

Western Technical College

10620152 Advanced PLC Programming

Course Outcome Summary

Course Information

Description	Hardware and software found in advanced Programmable Logic Controllers are presented. Students will be utilize tag based programming and will apply it in ladder logic and other programmable languages. A touchscreen will be programed and integrated into the control system and utilized as a HMI.
Career Cluster	Manufacturing
Instructional Level	Associate Degree Courses
Total Credits	3.00
Total Hours	90.00

Types of Instruction

Instruction Type	Credits/Hours
Lecture	1 CR / 18 HR
Lab	2 CR / 72 HR

Course History

Last Approval Date	9/8/2015
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Pre/Corequisites

Prerequisite	10620158 PLC Applications
Pre/Corequisite	10804114 College Technical Math 1B

Textbooks

Quick Start to Programming Alternative ControlLogix Languages. Copyright 2012. Stenerson, Jon. Publisher: Cengage Learning. **ISBN-13:**978-1-111-30971-8. Required.

Learner Supplies

Safety glasses with side eye protection that meet Z87 OSHA guidelines. **Vendor:** Campus Shop. Required.
Scientific calculator (recommend T1-36x Solar). **Vendor:** Campus Shop. Required.

Core Abilities

- 1. Apply mathematical concepts.**
Status Active
- 2. Demonstrate ability to think critically.**
Status Active
- 3. Transfer social and natural science theories into practical applications.**
Status Active
- 4. Use effective communication skills.**
Status Active
- 5. Use technology effectively.**
Status Active

Program Outcomes

- 1. Perform work safely**
Type TSA Status WIP

Criteria

- 1.1. Follow Lock-out Tag-out safety procedures and practices to ensure proper start-up and shutdown of equipment
- 1.2. Follow Personal Protective Equipment requirement
- 1.3. Follow established safety policies and practices (e.g. OSHA, site specific)

- 2. Troubleshoot electrical and mechanical systems and devices**
Type TSA Status WIP

Criteria

- 2.1. Verify proper operation or problem
- 2.2. Identify the cause of the problem: mechanical, electrical
- 2.3. Determine corrective action
- 2.4. Utilize appropriate test equipment

- 3. Repair electrical and mechanical systems**
Type TSA Status WIP

Criteria

- 3.1. Utilize tools appropriate to the electromechanical field
- 3.2. Select replacement components
- 3.3. Configure replacement components
- 3.4. Install replacement components
- 3.5. Validate system performance

- 4. Communicate Technical Information**
Type TSA Status WIP

Criteria

- 4.1. Interpret documentation of electro-mechanical devices and systems
- 4.2. Use field specific technical terminology in speaking and writing
- 4.3. Create electro-mechanical diagrams

- 4.4. Document problems and solutions
- 4.5. Interpret electro-mechanical diagrams

5. Integrate electrical and mechanical systems and devices

Type *TSA* *Status* *WIP*

Criteria

- 5.1. Identify required communication protocols
- 5.2. Configure electronic equipment for data communication compatibility
- 5.3. Configure sensors, controls and actuators for system compatibility
- 5.4. Install required communications infrastructure
- 5.5. Verify communications between systems and devices

Course Competencies

1. Investigate tag based software.

Domain *Cognitive* *Level* *Analyzing* *Status* *Active*

Linked Core Abilities

Demonstrate ability to think critically.
Use effective communication skills.

Linked Program Outcomes

Perform work safely
Communicate Technical Information

Assessment Strategies

- 1.1. Written objective test
- 1.2. Skill demonstration
- 1.3. Written product

Criteria

Performance will meet expectations when:

- 1.1. you complete the written objective test and the performance demonstration at or above 70%.
- 1.2. you attend class regularly
- 1.3. you arrive for class on time
- 1.4. written product follows prescribed format, meeting criteria for all components

Learning Objectives

- 1.a. Compare tag based and address based software.
- 1.b. Identify types and manufacturers of tag based software.
- 1.c. Investigate RSLogixs 5000 software.
- 1.d. Investigate added capability options.
- 1.e. Investigate necessary configurations to utilize tag based software.

2. Investigate basic elements of a tag based system.

Domain *Cognitive* *Level* *Analyzing* *Status* *Active*

Linked Core Abilities

Demonstrate ability to think critically.
Use effective communication skills.

Linked Program Outcomes

Perform work safely
Communicate Technical Information

Assessment Strategies

- 2.1. Written objective test
- 2.2. Skill demonstration
- 2.3. Written product

Criteria

Performance will meet expectations when:

- 2.1. you complete the written objective test and the performance demonstration at or above 70%.
- 2.2. you attend class regularly
- 2.3. you arrive for class on time
- 2.4. written product follows prescribed format, meeting criteria for all components

Learning Objectives

- 2.a. Investigate project options.
- 2.b. Investigate tag creation.
- 2.c. Investigate task options.
- 2.d. Investigate program types.
- 2.e. Investigate the function of routines.

