Experiment 2

Equipment and Instruments in the Lab

Objectives:

In this experiment you will learn the following:

- How to connect circuits using the breadboard.
- How to use the Tektronix PS 280 power supply.
- How to use the Agilent 33120A function generator.
- How to use the Fluke 45 digital multimeter.
- How to use the Tektronix TDS 220 oscilloscope.

A. Breadboard

The breadboard is a plastic perforated board on which you will build your circuits. The breadboard has many strips of metal (usually copper), which run underneath the board. The metal strips are laid out as shown in the figure below.

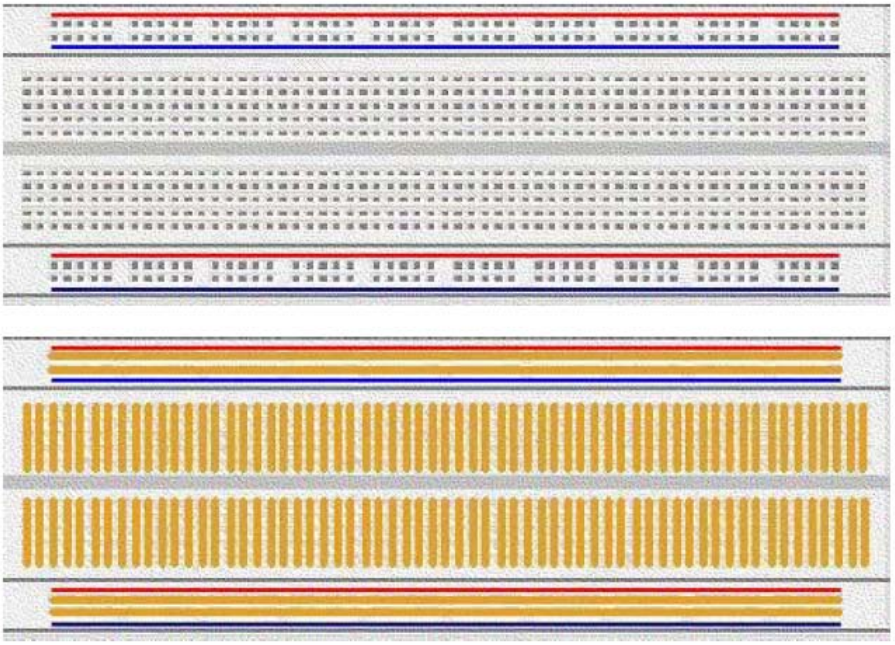
The metal strips connect the holes on the top of the board. This makes it easy to connect components together to build circuits. To use the breadboard, the legs of components are placed in the holes (the sockets). The holes are made so that they will hold the component in place. Each hole is connected to one of the metal strips running underneath the board.

Each wire forms a ***node***. A node is a point in a circuit where two components are connected. Connections between different components are formed by putting their legs in a common node. On the breadboard, a node is the row of holes that are connected by the strip of metal underneath.

Note

The long top and bottom row of holes are usually used for power supply connections. The rest of the circuit is built by placing components and connecting them together with jumper wires. When a path is formed by wires and components from the positive supply node to the negative supply node, current flows through the path and the circuit comes alive.

Integrated circuits are placed in the middle of the board so that half of the legs are on one side of the middle separator and half are on the other side.



B. Power Supply

The Tektronix PS 280 power supply provides one fixed 5 Volt DC supply and two variable DC power supplies: a master output on the right hand side and a salve output on the left hand side. The voltages and the currents of the variable outputs are adjustable.

