

# Recommendation to Replace the Junior Engineer's VirtualBench VB-8102

KRYSTAL VUONG



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*WRITER'S COMMENT: Equipment Evaluation Memos (also known as memorandums) are widely used in the professional workplace to bring attention to a problem as well as to propose a solution for that problem. Memos also serve as in-house documents for accountability purposes. Memos are written for multiple audience members including an executive, an expert, a technician, and a lay person.*

*I found this assignment—my first for UWP 102E (Writing in the Disciplines: Engineering)—to be really useful for my future career since it provides a realistic situation where I am a junior engineer at Biogenesis Engineering Associates and my supervisor, Robin Manfred, asks me to write her a memo describing and evaluating some piece of equipment I currently use in the lab. Among the equipment that I have seen in my labs for various courses, the VirtualBench is interesting because it is used not only for generating signals but also testing for circuit behaviors.*

*INSTRUCTOR'S COMMENT: An upper-division electrical engineering student with a passion for movies, travel, baking, and card games, Hong "Krystal" Vuong brought an insightful and engaging voice to our spring 2019 UWP 102E Writing as an Engineer course. In Krystal's workplace memo recommending the replacement of her antiquated VirtualBench VB-8012 with a new and more efficient 350 MHz VirtualBench VB 80-34 model, Krystal deftly transcends the conventional academic student-writing-for-teaching assistant model of composition to embrace a more challenging and profession-*

*ally useful paradigm of document design: that of a working professional engineer who aspires to communicate in a single concise memo with a variety of different audiences, including executives, experts, lay readers, and laboratory technicians. To this end, Krystal has logically compartmentalized her report, appropriately dividing information into clearly labeled compartments so that different audience members—each with an essential workplace role to play—can readily locate precisely the information he or she requires and just as readily skip over information that targets other audiences with divergent needs and responsibilities. This admirable efficiency of design renders Krystal’s memo useful to all of her professional colleagues, despite their disparate job titles, concerns, and knowledge levels. That’s quite an accomplishment for a humble workplace memo.*

—Victor Squitieri, University Writing Program



## BIOGENESIS ENGINEERING ASSOCIATES (BEA)

### MEMORANDUM

To: Robin Manfred, Technical Project Manager Supervisor,  
Technical Services

From: Krsytal Vuong, Junior Engineer, Technical Services

Date: 15 April 2019

Subject: Recommendation to Use Obsolete Funds to Replace  
the Junior Engineer's VirtualBench VB-8012 with a  
350 MHz VirtualBench VB-8034

Distribution: Bernie Bonds, Director of Finance Services  
Dave Ortiz, Technical Support  
Alexandra Rodriguez, Technical Support

As you requested in your memo of 10 April 2019, I have evaluated the equipment currently used in Technical Services lab. This report provides information about my current lab instrument, compares it with the newer model, and recommends that BEA use obsolete equipment funds to replace my current VirtualBench VB-8012 with a 350 MHz VirtualBench VB-8034.

## **Description of Current VirtualBench VB-8102**

Biogenesis Engineering Associates purchased my current lab instrument in October 2016 from National Instruments. It is an all-in-one personal lab instrument VirtualBench VB-8012 (serial number #H76798669R) with the following specifications:

- 100 MHz Maximum Bandwidth
- 1 GS/s (Gigasamples per Second) Maximum Sample Rate
- 2 Voltage Input Channels
- 31 W Total Output Power
- 20 MHz Analog Output Bandwidth
- 120 VAC Supported Power Input

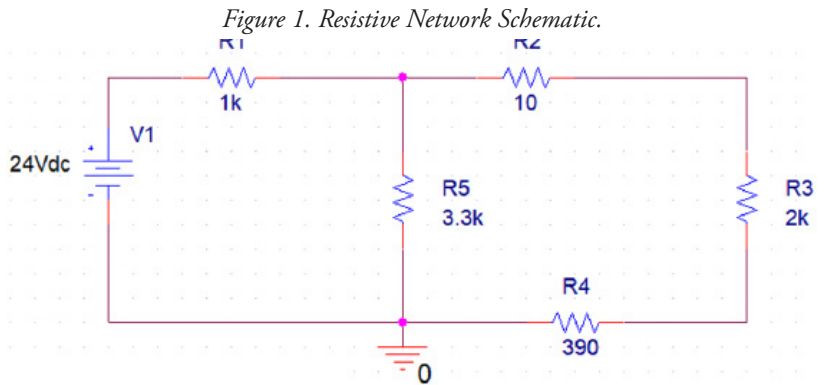
As you know, I usually spend most of my time working with PSpice Simulation Software on my computer in the lab, verifying the simulated results using the VirtualBench machine, and building the actual circuit on breadboard afterwards. I have noticed that in the last eight months we have been assigned technical tasks that required working with more advanced software as well as upgraded lab instrument to produce more accurate results.

