

AUTOMATION TECHNOLOGY STANDARDS



This document was prepared by:

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Draft for review by the Nevada State Board of Education on
July 19, 2018

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All Nevadans ready for success in the 21st century

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To improve student achievement and educator effectiveness by ensuring opportunities, facilitating learning, and promoting excellence



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ACKNOWLEDGEMENTS

The development of Nevada career and technical standards and assessments is a collaborative effort sponsored by the Office of Career Readiness, Adult Learning & Education Options at the Department of Education and the Career and Technical Education Consortium of States. The Department of Education relies on teachers and industry representatives who have the technical expertise and teaching experience to develop standards and performance indicators that truly measure student skill attainment. Most important, however, is recognition of the time, expertise and great diligence provided by the writing team members in developing the career and technical standards for Automation Technology.

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BUSINESS AND INDUSTRY VALIDATION

All CTE standards developed through the Nevada Department of Education are validated by business and industry through one or more of the following processes: (1) the standards are developed by a team consisting of business and industry representatives; or (2) a separate review panel was coordinated with industry experts to ensure the standards include the proper content; or (3) the adoption of nationally-recognized standards endorsed by business and industry.

The Automation Technology standards were validated through a complete review by an industry panel.

PROJECT COORDINATOR

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CONTENT STANDARD 1.0 : IDENTIFY LAB ORGANIZATION AND SAFETY PROCEDURES

PERFORMANCE STANDARD 1.1 : DEMONSTRATE GENERAL LAB SAFETY RULES AND PROCEDURES

- 1.1.1 Describe general shop safety rules and procedures
- 1.1.2 Demonstrate knowledge of OSHA and its role in workplace safety
- 1.1.3 Comply with the required use of personal protective equipment (PPE) during lab/shop activities
- 1.1.4 Utilize safe procedures for handling of tools and equipment
- 1.1.5 Operate lab equipment according to safety guidelines
- 1.1.6 Identify and use proper lifting procedures and proper use of support equipment
- 1.1.7 Utilize proper ventilation procedures for working within the lab/shop area
- 1.1.8 Identify marked safety areas
- 1.1.9 Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment
- 1.1.10 Identify the location and use of eye wash stations
- 1.1.11 Identify the location of the posted evacuation routes
- 1.1.12 Identify and wear appropriate clothing for lab/shop activities
- 1.1.13 Secure hair and jewelry for lab/shop activities
- 1.1.14 Demonstrate knowledge of the safety aspects of high/low voltage circuits
- 1.1.15 Locate and interpret safety data sheets (SDS)
- 1.1.16 Prepare time or job cards, reports or records
- 1.1.17 Perform housekeeping duties
- 1.1.18 Follow verbal instructions to complete work assignments
- 1.1.19 Follow written instructions to complete work assignments

PERFORMANCE STANDARD 1.2 : IDENTIFY AND UTILIZE HAND TOOLS

- 1.2.1 Identify hand tools and their appropriate usage
- 1.2.2 Identify standard and metric designation
- 1.2.3 Demonstrate the proper techniques when using hand tools
- 1.2.4 Demonstrate safe handling and use of appropriate tools
- 1.2.5 Demonstrate proper cleaning, storage, and maintenance of tools

PERFORMANCE STANDARD 1.3 : IDENTIFY AND UTILIZE POWER TOOLS AND EQUIPMENT

- 1.3.1 Identify power tools and their appropriate usage
- 1.3.2 Identify equipment and their appropriate usage
- 1.3.3 Demonstrate the proper techniques when using power tools and equipment
- 1.3.4 Demonstrate safe handling and use of appropriate power tools and equipment
- 1.3.5 Demonstrate proper cleaning, storage, and maintenance of power tools and equipment

CONTENT STANDARD 2.0 : INTRODUCTION TO AUTOMATION**PERFORMANCE STANDARD 2.1 : DESCRIBE THE HISTORY OF AUTOMATION**

- 2.1.1 Define automation and industry standard vocabulary
- 2.1.2 Identify automation achievements throughout history
- 2.1.3 Research how historical periods and regional styles have influenced the use of automation

PERFORMANCE STANDARD 2.2 : INVESTIGATE RELATED CAREERS IN AUTOMATION

- 2.2.1 Investigate automation careers, training options, and associated opportunities
- 2.2.2 Describe the difference between automation disciplines and job functions
- 2.2.3 Research the various types of engineering careers (e.g., chemical, civil, electrical, mechanical)

PERFORMANCE STANDARD 2.3 : ANALYZE ETHICS IN AUTOMATION

- 2.3.1 Analyze current professional automation codes of ethics
- 2.3.2 Analyze ethical automation issues
- 2.3.3 Analyze and explain ethical and technical issues contributing to an automation incident
- 2.3.4 Describe how ethics influence the automation process

