

# PLC124 LAB 1.2: WIRING A DUAL VOLTAGE TRANSFORMER FOR STEP-UP/DOWN CONFIGURATION

Student Name: \_\_\_\_\_

Student ID: \_\_\_\_\_

## LAB OUTCOMES:

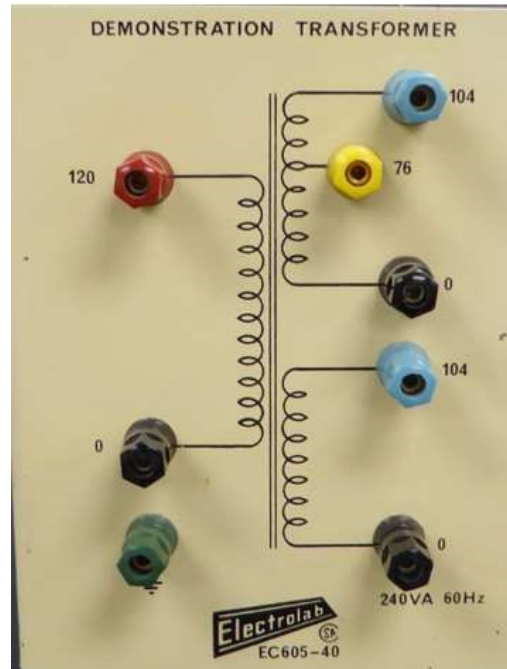
Upon completion of this lab procedure, the student should be able to:

1. Identify and explain all the windings and ratings on the demonstration transformer.
2. Measure the resistance of all the windings on the demonstration transformer.
3. Wire the demonstration transformer to step 120 VAC up to 208 VAC.
4. Wire the demonstration transformer to step the 120 VAC down to 104 VAC
5. Calculate the amount of current the transformer will be able to source.
6. Calculate the turns ratio of the demonstration transformer.

## LAB PROCESS:

Find a Machines Training Unit and an NSCC demonstration transformer. The Machines Training Unit can be used to get 120VAC and 208 VAC to power the transformer.

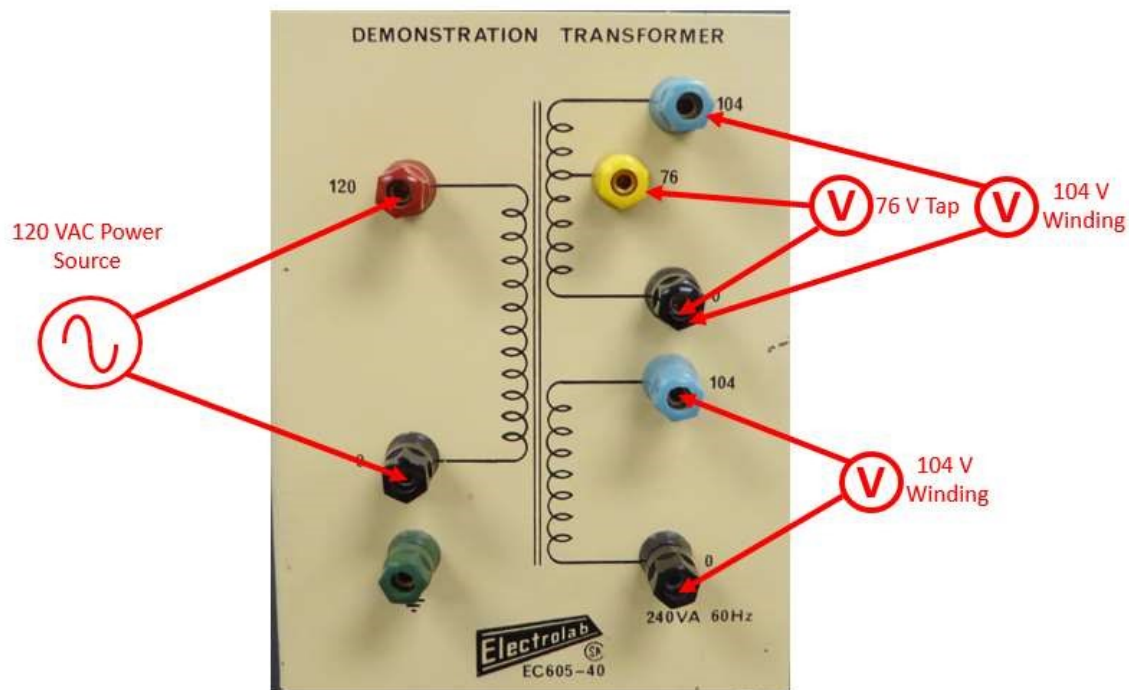
**Part 1:**



1. Review the transformer. Notice the equipment ground connector (green). This will be connected to the same grounding post on the Machines Training Unit.

The left side of the transformer is a 120 VAC winding (do not put 208V on this side). The right side of the transformer has two-104V windings, with the top winding having a 76V tap, to show the students how an extra lead can be brought out of the transformer to get different voltages.

