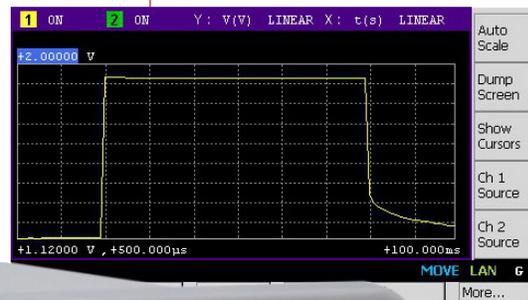


Keysight Technologies

Making Time Domain Measurement with Pulsed Source Using SMU

B2900A Precision Source/Measure Unit

Demo Guide



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 make a time domain measurement with pulsed current or voltage using the B2900A Series SMU.

Required Instrument and Accessories

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 Kelvin Probe Set, an LED.



Keysight B2902A/12A
Precision Source/Measure Unit



LED



11059A Kelvin Probe Set

Concept

Figure 1 illustrates the connection diagram used in the demo to make a time domain measurement of voltage with sourcing pulsed current to an LED using the B2900A Series SMU.

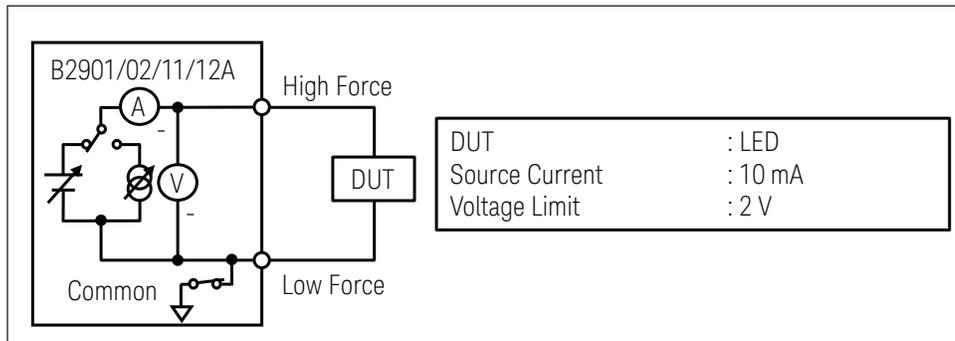


Figure 1. Connection diagram

Figure 2 shows the timing chart for the time domain measurement with the pulsed source with the front panel operation. In this case, the specified source value is sourced immediately after turning on **On/Off**. Then, when you press **Trigger**, the instrument will make a time domain measurement. Pulse parameters will be used in the example in order to source the pulsed current. Besides, if it is necessary, you can specify any measurement trigger delay time which is the wait time after each internal trigger and before making a measurement. If you configure the pulsed source, the measurement will be made with a FIXED measurement range operation automatically. The measurement range is selected by Limit value. The measurement time consists of Measurement Speed and some overhead time. Measurement Speed is the parameter specified by the user. Overhead time includes the time to change the measurement range, etc.