PERFORMANCE STANDARD 2.4 : INTERPRET SCHEMATICS AND TECHNICAL DRAWINGS

- 2.4.1 Identify industrial standard symbols (i.e., fluid power, electrical, mechanical)
- 2.4.2 Interpret schematics and technical drawings
- 2.4.3 Create schematic diagrams using proper symbols
- 2.4.4 Understand the general redline process for changing schematics/drawings

PERFORMANCE STANDARD 2.5 : INVESTIGATE THE ENGINEERING DESIGN PROCESS

- 2.5.1 Identify the engineering design process
- 2.5.2 Identify the activities that occur during each phase of the engineering design process
- 2.5.3 Utilize office software to perform engineering recordkeeping and communication
- 2.5.4 Describe the importance of engineering teams
- 2.5.5 Apply the steps of the engineering design process to solve a variety of design problems employing a core physics perspective

PERFORMANCE STANDARD 2.6 : INVESTIGATE MATERIALS USED IN AUTOMATION SYSTEMS
<p>2.6.1 Discuss the importance of material selection in an automated system</p> <p>2.6.2 Identify the major material families (e.g., wood, glass, metal, plastic)</p> <p>2.6.3 Differentiate between the various types of materials and their properties (e.g., mechanical, physical, chemical)</p> <p>2.6.4 Discuss the impact of material usage on the environment</p>
PERFORMANCE STANDARD 2.7 : IDENTIFY FUNDAMENTAL AUTOMATION COMPONENTS AND SYSTEMS
<p>2.7.1 Identify common automation systems</p> <p>2.7.2 Identify common components in automation systems</p> <p>2.7.3 Describe the function of components in automation systems</p> <p>2.7.4 Examine the functions of an industrial network</p> <p>2.7.5 Analyze the application of automation in various industries</p>

CONTENT STANDARD 3.0 : ELECTRONICS FOR AUTOMATION**PERFORMANCE STANDARD 3.1 : APPLY FUNDAMENTALS OF ELECTRICITY**

- 3.1.1 Define AC and DC electrical systems and terminology
- 3.1.2 Discuss the safety concerns of working with electricity (e.g., arc flash, electrical burns)
- 3.1.3 Describe the principles of generation, transmission, distribution, and storage of electricity
- 3.1.4 Compute values of current, resistance, and voltage using Ohm's law and power equations
- 3.1.5 Discuss the concept of impedance in relation to Ohm's Law
- 3.1.6 Identify series, parallel, and series-parallel (combination) circuits
- 3.1.7 Solve series and parallel circuits using basic laws of electricity including Kirchhoff's laws
- 3.1.8 Introduce single-phase and three-phase AC power
- 3.1.9 Construct and test simple electrical circuits from a schematic

PERFORMANCE STANDARD 3.2 : APPLY FUNDAMENTALS OF ELECTRONICS

- 3.2.1 Understand and demonstrate basic electrical theory
- 3.2.2 Identify electronic components and their applications (e.g., resistors, capacitors, inductors, and transformers)
- 3.2.3 Utilize tools and test equipment appropriately and safely (i.e., multi-meters)
- 3.2.4 Measure electrical characteristics of voltage, current, and resistance in basic electronic circuits
- 3.2.5 Demonstrate appropriate soldering and de-soldering techniques for electronic circuits
- 3.2.6 Demonstrate appropriate use of various connectors
- 3.2.7 Construct, measure, and analyze, simple series, parallel, and series-parallel (combination) circuits

CONTENT STANDARD 4.0 : CHARACTERIZE AUTOMATION CONTROL DEVICES

PERFORMANCE STANDARD 4.1 : INVESTIGATE MOTORS IN AUTOMATED SYSTEMS

- 4.1.1 Identify the function of an electric motor
- 4.1.2 Identify the various types of motors and their designated uses (e.g., 1 phase AC, 3 phase AC, DC, Servo)
- 4.1.3 Describe various motor applications in automation systems
- 4.1.4 Construct and test a simple motor application

PERFORMANCE STANDARD 4.2 : INVESTIGATE FLUID POWER SYSTEMS

- 4.2.1 Identify and apply safety protocols for fluid power systems
- 4.2.2 Identify components of fluid power systems
- 4.2.3 Describe the operation and use of fluid power in automation systems
- 4.2.4 Identify different control components used in pneumatic systems (e.g., DCVs, Flow control, Solenoids)
- 4.2.5 Construct and test a simple fluid power system

PERFORMANCE STANDARD 4.3 : INVESTIGATE SENSORS AND ACTUATORS

- 4.3.1 Differentiate between sensors and actuators
- 4.3.2 Describe the functions of sensors and actuators used in automation systems
- 4.3.3 Construct and test a circuit utilizing sensors and actuators
- 4.3.4 Define analog and binary sensors
- 4.3.5 Differentiate between different Binary sensors and what they detect (e.g., inductive, capacitive, photoelectric)

PERFORMANCE STANDARD 4.4 : INVESTIGATE SWITCHES AND RELAYS

- 4.4.1 Differentiate between switches and relays
- 4.4.2 Explain the characteristics and operations of switches and relays
- 4.4.3 Explain the role of electromagnetic relays
- 4.4.4 Construct and test a simple circuit utilizing switches and relays

