

PLC121 LAB 3.2: WIRING A 3 WIRE CONTROL CIRCUIT

Student Name: _____

Student ID: _____

LAB OUTCOMES:

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

1. Connect a pilot light directly to the DC source to show current flow.
2. Connect a DC motor directly to a DC source to show operation.
3. Measure the voltage across a powered load using a DMM.
4. Connect a circuit with a buzzer and knife switch.
5. Measure the voltage across a buzzer coil using a DMM.

LAB PROCESS:

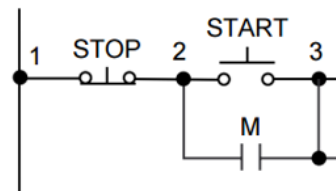
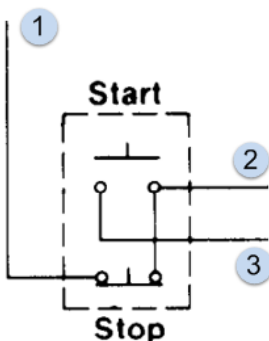
Open the AC/DC Training Unit. Setup the unit on its base, or lay flat on the work table.

Make sure all fault switches are in the 0 position.

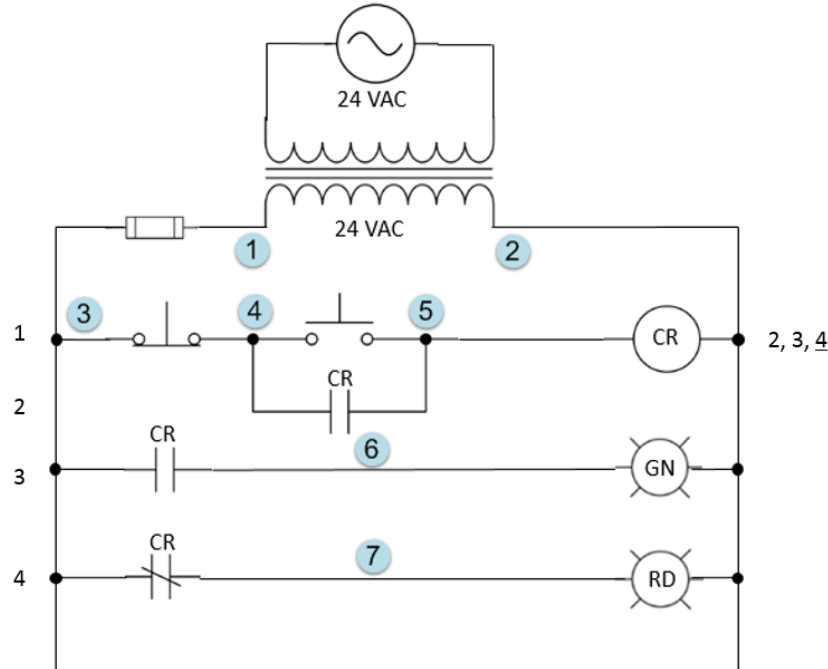
Connect the power cord and turn off the power input switch to make sure the unit is not powered.

Part 1

The term 3-wire control is used quite a lot in control circuits and in VFD (variable frequency drive) wiring circuits. The term stems from the fact that when a maintenance person is wiring in a pushbutton (start/stop) station, there will be 3 wires ran to the pushbutton station (not counting the green grounding wire). The above illustration shows a pushbutton station in the left image, a wiring diagram in the middle image, and the ladder diagram in the right most image. The 3-wire circuit also means that there will be a hold-in contact wired in parallel with the start button.



Wire the following circuit on the AC/DC training system.



1. Power on the “Power Input” switch (lower right) to power the training unit.
2. Make sure the CR is not yet energized.

What voltage is measured between nodes 1 & 2? _____

What voltage is measured between nodes 4 & 2? _____

What voltage is measured between nodes 5 & 2? _____

What voltage is measured between nodes 6 & 2? _____

What voltage is measured between nodes 7 & 2? _____

3. Momentarily press the start button to energize the control relay.

Does the relay stay energized when the start button is released?

