



**NIDA CORPORATION**

**MODEL 360S SYSTEMS TRAINER**

**COMPUTER ASSISTED INSTRUCTION  
LESSON and OBJECTIVE LISTING**

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**NIDA CORPORATION  
360S SYSTEMS TRAINER  
COMPUTER ASSISTED INSTRUCTION  
LESSON/OBJECTIVE INDEX**

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<b>MODEL 360S SYSTEMS PROGRAM</b>
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**BASIC SYSTEMS**

**INTRODUCTION TO SYSTEMS****7211-112-130 – SYSTEMS FAMILIARIZATION**

..... **ST101, ST102, ST103, ST104, ST105, ST106**

- \* Define a system.
- \* Define structure, interconnectivity, and behavior.
- \* Define input, process, and output.
- \* Define feedback and system control.
- \* Identify types of feedback and system control.
- \* Define interface.
- \* Apply a systems thinking approach.
- \* Set up a system.
- \* Follow setup instructions.
- \* Initialize, align, and operate a system.
- \* Perform a system E-Stop.
- \* Perform a system restart.
- \* Perform a system shutdown.

**7211-112-160 – SYSTEMS SAFETY**

- \* Define a hazard.
- \* Identify a hazard as physical, chemical, ergonomic, radiation, psychological, or biological.
- \* Perform a safety risk assessment.
- \* Apply the hierarchy of risk controls.
- \* Select the correct fire extinguisher to put out a class A, B, C, D, and combination fires.
- \* Read emergency evacuation route diagrams.
- \* Practice standard safety rules while working around and with electricity.
- \* Correlate OSHA safety code colors used in manufacturing to situations and devices.
- \* Read material safety data sheets (MSDS).
- \* Implement the 5-point eye safety checklist.
- \* Recognize the hazards of confined spaces.

**7211-112-190 – MULTIMETER FAMILIARIZATION**

..... **ST101, ST102, ST103, ST104, ST105, ST106**

- \* Define a digital multimeter's purpose.
- \* Identify quantities measured with a digital multimeter.
- \* Identify the sections of a digital multimeter.
- \* List the IEC Measurement Categories.
- \* List safe measurement techniques.
- \* Set up a DMM to measure DC and AC voltages, DC current, resistance, and continuity.
- \* Measure DC and AC voltages, DC current, resistance, and continuity.
- \* Read measured DC and AC voltages, DC current, resistance, and continuity.
- \* Apply safe voltage, current, resistance, and continuity measurement techniques.

**7211-112-220 – OSCILLOSCOPE FAMILIARIZATION**

..... **ST101, ST102, ST103, ST104, ST105, ST106**

- \* Define an oscilloscope's purpose.
- \* Identify quantities measured with an oscilloscope.
- \* Identify the sections of an oscilloscope.
- \* Set up an oscilloscope.
- \* Zero a trace.
- \* Perform probe compensation.
- \* Measure waveforms using an oscilloscope.
- \* Measure DC and AC voltage using an oscilloscope.
- \* Measure waveform period using an oscilloscope.
- \* Calculate frequency,  $V_{RMS}$ , phase, and pulse width using an oscilloscope.

## BASIC SYSTEMS continued

**SYSTEM STRUCTURE AND BEHAVIOR****7211-114-130 – SYSTEM INPUT AND OUTPUT DEVICES**

..... ST101, ST102, ST103, ST104, ST105, ST106

- \* Define a system input.
- \* Identify system input devices.
- \* Define a system output.
- \* Identify system output devices.
- \* Trace input and output subsystem connections using a block diagram and composite diagram.
- \* Perform an alignment procedure to adjust sensor sensitivity.
- \* Verify normal operation of speed, position, and direction sensors using displays, monitors, and a multimeter or an oscilloscope.
- \* Diagnose and resolve sensor malfunctions using a diagnostic checklist, troubleshooting tree, and test equipment.

**7211-114-160 – SYSTEM CONTROL AND INTERFACE**

..... ST101, ST102, ST103, ST104, ST105, ST106

- \* Define process control.
- \* Identify open loop control.
- \* Identify closed loop control.
- \* Read a control loop block diagram.
- \* Recognize control station devices.
- \* Define interface.
- \* Identify hardware interface.
- \* Identify software interface.
- \* Identify user interface.
- \* Trace sequential control device connections using blocks and composite diagrams.
- \* Operate a system using human machine interface.
- \* Verify normal system operation while using sequential control.

**7211-114-190 – SYSTEM INDICATOR, DISPLAY, AND MONITOR DEVICES**

..... ST101, ST102, ST103, ST104, ST105, ST106

- \* Trace indicator and display subsystem connections using a composite diagram.
- \* Calibrate analog and digital displays using an alignment procedure.
- \* Gather system information by reading analog, seven-segment, and digital displays.
- \* Verify normal operation of LEDs, an analog display, a digital display, and seven-segment displays by comparing displayed readings to output voltages and system performance.
- \* Diagnose and detect indicator and display malfunctions using a troubleshooting tree and test equipment.