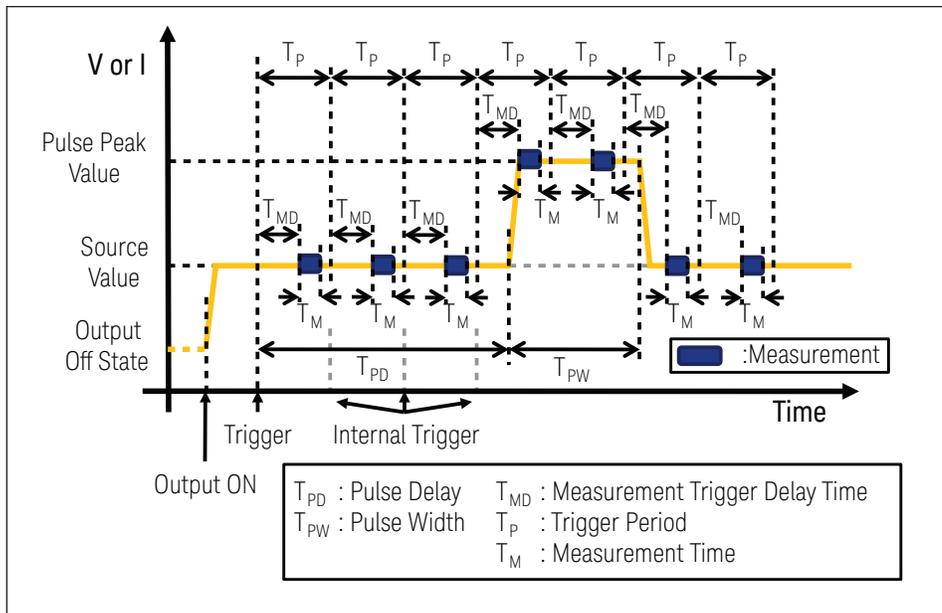
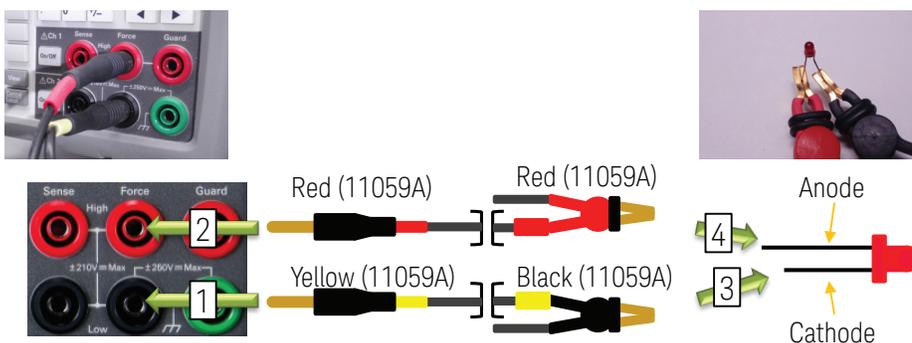


Figure 2. Timing chart for the time domain measurement with pulsed source

Setup

1. Connect the **yellow banana plug** to the **Ch 1 Low Force Terminal**.
2. Connect the **red banana plug** to the **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: Make Time Domain Measurement with Pulsed Source Using SMU

Demonstration

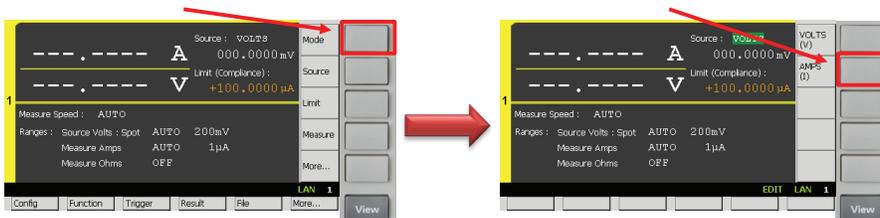
1. Change View mode to Channel 1 Single View

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

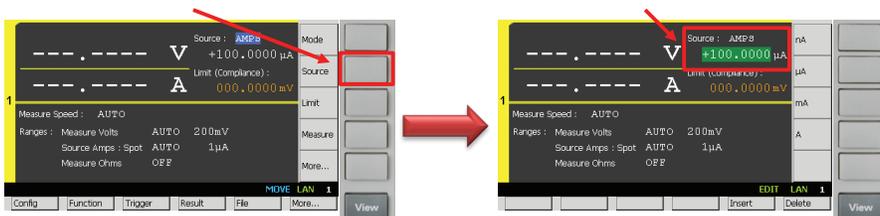


2. Configure the condition for Time Domain Measurement

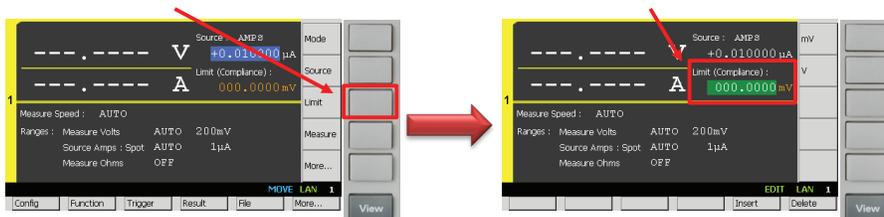
- 1) Press **Mode** to edit the **Source** function, and then select **AMPS (I)** to set the **Source** function to **Current source**.



