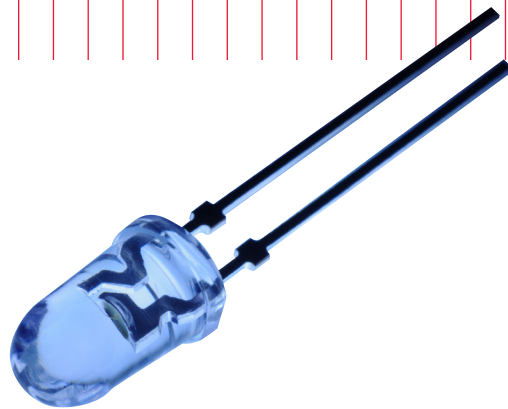


Keysight Technologies

# Making Current-Voltage Measurement Using SMU

Keysight B2901A/02A/11A/12A Precision Source/Measure Unit

Demonstration Guide



## Introduction

The Keysight Technologies, Inc. B2901A/02A/11A/12A Precision Source/Measure Units are compact and cost-effective bench-top Source/Measure Units (SMUs) with the capability to output and measure both voltage and current. The B2901A/02A/11A/12A enables you to make a wide range of current versus voltage (IV) measurements more accurately and quickly than ever before. In addition, the B2901A/02A/11A/12A 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 basic voltage - current measurement can be made using the Keysight B2901A/02A/11A/12A.

The demonstration includes not only a single point measurement where current is measured with sourcing constant voltage, but also a sweep measurement where currents are measured each voltage with stepping the source voltage.

## Required Instrument and Accessories

Keysight 11059A Kelvin Probe Set and LED Lamp are equipped as a demo kit with a demo unit of the Keysight B2900A Series of SMU.