**SYSTEM TESTING AND TROUBLESHOOTING****7211-116-130 – SYSTEM PERFORMANCE ANALYSIS**

..... ST101, ST102, ST103, ST104, ST105, ST106

- \* Diagnose and detect indicator and display malfunctions using a troubleshooting tree and test equipment.
- \* Examine system usability.
- \* Define system integrity.
- \* Differentiate error messages from warning messages.
- \* Read a log file.
- \* Optimize system performance.

**7211-116-160 – SYSTEM MAINTENANCE AND DIAGNOSTICS**

..... ST101, ST102, ST103, ST104, ST105, ST106

- \* Set up, initialize, and start up a system following a given procedure.
- \* Perform a preventive maintenance routine.
- \* Perform a scheduled maintenance routine.
- \* Use a diagnostic checklist to detect non-critical malfunctions.
- \* Perform an unscheduled maintenance routine.

**BASIC SYSTEMS continued****SYSTEM TESTING AND TROUBLESHOOTING continued****7211-116-190 – SYSTEM MALFUNCTIONS AND TROUBLESHOOTING**..... **ST101, ST102, ST103, ST104, ST105, ST106**

- \* Identify symptoms using sensor alerts, indicators, display readings, and test equipment.
- \* Use a diagnostic checklist to identify critical malfunctions.
- \* Use a troubleshooting tree to detect system malfunctions.
- \* Detect system malfunctions by using readings from monitoring devices.
- \* Separate a subsystem using an off-line procedure.
- \* Use test equipment to identify shorted, open, and overloaded subsystems.
- \* Perform a subsystem restart procedure.

**APPLIED SYSTEM CONCEPTS****7211-212-130 – OPEN AND CLOSED SYSTEMS**..... **ST101, ST102, ST103, ST104, ST105, ST106**

- \* Operate an open and closed system using negative feedback control and positive feedback control.
- \* Monitor and check normal open and closed system behavior by analyzing output performance using indicators, displays, monitors, and an operational checklist.
- \* Diagnose and detect open and closed system malfunctions using a diagnostic checklist and troubleshooting tree.
- \* Separate subsystems using an off-line procedure and follow a restart procedure.

**ALTERNATIVE ENERGY****INTRODUCTION****7231-112-130 – INTRODUCTION TO ALTERNATIVE ENERGY SYSTEMS .....**

- \* Express the need for alternative energy.
- \* Explain the four elements of alternative energy.
- \* Understand alternative energy sources.
- \* Describe energy conversion technologies.

**7231-112-160 – ENERGY SOURCES AND SITE SURVEYS .....**

- \* Describe alternative energy resources (wind, solar, hydroelectric, ocean wave, ocean tidal, ocean current, ocean thermal conversion, geothermal).
- \* Illustrate energy resources (wind, solar).
- \* Explain the use of a site survey.
- \* Describe how to perform a site survey.

**HOME ENERGY SYSTEMS****7231-114-130 – HOME SOLAR ENERGY SYSTEM FUNDAMENTALS**..... **ES101, ES102, ES103, ES105, ES106, ES107**

- \* Explain home solar energy operation.
- \* Describe solar resources and their uses for home energy.
- \* Recognize safe home solar energy maintenance methods.
- \* Recognize home solar energy common tools.
- \* Read a home solar energy block diagram to identify the major subsystems.
- \* Operate a home solar energy system using a block diagram.
- \* Verify the operation of the home solar energy system using sensors, monitors and display devices.
- \* Examine the operation of the home solar energy system.

## ALTERNATIVE ENERGY continued

**HOME ENERGY SYSTEMS continued****7231-114-160 – HOME WIND ENERGY SYSTEM FUNDAMENTALS**

..... ES101, ES102, ES103, ES105, ES106, ES107

- \* Explain home wind energy operation.
- \* Describe the effects of wind speed and wind obstructions.
- \* Describe tilt-up tower operation.
- \* Recognize safe home wind energy maintenance methods.
- \* Recognize home wind energy common tools.
- \* Read a home wind energy block diagram to identify the major subsystems.
- \* Operate a home wind energy system using a block diagram.
- \* Verify the operation of the home wind energy system using sensors, monitors and display devices.
- \* Examine the operation of a home wind energy system.

**7231-114-190 – HOME HYBRID ENERGY SYSTEM FUNDAMENTALS**

..... ES101, ES102, ES103, ES105, ES106, ES107

- \* Explain home backup power generation.
- \* Explain home inverter and grid-tied interface operation.
- \* Describe hybrid home energy system integration.
- \* Recognize safe home hybrid energy maintenance methods.
- \* Recognize home hybrid energy common tools.
- \* Read a home hybrid energy block diagram to identify the major subsystems.
- \* Operate a home hybrid energy system using a block diagram.
- \* Verify the operation of the home hybrid energy system using sensors, monitors and display devices.
- \* Examine the operation of each home hybrid energy subsystem.

