PLC 1 & 2 Course Overview

Data obtained from local employers show that their organizations have combination of legacy controllers (PLCs - Programmable Logic Controllers) and modern controllers (PACs - Programmable Automation Controllers), thus this course will be reflective of a local industry teaching both legacy controllers (AB MicroLogix, AB SLC-500 & PLC-5) and modern controllers (AB CompactLogix). More advanced PLC courses will be based on CompactLogix and ControlLogix platforms (including safety versions of the same platforms). As these legacy controllers are replaced with more modern controllers within the local industries, the curriculum at Terra State will evolve to align to the needs of the local employers.

EET2440-PLC 1 Topics:

Module 1: Basic PLC Operation and Communications: Topics and Activities:

1. Basic operation of a PLC system **(Ch 1 Maintainer)**
2. Explain a bit, byte, and a word in a PLC system
3. Identify the different PLCs used in the course (ML, SLC-500, PLC-5, CompactLogix)
4. Explain the addressing of each PLC used in this course.
5. Identify the processor, power supply, discrete input and output modules, and analog I/O module on each PLC used in the course **(Ch 2 Maintainer)**
6. Identify and explain the different communication ports on the different PLCs, and connecting cables
7. Identify what driver you need to communicate to the various ports in RSLinx.
8. Identify the RS-232 and Ethernet ports on the computer, and Ethernet connectivity to the switch
9. Interpret the diagnostic indicators on each processor and I/O modules used in this course
10. Set up an RSLinx RS-232 driver to communicate from computer to ML and SLC-500
11. Create an Ethernet driver in RSLinx to connect to the ControlLogix Gateway
12. Explain the purpose and configuration of the ControlLogix Gateway. **(Ch 5 Maintainer)**

Module 2: AB SLC-500 and RSLogix500 Basics: Topics and Activities:

a. **Explain the steps to create a new project in Rslogix500 software**
b. **How to configure your rack**
c. **How to control the read I/O config**
d. **What happens if you project configuration does not match your actual rack configuration?**

1. Create a new project in RSLogix500, and download to the processor
2. Go online to the processor and change the mode of the processor (run or program)
3. Explain the operation of the basic relay instructions (ote, xio, xic, otl, otu)
4. Identify how to look up the plc instructions in the help files.
5. Interpret and explain the I/O addressing of the MicroLogix and SLC-500 systems
6. Toggle the instruction descriptions and symbols on/off in RSLogix500
7. Create a profile on Rockwell Automation for access to the knowledge base
8. Setup the Emulator in the Virtual Machine and run the same program as done with hardware in the PLC lab

9. Download a manual for an I/O module and explain how to wire it.
10. Use RSLogix500 to do basic program functions (Download, go online, go offline, upload)

Module 3: AB SLC-500 Timer, Counter & Compare? Instructions: Topics and Activities:

1. Interpret the operation of the AB timer instructions, and their status bits-***Lab 3.1 & 3.2***
2. Interpret the operation of the AB counter instruction, and their status bits-***Lab 3.3***
3. Interpret the operation of the reset command (res)
4. Create PLC programs with timer & counter instructions and load into the PLC processor ***-Lab 3.4***
5. Print a project ladder file to a pdf file for viewing. ***-Lab 3.4***
6. Explain use of subroutines and how to create them **- *fka Lab 11-MCR, JMP, LBL, JSR, AFI, ONS***
   a. ONS, OSR, OSF and some commands are different and only reside in certain PLC's
7. Create multiple subroutines to logically control a process **- *fka Lab 11-***↑
8. Navigate through the RSLogix500 project (ID Application Components and Navigation) with search cross reference commands**- *fka Lab 11-***↑
9. Explain to the instructor how a PLC program operates that contains timers, counters and relay instructions

Module 4: AB PLC-5 and RSLogix5 Basics : Topics and Activities:

Indirect/Index Addressing? - *FKA Lab 12*

(This module satisfies the Ohio CTag requirement for University Transfer of this course)

1. Hardware basics on the AB PLC-5 system
2. I/O addressing in a PLC-5 system ***(L1 1&2 Slot Addressing-CTag)***
3. Purpose of DIP switches on the chassis and processor
4. Processor diagnostic indicators
5. Using RSLogix5 programming software with RSLinx to go Online with a PLC-5
6. Create a project in RSLogix5, with a Sequencer Output instruction to control the outputs on an PLC-5 hardware simulator ***(L2 Timer & LED Display-CTag), (L3 MUX BTR/BTW-CTag)***
7. Configure the Mask word in the Sequencer Output instruction ***(L4 Sequencer File-CTag)***
8. Load the file Integer file with data for the status of the output in the sequence
9. Create a PDF report of the ladder program and the cross reference report.
10. Explain the purpose of a block transfer instruction on a PLC-5 system