PERFORMANCE STANDARD 4.5 : EXPLORE PROGRAMMABLE LOGIC CONTROLLERS

- 4.5.1 Investigate the basic components of a programmable logic controller (PLC)
- 4.5.2 Identify the major advantages in the use of PLCs in automation
- 4.5.3 Identify the various programming devices used to program a PLC
- 4.5.4 Explain the various modes of operations of a PLC

PERFORMANCE STANDARD 4.6 : RESEARCH CONVEYANCE SYSTEMS

- 4.6.1 Investigate different conveyance systems
- 4.6.2 Describe control systems utilized in conveyance systems
- 4.6.3 Examine applications of conveyance systems in automation systems

PERFORMANCE STANDARD 4.7 : EXPLORE VARIABLE FREQUENCY DRIVES

- 4.7.1 Define the functions of variable frequency drives
- 4.7.2 Explore the application of variable frequency drives in automation systems
- 4.7.3 Construct and test a simple automated process utilizing variable frequency drives

PERFORMANCE STANDARD 4.8 : IDENTIFICATION AND VISION SYSTEMS

- 4.8.1 Identify different identification and vision systems used in automation systems
- 4.8.2 Investigate the applications of different identification and vision systems (i.e., barcode, RFID, QR codes, machine vision systems, applications of ID systems)

CONTENT STANDARD 5.0 : MODEL CONTROL SYSTEMS

PERFORMANCE STANDARD 5.1 : DEMONSTRATE CONTROL TECHNOLOGY AND AUTOMATION PRINCIPLES

- 5.1.1 Distinguish between standard and safety programmable controllers, their components, and their functions
- 5.1.2 Interpret programming diagrams (e.g., flow charts)
- 5.1.3 Sketch programming diagrams for real world applications
- 5.1.4 Compare and contrast open and closed loop control systems
- 5.1.5 Initialize a PLC
- 5.1.6 Understand and select proper communication drivers to interface with a PLC system
- 5.1.7 Apply suitable commands for PLC circuits
- 5.1.8 Apply timer and counter principles to industry-related problems
- 5.1.9 Program ladder logic statements to perform a specific task
- 5.1.10 Design, construct, and test an automated system

PERFORMANCE STANDARD 5.2 : DEMONSTRATE DIAGNOSTIC AND TROUBLESHOOTING PRACTICES

- 5.2.1 Explore diagnostic procedures
- 5.2.2 Identify components of a safety procedure checklist
- 5.2.3 Utilize all safety procedures necessary before performing a repair (e.g., lock-out/tag-out)
- 5.2.4 Navigate through user software
- 5.2.5 Understand and use software instructions offered in user software
- 5.2.6 Use manufacturer’s documentation for troubleshooting
- 5.2.7 Create a detailed troubleshooting checklist
- 5.2.7 Utilize diagnostic tools appropriately
- 5.2.8 Troubleshoot and repair common problems in control systems
- 5.2.9 Complete a troubleshooting work order

PERFORMANCE STANDARD 5.3 : DEMONSTRATE MAINTENANCE FUNDAMENTALS

- 5.3.1 Explore mechanical fundamentals (e.g., alignment, wear, lubrication)
- 5.3.2 Distinguish between preventative and predictive maintenance
- 5.3.3 Develop a routine maintenance plan
- 5.3.4 Utilize various repair, maintenance, and troubleshooting resources (e.g., print media, electronic, tech support, and local experts)

CONTENT STANDARD 6.0 : INTRODUCTION TO ROBOTIC SYSTEMS**PERFORMANCE STANDARD 6.1 : EXPLORE ROBOTIC SYSTEMS IN AUTOMATION**

- 6.1.1 Research the history of robotics (i.e., industrial and non-industrial)
- 6.1.2 Identify Isaac Asimov's three laws of robotics
- 6.1.3 Investigate the societal impact of robotics

PERFORMANCE STANDARD 6.2 : DETERMINE COMPONENTS IN ROBOTIC SYSTEMS FOR AUTOMATION

- 6.1.4 Apply robotic vocabulary (e.g., degrees of freedom, axis, work envelope, tool point, tool tip)
- 6.2.1 Identify main components of a robot
- 6.2.2 Investigate robotic specifications (e.g., payload, repeatability, environmental requirements, power sources)
- 6.2.3 Identify robot control systems
- 6.2.4 Describe end effectors utilized by robots
- 6.2.5 Identify teaching and programming interfaces for robots
- 6.2.6 Construct a simple automated system utilizing HMI interfaces

PERFORMANCE STANDARD 6.3 : CONSTRUCT A ROBOTIC SYSTEM FOR AUTOMATION

- 6.3.1 Identify programming languages for robotics applications
- 6.3.2 Identify path control techniques used by robots
- 6.3.3 Create a robotic control program
- 6.3.4 Construct a robotic control system combining several automation components (e.g., electrical, pneumatic, conveyance, VFDs, PLCs, and HMIs)