**7231-114-220 - HOME ENERGY SYSTEM MAINTENANCE & DIAGNOSTICS**

..... ES101, ES102, ES103, ES105, ES106, ES107

- \* Recognize typical home energy preventive, scheduled and unscheduled maintenance routines.
- \* Describe general inspection techniques for home energy systems.
- \* Recognize unscheduled maintenance routines.
- \* Describe when unscheduled maintenance is necessary.
- \* Set up and initialize a home energy system following a given procedure.
- \* Perform a home energy operational check.
- \* Show proper use of measurement devices.
- \* Examine home energy system fault isolation procedures.
- \* Demonstrate the ability to diagnose a defective subsystem in a home energy system using fault isolation procedures.

**7231-114-250 - HOME ENERGY SYSTEM MALFUNCTIONS & TROUBLESHOOTING**

..... ES101, ES102, ES103, ES105, ES106, ES107

- \* Examine the troubleshooting process for home energy systems.
- \* Describe the basic tools used to troubleshoot home energy systems.
- \* Set up and initialize a home energy system following a given procedure.
- \* Validate system operation using sensors, displays, and monitoring devices.
- \* Verify symptoms of home energy subsystem malfunctions
- \* Use a digital multimeter to take measurements.
- \* Troubleshoot malfunctioning subsystems in a home energy system.

## ALTERNATIVE ENERGY continued

**WIND ENERGY SYSTEMS****7231-116-130 – WIND TURBINE SYSTEM FUNDAMENTALS**

.....ES101, ES102, ES103, ES110, ES111, ES112

- \* Describe the types of wind turbines (HAWT and VAWT).
- \* Describe the differences between commercial and residential wind generation.
- \* Recognize safe wind turbine maintenance methods.
- \* Explain commercial wind power subsystem operation (generator, gearing, cooling, control, yaw, pitch, brake).
- \* Read a wind turbine block diagram to identify major subsystems.
- \* Set up and initialize a wind turbine system following a given procedure.
- \* Operate a wind turbine system using a block diagram.
- \* Verify the operation of a wind turbine system using sensors, monitors, and display devices.
- \* Examine the operation of each wind turbine subsystem.

**7231-116-160 - 3-PHASE POWER FUNDAMENTALS**

.....ES101, ES102, ES103, ES110, ES111, ES112

- \* Describe 3-phase power.
- \* Describe the operation of an AC generator.
- \* Describe the operation of inverters.
- \* Describe the difference between 50 Hz and 60 Hz power.
- \* Read a wind turbine block diagram.
- \* Operate a wind turbine system using a block diagram.
- \* Verify the presence of 3-phase power using an oscilloscope.

**7231-116-190 – WIND TURBINE SYSTEM MAINTENANCE AND DIAGNOSTICS**

.....ES101, ES102, ES103, ES110, ES111, ES112

- \* Recognize wind turbine preventive/scheduled and unscheduled maintenance routines.
- \* Describe physical inspection techniques for a wind turbine system.
- \* Recognize unscheduled maintenance routines.
- \* Describe when unscheduled maintenance is necessary.
- \* Set up and initialize a wind turbine system following a given procedure.
- \* Perform a wind turbine system operational check.
- \* Show proper use of measurement devices.
- \* Examine wind turbine system fault isolation procedures.
- \* Demonstrate the ability to diagnose a defective subsystem in a wind turbine system using fault isolation procedures.

**7231-116-220 – WIND TURBINE SYSTEM MALFUNCTIONS AND TROUBLESHOOTING**

.....ES101, ES102, ES103, ES110, ES111, ES112

- \* Examine the troubleshooting process for wind turbine systems.
- \* Describe the basic tools used to troubleshoot commercial wind turbine systems.
- \* Initialize a wind turbine system.
- \* Validate a wind turbine system operation.
- \* Recognize symptoms of wind turbine subsystem malfunctions.
- \* Use a digital multimeter and oscilloscope to take measurements.
- \* Identify a malfunctioning subsystem in a wind turbine power system.

**SOLAR ENERGY SYSTEMS****7231-118-130 – SOLAR THERMAL SYSTEM FUNDAMENTALS .....**

- \* Express the need for solar thermal power as an alternative energy.
- \* Differentiate non-concentrating and concentrating thermal collectors.
- \* Explain the three main classes of solar thermal collectors.
- \* Examine solar pool heating systems.
- \* Examine solar water heating systems.
- \* Examine solar space heating systems.
- \* Examine parabolic trough systems.
- \* Examine solar dish (Stirling engine) systems.
- \* Examine solar power tower systems.