Procedure

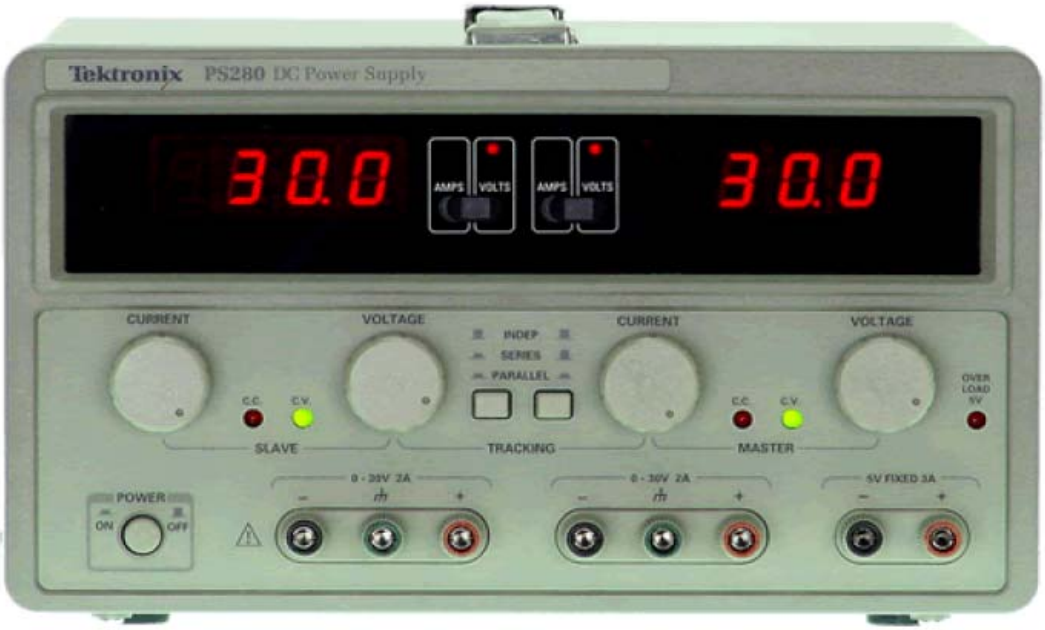
- Plug the instrument in the power outlet.
- Insert the probes in their proper sockets: *black* probe in the - (minus) socket and *red* probe in the + (plus) socket.
- Turn the power supply on and make sure that none of the probes is in contact with the other probe, as this creates a *short-circuit*.
- When using the variable supplies, you can adjust the voltage with the voltage knob and the current limit with the current knob for both supplies.

Note - The variable power supplies can be operated in three modes:

- Independent, when both push buttons in the middle are depressed.
- In series, when the left button is pressed and the right button is depressed.
- In parallel when both push buttons are pressed.

Exercise B-1:

Practice setting different voltages and different modes of operation



C. Digital Multimeter (DMM)

The Fluke 45 DMM can measure AC and DC voltages and AC and DC currents. Moreover, the DMM can measure resistance and diode voltage drop.

Procedure

- Switch the DMM on using the green switch below the front panel.
- Plug the probes in the appropriate plugs, according to the measurement you are going to perform.
- Select the type of measurement form the selection push buttons located on the front panel of the DMM.
- The DMM is equipped with an auto scale option that will automatically select the proper scale for your measurement.

Note - Current measurement is done *in series* whereas voltage measurement is done *in parallel*.

Exercise C-1:

Practice measuring voltages and currents as well as resistances.

D. Function Generator

The function generator (HP Agilent 33120A) is a source of time-varying signals. It is capable of supplying three types of signals (square, triangle, and sine waves) with a variable frequency and a variable peak-to-peak voltage. It can also add to the signal a DC offset voltage, and can provide unequal duty cycles.

Procedure

- Plug the instrument in the power outlet and turn it on using its on/off power switch.
- Plug the output cable in the lower BNC connector labeled “OUTPUT”.
- Select the desired signal type by pressing the appropriate key (sin, square, triangle.)
- Adjust the frequency, amplitude, and DC offset by selecting the appropriate key; adjust the duty cycle by pressing shift then DC offset.
- Numeric values can be changed either using the rotating knob on the screen, or directly by pressing enter number and then enter.

Exercise D-1:

Practice setting different signals and values on the function generator

E. Oscilloscope

The Tektronix TDS220 oscilloscope is the device that can display the signals in the time domain. It can also provide a number of measurements related to the signal you are trying to analyze.

Procedure

- Plug the instrument in the power outlet and turn it on using the on/off switch.
- Plug the measuring probe in one of the channel BNC connectors (it is preferable to use CH1 if you intend to use only one channel of the scope.)
- The scope is equipped with an auto set feature that will automatically set the scope for proper signal measurement.
- Pressing the channel menu will allow you to change the coupling (DC, AC, Ground) as well as the probe gain setting (1x, 10x, 100x, 1000x).
- Turning the VOLTS/DIV knob for each channel can change the y or voltage scale. The scale appears at the bottom of the screen.
- Turning the SEC/DIV knob will change the x or time scale for both channels. The time scale appears at the bottom of the screen.
- The measure function will allow you to directly take a reading from the screen without the need to count the squares and to multiply by the scale. The following measurement can be made: Peak-to-peak, RMS, Frequency, Period, Mean.

Exercise E-1:

Practice applying different signals from the function generator to the scope and making measurements along with a comparison of the reading provided by the function generator and the scope.