Northwest State Community College  
Course Information Sheet

# Course Information

Title: Industrial Electricity 2C

Course Number: PLC 125

Credit Hours: 1

Pre-requisite: PLC124

# Description

The purpose of PLC 125 is to develop the student’s knowledge and skills in the area of electrical safety, DC/AC machines, and basic control circuits. The electrical safety module will focus on lockout/tagout, arc-flash standards, PPE, electrical panels, and overcurrent protection. The DC/AC machines will focus on the wiring and troubleshooting of DC shunt motors, single phase motors (split-phase, capacitor-start, and permanent capacitor), dual voltage transformers, and three phase motors. The basic control circuits will consist of start/stop/jog, dual start/stop, sequence circuits, and reversing circuits. There will also be a module focused on the installation of a PLC system (based on the Micrologix 1200 PLC). Students will learn how to utilize test equipment and electrical prints to troubleshoot electrical systems.

# Learning Outcomes

Upon completion of this course the students will be able to:

1. Install forward/reversing motor control circuits
2. Troubleshoot forward/reversing motor control circuits
3. Install solid state discrete sensors (proximity & photo-electric)
4. Troubleshoot solid state discrete sensors (proximity & photo-electric)
5. Install electrical control circuits
6. Install a PLC hardware I/O installation
7. Troubleshoot a PLC hardware I/O installation

# Required Material

**Text:**

Electrical Motor Controls (For Integrated Systems), 5th Edition, by Gary Rockis & Glen Mazur.   
ISBN: 978-0-8269-1226-8

Ugly’s Electrical References, 2020 Edition.  
ISBN: 978-1284194531

**Supplies:**

Calculator

Safety Eyewear

Wire Strippers

Wiring Kit

# Module 1 - Control Circuits II (Sequence Control Circuit, On/Off Delay Programmable Timers)

Module 1 will introduce the students to discrete time delay type of functions, focusing on the operation of on and off delay timing devices used in industrial control circuits.  Students will also learn the basic JIC symbols for discrete sensing devices for pressure, level, flow and temperature, as well other discrete control devices used in an electrical circuit and represented on an electrical print.

Upon completion of this module the student will be able to:

1. Explain the operation and purpose of on-delay and off-delay timers
2. Interpret the Manufacturer’s data for the AB 700-HR timer module
3. Wire and troubleshoot an on-delay timer motor control circuit
4. Wire and troubleshoot an off-delay timer motor control circuit
5. Wire and troubleshoot a cycle timer within a motor control circuit
6. Wire and troubleshoot a sequence control, motor control circuit
7. Predict the operation of an electrical circuit, based on an electrical print

### Module 1 Activities

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 Read Electrical Motor Controls, pages 347-358 - Timing and Counting Functions

Text Book

 Review cut sheet: Plug-in Timing Relays

<https://configurator.rockwellautomation.com/api/Product/700-HR52TA17/cutsheet>

 Complete Quiz 125-1

See Quiz INT125-1 Content Packaging files to upload into an LMS System

 Review Hands-on Lab 125-1.1, Lab 125-1.2 and Lab 125-1.3

See Lab Documents

 Schedule and complete Hands-on Lab 125-1.1

See INT125 1.1 Lab Document

 Schedule and complete Hands-on Lab 125-1.2

See INT125 1.2 Lab Document

 Schedule and complete Hands-on Lab 125-1.3

See INT125 1.3 Lab Document

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# Module 2 - Control Circuits III (Reversing Circuits, Proximity and Photoelectric Switches)

Module 2 will introduce the students to motor reversing control and power circuits.  Students will learn how to wire and IEC reversing motor starter control circuit, and how the power circuit will be used to reverse the leads going to an AC three phase motor to safely reverse the direction of rotation of the motor.  Students will also be introduced to proximity and photo-electric switches, and how they are used in industrial control circuits to sense occurrences on an industrial machine.  Students will learn how to interpret the manufacturers cut sheets on these devices and how to wire them into a control circuit.