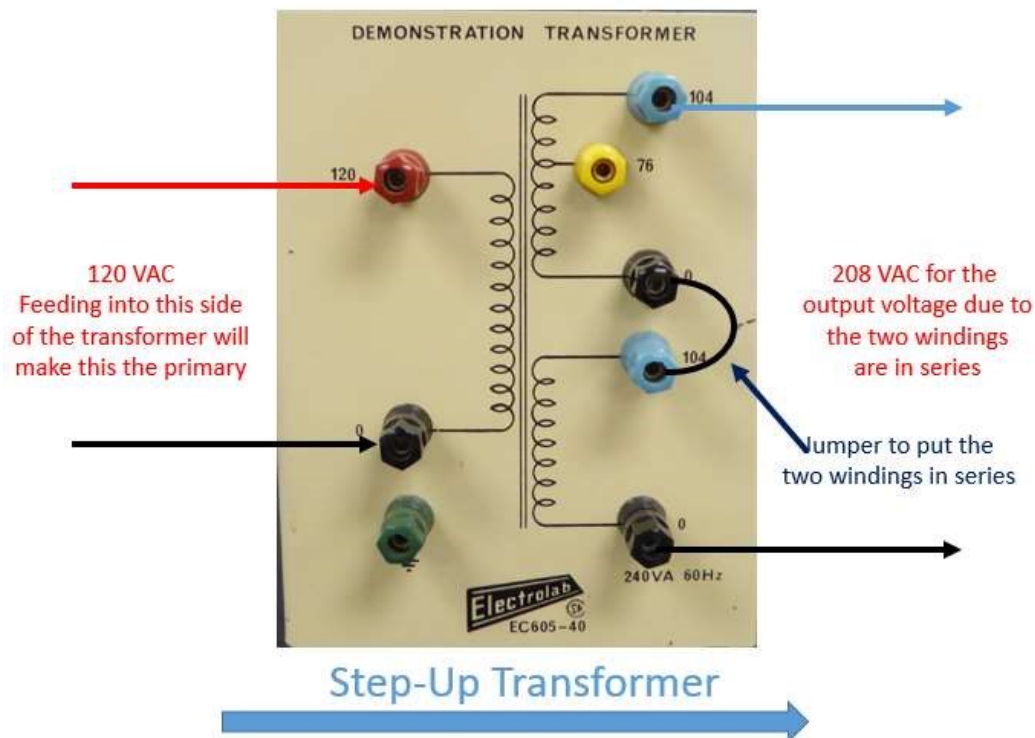
Realize that transformers work both ways, which means the user can bring power in from the right, or from the left. Also notice that the transformer is rated at 240VA (volt-amps), which is an indication of how much power it can handle. From this data, the user can also calculate what the current capability is. For example:  $240\text{VA}/120\text{V} = 2\text{A}$ , which means that the winding on the left can only handle 2 amps.



2. Find the 120VAC source on the Machines Training Unit, and apply it to the left side of the transformer, as shown in the above illustration.
3. Using the voltmeter, measure the incoming voltage to verify the value = \_\_\_\_\_
4. Using the voltmeter, measure the voltage across the bottom 104V winding = \_\_\_\_\_
5. Using the voltmeter, measure the voltage across the top 104V winding = \_\_\_\_\_
6. Using the voltmeter, measure the voltage across the 76 volt tap (measure from the black connector to the yellow connector) = \_\_\_\_\_

- Power down the Machines Training Unit, and verify the circuit is dead with the voltmeter.

**Part 2:**

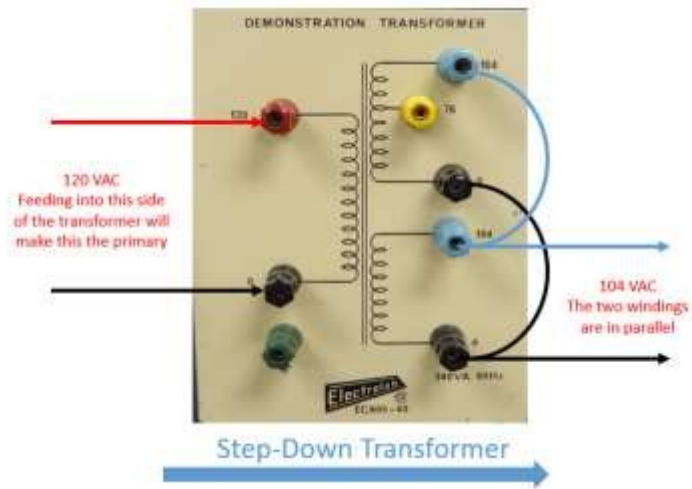


- Connect the two 104V windings in series, as shown in the above illustration. This should give the user a step up configuration (120V to 208V).
- Calculate the turns ratio. Secondary voltage divided by primary voltage, is equal to:  $208V / 120V = 1.73$ . So the turns ratio of the transformer is **1:1.73**.
- Apply the 120VAC to the left winding.

