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Northeast Wisconsin Technical College

10-664-100 054695 Automation 1: Control Logic

Course Outcome Summary

Course Information

Description	10-664-100 AUTOMATION 1: CONTROL LOGIC ...electric motor control components such as switches, relays, starters, transformers; and safely mount and install motor and motor control components and perform related wiring and troubleshooting of motor control circuits.
Total Credits	1
Total Hours	36

Course History

Last Revision Date	12/14/2017
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Employability Skills

1. Communicate Effectively
2. Demonstrate Personal Accountability
3. Solve Problems Effectively
4. Think Critically and Creatively
5. Value Individual Differences and Abilities
6. Work Cooperatively and Professionally

Program Outcomes

1. TSA1 - Perform work safely
2. TSA2 - Troubleshoot electrical and mechanical systems and devices
3. TSA3 - Repair electrical and mechanical systems
4. TSA4 - Communicate Technical Information
5. Understand and apply knowledge of electricity, electronics, hydraulics, and electric motors and mechanics.
6. Read technical drawings, schematics, and diagrams.
7. Document technical information through descriptive writing, sketches/diagrams, mathematical

- expression, computation, and graphs.
8. Perform electrical, mechanical, and fluid measurements by properly selecting tools and test equipment.
 9. Perform electrical/mechanical assembly/disassembly, repair, or calibrate components by properly selecting tools and equipment and following procedures.
 10. Understand the overall operation and control of machines.
 11. Apply electrical skills to troubleshoot control and operator panels.
 12. Apply critical thinking skills to solving problems.
 13. Perform safe work practices.

Course Competencies

1. Apply basic manual motor control principles

Assessment Strategies

LAP skill accomplishment points evaluated on lab station by instructor

Skill accomplishment test evaluated by instructor on lab station

Lab activity packet quiz given by instructor

Learning Objectives

- 1.a. Perform electrical motor control safely
- 1.b. Describe three-phase power systems
- 1.c. Describe disconnects and protective devices
- 1.d. Perform three-phase motor connections

Criteria

Your performance will be successful when:

- 1.1. explain the importance of the equipment ground connection
- 1.2. describe ten basic rules of electrical safety
- 1.3. describe the purpose of the lockout/tagout system used in industry
- 1.4. perform lockout/tagout
- 1.5. describe the operation of three-phase power
- 1.6. explain the function of neutral
- 1.7. use a Voltmeter to verify supply voltage
- 1.8. describe the operation of grounded and ungrounded systems
- 1.9. describe two devices used to disconnect power to a circuit
- 1.10. use an ohmmeter to check the condition of a fuse
- 1.11. explain why time-delay fuses are used with motor starting circuits
- 1.12. describe three important factors to consider with overcurrent protection devices.
- 1.13. describe the operation of a three-phase motor
- 1.14. describe the operating data on a motor's nameplate
- 1.15. define service factor and explain its importance
- 1.16. connect a dual-voltage three-phase motor for low voltage operation
- 1.17. explain why dual-voltage motors should be run on the highest voltage operation
- 1.18. lockout/tagout safety test worth 11pts. (questions: multiple choice, must achieve 100% of points)
- 1.19. LAP skill accomplishment evaluation worth 20pts. (observation and verbal evaluation, must achieve at least 15/20 points)
- 1.20. LAP skill accomplishment test worth 5pts (problem solving sheet, must achieve at least 4/5 points)
- 1.21. quiz grade worth 14pts. (questions: multiple choice, must achieve at least 11/14 points)

2. Apply manual motor control principles with overload protection

Assessment Strategies

LAP skill accomplishment points evaluated on lab station by instructor

skill accomplishment test evaluated by instructor on lab station

lab activity packet quiz given by instructor

Learning Objectives

- 2.a. perform simple motor control circuit operation
- 2.b. perform operational tests on a manual motor starter
- 2.c. perform overload setup on a manual motor starter

Criteria

Your performance will be successful when:

- 2.1. describe five functions of motor control
- 2.2. describe the four basic requirements for a typical motor installation
- 2.3. define motor controller and motor starter
- 2.4. connect and operate a simple motor control circuit
- 2.5. describe the functions of two categories of motor starters
- 2.6. describe the functions of two types of manual starters
- 2.7. describe the operation of a manual motor starter
- 2.8. start and stop a motor using a manual starter
- 2.9. define low-voltage protection and describe its importance
- 2.10. describe how low-voltage protection is accomplished in a manual starter
- 2.11. describe the function of three types of overloads and give an application of each
- 2.12. describe the operation of two types of thermal overloads
- 2.13. describe the operation of a magnetic overload.
- 2.14. set the trip level of a bimetallic overload
- 2.15. select the correct heaters for a NEMA overload
- 2.16. LAP skill accomplishment test worth 4pts (problem solving sheet, must achieve at least 3/4 points)
- 2.17. LAP skill accomplishment points worth 20 pts (observation and verbal evaluation, must achieve at least 15/20 points)
- 2.18. Quiz grade worth 12 pts (questions: multiple choice, must score at least 9/12)

3. Apply control transformers to circuits

Assessment Strategies

LAP skill accomplishment points evaluated on lab station by instructor
skill accomplishment test evaluated by instructor on lab station
lab activity packet quiz given by instructor

Learning Objectives

- 3.a. Perform transformer turns ration and votage calculations
- 3.b. Perform transformer connections
- 3.c. Perform transformer sizing

Criteria

Your performance will be successful when:

- 3.1. Describe the operation of transformer and give its schematic symbol
- 3.2. Define turn ration and describe how it is calculated
- 3.3. Calculate the turns ratio of a transformer
- 3.4. Describe how the turns ration determines the secondary voltage of a transformer
- 3.5. Calculate the secondary voltage of a transformer
- 3.6. Describe the function of the four basic components of an electrical control circuit
- 3.7. Describe the function of an electrical schematic diagram
- 3.8. Describe the function of a control transformer
- 3.9. Describe the operation of a control transformer and give its schematic symbol
- 3.10. Connect and operate a control transformer
- 3.11. Describe how to test a transformer
- 3.12. Test a control transformer
- 3.13. Describe how to size a transformer
- 3.14. Size a control transformer
- 3.15. Describe the operation of a separate control circuit
- 3.16. LAP skill accomplishment test worth 4pts (problem solving sheet, must achieve at least 3/4 points)
- 3.17. LAP skill accomplishment points worth 20 pts (observation and verbal evaluation, must achieve at least 15/20 points)
- 3.18. Quiz grade worth 12 pts (questions: multiple choice, must score at least 9/12)

4. Apply basic control logic to circuits

Assessment Strategies

LAP skill accomplishment points evaluated on lab station by instructor
skill accomplishment test evaluated by instructor on lab station
lab activity packet quiz given by instructor

Learning Objectives

- 4.a. Perform connections of basic control circuits
- 4.b. Perform Connections of basic control circuits from ladder diagrams
- 4.c. Perform control logic AND/OR operations
- 4.d. Perform control logic NAND/NOR/NOT operations

Criteria

Your performance will be successful when:

- 4.1. describe the function of three types of electrical control systems and give an examples of each
- 4.2. describe the three steps of a control process
- 4.3. describe the function of an indicator lamp and give an application
- 4.4. describe the operations of a pushbutton switch and give its schematic symbol
- 4.5. connect and operate a basic electrical control circuit which uses a pushbutton switch
- 4.6. describe the operation of a selector switch and give its schematic symbol
- 4.7. connect and operate a basic electric control circuit using a selector switch
- 4.8. describe the function of a ladder diagram
- 4.9. describe the function of four components of a ladder diagram
- 4.10. describe six rules of drawing a ladder diagram
- 4.11. draw a ladder diagram of a control circuit
- 4.12. describe how to determine the operation of a circuit given a ladder diagram
- 4.13. connect and operate a control circuit given a ladder diagram
- 4.14. list six elements of control logic
- 4.15. describe the operation of AND logic and give an application
- 4.16. connect and operate an AND logic circuit
- 4.17. describe the operation of OR logic and give an application
- 4.18. connect and operate an OR logic circuit
- 4.19. describe the operation of NOT logic and give an application
- 4.20. connect and operate a NOT logic circuit
- 4.21. describe the operation of NOR logic and give an application
- 4.22. connect and operate an NOR logic circuit
- 4.23. describe the operation of NAND logic and give an application
- 4.24. connect and operate an NAND logic circuit
- 4.25. design a multiple start/stop pushbutton station control circuit
- 4.26. LAP skill accomplishment test worth 4pts (problem solving sheet, must achieve at least 3/4 points)
- 4.27. LAP skill accomplishment points worth 20 pts (observation and verbal evaluation, must achieve at least 15/20 points)
- 4.28. Quiz grade worth 12 pts (questions: multiple choice, must score at least 9/12)