What voltage is measured between nodes 1 & 2? _____

What voltage is measured between nodes 4 & 2? _____

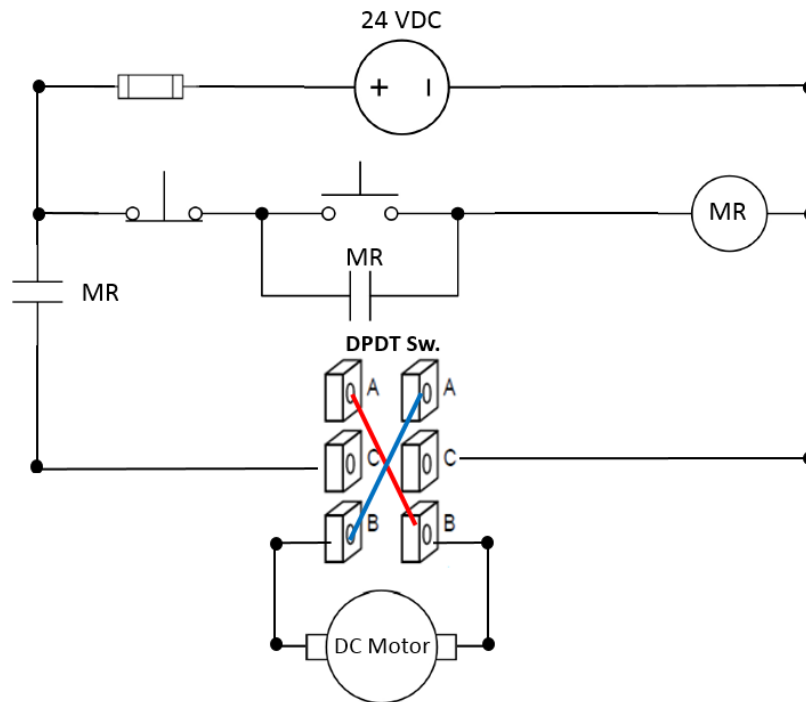
What voltage is measured between nodes 5 & 2? _____

What voltage is measured between nodes 6 & 2? _____

What voltage is measured between nodes 7 & 2? _____

Part 2

Wire the following circuit on the AC/DC training system.



A common application of a relay on any industrial machine is for safety. In this circuit the relay is termed a master relay (MR). When it is energized, it will allow power to flow in the rest of the circuit. When the stop button is pushed, it will disable power to the rest of the circuit.

1. Power on the "Power Input" switch (lower right) to power the training unit.
2. Flip the DPDT switch to the up position.
3. Press the start (N.O.) pushbutton, and release. Does the DC Motor start running?

Does the relay remain energized when the start pushbutton is released?

Explain why!

4. Press the stop (N.C.) pushbutton, and release. Does the relay shut off?

5. Press the start (N.O.) pushbutton to start the DC Motor.
6. Flip the DPDT switch to the down position.

What happens with the motor?

7. Trace the current paths from the DC power source to the DC Motor, based on when the switch is in the up position, and when it is in the down position.

Questions

1. In the Part 2 circuit, what is the purpose of the MR relay?
2. In the Part 2 circuit, what is the purpose of the DPDT switch?
3. In the Part 2 circuit, explain why a N.O. contact is wired in parallel with the start pushbutton.
4. In the Part 1 circuit, if the relay is de-energized, and none of the pushbuttons are actuated, what voltage will be between the following electrical nodes?
 - a. 1 & 2:
 - b. 3 & 2:
 - c. 6 & 2:
 - d. 7 & 2:
5. In the Part 1 circuit, if the relay is energized, and none of the pushbuttons are actuated, what voltage will be between the following electrical nodes?

- a. 1 & 2:
- b. 3 & 2:
- c. 6 & 2:
- d. 7 & 2:

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/).