3. Program basic elements of tag based system.

Domain Psychomotor Level Practicing Status Active

Linked Core Abilities

Apply mathematical concepts.
Transfer social and natural science theories into practical applications.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Troubleshoot electrical and mechanical systems and devices
Repair electrical and mechanical systems
Communicate Technical Information
Integrate electrical and mechanical systems and devices

Assessment Strategies

- 3.1. Written objective test
- 3.2. Skill demonstration
- 3.3. Written product

Criteria

Performance will meet expectations when:

- 3.1. you complete the written objective test and the performance demonstration at or above 70%.
- 3.2. you attend class regularly
- 3.3. you arrive for class on time
- 3.4. you select the correct tools, equipment, instruments, materials, supplies
- 3.5. you perform all critical steps in the right order
- 3.6. you follow safety procedures
- 3.7. you wear personal protective equipment
- 3.8. written product follows prescribed format, meeting criteria for all components

Learning Objectives

- 3.a. Create a project.
- 3.b. Create tags needed for programming.
- 3.c. Select tasks needed for the project.
- 3.d. Create applicable programs.
- 3.e. Create routines for the programs.
- 3.f. Troubleshoot operation of basic elements.
- 3.g. Fix any problems identified.

4. Program in Ladder Logic.

Domain Psychomotor Level Practicing Status Active

Linked Core Abilities

Apply mathematical concepts.
Transfer social and natural science theories into practical applications.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Troubleshoot electrical and mechanical systems and devices
Repair electrical and mechanical systems
Communicate Technical Information
Integrate electrical and mechanical systems and devices

Assessment Strategies

- 4.1. Written objective test
- 4.2. Skill demonstration
- 4.3. Written product

Criteria

Performance will meet expectations when:

- 4.1. you complete the written objective test and the performance demonstration at or above 70%.
- 4.2. you attend class regularly
- 4.3. you arrive for class on time
- 4.4. you select the correct tools, equipment, instruments, materials, supplies
- 4.5. you perform all critical steps in the right order
- 4.6. you follow safety procedures
- 4.7. you wear personal protective equipment
- 4.8. written product follows prescribed format, meeting criteria for all components

Learning Objectives

- 4.a. Program XIO and XIC as it pertains to input devices.
- 4.b. Program OTE, OTL and OTU as it pertains to output devices.
- 4.c. Program One Shot as it pertains to input devices.
- 4.d. Program Bit Shift instructions.
- 4.e. Program the MOV and MVM commands.
- 4.f. Program Subroutines.
- 4.g. Utilize MCR commands.
- 4.h. Program math and comparison instructions.
- 4.i. Utilize the sequencer instruction.
- 4.j. Troubleshoot operation of hard wired system.
- 4.k. Fix any problems identified.

5. Program in Structured Text.

<i>Domain</i>	<i>Psychomotor</i>	<i>Level</i>	<i>Practicing</i>	<i>Status</i>	<i>Active</i>
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Linked Core Abilities

Apply mathematical concepts.
Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Troubleshoot electrical and mechanical systems and devices
Repair electrical and mechanical systems
Communicate Technical Information
Integrate electrical and mechanical systems and devices

Assessment Strategies

- 5.1. Written objective test
- 5.2. Skill demonstration
- 5.3. Written product

Criteria

Performance will meet expectations when:

- 5.1. you complete the written objective test and the performance demonstration at or above 70%.
- 5.2. you attend class regularly

- 5.3. you arrive for class on time
- 5.4. you select the correct tools, equipment, instruments, materials, supplies
- 5.5. you perform all critical steps in the right order
- 5.6. you follow safety procedures
- 5.7. you wear personal protective equipment
- 5.8. written product follows prescribed format, meeting criteria for all components

Learning Objectives

- 5.a. Utilize the jump to subroutine (JSR) instruction.
- 5.b. Program "IF" statements.
- 5.c. Program "ELSIF" statements.
- 5.d. Program assignment statements.
- 5.e. Program arithmetic operators.
- 5.f. Utilize combination logic.
- 5.g. Troubleshoot structured text programs.
- 5.h. Fix any problems identified.

6. Program in Function Block.

Domain Psychomotor Level Practicing Status Active

Linked Core Abilities

- Apply mathematical concepts.
- Demonstrate ability to think critically.
- Use effective communication skills.
- Use technology effectively.

