# Three phase rectifier lab

## Introduction

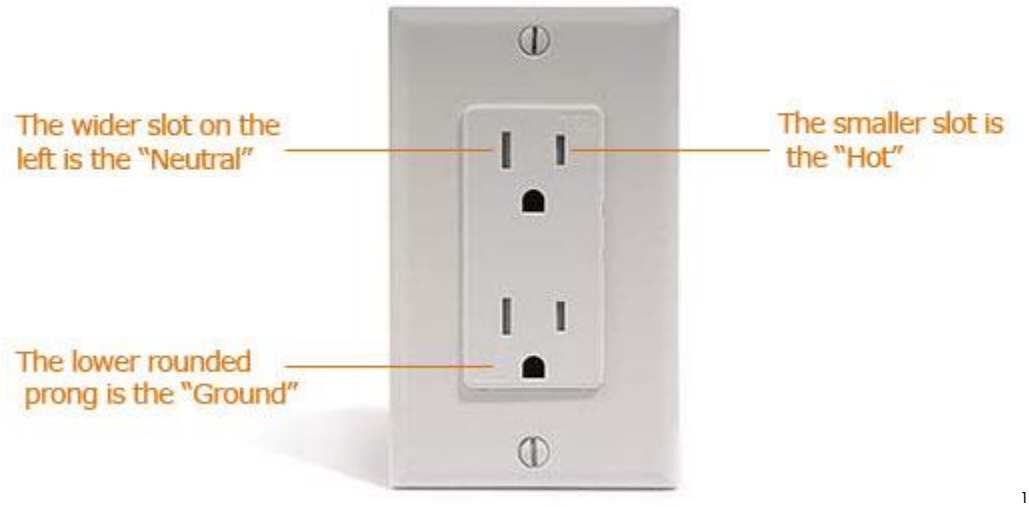
Three phase power is common in commercial/institutional settings because of the reduced wiring costs. Bowers has 3 phase power and we will tap into that for today's lab to construct a 4-wire ~12$V_{RMS}$ WYE three phase power supply.

### Equipment

- 3 10:1 step down transformers with hot wire labeled.
- 1 extension cord.
- 6 power diodes.
- 1 10kΩ resistor.

### Construct your power supply

You will be making a 4-wire ~12$V_{RMS}$ WYE three phase power supply using 3 transformers on three separate circuits. Splitting into groups, and use one of the corner lab stations (which are well situated for pulling power from 3 different circuits). Identify 3 outlets on different circuits labeled ( -1, -3, -5) or (-2, -4, -6). Each outlet has a hot, neutral, and ground connection:




[1]

Currently our transformers lack grounding plugs so you will have to use some care to properly plug your transformer into the outlet. Each transformer has a red dot on its plug and cover denoting which side should be hot (left side). Turn off each transformer and plug it in with the correct orientation. Use extension cords as needed to arrange the three transformers side-by-side.

[1] http://www.homemaintenancereminder.com/articles_openground.htm

Wire the neutrals of the transformers up in a WYE configuration using the right tap as neutral and the left as the hot wire. While the conventional color for neutral (see Table 1) is white, we have no white banana plug wires so use yellow instead as the next best thing.

*Table 1: conventional colors for 3 phase AC power.*

| Wire use | Conventional color |
|---|---|
| Phase A | Black |
| Phase B | Red |
| Phase C | Blue |
| Neutral | White |
| Ground | Green, bare, or green and yellow striped. |

You won't know in advance which transformer is producing $\phi_A$, $\phi_B$, or $\phi_C$.but you can simply pick one to be $\phi_A$ arbitrarily. Plug both ends of a black lead into that hot output (so you don't accidentally short anything) of the transformer you have selected to be $\phi_A$. To determine which of the remaining outputs is phases is $\phi_B$ and $\phi_c$ use the 4-channel oscilloscope. Connect the outputs of the three transformers to the 4-channel oscilloscope (and the ground of the leads to the neutral output). Turn on your transformers and get all three signals to appear clearly on the oscilloscope at the same time. By toggling the signals on and off determine a positive sequence for the transformer outputs ($\phi_A$ leads $\phi_B$ by 120° which leads $\phi_C$ by 120°). Arrange your transformers in a positive sequence, use the appropriate color test leads to label each phase (use both ends of the same color in at the hot terminal to guard against shorts), and record the order of the outlet labels in table 2.

## Construct your full bridge 3-phase rectifier

Use 6 power diodes (conventional current flows out of the double contact side) to assemble a 3-phase full bridge rectifier using your newly constructed power supply.

Use the 10kOhm resistor as your load for the DC output of your rectifier.

With a ground defeater in place on the oscilloscope, measure the voltage across the load and record it. Also record the peak-to-peak ripple amplitude. You may find a x10 probe to be useful.

Measure the neutral current and record it.

# Data sheet

*Table 2: Positive sequence three phase source.*

| Phase | Outlet label | Wire color |
|---|---|---|
| | | |
| | | |
| | | |

Rectifier output voltage (DC component):

Peak-to-peak ripple voltage.:

Ratio:

Neutral current (RMS value):