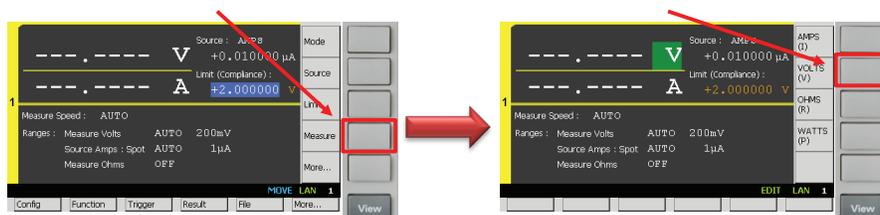
- 2) Press **Source** to edit the **Source** value, and then enter **10 nA** to set the **Source** value to **10 nA**.



- 3) Press **Limit** to edit the **Limit** value, and then enter **2 V** to set the **Limit** value to **2 V**.



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



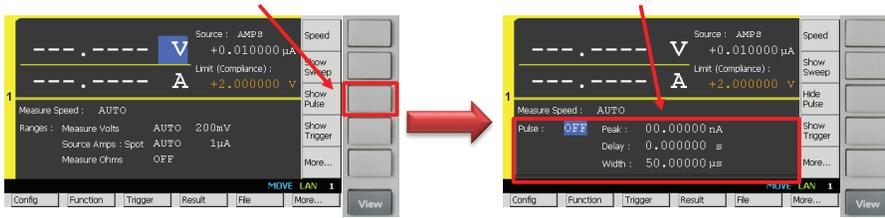
Objective

This demo illustrates the function to make a time domain measurement of voltage with sourcing pulsed current to an LED using a Source/Measure Unit.

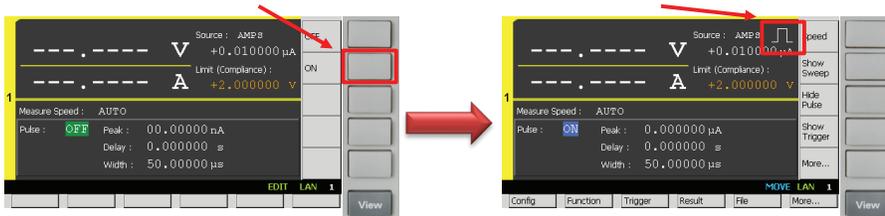
Procedure

1. Change View mode to Channel 1 Single View
2. Configure the condition for Time Domain Measurement
3. Change View mode to Graph View
4. Perform the measurement
5. View the measurement result graph
6. View the list of measurement results
7. (Optional) Configure the measurement speed

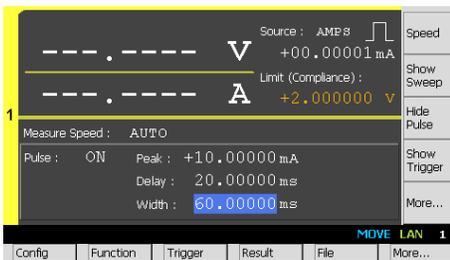
5) Press **More...** to change the keys shown in Assist keys, and then press **Show Pulse** to show Pulse Sub-Panel.



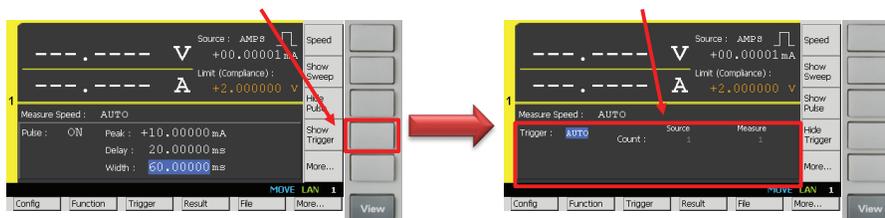
6) Press **ON**, then press **ON** to set the Pulse source ON. After turning on the pulse source, you can see **Source Shape** which shows the pulse source mode.