Keysight B2901A/02A/11A/12A  
Precision Source/Measure Unit



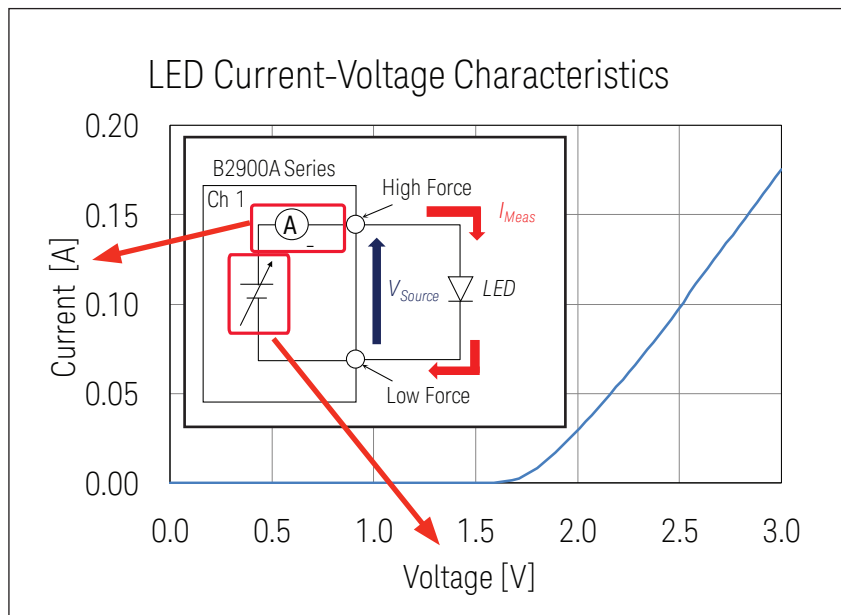
Keysight 11059A Kelvin Probe Set



LED Lamp

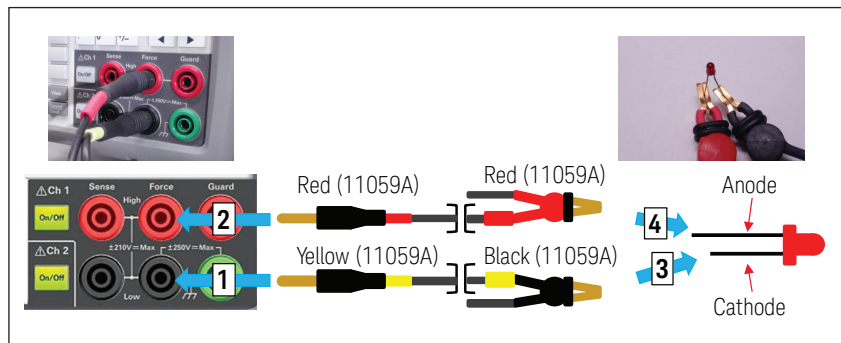
## Measurement concept

- Sourcing voltage to turn the LED on.
- Limit value feature prevent the instrument from sourcing too much even if Source value is increased.
- Stepping voltages from start voltage to stop voltage with making current measurement at each voltage step.
- Voltage steps are sourced from an internal voltage source.
- Current measurements are made by an internal current meter.
- The complicated measurement as above can be configured and made easily with Intuitive Graphical User Interface (GUI).
- Current-voltage curve can be seen easily by changing View mode.



## Setup

1. Connect the **yellow banana plug** to **Ch 1 Low Force** Terminal.
2. Connect the **red banana plug** to **Ch1 High Force** Terminal.
3. Clip the **LED cathode** terminal with the **black gold-plated tweezers**.
4. Clip the **LED anode** terminal with the **red gold-plated tweezers**.



## LAB 1: Turn on the LED and Measure LED Current

### Objective

This demo shows how easily a current-voltage measurement can be made with the B2900A Series through the Light Emitting Diode (LED) characteristics measurement.

### Procedure overview

1. Change View mode to Single View
2. Source voltage to turn on the LED
3. Make measurement of the LED current
4. Turn off the channel output

### Demonstration

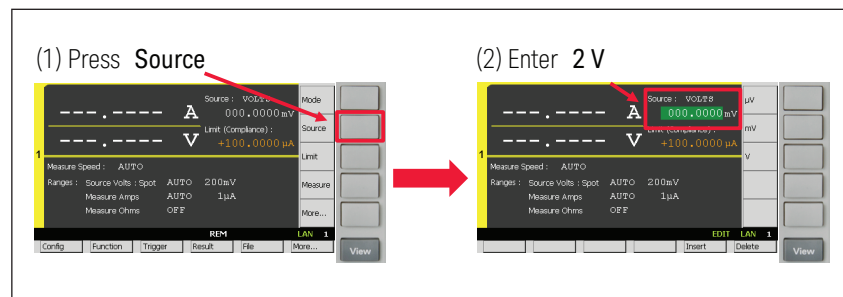
1. Change View mode to Single View

- a. Press **View** repeatedly until **Single View** for Channel 1 is shown in the display.

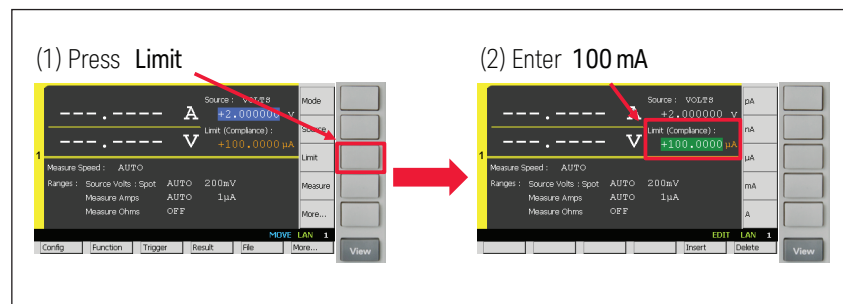


2. Source voltage to turn on the LED

- a. Press **Source** to edit **Channel 1 Source value**, and then enter **2 V** to set **Source value to 2 V**.



- b. Press **Limit** and set **Channel 1 Limit value to 100 mA**.





- c. Press Ch1 **On/Off** to turn on Channel 1 Output relay.



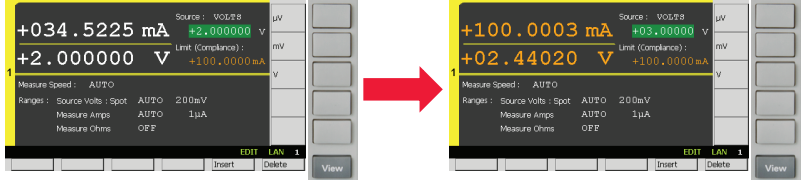
You will see LED is turned on because voltage is sourced by the channel



## LAB 1: Turn on the LED and Measure LED Current (continued)


d. Press **Source** and rotate  until **Source value** achieves **3 V**. You will see the measurement parameters turn orange, which means they reach **Limit value**.


