G-12 Laboratory Equipment

The G-12 power laboratory contains four stations each equipped with power sources, loads, power electronics, machinery, and metering equipment. The power sources and the power electronic equipment is contained in a 19" rack. The remainder of the equipment (with the exception of the load box) is located on the bench. Below is a detailed description of the equipment.

Source Panel

Figure 1 shows a layout diagram of the source panel which is located in the 19" equipment rack. The source consists of a three-phase variac followed by a three-phase diode rectifier. The input voltage comes from a 208-V (line-to-line) three-phase supply available in the laboratory. By switching on the main breaker (top left) and turning the variac (bottom left) clockwise, the ac and dc voltage outputs can be increased. The line-to-line rms ac output voltage is displayed on the meter labeled "VOLTS AC" and outputs on the connectors below that meter labeled "A", "B", and "C". The ac output voltage can be varied from 0 to 208-V and is fused at 10-A by fuses accessible on the front panel (next to the ac connectors). The dc voltage is displayed on the meter labeled "VOLTS DC" and outputs on the connectors below this meter. It can be varied from 0 to 294-V and is also fused at 10-A. One thing to keep in mind is that there is no switch to select ac or dc operation and so both voltages will increase at the same time. The user, therefore selects ac or dc by connecting into one or the other (but not both).

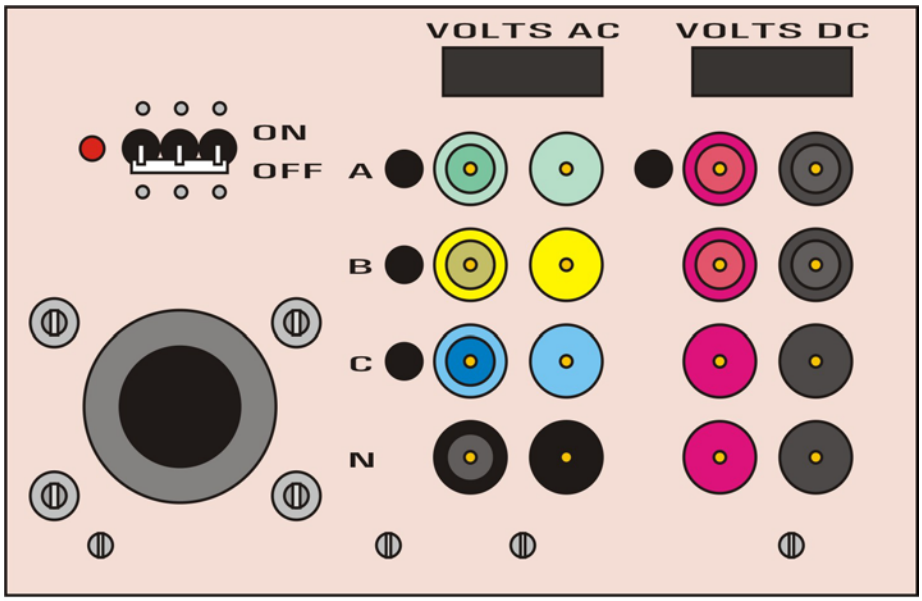

Figure 1. Source panel layout.

Load Box

A load box is located at the end of each bench. It contains resistor, inductor, and capacitor elements and is wired as a three-phase wye-connected load. Figure 2 shows the front view of the load box. Next to the schematic symbol for each element is a switch for using that particular element. As and example, a three-phase resistive load can be selected switching the switches on (up position) for the resistors and off (down position) for all of the inductors and capacitors. This configuration is shown in Figure 2. There are a few precautions for using the load box. First, switching all of the switches off will bypass all elements and short-circuit the load. Second, the inductors and capacitors are sized to have the same reactance at 60-Hz and will lead to an effective short-circuit if a pure L-C load (one with no resistance) is selected for a 60-Hz application. Lastly, the cooling fans must be switched on (the switch is on the back of the box) whenever the resistive elements are used. The resistors are made from heating elements and naturally give off heat which must be removed by the fans.