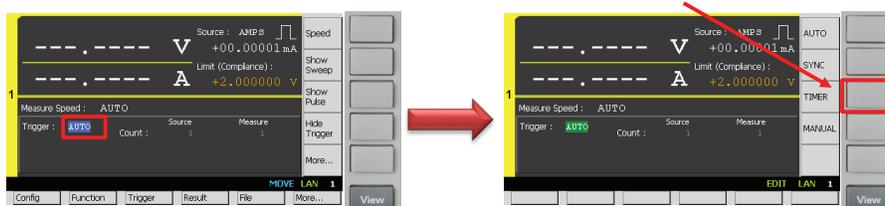
7) Rotate **Channel 1** to select Channel 1 Pulse Parameters and set them up as below. (Peak: 10 mA, Delay: 20 ms, Width: 60 ms)



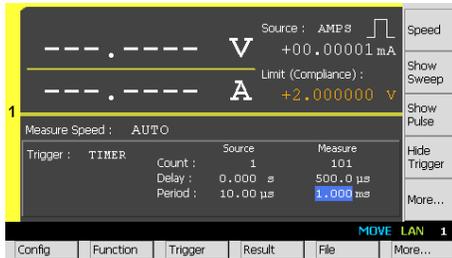
8) Press **Show Trigger** to show Trigger Sub-Panel.



9) Press **TIMER** to edit the Trigger type, and then select **TIMER** to set the Trigger type to TIMER.



10) Rotate  to select Channel 1 Trigger Parameters and set them up as below. Measurement Trigger Count defines the number of sampling and Measurement Trigger Period defines the interval of sampling. (Source Trigger Count: 1, Measurement Trigger Count: 101, Measurement Trigger Delay Time: 500 us, Measurement Trigger Period: 1 ms)



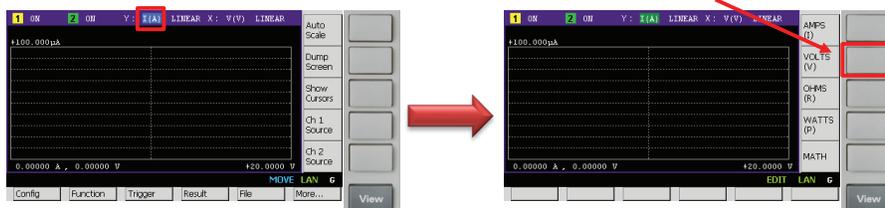
Now you've configured a 1 ms measurement trigger period for a sampling measurement. The measurement will be performed every 1 ms periodically. However, please note that a FIXED current measurement range operation will be used to control the trigger period strictly. The measurement range is selected by Limit value. In this example, a 2 V measurement range will be used.

3. Change View mode to Graph View

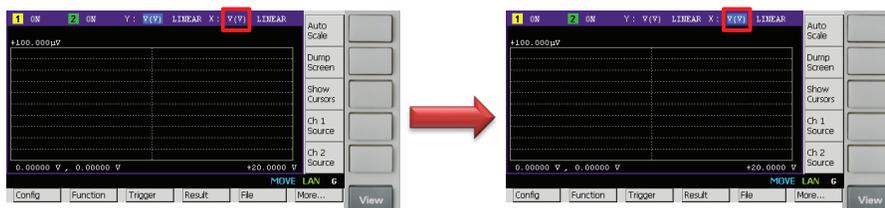
1) Press  repeatedly until Graph View is displayed.