ALTERNATIVE ENERGY continued

**SOLAR ENERGY SYSTEMS continued**

**7231-118-160 – SOLAR PHOTOVOLTAIC SYSTEM FUNDAMENTALS**

.....ES101, ES102, ES103, ES107, ES108, ES109

- \* Express the need for solar photovoltaic power as an alternative energy.
- \* Explain the photovoltaic (PV) effect and construction.
- \* Describe solar resources.
- \* Describe general solar photovoltaic personal protective equipment.
- \* Explain proper installation procedures.
- \* Recognize safe installation and maintenance methods.
- \* Recognize solar PV system common tools.
- \* Read a solar photovoltaic system block diagram to identify the major subsystems.
- \* Set up and initialize a solar PV system following a given procedure.
- \* Operate a solar photovoltaic system using a block diagram.
- \* Verify the operation of a solar photovoltaic system using sensors, monitors, and display devices.
- \* Examine the operation of each solar photovoltaic subsystem.

**7231-118-190 – SOLAR PHOTOVOLTAIC SYSTEM MAINTENANCE AND DIAGNOSTICS**

.....ES101, ES102, ES103, ES107, ES108, ES109

- \* Recognize solar photovoltaic preventive/scheduled and unscheduled maintenance routines.
- \* Describe physical inspection techniques for solar photovoltaic systems.
- \* Recognize unscheduled maintenance routines.
- \* Describe when unscheduled maintenance is necessary.
- \* Set up and initialize a solar PV system following a given procedure.
- \* Perform a solar photovoltaic system operational check.
- \* Show proper use of measurement devices.
- \* Examine solar photovoltaic system fault isolation procedures.

**7231-118-220 – SOLAR PHOTOVOLTAIC SYSTEM MALFUNCTIONS AND TROUBLESHOOTING**

.....ES101, ES102, ES103, ES107, ES108, ES109

- \* Examine the troubleshooting process for solar photovoltaic systems.
- \* Describe the basic tools used to troubleshoot solar photovoltaic systems.
- \* Set up and initialize a solar PV system following a given procedure.
- \* Validate system operation using sensors, displays, and monitoring devices.
- \* Verify symptoms of solar photovoltaic subsystem malfunctions.
- \* Use a digital multimeter and oscilloscope to take measurements.
- \* Troubleshoot malfunctioning subsystems in a solar photovoltaic system.

**BIOFUELS**

**7231-312-130 – BIOFUELS.....--**

- \* Define biofuel.
- \* Identify types of biofuels.
- \* Explore biofuel processes.
- \* Recognize biofuel utilization.

**ENERGY STORAGE SYSTEMS**

**7231-314-130 ENERGY STORAGE FUNDAMENTALS .....--**

- \* Describe various large-scale energy storage systems.
- \* Compare the benefits and downfalls of varied large-scale energy storage systems.

**7231-314-160 – BATTERY TYPES AND APPLICATIONS .....--**

- \* Describe primary and secondary batteries and their applications.
- \* Recognize safe installation and maintenance methods.



ALTERNATIVE ENERGY continued

**ENERGY STORAGE SYSTEMS, continued**

**7231-314-190 – BATTERY EXPERIMENTS**

- .....ESxxx, ESxxx, ESxxx, ESxxx, ESxxx, ESxxx
- \* Read a battery bank system block diagram to identify the major subsystems.
  - \* Set up and initialize a battery bank system following a given procedure.
  - \* Perform a battery bank operational check using a block diagram.
  - \* Show proper use of measurement devices.
  - \* Identify the operation of a battery bank.
  - \* Demonstrate the ability to diagnose a defect in a battery bank using fault isolation procedures.

**7221-314-220 – FUEL CELL TYPES AND APPLICATIONS** .....

- \* Describe fuel cell types and their applications.
- \* Recognize benefits and challenges of fuel cells.

**7231-314-250 – FUEL CELL EXPERIMENTS**

- .....ESxxx, ESxxx, ESxxx, ESxxx, ESxxx, ESxxx
- \* Read a fuel cell system block diagram to identify the major subsystems.
  - \* Set up and initialize a fuel cell system following a given procedure.
  - \* Perform a fuel cell system operational check.
  - \* Show proper use of measurement devices.
  - \* Identify the operation of a fuel cell system.
  - \* Demonstrate the ability to diagnose a defect in a fuel cell using fault isolation procedures.

**INDUSTRIAL PROCESS AND CONTROL SYSTEMS**

**INTRODUCTION TO INDUSTRIAL SYSTEMS**

**7241-112-130 – INDUSTRIAL SYSTEM FUNDAMENTALS**.....TBD

- \* Operate a sample industrial system.
- \* Trace industrial systems interconnections using a composite diagram and test equipment.
- \* Troubleshoot and identify defects in an industrial system.
- \* Explore common industry safety concerns.
- \* Apply a lockout/tag out after performing an emergency stop or unscheduled shutdown.

**INTRODUCTION TO INDUSTRIAL PROCESS CONTROLLERS**

**7241-212-130 – SYSTEM PROCESS CONTROLLER FUNDAMENTALS**.....TBD

- \* Explore the history, present state, and future of process controllers.
- \* Categorize discrete, batch, and continuous process control requirement examples.
- \* Identify differences between Distributed Control Systems (DCS) and Supervisory Control and Data Acquisition (SCADA).
- \* Identify differences between Programmable Logic Controllers (PLC) and Programmable Automation Controllers (PAC).
- \* Describe the functions of the Human Machine Interface (HMI) and the Remote Terminal Unit (RTU).