(1) Press **Source** and rotate  until Source value achieves 3 V

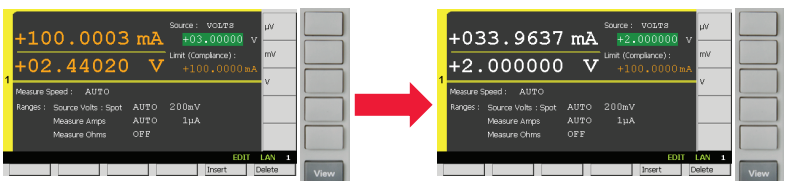
Measurement parameters will turn orange



e. Rotate  until **Source value** achieves **2 V** and then press  to set **Source value** to 2 V.

(1) Rotate  until Source value achieves 2 V

(2) Press  to set Source value to 2 V



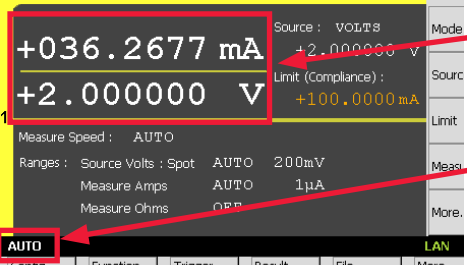
### 3. Make measurement of the LED current

a. Press **Trigger** to perform a single point measurement.



Measurement parameters are updated whenever Trigger Button is pressed

b. Press **Auto** to repeat single point measurements periodically.



Measurement parameters are updated periodically

"Auto" indicator is turned on

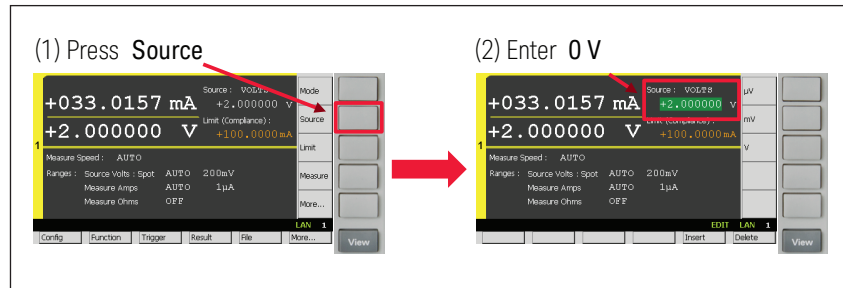
## LAB 1: Turn on the LED and Measure LED Current (continued)

c. Press **Auto** to stop making measurements periodically.



4. Turn off the channel output

a. Press **Source** to edit **Channel 1 Source value**, and then enter **0 V** to set **Source value to 0 V**.



b. Press Ch1 **On/Off** to turn off Channel 1 Output relay.

## Lab 2: Make Current – Voltage (I – V) Sweep Measurement to get LED I – V Characteristics

### Objective

This demo shows how easily current-voltage characteristics can be obtained with the B2900A Series through the Light Emitting Diode (LED) characteristics measurement.

### Procedure overview

1. Change View mode to Single View
2. Configure the condition to source and measure
3. Change View mode to Graph View
4. Perform the measurement
5. View the measurement result graph
6. Change the graph scale
7. View the list of the measurement data

### Demonstration

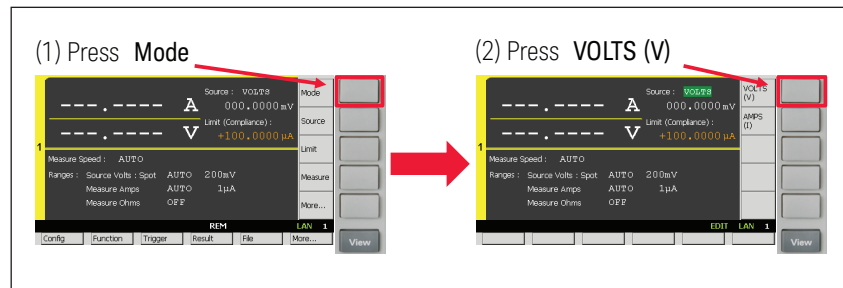
1. Change View mode to Single View

- a. Press **View** repeatedly until **Single View** for Channel 1 is shown in the display.