Linked Program Outcomes

- Perform work safely
- Troubleshoot electrical and mechanical systems and devices
- Repair electrical and mechanical systems
- Communicate Technical Information
- Integrate electrical and mechanical systems and devices

Assessment Strategies

- 6.1. Written objective test
- 6.2. Skill demonstration
- 6.3. Written product

Criteria

Performance will meet expectations when:

- 6.1. you complete the written objective test and the performance demonstration at or above 70%.
- 6.2. you attend class regularly
- 6.3. you arrive for class on time
- 6.4. you select the correct tools, equipment, instruments, materials, supplies
- 6.5. you perform all critical steps in the right order
- 6.6. you follow safety procedures
- 6.7. you wear personal protective equipment
- 6.8. written product follows prescribed format, meeting criteria for all components

Learning Objectives

- 6.a. Program FB ADD instruction.
- 6.b. Program FB OR instruction.
- 6.c. Program FB counters.
- 6.d. Program FB timers.
- 6.e. Program boolean FB instructions.
- 6.f. Program FB math instructions.
- 6.g. Utilize IREFs, OREFs, OCONs, ICONs to terminate function blocks.
- 6.h. Create multiple sheets for the program.
- 6.i. Reset blocks utilizing a feedback loop.
- 6.j. Troubleshoot function block programs.
- 6.k. Fix any problems identified.

7. Integrate HMI into a tag based system.

Domain Psychomotor Level Adapting Status Active

Linked Core Abilities

Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Troubleshoot electrical and mechanical systems and devices
Repair electrical and mechanical systems
Communicate Technical Information
Integrate electrical and mechanical systems and devices

Assessment Strategies

- 7.1. Written objective test
- 7.2. Skill demonstration
- 7.3. Written product

Criteria

Performance will meet expectations when:

- 7.1. you complete the written objective test and the performance demonstration at or above 70%.
- 7.2. you attend class regularly
- 7.3. you arrive for class on time
- 7.4. you select the correct tools, equipment, instruments, materials, supplies
- 7.5. you perform all critical steps in the right order
- 7.6. you follow safety procedures
- 7.7. you wear personal protective equipment
- 7.8. written product follows prescribed format, meeting criteria for all components

Learning Objectives

- 7.a. Wire communications and power to human machine interface (HMI) and applicable devices.
- 7.b. Configure drivers, programs and hard ware settings for needed human machine interface (HMI) communications.
- 7.c. Program human machine interface (HMI) for optimal operation.
- 7.d. Troubleshoot HMI operation.
- 7.e. Fix any problems identified.

8. Integrate a variable frequency drive (VFD) into a tag based system.

Domain Psychomotor Level Adapting Status Active

Linked Core Abilities

Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Troubleshoot electrical and mechanical systems and devices
Repair electrical and mechanical systems
Communicate Technical Information
Integrate electrical and mechanical systems and devices

Assessment Strategies

- 8.1. Written objective test
- 8.2. Skill demonstration
- 8.3. Written product

Criteria

Performance will meet expectations when:

- 8.1. you complete the written objective test and the performance demonstration at or above 70%.
- 8.2. you attend class regularly
- 8.3. you arrive for class on time
- 8.4. you select the correct tools, equipment, instruments, materials, supplies
- 8.5. you perform all critical steps in the right order
- 8.6. you follow safety procedures
- 8.7. you wear personal protective equipment
- 8.8. written product follows prescribed format, meeting criteria for all components

Learning Objectives

- 8.a. Wire communications and power to VFD and applicable devices.
- 8.b. Configure drivers, programs and hard ware settings for needed VFD communications.
- 8.c. Program VFD for optimal operation.
- 8.d. Troubleshoot VFD operation within the tag based system.
- 8.e. Fix any problems identified.

9. Integreat a servodrive system into a tag based system.

Domain Psychomotor Level Adapting Status Active

Linked Core Abilities

Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Troubleshoot electrical and mechanical systems and devices
Repair electrical and mechanical systems
Communicate Technical Information
Integrate electrical and mechanical systems and devices

Assessment Strategies

- 9.1. Written objective test
- 9.2. Skill demonstration
- 9.3. Written product

Criteria

Performance will meet expectations when:

- 9.1. you complete the written objective test and the performance demonstration at or above 70%.
- 9.2. you attend class regularly
- 9.3. you arrive for class on time
- 9.4. you select the correct tools, equipment, instruments, materials, supplies
- 9.5. you perform all critical steps in the right order
- 9.6. you follow safety procedures
- 9.7. you wear personal protective equipment
- 9.8. written product follows prescribed format, meeting criteria for all components

Learning Objectives

- 9.a. Wire communications and power to servodrive and applicable devices.
- 9.b. Configure drivers, programs and hard ware settings for needed servodrive communications.
- 9.c. Program servodrive for optimal operation.
- 9.d. Troubleshoot servodrive operation within a tag based system.
- 9.e. Fix any problems identified.