**INDUSTRIAL PROCESS AND CONTROL SYSTEMS continued****PLC SYSTEMS****7241-214-130 – PROGRAMMABLE LOGIC CONTROLLERS SYSTEM .....TBD**

- \* Compare relay logic to PLC logic.
- \* Identify PLC analog and discrete inputs and outputs.
- \* Demonstrate PLC hardware functions.
- \* Perform PLC adjustments, alignments, and operational checks.
- \* Measure and confirm closed loop operation, set points, and feedback.

**7241-214-160 – PLC SYSTEM PROGRAMMING FUNDAMENTALS .....TBD**

- \* Identify different types of instructions.
- \* Compare different types of files.
- \* Use a defined process to develop an organized programming strategy.
- \* Identify the correct ladder logic program for a specified process.
- \* Explore basic operation instructions.

**7241-214-190 – PLC MALFUNCTIONS AND TROUBLESHOOTING .....TBD**

- \* Initialize a PLC system.
- \* Validate proper operation of a PLC system.
- \* Identify improper symptoms of a PLC system.
- \* Use a digital multimeter and oscilloscope to take measurements.
- \* Troubleshoot system malfunctions.
- \* Identify malfunctioning subsystems in a PLC system.

**PAC SYSTEMS****7241-216-130 – PROGRAMMABLE AUTOMATION CONTROLLERS SYSTEM .....TBD**

- \* Compare relay and ladder logic to PAC logic.
- \* Identify elements and components of a PAC.
- \* Demonstrate PAC hardware functions.
- \* Perform PAC adjustments, alignments, and operational checks.
- \* Measure and confirm closed loop operation, set points, and feedback.

**7241-216-160 – PROGRAMMABLE AUTOMATION CONTROLLERS MAINTENANCE AND DIAGNOSTICS .....TBD**

- \* Identify PAC systems preventive and scheduled maintenance.
- \* Identify PAC systems unscheduled maintenance.
- \* Perform a PAC systems operational check.
- \* Show proper use of measurement devices.
- \* Identify malfunctioning subsystems in a PAC system.

**7241-216-190 – PAC MALFUNCTIONS AND TROUBLESHOOTING .....TBD**

- \* Initialize a PAC system.
- \* Validate proper operation of a PAC system.
- \* Identify improper symptoms of a PAC system.
- \* Use a digital multimeter and oscilloscope to take measurements.
- \* Troubleshoot system malfunctions.
- \* Identify malfunctioning subsystems in a PAC system.

**INDUSTRIAL SYSTEMS INPUT DEVICES****7241-312-130 – SENSOR FUNDAMENTALS .....TBD**

- \* Identify functions of sensors used in industry.
- \* Summarize sensor types most often used in industry.

**7241-312-160 – MECHANICAL, MAGNETIC, AND PROXIMITY SENSORS .....TBD**

- \* Identify types, benefits, limitations, and applications of mechanical, magnetic, and proximity sensors.
- \* Test and confirm proper operation of micro, reed, magnetic, and hall effect sensors.

**7241-312-190 – OPTICAL AND SOUND SENSORS .....TBD**

- \* Identify types benefits, limitations, and applications of optical and sound sensors.
- \* Test and confirm proper operation of photodiode and phototransistor optical sensors.

**INDUSTRIAL PROCESS AND CONTROL SYSTEMS continued****INDUSTRIAL SYSTEMS INPUT DEVICES continued****7241-312-220 – TEMPERATURE, LEVEL AND FLOW SENSORS ..... TBD**

- \* Identify types, benefits, limitations, and applications of temperature, level, and flow sensors.
- \* Test and confirm proper operation of temperature sensors.

**7241-312-250 – MOTION, PRESSURE, AND FORCE SENSORS ..... TBD**

- \* Identify types, benefits, limitations, and applications of motion and force sensors.
- \* Test and confirm proper operation of motion and pressure sensors.

**INDUSTRIAL SYSTEMS OUTPUT DEVICES****7241-314-130 – ACTUATOR FUNDAMENTALS ..... TBD**

- \* Identify functions of actuators used in industry.
- \* Summarize sensor types most often used in industry.

**7241-314-160 – MOTORS AND RELAYS ..... TBD**

- \* Identify types of motors and purposes of relays used in industry.
- \* Test and confirm proper operation of DC motor and stepper motor using relays and electronic circuitry in response to sensor readings system control.

**7241-314-190 – SYSTEM ELECTRICAL CONTROL OF HYDRAULIC AND PNEUMATIC ACTUATORS ..... TBD**

- \* Identify methods of activating hydraulic and pneumatic actuators using system control.
- \* Outline requirements for hydraulic and pneumatic industrial systems with system control integration.

