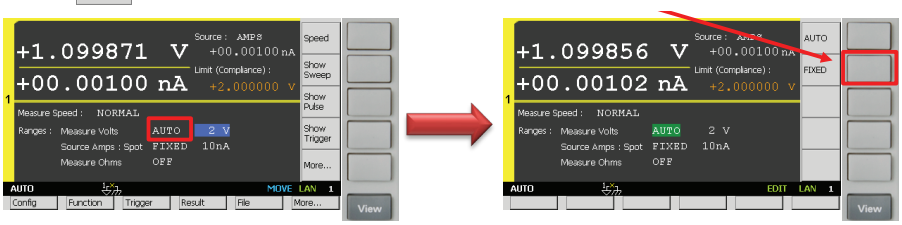
The parameters which configure the measurement range operation can be displayed in the Range Sub-panel in the Channel 1 Single View. In the default setting, the B2900A Series SMU performs the voltage measurement using a 200 mV voltage minimum measurement range with AUTO range operation. With AUTO range operation, the B2900A Series SMU selects the proper range for the measurement with the specified minimum measurement range so that you don't need to take care about it. To know how to change the measurement range setting, try to configure to use the 2 V voltage minimum measurement range with AUTO range operation.

1) Rotate and press  to edit the **Voltage minimum measurement range**, and then select 2 V to set it to **2 V**.



If you'd like to fix the measurement range, you can select FIXED range operation as below.

2) Rotate and press  to edit the **Voltage measurement range operation**. Then Select FIXED to set the **Voltage measurement range operation** to **FIXED**



Conclusion

The Keysight B2900A Series Precision Source/Measure Unit (SMU) is a compact and cost-effective bench-top SMU with the capability to output and measure both voltage and current. Although it has the capability to make a wide range of current versus voltage (IV) measurements as its intrinsic function, the B2900A Series SMU can be used as a voltmeter easily.

B2900 Precision Instrument Family

The B2900 family contains products that perform both precision sourcing and precision measurement. **www.keysight.com/find/b2900a**

Evolving

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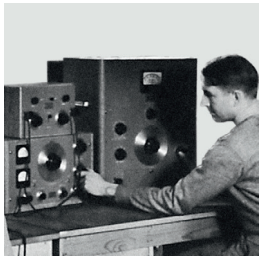

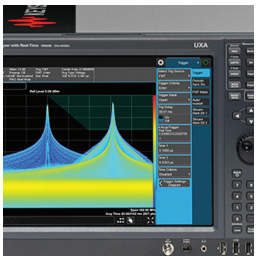

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