

# **Keithley2002 and HP3458A DMM Performance Evaluation**

**May 3, 2002**

**Yongbin Leng**

**Test Done for Marty Kesselman**

**leng@bnl.gov  
EXT 2835**

**BNL SNS Controls**

## Comparison of Keithley2002 and HP3458A DMM

### 1. Specification

		Keithley2002	HP3458A	Winner
Price				Keithley2002
Size		90 × 214 × 369 mm	88.9 × 425.5 × 502.9 mm	Keithley2002
Weight		4.2Kg	12Kg	Keithley2002
Operating Temperature		0°C to 50°C	0°C to 55°C	HP3458A
Consumption		< 55VA	< 80VA	Keithley2002
Digital resolution		8.5 digits	8.5 digits	Same
DC Volts	Ranges	5, 0.2V to 1000V	5, 0.1V to 1000V	Same
	Resolution	> 2nV	> 1nV	HP3458A
	Accuracy (24hours)	> 1.3ppm	> 0.6ppm	HP3458A
	Voltage Reference Stability (year)	>10ppm	>8ppm	HP3458A
AC Volts	Ranges	5, 0.2V to 750V	6, 0.01V to 1000V	HP3458A
	Bandwidth	20Hz to 2MHz	1Hz to 10MHz	HP3458A
	Accuracy (24hours)	> 300ppm	> 100ppm	HP3458A
DC Current	Ranges	5, 200uA to 2A	8, 100nA to 1A	HP3458A
	Sensitivity	> 10pA	> 1pA	HP3458A
	Accuracy (24hours)	> 55ppm	> 14ppm	HP3458A
AC Current	Ranges	5, 200uA to 2A	5, 100uA to 1A	Keithley2002
	Bandwidth	20Hz to 100kHz	10Hz to 100kHz	HP3458A
	Accuracy (24hours)	> 1600ppm	> 500ppm	HP3458A
Ohms	Ranges	9, 20Ω to 1G Ω	9, 10Ω to 1G Ω	Same
	Sensitivity	> 20u Ω	> 10u Ω	HP3458A
	Accuracy (24hours)	> 2.8ppm	> 2.2ppm	HP3458A
Frequency	Voltage Range	1Hz to 15MHz	1Hz to 10MHz	Keithley2002
	Current Range	1Hz to 1MHz	1Hz to 10MHz	HP3458A
	Accuracy	300ppm	100ppm	HP3458A
Temperature		Build-in	N/A	Keithley2002

From above specifications, HP3458A is better than Keithley2002 in resolution, accuracy and stability, and Keithley2002 is better than HP3458A in size, weight and cost. So for bench test application HP3458A is the primary choice and for field test Keithley2002 should be better.

## 2. DC voltage meter test

Test set is shown in Fig. 1.

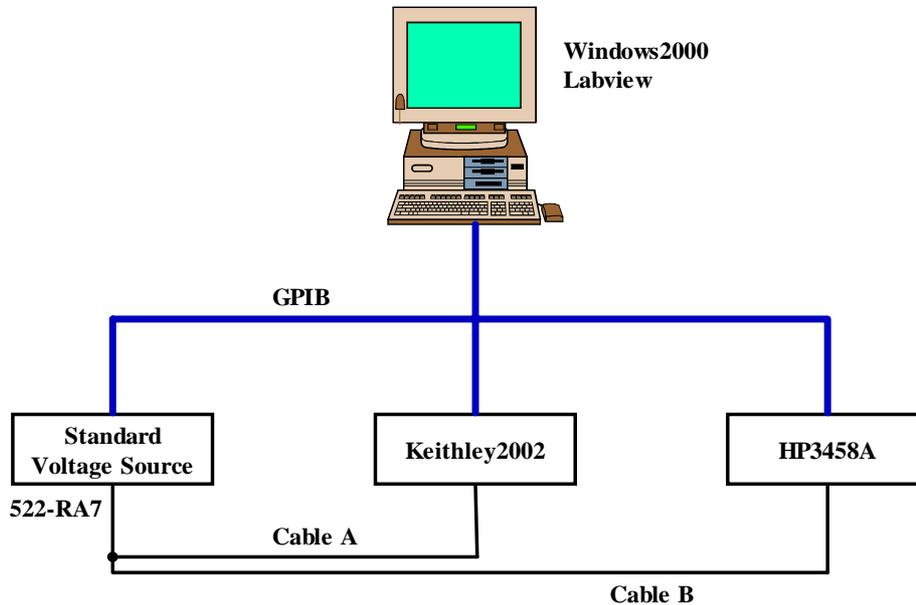


Fig. 1 DMM test setup

Data acquisition PC sets voltage source output value and gets Keithley2002 and HP3458A readback data at the same time via GPIB bus.

