COURSE INFORMATION

Alternate Title: Automation 2: Motor Control

Description:

10-664-101 AUTOMATION 2: MOTOR CONTROL ...electric motor control components such as sensors, timers and counters. (Co-requisite: 10-664-100, Automation 1: Control Logic)

Instructional Level: 10

Total Credits: 1

Total Hours: 36

COURSE HISTORY

Status: Active

Active Date: 12/5/2011

Last Revision Date: 11/27/2023

Revised By: SYSTEM IMPORT

EMPLOYABILITY SKILLS

1. **Communicate Effectively**

    Type: NWTC   Status: Active

2. **Demonstrate Personal Accountability**

    Type: NWTC   Status: Active

3. **Solve Problems Effectively**

    Type: NWTC   Status: Active

4. **Think Critically and Creatively**

    Type: NWTC   Status: Active

5. **Value Individual Differences and Abilities**

    Type: NWTC   Status: Active

6. **Work Cooperatively and Professionally**

    Type: NWTC   Status: Active

PROGRAM OUTCOMES

1. **TSA1 - Perform work safely**

    Type: TSA   Status: Active

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. **TSA2 - Troubleshoot electrical and mechanical systems and devices**

Type: TSA   Status: Active

Criteria

2.1. Verify proper operation or proble

2.2. Identify the cause of the problem: mechanical, electrical

2.3. Determine corrective actio

2.4. Utilize appropriate test equipment

3. **TSA3 - Repair electrical and mechanical systems**

Type: TSA   Status: Active

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. **TSA4 - Communicate Technical Information**

Type: TSA   Status: Active

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. **Understand and apply knowledge of electricity, electronics, hydraulics, and electric motors and mechanics.**

Status: Active

6. **Read technical drawings, schematics, and diagrams.**

Status: Active

7. **Document technical information through descriptive writing, sketches/diagrams, mathematical expression, computation, and graphs.**

Status: Active

8. **Perform electrical, mechanical, and fluid measurements by properly selecting tools and test equipment.**

Status: Active

9. **Perform electrical/mechanical assembly/disassembly, repair, or calibrate components by properly selecting tools and equipment and following procedures.**

Status: Active

10. **Understand the overall operation and control of machines.**

    Status: Active

11. **Apply electrical skills to troubleshoot control and operator panels.**

    Status: Active

12. **Apply critical thinking skills to solving problems.**

    Status: Active

13. **Perform safe work practices.**

    Status: Active

COURSE COMPETENCIES

1. **Troubleshoot industrial control system circuits**

    Status: Active

    Assessment Strategies

    1.1. LAP Skill Accomplishment points evaluated on lab station by Instructor

    1.2. Lab Activity Packet Quiz given by Instructor

    1.3. Skill accomplishment evaluated by Instructor on lab station

    Criteria

    Your performance will be successful when:

    1.1. describe a six step troubleshooting sequence

    1.2. describe four methods of systems level troubleshooting and give an advantage of each

    1.3. describe five types of in-circuit component tests

    1.4. describe how to test and analyze circuit signals

    1.5. perform and analyze circuit signal tests

    1.6. use the symptom and cause troubleshooting method to isolate a bad component

    1.7. Use the output-back troubleshooting method to isolate a bad component

    1.8. Use the half-split troubleshooting method to isolate a bad component

    1.9. Use the shotgun troubleshooting method to isolate a bad component

    1.10. Troubleshoot a 2-wire control system

    1.11. Troubleshoot a 3-wire control system

    1.12. LAP Skill Accomplishment points worth 20pts. (Observation and verbal evaluation). Must achieve at least 15/20 points.

    1.13. LAP Skill Accomplishment Test worth 7pts. (Problem solving sheet). Must achieve at least 5/7 points.

    1.14. Quiz grade worth 8pts. (Questions: multiple-choice). Must achieve at least 6/8 points.

    Learning Objectives

    1.a. Perform Electrical Circuit Tests

    1.b. Perform Electrical Circuit Troubleshooting

    1.c. Perform 2-Wire and 3-Wire Control System

2. **Apply reversing motor control**

Status: Active

Assessment Strategies

2.1. LAP Skill Accomplishment points evaluated on lab station by Instructor

2.2. Lab Activity Packet Quiz given by Instructor

2.3. Skill accomplishment evaluated by Instructor on lab station

Criteria

Your performance will be successful when:

2.1. State the NEMA and IEC standard for reversing the rotation of a three-phase motor.

2.2. List two common control methods used to reverse a three-phase motor.

2.3. Describe the function and operation of a drum switch.

2.4. Connect and operate a drum switch to reverse a motor.

2.5. Describe the function and operation of a reversing magnetic motor starter.

2.6. Connect and operate a reversing magnetic motor starter to reverse a motor.

2.7. Design a motor reversing circuit that uses a drum switch and a magnetic motor starter.

2.8. Describe the function of interlocking control and give an application.

2.9. Describe three interlocking methods used in reversing motor control.

2.10. Connect and operate a reversing motor circuit with mechanical and auxiliary contact interlocking.

2.11. Troubleshoot a reversing motor control circuit.

2.12. Design a reversing motor control circuit that uses pushbutton interlocking.

2.13. Describe the function of manual and automatic modes and give an application of each.

2.14. Describe the operation of two types of motor jogging circuits.

2.15. Connect and operate a control circuit to jog a motor.

2.16. Connect and operate a forward/reverse jog control circuit.

2.17. Troubleshoot a circuit that has manual and automatic modes.

2.18. Describe the operation of a hand-off-automatic motor control circuit.

2.19. Connect and operate a hand-off-automatic motor control circuit.

2.20. Design a hand-off-automatic motor control circuit.

2.21. LAP Skill Accomplishment points worth 20pts. (Observation and verbal evaluation). Must achieve at least 15/20 points.

