**Project Report**

**ATX BENCH POWER SUPPLY**

## A. Introduction

This report discusses the implementation of repurposing an Advanced Technology Extended (ATX) PC power supply unit (PSU) into a bench PSU, for home usage, such that it is capable of simultaneously supplying multiple power outputs. The repurposed supply is intended to consist of multiple fixed output terminals with voltages of 3.3V, 5V and 12V, a variable output of approximately 1-12V.

## B. Required Materials

The following components are required for the implementation of the ATX bench PSU:

1. ATX PC PSU
2. DC-DC Step-Down Buck Converter (LM2596)
3. USB Hub
4. Banana Jack Terminals (x8)
5. 220Ω Resistors (x2)
6. Light Emitting Diodes (LEDs) (x2)
7. 10Ω 10W Resistor
8. Digital Voltmeter and Ammeter
9. Single Pole Single Throw (SPST) switch
10. 10K Ω Potentiometer
11. 3D Print Filament

## C. Design and Implementation

- **Wire Connections:**

Inside the PSU there is a 24-pin connector that consists of numerous voltage output, ground, and signal wires, all of which are colour coordinated. Before performing any changes to the wires from the PSU, the PSU needs to be tested to ensure that it operational. This is done by short circuiting the “Power Supply On” wire (green) with a ground wire (black). A general indication that the PSU is operational is that its internal fan will turn on.

Once it is determined that the PSU is operational, it should be disconnected from the mains outlet to allow the capacitors to fully discharge as a safety measure when working with it. Thereafter, the wires can be removed from the connectors and grouped together according to their voltages/colour schemes.

The ground and output rails (red, orange, and yellow) are to be attached to the banana jack terminals and placed in their respective sockets on the 3D printed body. To ensure that enough current can be supplied to a load, each terminal has four wires attached to it. Should a larger current be needed, more wires can be attached to the terminals to increase the current supplied.

A SPST switch is connected to the green and a black wire that are previously short circuited so that the PSU can be turned on or off seamlessly. Additionally, when the PSU is turned on, the “Power Ok” wire (grey) supplies +5V. This wire is used to power an LED to indicate when the power supply is turned on. A second LED is connected to the ground and +5V stand-by (purple) wire. The purple wire always supplies +5V, provided that the PSU is connected to a mains outlet. Therefore, the purpose of the second LED is to indicate when the PSU is in stand-by [1].

- **Load Resistor:**

An ATX PSU is designed to operate with a load attached to it, which in typical cases would be the components of a PC, such as a motherboard or CPU. However, when there is no load attached, the PSU may not

turn on, the outputs may not supply steady power, or the PSU may shut down [2]. To prevent any of these potential shortfalls from occurring, a load resistor is attached to the output rail with the highest output DC current.

For the specific PSU that is used in this project, the red rail (+5V) has the highest output current of 31A. Thus, to ensure a steady output, a 10Ω 10W resistor is attached to a ground and +5V wire.

a) **Variable Output:**

A variable output can be achieved either by using a voltage regulator and a potentiometer or by using a DC-DC step down buck converter. Both configurations are tested, and the following conclusions can be relayed:

Voltage Regulator: The LM317 voltage regulator is configured according to the data sheet using a 10k potentiometer [3]. A signal is sent from the configured regulator to an op-amp which acts as a buffer. This is done to isolate the input (that is received from the regulator) from the output (that is sent to the load) to prevent loading.

The op-amp that is tested can output the required output voltages of 1-12V but can only output 10mA of current due to its high internal impedance. Therefore, a voltage regulator is not used as the buffer cannot supply enough current to a load.

DC-DC Buck convertor: The LM2596 DC-DC buck converter is tested, which has a rated maximum current of 3A and an output voltage of 1.2-37V [4]. When tested with a 10K potentiometer, output voltages of 1.3-11.6 V are obtained from a 12V input. Like the voltage regulator, a relatively small current is supplied by the buck. However, by connecting multiple +12V wires to the input of the buck, more current can be supplied and outputted with minimal losses. Therefore, the buck is used in the design of the bench PSU.