Since DMMs under test are 8.5 digits high sensitive instruments, the difference between cable A and cable B should be considered. In order to figure out this difference we set voltage source output to 0 volt and compared two test data under different cable connections: one is Keithley2002 connected via cable A and HP3458A connected via cable B; the other is HP3458A connected via cable A and Keithley2002 connected via cable B. The result is shown in Fig.2.

From this test we can find that the difference of cables just provide an offset but does not change readback distribution. So in our distribution test we can ignore the difference of cables.

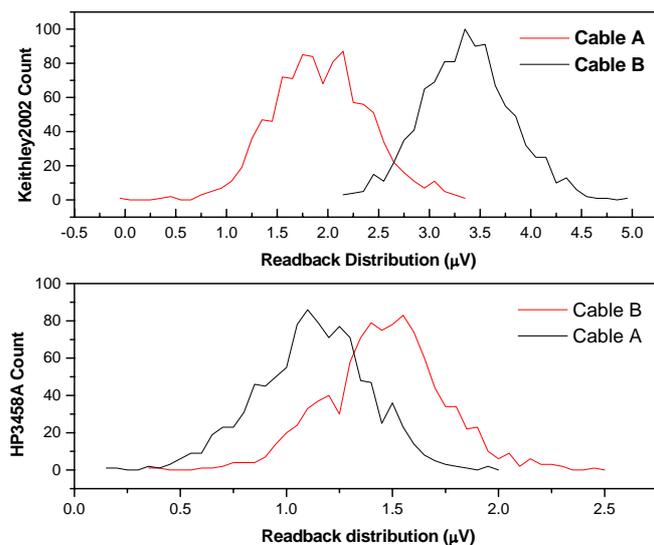


Fig. 2 Readback distributions under different connections

Fig. 3 ~ 7 display the distribution test results.