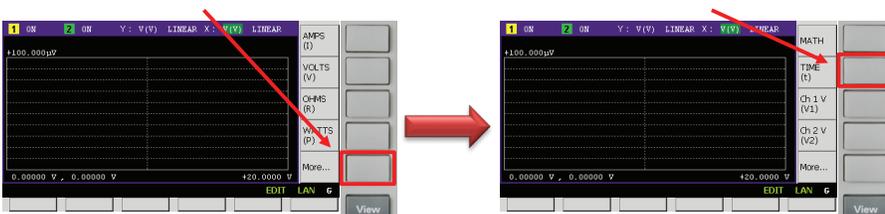
2) Rotate and press  to edit the Y-axis data type, and then select  to set the Y-axis data type to Voltage.



3) Rotate and press  to edit the X-axis data type.



4) Press  , and then select  to set the X-axis data type to Time.



4. Perform the measurement

- 1) Press **On/Off** to source the current specified by the Source value, and then press **Trigger** to perform a measurement.

(The status information will show **ARM** during the measurement.)

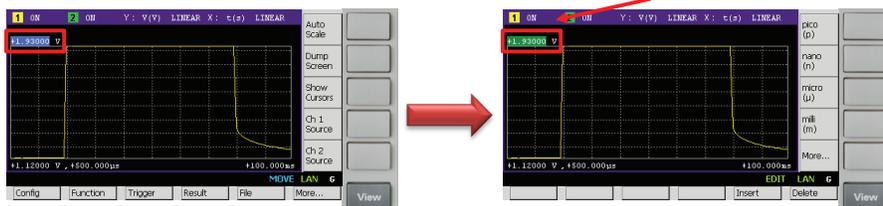


5. View the measurement result graph

- 1) Press **Auto Scale** to adjust the scale of the graph after finishing the measurement.



- 2) Rotate and press **View** to edit the Y-axis scaling, and then enter **2 V** to adjust the graph scale.



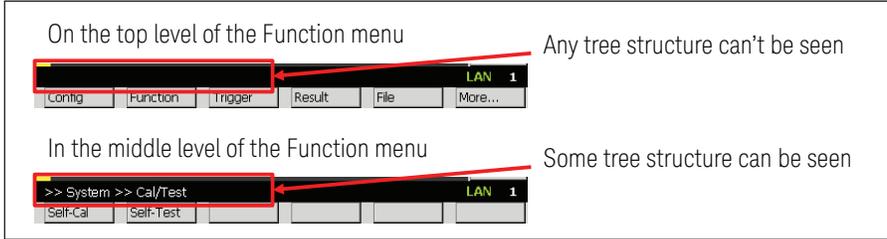
Now you can see the measurement result on the GUI of the B2900A series SMU as below.



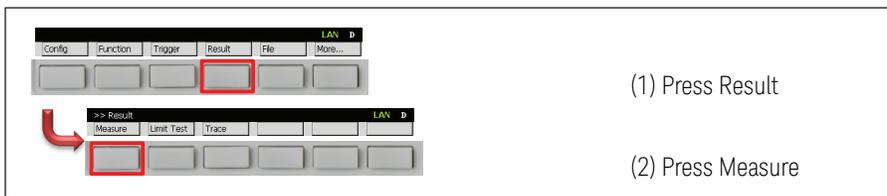
6. View the list of measurement results

The measurement results including the measurement time stamp can be referred by the following steps.

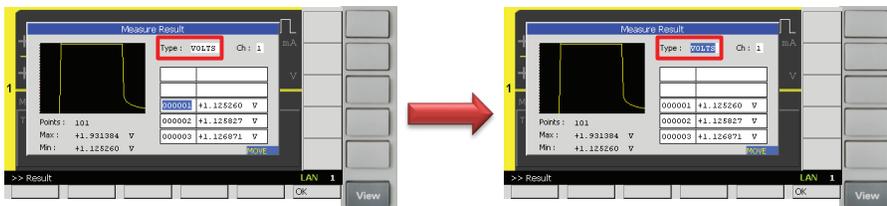
- 1) If you aren't on the top of the Function menu, press **Cancel Local** repeatedly to return to the top level.



