Chapter 14O

Online Content: Logic Gates

14O.1 Adding a 3.3V supply to the PB-503 breadboard

14O.1.1 Why we add a voltage regulator to the breadboard

The FPGA and microcontroller used in the second half of the book run on a supply voltage of $+3.3\mathrm{V}$. Voltages $> 3.6\mathrm{V}$ are likely to damage these relatively expensive parts. In the lab setup of §14L.1.2, we've asked you to adjust the breadboard variable supply to 3.3V and we recommend fixing the adjustment knob in place with hot melt or silicon glue. Small movements of the knob result in a large voltage change, so keeping the knob from moving is important.

In our lab, we go one step further and add a voltage regulator to create a fixed 3.3V bus on the breadboard: see Fig. 14O.1. This is not a perfect solution, because the logic switches still use the breadboard positive variable supply for a logic high, meaning we still must adjust it to 3.3V, but it reduces the chance of destroying the FPGA or microcontroller.[1]

The 3.3V bus uses yellow wire. We retain the red $+5\mathrm{V}$ bus since several of the lab experiments using standard 74LS or 74HCT logic require it. The blue negative supply bus is set to $-3.3\mathrm{V}$, but is not used in any of the digital labs.

14O.1.2 How to add the voltage regulator to the breadboard

We use an LD1117, 3.3V low dropout voltage (LDO), three-terminal regulator to regulate the 5V breadboard supply down to 3.3V.[2] This device is rated at 800mA, more than enough

[1] If you accidentally increase the breadboard supply while a logic switch is in the '1' position and connected to a FPGA or microcontroller input, you may damage the input but hopefully you will still be able use other inputs on the device. If you want to minimize even that possibility, you can add a series resistor of $1\mathrm{k}$ or so between the logic switch and the device input.

[2] Other 3.3V, LDO regulators, such as the LT1086CM-3.3 will work as well.

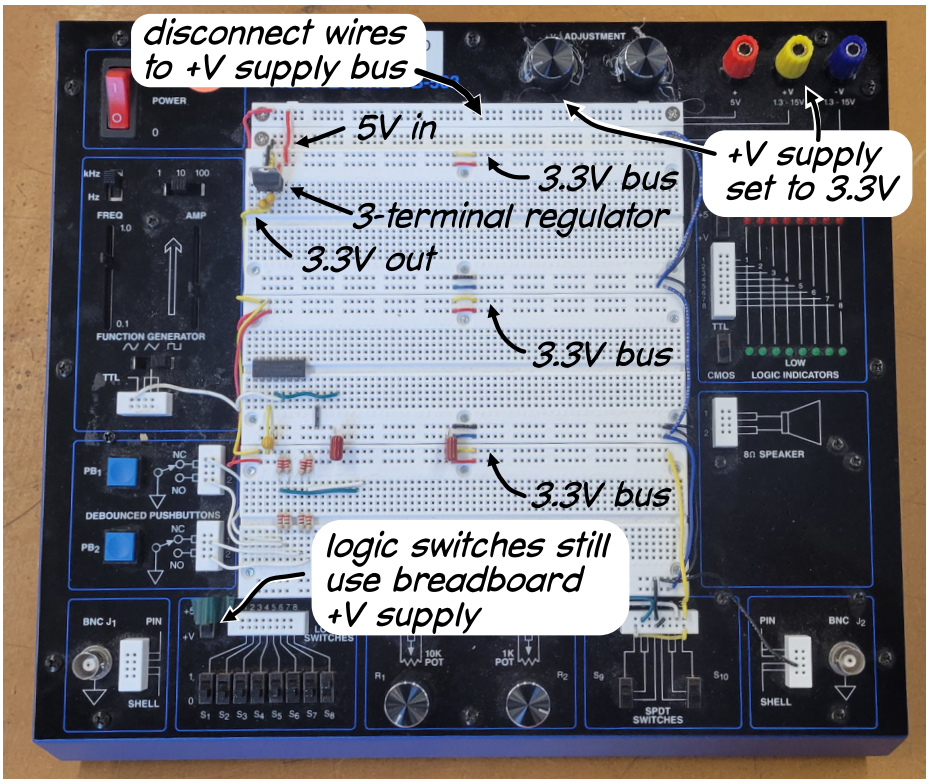

Figure 14O.1: PB-503 breadboard with voltage regulator added to create a 3.3V power bus.

for the lab experiments in LAoE. The regulator only requires the addition of input and output bypass capacitors to function:see Fig. 14O.2. Capacitor values are not critical, the values shown are those recommended on the datasheet. Several close up views of our build are shown in Fig. 14O.3 on the following page. *Be sure to disconnect any wires from the positive variable supply (the second horizontal bus at the top of the breadboard) if you add the voltage regulator.*