**INTRODUCTION TO INDUSTRIAL SYSTEMS INSTRUMENTATION****7241-412-130 – INSTRUMENTATION FUNDAMENTALS..... TBD**

- \* Identify functions of industrial instrumentation.
- \* Troubleshoot and identify defects in industrial instrumentation.

**7241-412-160 – HUMAN-MACHINE INTERFACE (HMI) ..... TBD**

- \* Define HMI functions.
- \* Identify communications methods and protocols.
- \* Troubleshoot abnormal operation of instrumentation and indicators.

**TYPES OF INDUSTRIAL SYSTEMS INSTRUMENTATION****7241-414-130 – DCS AND SCADA FUNCTIONS ..... TBD**

- \* Create a block diagram of a distributed control system.
- \* Create a block diagram of a supervisory control and data acquisition system.
- \* Compare different types of interconnections and interfaces.

**7241-414-160 – FIELDBUS SYSTEMS AND PROTOCOLS..... TBD**

- \* Explore hardware standards EIA-232, 422, and 485.
- \* Compare fieldbus maximum allowed distances, maximum number of allowed devices, voltages, and protocols for each standard.
- \* Identify standard connectors and pin layouts used.
- \* Build and test popular connectors to standards.

**7241-414-190 – 4-20 mA CURRENT LOOP SYSTEMS ..... TBD**

- \* Examine current loop basics.
- \* Perform measurements on a typical 4-20 mA current loop.
- \* Design 4-20 mA current loop systems.

**7241-414-220 – HIGHWAY ADDRESSABLE REMOTE TRANSDUCER SYSTEMS..... TBD**

- \* Examine HART basics.
- \* Compare a typical HART analog signal to a typical HART digital signal.
- \* Troubleshoot a simulated 2.4 GHz HART wireless signal.

**7241-414-250 – ETHERNET-BASED COMMUNICATIONS AND PROTOCOLS..... TBD**

- \* Explore hardware standards EIA-568A and 568-B.
- \* Examine an industrial system using TCP/IP Internet Protocol Suite.
- \* Demonstrate knowledge of static and dynamic TCP/IP address assignments.
- \* Assemble and test a network cable using RJ-45 connectors.

**INDUSTRIAL PROCESS AND CONTROL SYSTEMS continued****OTHER INDUSTRIAL SYSTEMS COMMUNICATIONS AND PROTOCOLS****7241-416-130 – OTHER INDUSTRIAL SYSTEMS COMMUNICATIONS AND PROTOCOLS .....TBD**

- \* Examine an industrial system using digital communications.
- \* Examine an industrial system using Dual-Tone Multi-Frequency (DTMF) protocol.
- \* Examine an industrial system using Frequency Shift Keying (FSK) protocol.

**TROUBLESHOOTING****7241-812-130 – INDUSTRIAL SYSTEM TROUBLESHOOTING .....TBD**

- \* Operate a sample industrial system using different controllers and communications protocols.
- \* Trace industrial systems interconnections using a composite diagram and test equipment.
- \* Troubleshoot and identify defects in an industrial system.

**FIRE, SECURITY, AND ACCESS CONTROL SYSTEMS****INTRODUCTION****7261-112-130 – INTRODUCTION TO FIRE, SECURITY, AND ACCESS CONTROL SYSTEMS .....TBD**

- \* Explore purposes and functions of a fire alarm system.
- \* Explore purposes and functions of a security alarm system.
- \* Explore purposes and functions of an access controlled system.
- \* Identify fire, security, and access control subsystems and zones as either input, process, or output.
- \* Identify alarm and alert methods used in fire, security, and access control systems.

**FIRE ALARM SYSTEMS****7261-212-130 – INTRODUCTION TO FIRE SYSTEMS .....TBD**

- \* Explore purposes and functions of a fire system.
- \* Read a fire system block diagram.
- \* Identify subsystems and zones as either input, process, or output.
- \* Execute specific workplace safety practices.
- \* Demonstrate knowledge of regulating codes, standards, and authorities.
- \* Perform a visual inspection of fire system hardware.
- \* Set up, initialize, and start up a fire system following a given procedure.
- \* Verify normal fire system behavior by analyzing output indicators and displays.

**7261-214-130 – FIRE SYSTEM WIRING AND MANUAL & AUTOMATIC SWITCH****SENSOR DEVICES .....TBD**

- \* Identify types of manual pull and automatic tamper and flow switches.
- \* Identify types and installation of 2- and 4-conductor wire used in commercial and residential applications.
- \* Demonstrate proper operation and placement of fire pull stations.
- \* Demonstrate types and placement of tamper and flow switches.
- \* Demonstrate reasons for and failures of end of line resistors.
- \* Verify normal and failed operation of switched fire devices.

**7261-214-160 – FIRE SYSTEM HEAT, SMOKE, FLAME, AND GAS SENSOR DEVICES .....TBD**

- \* Identify four types and applications of smoke detectors
- \* Identify purposes and types of heat and flame detectors
- \* Identify types and purposes of combustible and toxic gas detectors.
- \* Demonstrate types and placement of heat, smoke, flame, and gas detectors.
- \* Demonstrate proper wiring methods used for 4-conductor fire devices.