2.22. LAP Skill Accomplishment Test worth 7pts. (Problem solving sheet). Must achieve at least 5/7 points.

2.23. Quiz grade worth 8pts. (Questions: multiple-choice). Must achieve at least 6/8 points.

Learning Objectives

2.a. Perform motor reverse using a drum switch

2.b. Perform motor reverse using a magnetic motor starter

2.c. Perform motor reverse with pushbutton interlocking

2.d. Perform motor reverse with jog

2.e. Perform motor H-O-A control

3. **Apply automatic input devices**

Status: Active

Assessment Strategies

3.1. LAP Skill Accomplishment points evaluated on lab station by Instructor

3.2. Lab Activity Packet Quiz given by Instructor

3.3. Skill accomplishment evaluated by Instructor on lab station

Criteria

Your performance will be successful when:

3.1. Describe the functions of four types of automatic input devices and give an application of each.

3.2. Describe the operation of a limit switch and give its schematic symbol.

3.3. Describe the operation of a limit switch and give its schematic symbol.

3.4. Design an overhead door motor control circuit.

3.5. Describe the operation of afloat switch and give its schematic symbol

3.6. Connect and operate a float switch.

3.7. Describe the operation of a pump control circuit.

3.8. Connect and operate a pump control circuit.

3.9. Describe the operation of a pressure switch and give its schematic symbol.

3.10. Connect and operate a pressure switch.

3.11. Design a pump control circuit that includes H-O-A operation.

3.12. Describe how to test an automatic input switch.

3.13. Test an automatic input switch.

3.14. Describe the function of a sequence control circuit and give an application.

3.15. Describe the operation of a sequence switch.

3.16. Connect and operate a sequence control circuit.

3.17. Design a sequence control circuit.

3.18. LAP Skill Accomplishment points worth 20pts. (Observation and verbal evaluation). Must achieve at least 15/20 points.

3.19. LAP Skill Accomplishment Test worth 7pts. (Problem solving sheet). Must achieve at least 5/7 points.

3.20. Quiz grade worth 8pts. (Questions: multiple-choice). Must achieve at least 6/8 points.

Learning Objectives

3.a.   a.Perform Limit Switch Device Connection and Operation

3.b.   b.Perform Float Switch Device Connection and Operation

3.c.   c.Perform Pressure Switch Device Connection and Operation

3.d.   d.Perform Sequence Control Troubleshooting

4. **Apply basic timer control**

   Status: Active

Assessment Strategies

4.1. LAP Skill Accomplishment points evaluated on lab station by Instructor

4.2. Lab Activity Packet Quiz given by Instructor

4.3. Skill accomplishment evaluated by Instructor on lab station

Criteria

Your performance will be successful when:

4.1. describe the function of a time-delay relay and give an application

4.2.   describe the function of two types of timer relays and give an application of each

4.3.   Describe the operation of an On-Delay timer relay and give its schematic symbol.

4.4.   Connect and operate an On-Delay timer circuit.

4.5.   Describe the operation of a timer relay in an unloaded motor start circuit.

4.6.   Design a control circuit to perform an unloaded start of a motor.

4.7.   Describe the operation of an Off-Delay timer relay and give its schematic symbol.

4.8.   Connect and operate an Off-Delay timer circuit.

4.9.   Describe the operation of a time-delay relay in time-driven sequencing.

4.10. Design a motor control circuit to perform time-driven sequencing.

4.11. Describe how to test a timer relay.

4.12. Test a timer relay.

4.13. Troubleshoot an On-Delay timer circuit.

4.14. Troubleshoot an Off-Delay timer circuit.

4.15. LAP Skill Accomplishment points worth 20pts. (Observation and verbal evaluation). Must achieve at least 15/20 points.

4.16. LAP Skill Accomplishment Test worth 7pts. (Problem solving sheet). Must achieve at least 5/7 points.

4.17. Quiz grade worth 8pts. (Questions: multiple-choice). Must achieve at least 6/8 points.

Learning Objectives

4.a.   Perform on-delay timer connections and operations

4.b.   Perform off-delay timer connections and operations

4.c.   Perform timer circuit troubleshooting

5.   **Apply electrical sensors**

   Status: Active

Criteria

Your performance will be successful when:

5.1.

Learning Objectives

5.a.   Perform inductive sensor connections and operation

5.b.   Perform capacitive proximity sensor connection and operation

5.c.   Perform photoelectric sensor connection and operation