Upon completion of this module the student will be able to:

1. Identify and explain all contacts and coils on an IEC reversing starter
2. Wire and troubleshoot an IEC reversing motor starter control circuit
3. Interpret electrical prints with motor reversing power and control circuits
4. Interpret the manufacturer’s cut sheets for 2, 3 and 4 wire proximity switches
5. Wire in a proximity switch into an electrical circuit
6. Troubleshoot a proximity switch in a live electrical circuit
7. Interpret the industrial wiring prints for the proximity switch installation
8. Interpret the manufacturer’s cut sheets for multiple photo-electric switches
9. Wire in a photo-electric switch into an electrical circuit
10. Troubleshoot a photo-electric switch in a live electrical circuit

### Module 2 Activities

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 Read Electrical Motor Controls, pages 23-337 - Reversing Motors

Text Book

 Read Electrical Motor Controls, pages 453-454 - Semiconductor Input Devices, Proximity Sensors

Text Book

 Read Electrical Motor Controls, pages 501-519 - Photoelectric, Semiconductors and Light-Based Applications, Photoelectric Devices

Text Book

 Read article: Proximity Sensors Compared: Inductive, Capacitive, Photoelectric, and Ultrasonic

<https://www.softnoze.com/downloads/proximity-sensors-compared-inductive-capacitive-photoelectric-and-ultrasonic-softnoze.pdf>

 Review cut sheet: AB Reversing Contactor (Starter w/o OL)

<https://literature.rockwellautomation.com/idc/groups/literature/documents/td/100-td013_-en-p.pdf>

 Review cut sheet: AB Photo-Electric Switch

<https://literature.rockwellautomation.com/idc/groups/literature/documents/in/9000-in002_-en-p.pdf>

 Review cut sheet: AB Proximity Switch

<https://literature.rockwellautomation.com/idc/groups/literature/documents/td/prox-td001_-en-p.pdf>

 Complete Quiz 125-2

See Quiz INT125-2 Content Packaging files to upload into an LMS System

 Review Hands-on Lab 125-2.1, Lab 125-2.2 and Lab 125-2.3

See Lab Documents

 Schedule and complete Hands-on Lab 125-2.1

See INT125 2.1 Lab Document

 Schedule and complete Hands-on Lab 125-2.2

See INT125 2.2 Lab Document

 Schedule and complete Hands-on Lab 125-2.3

See INT125 2.3 Lab Document

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# Module 3 - Wiring & Troubleshooting a PLC Installation (Allen Bradley MicroLogix 1200)

Module 3 will introduce the students to the basic wiring and troubleshooting of a Programmable Logic Controller (PLC) system used on an industrial machine.  Students will wire 4 discrete inputs and 3 discrete outputs into an Allen Bradley Micrologix 1200 based system.  The intent is to have student learn how signals flow in a PLC system and develop their hardware troubleshooting skills.  PLC processor diagnostic indicators and discrete input/output status indicators will also be discussed.  Interpreting and troubleshooting electrical prints with a PLC installation will be a critical part of this module.

Upon completion of this module the student will be able to:

1. Explain the function of the major parts of a PLC system
2. Interpret an electrical print with the PLC wiring diagram
3. Interpret the wiring cut sheets from the PLC manufacturer
4. Explain what turns on/off the I/O indicator lights on a PLC system
5. Wire 4 discrete inputs and 3 discrete outputs into the PLC system
6. Test all wiring connections with PLC I/O indicators
7. Explain the operation of the program in the PLC
8. Explain how to determine if the PLC is in the Run mode

### Module 3 Activities

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 Review PowerPoint: Basic PLC Operation (Tom Wiley Powerpoint)

See attached PowerPoint presentation

 Review MicroLogix 1200 Programmable Controllers Installation Instructions

<https://literature.rockwellautomation.com/idc/groups/literature/documents/um/1762-um001_-en-p.pdf>

 Complete Quiz 125-3

See Quiz INT125-3 Content Packaging files to upload into an LMS System

 Review Hands-on Lab 125-3.1, and Lab 125-3.2

See Lab Documents

 Schedule and complete Hands-on Lab 125-3.1

See INT125 3.1 Lab Document

 Schedule and complete Hands-on Lab 125-3.2

See INT125 3.2 Lab Document

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