**FIRE, SECURITY, AND ACCESS CONTROL SYSTEMS continued****FIRE ALARM SYSTEMS continued****7261-214-190 – FIRE SYSTEM ALERT, LOCKING, AND UNLOCKING DEVICES ..... TBD**

- \* Identify sirens, bells, and voice fire alarm alert device requirements and applications.
- \* Identify visual fire alarm alert device types, requirements, and applications.
- \* Describe the uses for magnetic locks and door strikes in fire system applications.
- \* Demonstrate types and placement of heat, smoke, flame, and gas detectors.
- \* Identify proper wiring methods and connections used for 4-conductor fire devices.

**7261-214-220 – FIRE SYSTEM CONTROL PANELS AND ZONES..... TBD**

- \* Explore purposes and functions of a fire system control panel.
- \* Read a typical fire control panel block diagram.
- \* Identify and define control panel subsystems and functions.
- \* Demonstrate knowledge of control panel indicators.
- \* Identify control panel wire connections and purposes.
- \* Demonstrate knowledge of a fire system backup battery requirements.
- \* Identify typical addressable fire zone purposes, wire connections, and protocol.

**7261-214-250 – FIRE SYSTEM COMMUNICATORS..... TBD**

- \* Explore purposes and functions of a fire system communicator.
- \* Identify typical communication dialer protocols to central station receivers.
- \* Demonstrate wiring method and reasons for using the RJ-31X jack.
- \* Identify alternate alarm panel communication methods.

**7261-216-130 – FIRE ALARM SYSTEM MALFUNCTIONS AND TROUBLESHOOTING ..... TBD**

- \* Initialize a fire alarm system with default settings.
- \* Validate system operation using sensors and display devices.
- \* Verify symptoms of fire system subsystem malfunctions.
- \* Use a digital multimeter to take measurements.
- \* Troubleshoot a malfunctioning subsystem in a fire alarm system.
- \* Power down the fire alarm system.

**SECURITY ALARM SYSTEMS****7261-312-130 – INTRODUCTION TO SECURITY SYSTEMS ..... TBD**

- \* Explore purposes and functions of a security system.
- \* Read a security system block diagram.
- \* Identify subsystems and zones as either input, process, or output.
- \* Execute specific workplace safety practices.
- \* Demonstrate knowledge of regulating codes, standards, and authorities.
- \* Perform a visual inspection of security system hardware.
- \* Set up, initialize, and start up a security system following a given procedure.
- \* Verify normal security system behavior by analyzing output indicators and displays.

**7261-314-130 – SECURITY SYSTEM WIRING AND MAGNETIC REED AND TAMPER SWITCHES..... TBD**

- \* Identify types of magnetic reed switches.
- \* Identify types and installation of 2- and 4-conductor wire used in commercial and residential applications.
- \* Demonstrate proper placement of magnetic reed switches on doorways and windows.
- \* Demonstrate types and placement of tamper switches.
- \* Identify reasons for end of line resistors.
- \* Verify normal and failed operation of magnetic reed and tamper switches.

**7261-314-160 – SECURITY SYSTEM MOTION DETECTION DEVICES ..... TBD**

- \* Identify four different types of motion detections.
- \* Identify purposes of each type of motion detector.
- \* Demonstrate correct placement of motion detectors in different environments.
- \* Describe methods of reducing false alarms.

**FIRE, SECURITY, AND ACCESS CONTROL SYSTEMS continued****SECURITY ALARM SYSTEMS continued****7261-314-190 – SECURITY SYSTEM GLASS BREAKAGE AND SHOCK SENSOR DEVICES ..... TBD**

- \* Identify three different methods used to detect glass breakage and shock.
- \* Identify technology, benefits, and drawbacks of each type of glass break detection.
- \* Demonstrate correct placement of glass breakage and shock detectors.
- \* Describe methods of reducing false alarms.

**7261-314-220 – SECURITY SYSTEM CONTROL PANELS AND ZONES..... TBD**

- \* Explore purposes and functions of a security system control panel.
- \* Read a typical security control panel block diagram.
- \* Identify and define control panel subsystems and functions.
- \* Demonstrate knowledge of control panel keypad indicators and displays.
- \* Identify control panel wire connections and purposes.
- \* Demonstrate knowledge of security system backup battery requirements.

**7261-314-250 – SECURITY SYSTEM COMMUNICATORS..... TBD**

- \* Explore purposes and functions of a security system communicator.
- \* Identify typical communication dialer protocols to central station receivers.
- \* Demonstrate wiring method and reasons for using the RJ-31X jack.
- \* Identify alternate alarm panel communication methods.