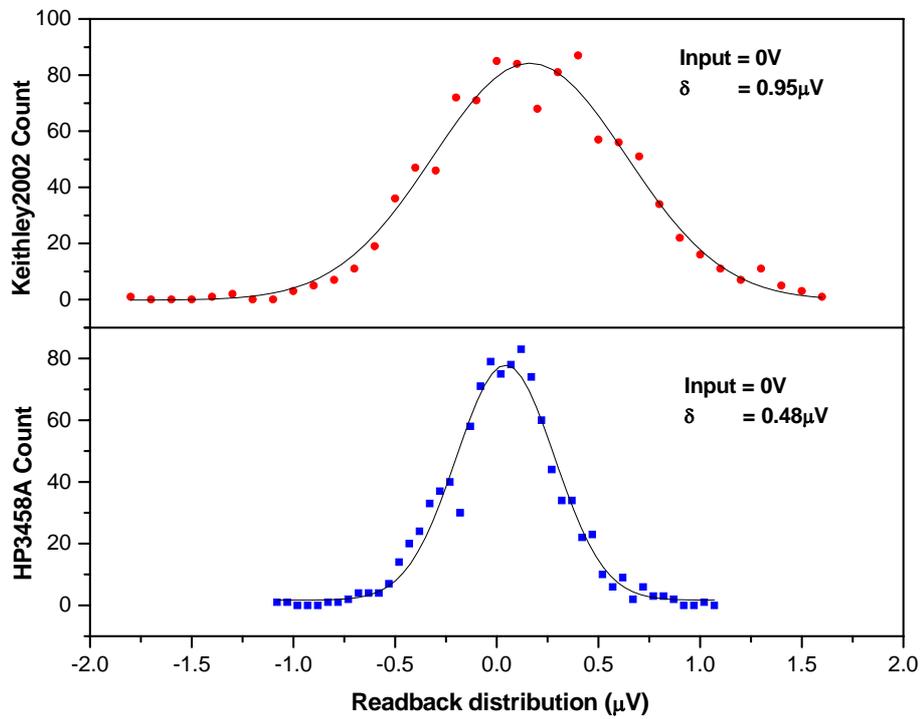


Fig. 3 Input = 0V

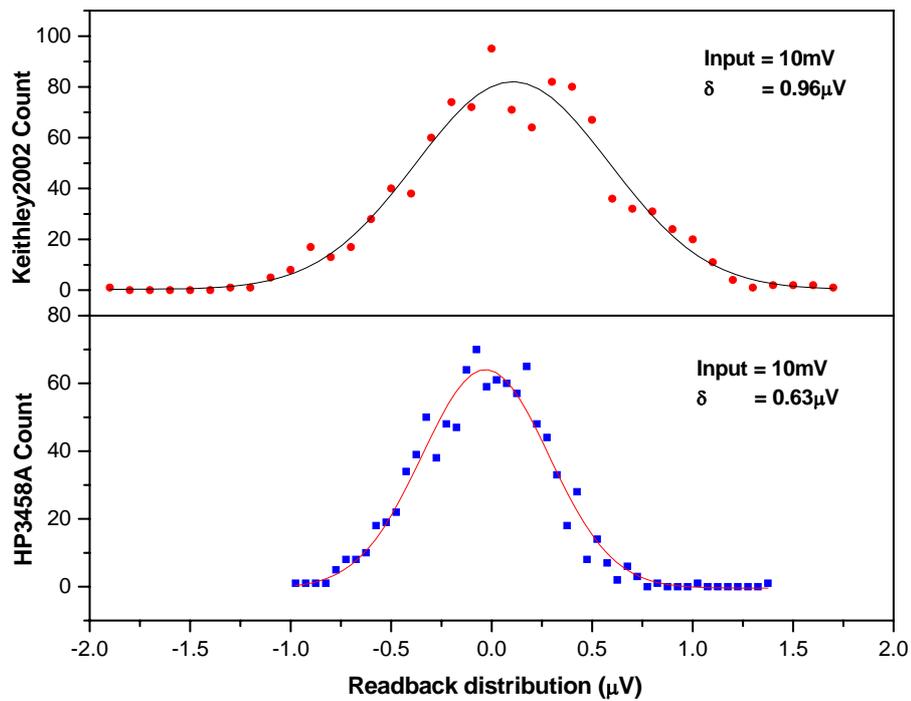


Fig. 4 Input = 10mV

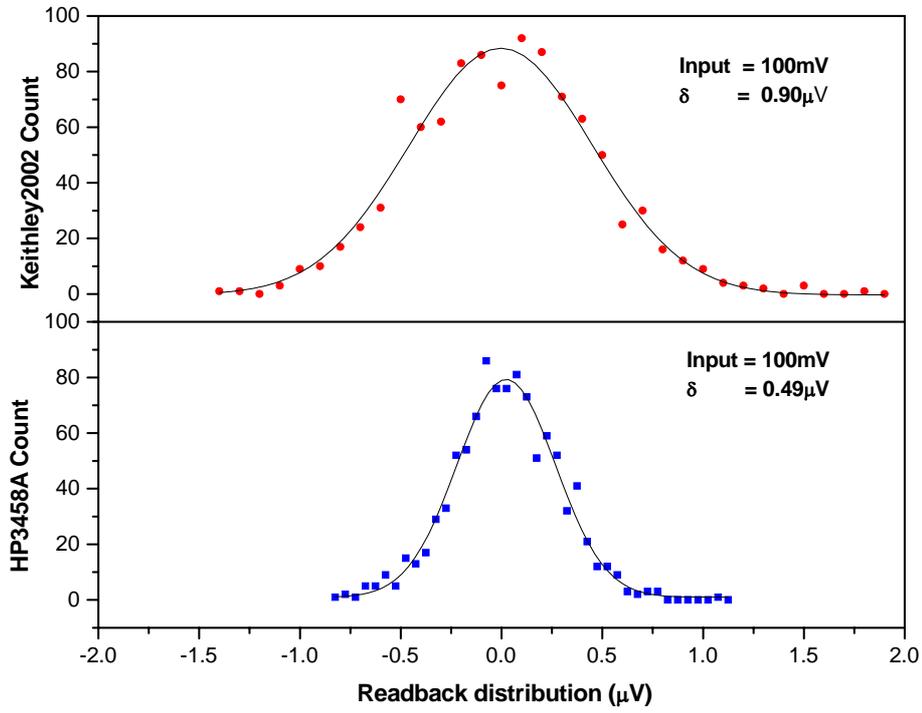


Fig. 5 Input = 100mV

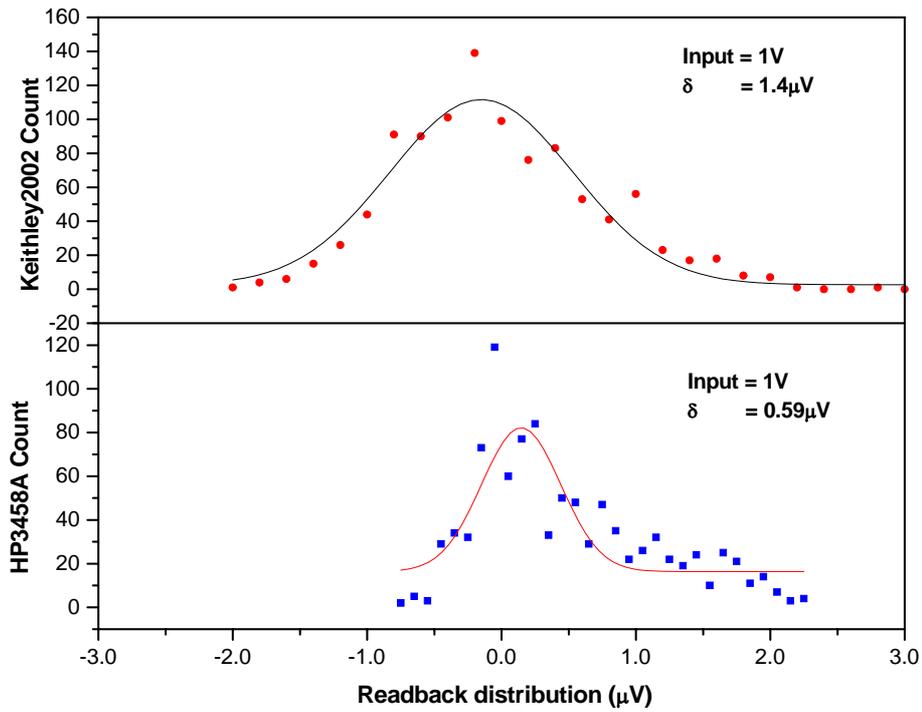