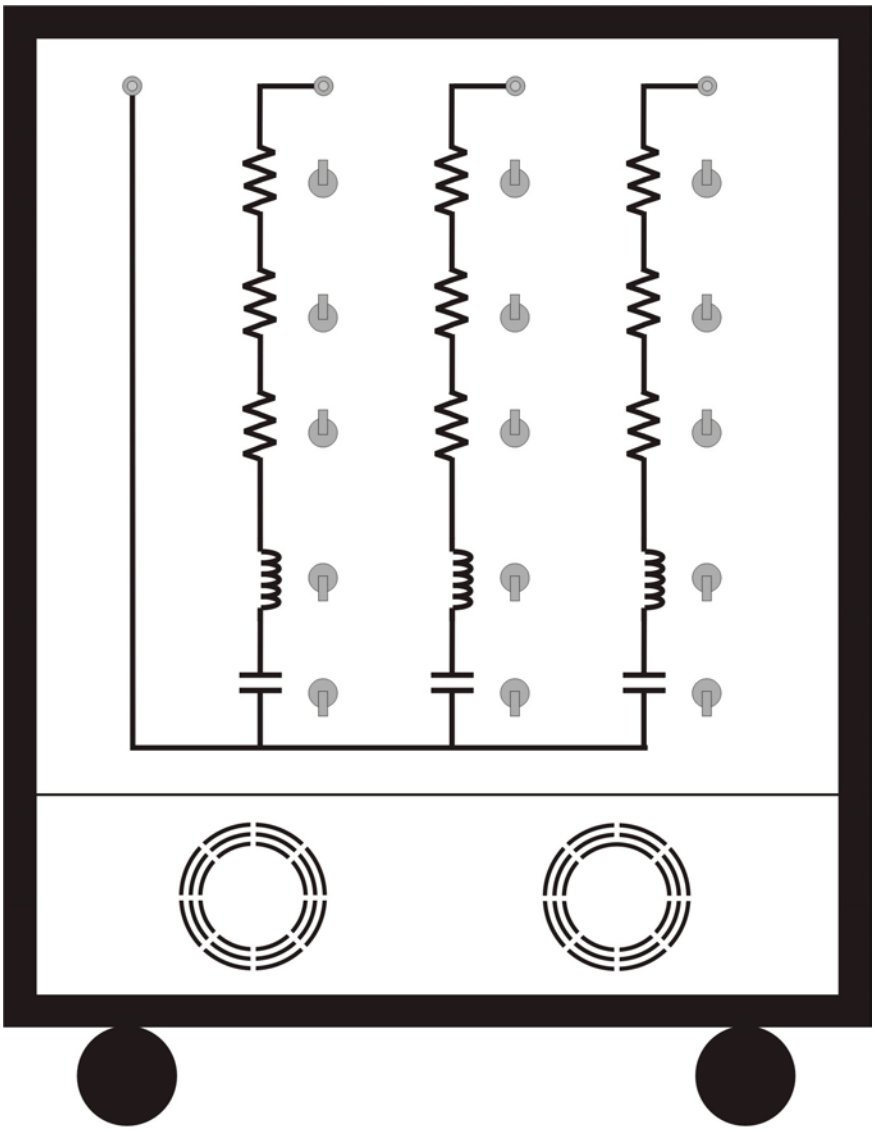

Figure 2. Load box panel.

Meter Box

Figure 3 shows the front view of the meter box. It consist of six voltage/current channels. When wiring a circuit, the power may be passed through the channels on the meter box for measurement of voltage, current, real power, and reactive power. Both instantaneous and rms (or average) quantities can be displayed on the computer screen. The display depends on the software program used. As an example, the screen-shot from the Single- and Three-Phase Power Measurements is shown in Figure 3. In this example, the first two channels are used. The three waveform plots show instantaneous values of voltages, currents, and powers. Below these graphs, the rms voltages and currents are shown as well as the average powers.

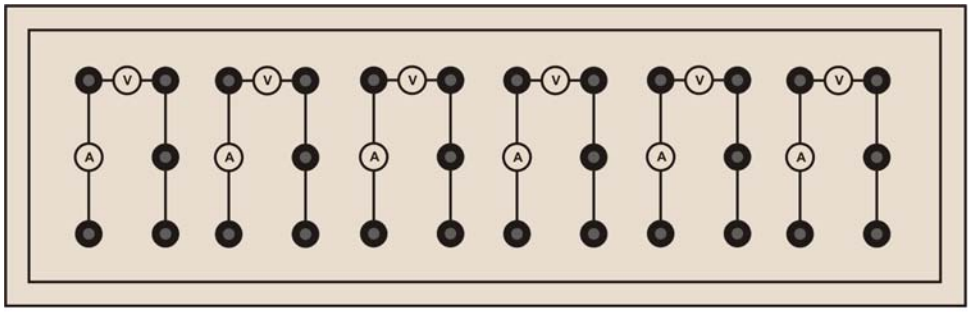

Figure 3. Meter box and software interface.