## **Comparison Between VirtualBench Models: VB-8102 vs. VB-8034**

VirtualBench is a multifunctional lab instrument that can perform

several tasks at the same time. One of the most useful and common usages of the VirtualBench is its ability to function as a digital multimeter (DMM). A digital multimeter is used to measure the resistance of a circuit element, the voltage across that element or the current going through it.

In order to test the accuracy of measuring the voltage across the resistors, I designed a simple resistive network consists of five different resistors with values ranging from 10 ohm to 3.3 kilohm connected with a 24-V DC power supply (Figure 1).



Then, I calculated the theoretical values for the voltage across each resistor (Table 1). These numbers told me what I should expect when I run the simulation or directly measure from the circuit.

*Table 1. Theoretical values for the voltage across resistors.*

Resistor	Resistance( $\Omega$ )	Voltage (V)
R1	1k	10.04
R2	10	0.05817
R3	2k	11.63
R4	390	2.272
R5	3.3k	13.96

Next, I ran the PSpice Software to obtain the simulated voltage values for the resistive network. Table 2 below shows the simulation results:

*Table 2. PSpice Simulation Values for the Resistive Network.*

Resistor	Resistance( $\Omega$ )	Voltage (V)
R1	1k	10.04
R2	10	0.06000
R3	2k	11.632
R4	390	2.268
R5	3.3k	13.96

Finally, I built the circuit on the breadboard, connected the five resistors as in Figure 1 and measured the voltage across each resistor using the digital multimeter built-in function of my VirtualBench VB-8012. I recorded the data given by my VirtualBench VB-8012 and calculated the percentage error between the measured values and the theoretical values, as well as between the measured values and the simulated values (Table 3).

*Table 3. Measured Voltage Values and the percentage error, VirtualBench VB-8012 (Current).*

Resistor	Resistance ( $\Omega$ )	Measured Voltage (V)	% Error (Measured vs. Theoretical)	% Error (Measured vs. Simulated)
R1	1k	8.21	18.23	18.23
R2	10	0.0500	14.04	16.67
R3	2k	10.290	11.52	11.54
R4	390	1.973	13.16	13.01
R5	3.3k	12.78	8.452	8.453

I contacted Professor Hooman Rashtian from Department of Electrical Engineering and Computer Engineering at the University of California, Davis and he let me test the new VirtualBench VB-8034 in their computer lab. I used the same circuit that I tested on my VirtualBench VB-8012 to run the same test on their new VirtualBench VB-8034 and obtained the following results:

Table 4. Measured Voltage Values and the percentage error, VirtualBench VB-8034 (UC Davis Computer Lab).

Resistor	Resistance ( $\Omega$ )	Measured Voltage (V)	% Error (Measured vs. Theoretical)	% Error (Measured vs. Simulated)
R1	1k	10.03	0.09960	0.09960
R2	10	0.0587	0.9111	2.167
R3	2k	11.34	2.49	2.51
R4	390	2.280	0.3521	0.5291
R5	3.3k	13.98	0.1433	0.1433

As we see, the large percentage error of my current VirtualBench VB-8012 (more than 10%) shows the instability and unreliability in measuring values of circuit elements, which is an issue in debugging the circuit. We usually rely on these numbers (voltages drop across elements) to figure out what is going on in the circuit and, from there, we will be able to debug the circuit. Therefore, not being able to rely on these values will affect the ability to debug the circuit effectively and precisely.

## Recommendation

Based on the evaluation, I recommend that Technical Services request obsolete equipment funds to replace my VirtualBench VB-8012 with a 350 MHz VirtualBench VB-8034.

If BEA replaces my VirtualBench VB-8012 with a VirtualBench VB-8034, Technical Services could donate the old VirtualBench VB-8012 to the computer lab at the University of California, Davis. Despite the fact that the VirtualBench VB-8012 lacks the ability to handle the accuracy of our tasks, it is still capable of simple tasks for educational purposes.

I hope this memo provides useful information. Please contact me if you have any further questions. I look forward to discussing my recommendation with you next Wednesday at our weekly meeting.

KV: rk