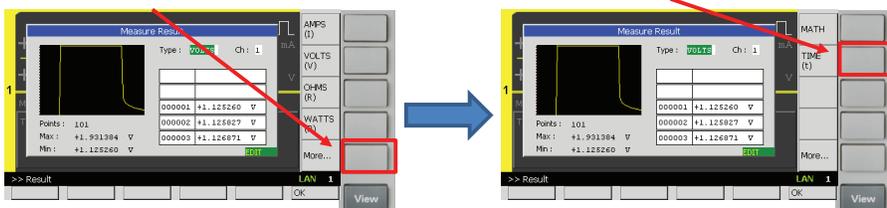
- 2) If you'd like to see the list of the measurement result, press **Result**, then press **Measure** to open Measure Result dialogue.



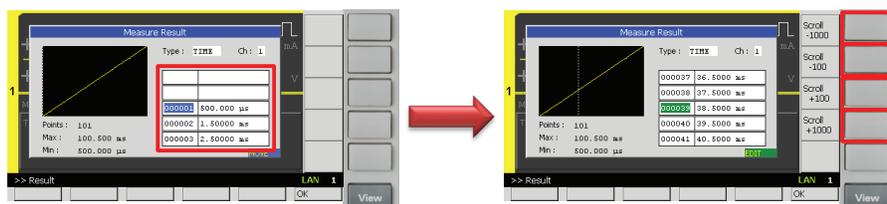
- 3) Rotate and press **View** to select the Data Type field.



- 4) Press **More...** to change the keys shown in Assist keys, and then press **TIME (t)** to select Time as the Data type.



- 5) Rotate and press **View** to select the Data field. Then rotate **View** to scroll the data list.



7. (Optional) Configure the measurement speed

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

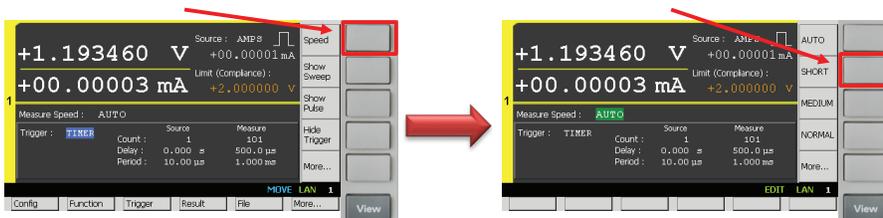
For example, let's try to change the measurement speed to SHORT to make a measurement more quickly. If you select SHORT, the aperture time is set to 0.01 PLC. Here, PLC stands for power line cycle and the specified number of power line cycles is used per a measurement.

1) Press **View** repeatedly until the Channel 1

Single View is displayed.



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



Controlling the B2900A Series SMU using SCPI commands

If you prefer to control the B2900A Series SMU remotely using SCPI remote commands, then the following material explains how to do this.

The series of commands shown in group “A” configure the pulse condition. Next the series of commands shown in group “B” configure the trigger condition. Finally, the series of commands shown in group “C” should be sent to initiate the channel to output signal.

B2900A Series SMU SCPI command example

```
*RST

:SOUR:FUNC:MODE CURR
:SOUR:CURR 1E-8
:SENS:FUNC 'VOLT'
:SENS:VOLT:PROT 2
:SOUR:FUNC:SHAP PULS
:SOUR:CURR:LEV:TRIG:AMPL 1E-2
:SOUR:PULS:DEL 2E-2
:SOUR:PULS:WIDT 6E-2

:TRIG:SOUR TIM
:TRIG:TRAN:COUN 1
:TRIG:TRAN:DELAY 0
:TRIG:ACQ:COUN 101
:TRIG:ACQ:DELAY 5E-4
:TRIG:ACQ:TIM 1E-3

:OUTP ON
:INIT (@1)
```

} **A** } **B**
} **C**

Optionally, a command shown in “D” configure the measurement integration condition.

B2900A Series SMU SCPI command example

7. (Optional) Configure the measurement speed

```
:SENS:VOLT:NPLC 0.01
```

D

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. Configuring the B2900A series SMU properly enables you not only to make a simple current versus voltage (IV) measurement, but also to make a time domain measurement with sourcing pulsed current or voltage as if it were an oscilloscope.

B2900 Precision Instrument Family

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



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