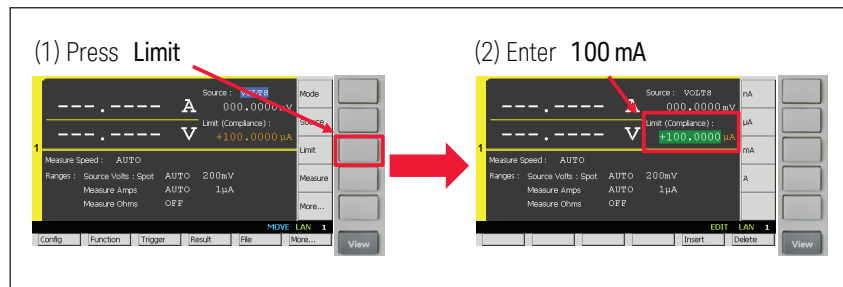


2. Configure the condition to source and measure

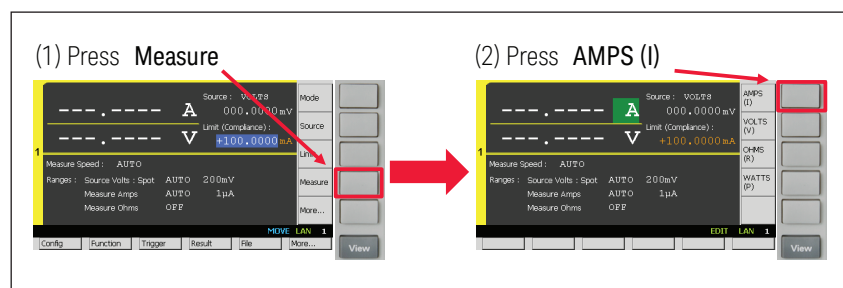
- a. Press **Mode**, then press **VOLTS (V)** to set Channel 1 V/I Source Function to **V Source**. (If **Mode** can't be found on the Assist keys, press **More...** to change the keys.)



- b. Press **Limit** and set Channel 1 Limit value to 100 mA.

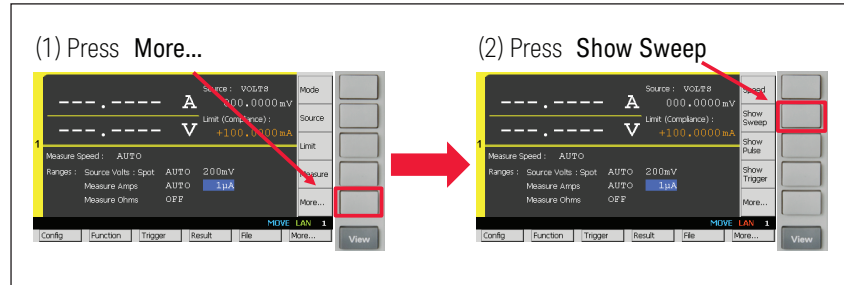




- c. Press **Measure**, then press **AMPS (I)** to set Channel 1 Measurement Parameter to Current.

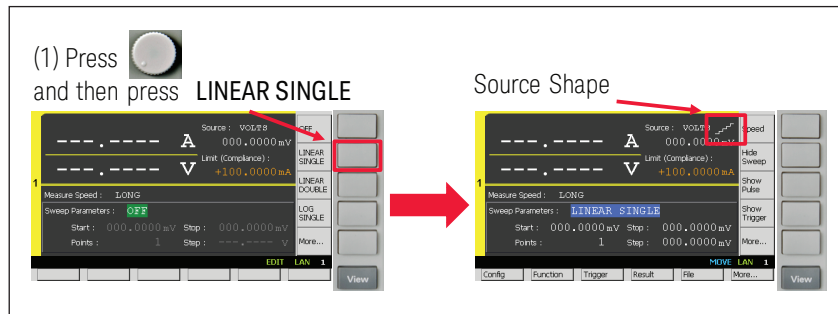



## Lab 2: Make Current – Voltage (I – V) Sweep Measurement to get LED I – V Characteristics

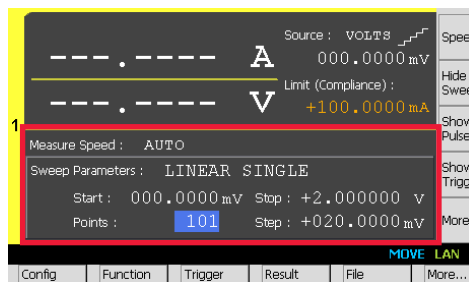
d. Press , and then press  to show Sweep Sub-Panel.




e. Press , then press  to turn on Single Linear Sweep Mode. After turning on Single Linear Sweep Mode, you can see Source Shape which shows the single linear sweep mode.



f. Rotate  to select Channel 1 Sweep Parameters and set them up as below. (Start: 0 V, Stop: 2 V, Points: 101, Step: 20 mV)



3. Change View mode to Graph View

a. Press  repeatedly until Graph View is shown in the display.