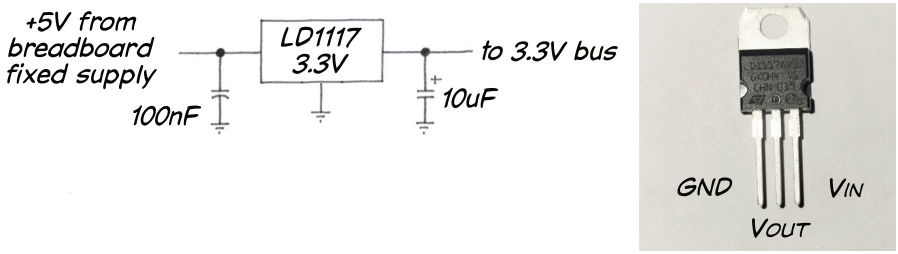

Figure 14O.2: Schematic of 3.3V regulator. Capacitors should be ceramic or tantalum.

Please send comments or corrections to: authors@LAoE.link

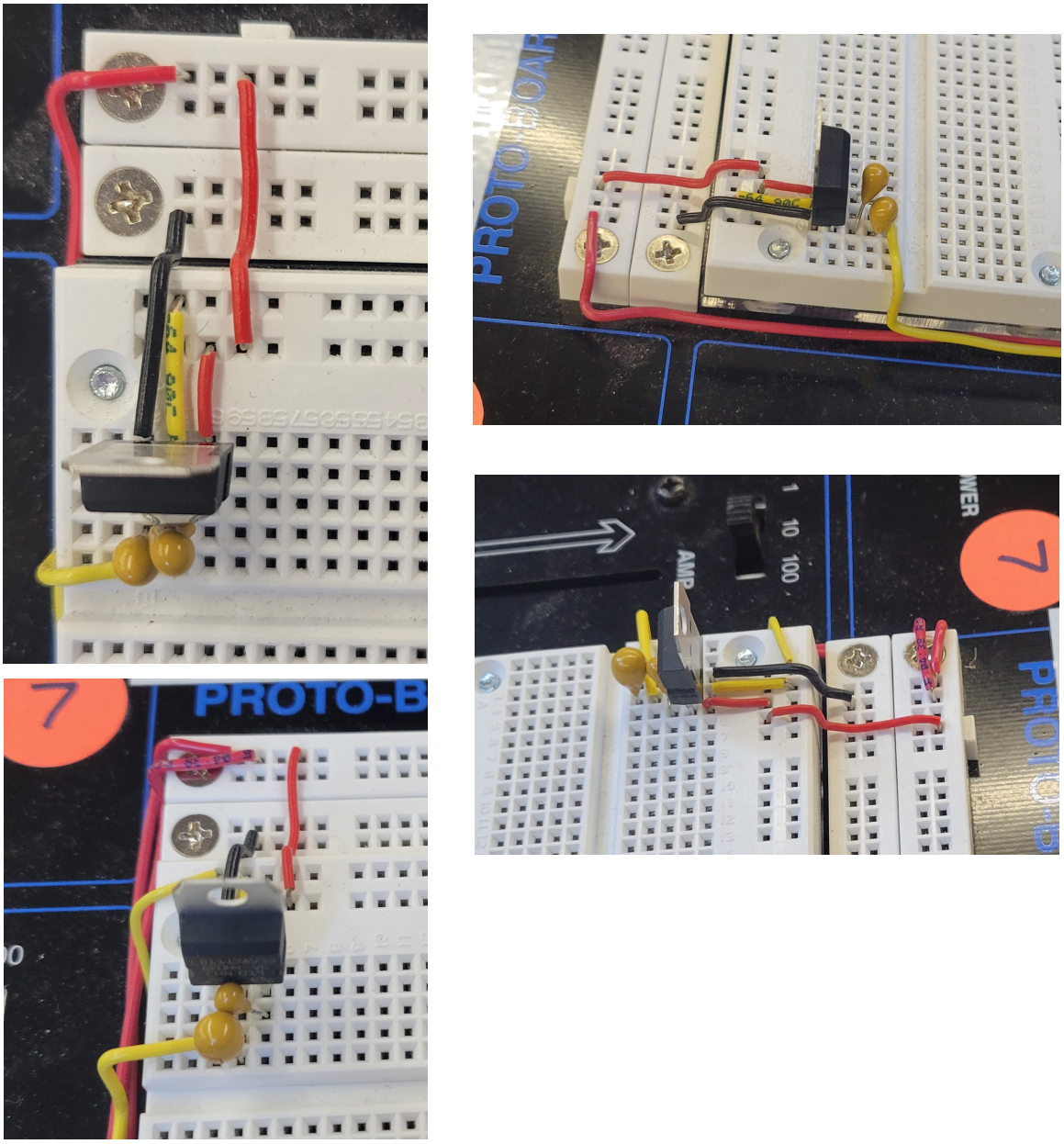

Figure 14O.3: Close up views of our build from different angles.