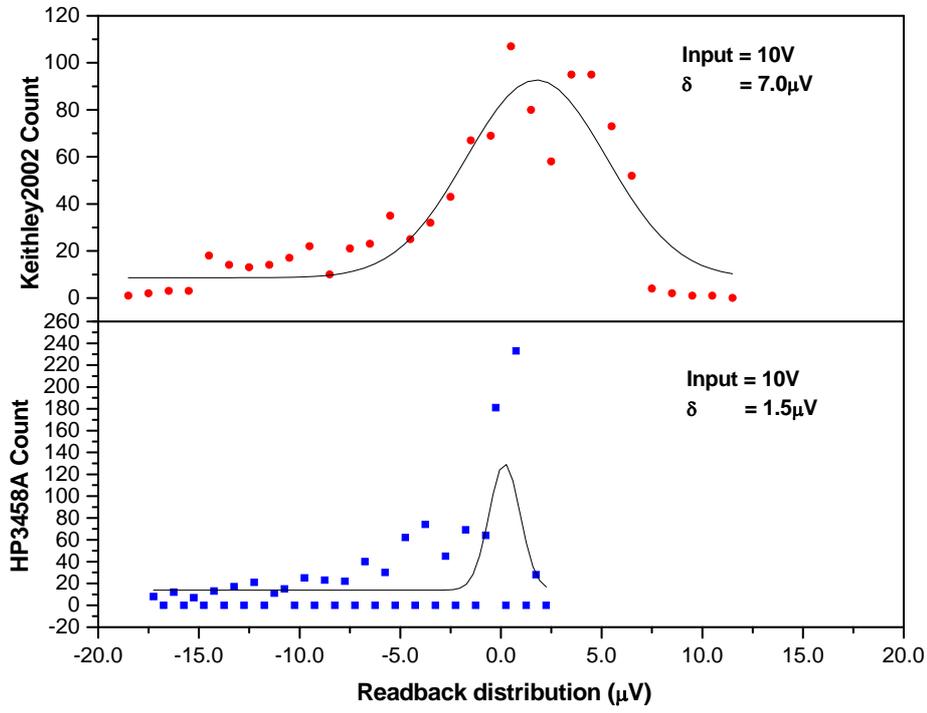


Fig. 6 Input = 1V



**Fig. 7 Input = 10V**

From above test results HP3458A is better than Keithley2002 running in DCV mode. It fits for their specifications.