## Lab 2: Make Current – Voltage (I – V) Sweep Measurement to get LED I – V Characteristics

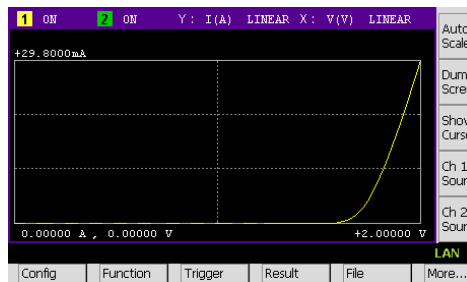
### 4. Performing the measurement

- a. Press Ch1  to turn on Channel 1 Output relay, and then press  to perform a sweep measurement. During the measurement, the status information will show **ARM**



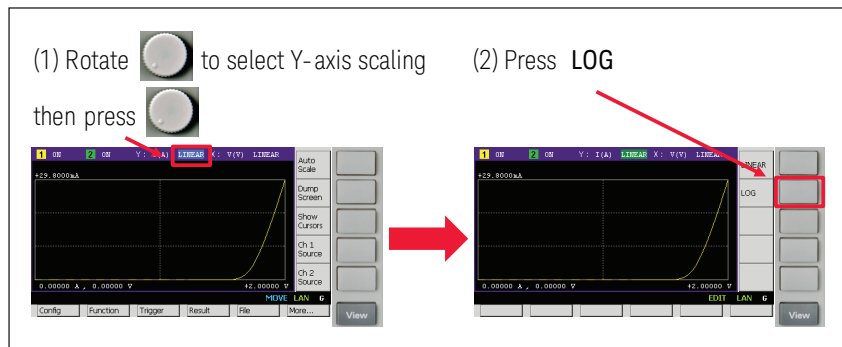
### 5. View the measurement result graph

- a. Press  to adjust the scale of the graph after finishing the measurement.

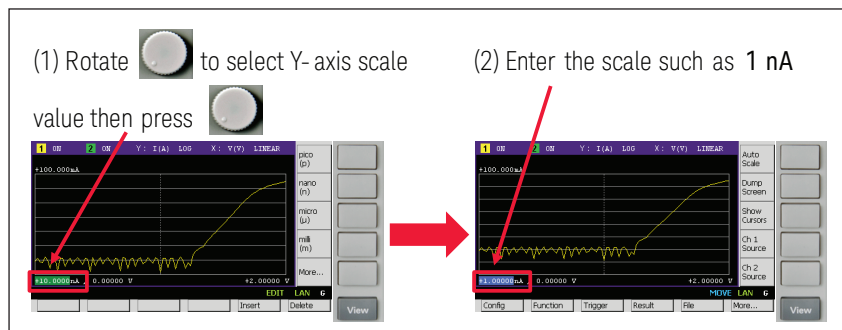


### 6. Change the graph scale

- a. To change the graph scaling of Y-axis from **LINEAR** to **LOG**, rotate and press  to select Y-axis scaling.



- b. To change the graph scale value of Y-axis, rotate and press  to modify Y-axis scale value.



## Lab 2: Make Current – Voltage (I – V) Sweep Measurement to get LED I – V Characteristics

### 7. View the list of the measurement data



- a. If you'd like to see the list of the measurement result, press, **Result** then press **Measure** to open **Measure Result** dialogue.

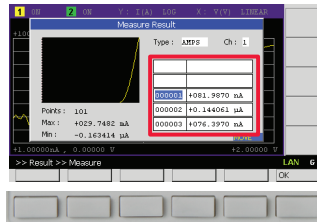


(1) Press Result

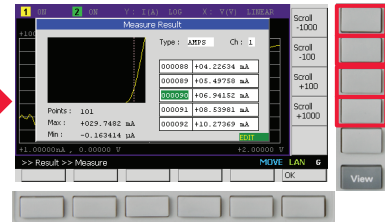



(2) Press Measure

- b. Rotate and press  to select **List Area**. Then rotate  to scroll the data list.



(1) Rotate and press  to select List Area



(2) Rotate  or press Assist key to scroll the list

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