5. Apply control relays and motor starters to circuits

Assessment Strategies

LAP skill accomplishment points evaluated on lab station by instructor
skill accomplishment test evaluated by instructor on lab station
lab activity packet quiz given by instructor

Learning Objectives

- 5.a. Perform connections of basic control relay circuits
- 5.b. Describe the operation of memory logic and give an application
- 5.c. Perform connections of magnetic motor starters
- 5.d. Perform connections of two wire motor control circuits
- 5.e. Perform connections of three wire motor control circuits

Criteria

Your performance will be successful when:

- 5.1. describe the function of a control relay and give an application
- 5.2. describe the operation of a control relay and give its schematic symbol
- 5.3. describe the operation of two types of control relays and give an application of each
- 5.4. describe how detached symbology is used to show a control relay on a ladder diagram
- 5.5. connect and operate a control relay in a circuit
- 5.6. connect and operate a memory logic circuit
- 5.7. describe the operation of a magnetic motor starter
- 5.8. connect and operate a magnetic motor starter connected to a three phase motor
- 5.9. describe the operation of a two wire motor control circuit and give an application
- 5.10. connect and operate a two wire motor control circuit
- 5.11. describe the operation of a three wire motor control circuit and give an application
- 5.12. connect and operate a three wire motor control circuit
- 5.13. design a multiple operator station three wire motor control circuit
- 5.14. describe the function of a push to test pilot light and give an application
- 5.15. describe the operation of a push to test light and give its schematic symbol
- 5.16. connect and operate a three wire control circuit with a push to test pilot light
- 5.17. LAP skill accomplishment test worth 4pts (problem solving sheet, must achieve at least 3/4 points)
- 5.18. LAP skill accomplishment points worth 20 pts (observation and verbal evaluation, must achieve at least 15/20 points)
- 5.19. Quiz grade worth 12 pts (questions: multiple choice, must score at least 9/12)

6. Troubleshoot basic motor control circuits

Assessment Strategies

LAP skill accomplishment points evaluated on lab station by instructor
 skill accomplishment test evaluated by instructor on lab station
 lab activity packet quiz given by instructor

Learning Objectives

- 6.a. Perform electrical component tests
- 6.b. Perform control component troubleshooting
- 6.c. perform motor starter troubleshooting
- 6.d. perform power component troubleshooting

Criteria

Your performance will be successful when:

- 6.1. describe two levels of troubleshooting and give an application of each
- 6.2. describe the three methods of testing a component and give an application of each
- 6.3. describe how to test an indicator lamp
- 6.4. test an indicator lamp
- 6.5. describe how to test a manual switch
- 6.6. test a manual switch
- 6.7. describe how to test a control relay
- 6.8. test a control relay
- 6.9. describe how to test a motor contractor
- 6.10. test a motor contractor
- 6.11. describe how to test an overload relay
- 6.12. test an overload relay
- 6.13. describe how to test a three phase motor
- 6.14. test a three phase motor
- 6.15. test a control transformer
- 6.16. LAP skill accomplishment test worth 4pts (problem solving sheet, must achieve at least 3/4 points)
- 6.17. LAP skill accomplishment points worth 20 pts (observation and verbal evaluation, must achieve at least 15/20 points)
- 6.18. Quiz grade worth 12 pts (questions: multiple choice, must score at least 9/12)