Module 5: AB CompactLogix, ControlLogix and Studio5000 Basics: Topics and Activities:

1. Hardware basics on the AB CompactLogix
2. Power supply requirements and placement CompactLogics Only, could include Point I/O rack requirements. The power supply placement only deals with certain CompactLogics processors not all - ***(is this relevant to CompactLogix AND ControlLogix?)***
3. Processor diagnostic indicators
4. Identify and explain all communication ports on the CompactLogix processor
5. I/O tags (addressing) on the CompactLogix, Alias tags, base tags, controller tags, program tags, user defined tags **(Ch 8 Maintainer)**

5a. Create a user defined tag and explain how it works. **echoed this too, but in PLC 2!**

6. Create a new project in Studio5000, by configuring the I/O, and creating alias and base tags in the Controller Tags settings.
6a. tasks, continuous, event driven, periotic and how you can have multiple programs running in a PLC at the same time. How then a program tag is more efficient than a controller tag and why use each.
7. Explain the difference between controller tags and program tags **(Ch 9 Maintainer)**
8. Create a 4 rung program in a new project with the relay and timer instructions, using Studio5000
9. Use Studio5000 to do basic program functions (Download, go online, go offline, upload) **(Ch 4 Maintainer, Ch 6 Maintainer)**

Module 6: AB CompactLogix: Data Types, Timer & Counter Instructions: Topics and Activities:
1. Explain the difference between timer and counter data types, as well as Integer, Signed Integer and Double Integer, Real, and Sint's
2. Interpret the operation of the AB timer instruction, and their status bits on a CompactLogix system
3. Interpret the operation of the AB counter instruction, and their status bits on a CompactLogix system
4. Create PLC programs with timer & counter instructions and load into the PLC processor
5. Navigate through the Studio5000 project (ID Application Components and Navigation) with search cross reference commands **(Ch 3 Maintainer)**
6. Explain to the instructor how a PLC program operates that contains timers, counters and relay instructions
7. Print a project ladder file to a pdf file for viewing. **(Ch 10 Maintainer)**
8. Explain the differences in timers TON, TOF, RTO, and reset instructions
9. Explain the differences in timers between the legacy PLC's and the Control/Compact Logics PLC's

Module 7: Allen Bradley Compare and Move Instructions: Topics and Activities:
1. Interpret the operation of the AB basic compare instructions (LES, GRT, EQU, LEQ, GEQ, NEQ)
2. Interpret the operation of the AB limit test instruction (LIM), including circular & non-circular
3. Interpret the operation of the AB MOV and MVM instruction, with students setting up masking data
4. Interpret the hardware electrical prints of an MicroLogix 1000 system
4a. Interpret the hardware electrical prints of an AB SLC-500 based system
4b. Interpret the hardware electrical prints of an AB PLC-5 based system
4c. Interpret the hardware electrical prints of an AB ControlLogix based system
4c. Interpret the hardware electrical prints of an AB CompactLogix based system
5. Predict the operation of a program that includes compare, Limit, and move instructions
6. Create PLC programs using compare and limit instructions and load into the PLC processor
7. Explain to the instructor how a PLC program operates that contains compare and limit instructions

Module 8: PLC Troubleshooting & Maintenance: Topics and Activities:
1. Recover from a hardware fault on a legacy or modern type of controller
2. Find and interpret the error causing the fault
3. Manipulate I/O with force commands (On, Off, Remove), as well as interpreting the Force indicator light **(Ch 13 Maintainer)**
4. Modify a ladder program while online to a legacy or modern controller (online programming)
5. Modify a ladder program while online to a Control/Compact Logic processor

6. Utilize search commands to find instructions throughout a large PLC program
7. Troubleshoot a PLC system with an injected fault, using the software and hardware print
8. Replace a faulty I/O module on a PLC system
9. Replace a faulty processor on a PLC based system
10. Finding an output light on a PLC system based on addressing and electrical print

(Ch 14 digital Troubleshooting Maintainer)
(Ch 15 analog Troubleshooting Maintainer)
(Ch 16 Controller Troubleshooting Maintainer)

***EET2790-PLC 2 Topics*:**

Module 1: Basic PLC Operation and Communications: Topics and Activities:

1. ControlLogix/CompactLogix Comparison Instructions (covered in PLC 1 but can review)
2. ControlLogix/CompactLogix Move/Logical Instructions (covered in PLC 1 but can review)
3. ControlLogix/CompactLogix File/Misc. Instructions (FIFO Load/Unload, FAL, masked moves, etc.…)
4. ControlLogix/CompactLogix Types of Data Tags.
5. Add on instructions and the purpose and use of them. **echoed this too!**
6. How to call an add on instruction.