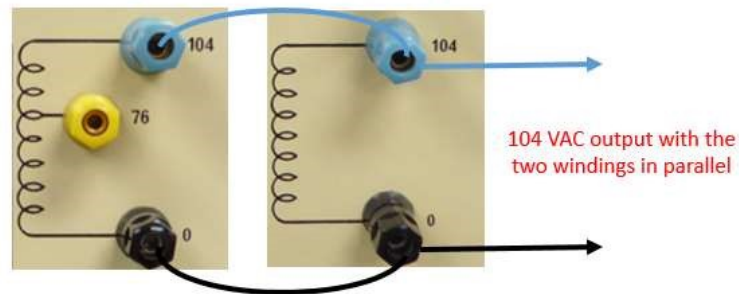
What is the voltage reading across the full secondary winding = \_\_\_\_\_?

- How much current could the secondary handle? \_\_\_\_\_. Take  $240VA/208V = 1.15A$ .
- Power down the Machines Training Unit, and verify the voltage is dead with the voltmeter.

**Part 3:**



Parallel windings drawn a different way to illustrate the connections

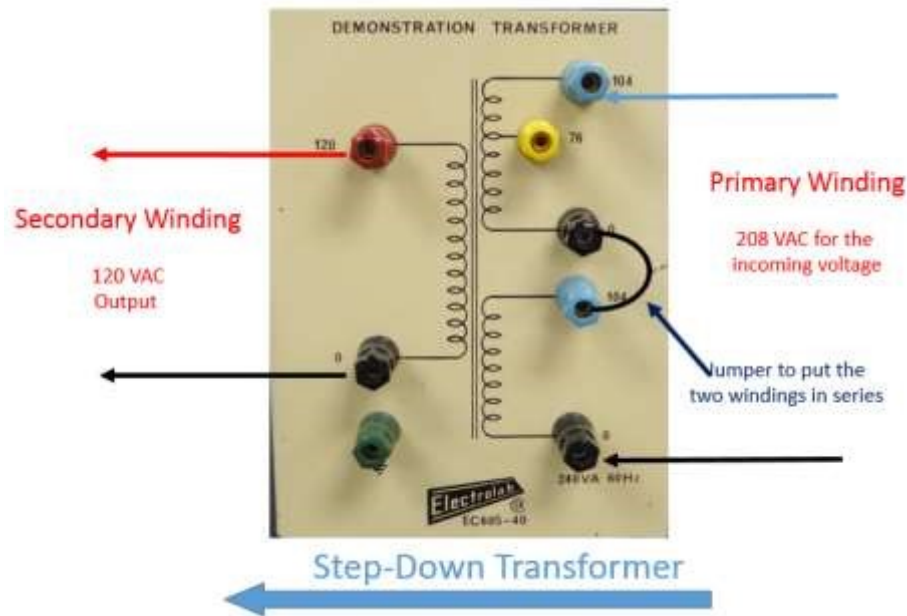


1. Connect the two 104V windings in parallel. Winding in parallel should give the user 104V output.

Power the unit to verify the output voltage = \_\_\_\_\_

2. Calculate the turns ratio of the transformer = output voltage / incoming voltage =  $104V / 120V = .87$ . So the turns ratio = **1:0.87** (or 1 to .87).
3. How much current can the right side handle? \_\_\_\_\_.  $240VA/104 = 2.3$  amps.
4. Power off the Machines Training Unit, and verify the voltage is dead with a voltmeter.

**Part 4:**



1. Verify the transformer works the other way. Connect the two 104V winding in series, then connect 208VAC from the Machines Training Unit to the right winding as shown in the above illustration.
2. Power the Machines Training Unit. Verify the incoming voltage = \_\_\_\_\_.
3. With the voltmeter, check the output voltage (left side) = \_\_\_\_\_
4. Power down the Machines Training Unit, and verify the voltage is dead with the voltmeter.
5. Disconnect all wires and put the demonstration transformer back on its storage shelf.

**Questions:**

1. Since the two 104V windings on the right side of the transformer are rated for 240VA when they are connected in series, what would be their individual VA rating if they would not be connected in series?

2. If there are no wires connected to the windings of the transformer, is there any continuity between the right and left side of the transformer?
  
3. What determines which side of the transformer is the primary winding, and which side of the transformer is the secondary side of the winding?
  
4. What could be wrong if in step 5 of this lab, 208V was applied to the right side of the transformer, but the user measured 0VAC on the left side?

*The outcomes of this exercise (listed on page 1) specifies the skills that the Student must demonstrate to the Instructor. Once the Instructor is satisfied with the demonstration of Knowledge & Skills by the individual student, they will sign this document (for the student), then enter a 100% into the Hands-On Lab grade in Sakai.*

I verify that this student has completed all of the requirements of this Hands-On Assessment:

Student Name: \_\_\_\_\_

Faculty Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**DOL DISCLAIMER:**

This product was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The product was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership.



This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).