To display the variable output current and voltage supplied by the buck convertor, a digital voltmeter and ammeter is connected to the buck and the jack terminal where a load is attached.

**References**

[1] ThomasVDD. "*Variable ATX Bench Power supply,"* Instructables, 2015. [Online]. https://www.instructables.com/Variable-ATX-bench-powersupply-FabLab-edition/. [Accessed 1 February 2023].

[2] PCB Smoke. "*Converting an ATX Power Supply into a DC Bench Supply,"* 2012. [Online] https://pcbsmoke.wordpress.com/2012/11/21/converting-an-atx-power-supply-into-a-dc-bench-supply/#:~:text=Some%20ATX%20PSUs%20will%20supply,to%20the%20different%20voltage%20outputs. [Accessed 1 February 2023].

[3] LM317 3-Terminal Adjustable Regulator, Texas Instruments, April 2022

[4] LM2596 3.0 A, Step-Down Switching Regulator, ONSEMI, December 2022

# Appendix A: Diagrams and Images of the projects

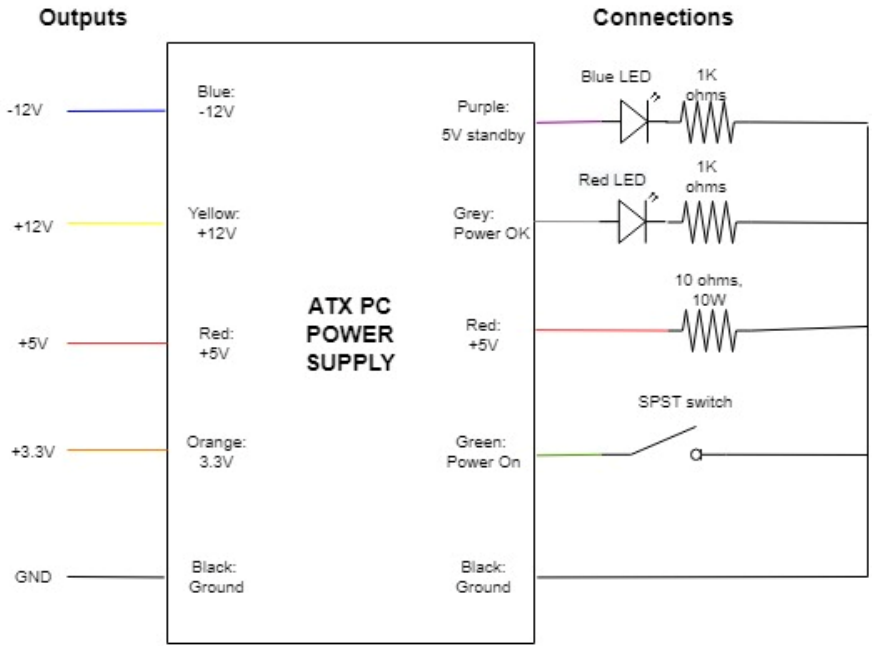


Figure 1: Diagram illustrating the specific connections made to wires

Figure 2: Final of implementation of the bench PSU.

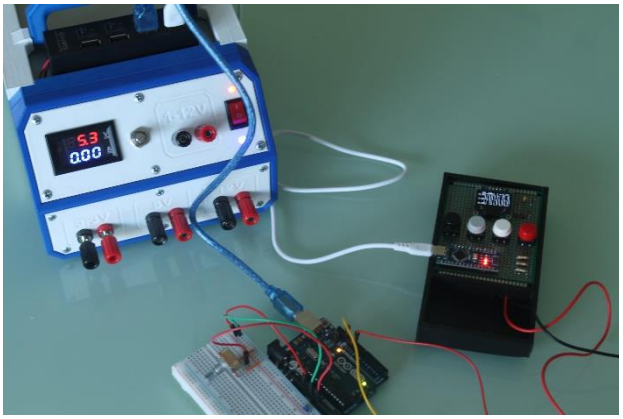

Figure 3: The bench PSU powering an oscilloscope and a function generator