Module 2: Compact/ControlLogix Tasks, Programs, Routines and Analog Modules:

1. ControlLogix/CompactLogix Project Structure, Tasks , Programs & Routines (expand more on the type of tasks, the number of tasks you can have, etc.…)
2. Organizing Arrays in a Logix Designer Project
3. Creating a Continuous Task in a Logix designer Project
4. Creating a Periodic Task in a Logix designer Project
5. Creating an Event Task in a Logix designer Project
6. Creating a User-Defined Data Type in a Logix Designer Project
7. ControlLogix/CompactLogix Searching and Documentation
8. ControlLogix/CompactLogix Analog Modules

Module 3: ControlLogix Local and Remote Communications:

1. Configuring ControlLogix/CompactLogix Communications with Ethernet (Messaging & Remote I/O) Configuring a Logix5000 Message?
2. Configuring Logix5000 Controllers to communicate to remote devices and drives.
3. Configuring ControlLogix/CompactLogix Communications with Ethernet (Producer/Consumer Tags)
4. Retrieving and Setting Logix5000 Controller Status Values with GSV/SSV Instructions
5. DeviceNet?? (probably not unless we get the deviceNet software for configuring)
6. Configuring a trend and data logging in Logix5000.

Module 4: Controlling Systems with ControlLogix

1. ControlLogix/CompactLogix Tags & Communication with Fanuc Robot
2. ControlLogix/CompactLogix Tags & Communication with PowerFlex Drives (525 & 700 series)
3. ControlLogix/CompactLogix Tags & Communication with a Panelview

Making sure students know how and where to get (correct/safe) EDS files from and how to install them. Both of these should probably be PLC 2-Here, or Module 8?

4. Setting up alarms in Logix5000 and how to pass them over to an HMI.

Module 5: Programming ControlLogix with Alternative Languages

1. Programming with Function Blocks
2. Programming with Structured Text
3. Programming with Sequential Function Charts

Module 6: Safety environments, Safety Relays and Safety Controllers:

1. Safety standards (SIL 1-4)
2. Safety relays
3. Safety controllers
4. Force guided relays

Module 7: Programming Safety PLCs (Guard Logix & Guard CompactLogix):

1. Safety PLC versus Standard PLC
2. Redundancy
3. Communication channels
4. Configuring of safety inputs and outputs in Logix5000.

Module 8: Maintaining & Troubleshooting ControlLogix Systems: Topics and Activities:

1. ControlFlash to upgrade firmware (is this relevant to SLC500/PLC5? Not relevant) on PLC5 or SLC500 and reset to factory defaults **(Ch 7 Maintainer)**
2. ControlFlash to upgrade firmware on PLC modules and reset to factory defaults.
3. Electronic Keying in Logix5000, the purpose of it and cause and effect of different keying options.
4. Troubleshoot PLC Faults and communications errors.
5. Troubleshooting modules that are not working or communicating with the PLC
6. Procedures for replacing a PLC card that has faulted.

FYI-EET2790 PLC II-Current Labs-relevant/useful to implement into PLCI or PLC II?

L1-PLC5 Analog I/O
L2-SLC500 Temp Module
L3-SLC500 Analog I/O

L4-CLX5000 Analog I/O
L5-PLC5 PID Temp Control
L6-CLX5000 Ethernet Network/Message
L7-SLC500 BSL-Last used 2020
L8-SLC500 BSR-Last used 2020
L9-SLC500 FIFO-Last used 2020
L10-SLC500LIFO-Last used 2020
L11-CLX5000 Motion Control/Servo
L12-CLX5000 FBD & ST

EET1200-Electrical Troubleshooting (fka Electrical Codes & Prints) Topics:

Module 1: Troubleshooting Electrical Circuits I (AC/DC Trainers): Topics:
1. Blah, Blah, Blah

Module 2: Troubleshooting Electrical Circuits II (AC/DC Trainers): Topics:
: Topics and Activities:
1. Blah, Blah, Blah

Module 3: Pneumatic Symbols and Circuits: Topics:
1. Blah, Blah, Blah

Module 4: Pneumatic Circuits Controlled by Electrical/PLC Circuits: Topics:
1. Blah, Blah, Blah

Module 5: PLC Operation and Troubleshooting: Topics:
1. Blah, Blah, Blah

Module 6: Human Machine Interfaces: Topics:
1. Blah, Blah, Blah

Module 7: Variable Frequency Drives: Operation and Troubleshooting: Topics:
1. Blah, Blah, Blah

Module 8: Robotics Troubleshooting: Topics:
1. Blah, Blah, Blah