**7261-316-130 – SECURITY ALARM SYSTEM MALFUNCTIONS AND TROUBLESHOOTING ..... TBD**

- \* Validate alarm system operation using sensors and display devices.
- \* Verify symptoms of security system subsystem malfunctions.
- \* Use a digital multimeter to take measurements.
- \* Troubleshoot a malfunctioning subsystem in a security alarm system.

**ACCESS CONTROL SYSTEMS****7261-412-130 – INTRODUCTION TO ACCESS CONTROL SYSTEMS..... TBD**

- \* Explore purposes and functions of an access control system.
- \* Read an access control system block diagram.
- \* Identify subsystems and zones as either input, process, or output.
- \* Execute specific workplace safety practices.
- \* Perform a visual inspection of access control system hardware.
- \* Set up, initialize, and operate an access control system following a given procedure.
- \* Verify normal access control system behavior by analyzing output indicators and displays.

**7261-414-130 – ACCESS CONTROL SYSTEM ENTRANCE AND EXIT LOCKING DEVICES ..... TBD**

- \* Identify door strikes and applications for use.
- \* Identify magnetic locks and applications for use.
- \* Display familiarity with large access control installations and locking devices.

**7261-414-160 – ACCESS CONTROL SYSTEM ENTRY AND EXIT ACCEPTANCE DEVICES..... TBD**

- \* Identify keypad and bar code readers and applications.
- \* Identify magnetic card readers and applications.
- \* Identify proximity and RFID readers and applications.
- \* Identify biometric fingerprint and hand recognition readers and applications.
- \* Identify exit request devices.

**7261-414-190 – ACCESS CONTROL SYSTEM CONTROL PANELS, SOFTWARE, AND PROGRAMMING ..... TBD**

- \* Explore purposes and functions of an access control panel.
- \* Read a typical access control panel block diagram.
- \* Identify and define control panel subsystems and functions.
- \* Demonstrate knowledge of the information stored in an access control database.
- \* Identify control panel wire connections and purposes.
- \* Identify methods of integrating cameras and video into an access control system.

**7261-416-130 – ACCESS CONTROL SYSTEM MALFUNCTIONS AND TROUBLESHOOTING ..... TBD**

- \* Validate system operation using reader, locking devices, and display devices.
- \* Verify symptoms of access control system subsystem malfunctions.
- \* Use a digital multimeter to take measurements.
- \* Troubleshoot a malfunctioning subsystem in an access control system.
- \* Power down the access control system.

**3-PHASE POWER****3-PHASE POWER GENERATION****7271-112-130 – 3-PHASE POWER GENERATION SYSTEM FAMILIARIZATION..... TBD**

- \* Read a power generation block diagram.
- \* Operate a power generation system using a block diagram.
- \* Verify the operation of a power generation system using sensors, monitors, and display devices.

**7271-112-160 – 3-PHASE POWER GENERATION SYSTEM MAINTENANCE****AND DIAGNOSTICS ..... TBD**

- \* Perform a power generation system operational check.
- \* Show proper use of measurement devices.
- \* Examine power generation system fault isolation procedures.
- \* Demonstrate the ability to diagnose a defective subsystem in a power generation system using fault isolation procedures.

**7271-112-190 – 3-PHASE POWER GENERATION SYSTEM MALFUNCTIONS AND****TROUBLESHOOTING ..... TBD**

- \* Validate operation using sensors, monitors, and display devices.
- \* Verify symptoms of power generation malfunctions.
- \* Use a digital multimeter and oscilloscope to take measurements.
- \* Troubleshoot malfunctions in a power generation device.

**3-PHASE POWER TRANSMISSION****7271-114-130 – 3-PHASE POWER TRANSMISSION SYSTEM FAMILIARIZATION..... TBD**

- \* Read a power transmission block diagram.
- \* Operate a power transmission system using a block diagram.
- \* Verify the operation of a power transmission system using sensors, monitors, and display devices.
- \* Examine the operation of each power transmission subsystem.

**7271-114-160 – 3-PHASE POWER TRANSMISSION SYSTEM MAINTENANCE****AND DIAGNOSTICS ..... TBD**

- \* Perform a power transmission system operational check.
- \* Show proper use of measurement devices.
- \* Examine power transmission system fault isolation procedures.
- \* Demonstrate the ability to diagnose a defective subsystem in a power transmission system using fault isolation procedures.

**7271-114-190 – 3-PHASE POWER TRANSMISSION SYSTEM MALFUNCTIONS****AND TROUBLESHOOTING..... TBD**

- \* Validate system operation using sensors, monitors, and display devices.
- \* Verify symptoms of power transmission subsystem malfunctions.
- \* Use a digital multimeter and oscilloscope to take measurements.
- \* Troubleshoot malfunctioning subsystems in a power transmission system.

## INVENTORY CONTROL

**ELECTRONIC TRACKING AND IDENTIFICATION SYSTEMS****7281-112-130 – TRACKING/ID SYSTEM TYPES AND APPLICATIONS .....TBD**

- \* Explore the past, present, and future of tracking systems.
- \* Identify elements and components of a tracking system.
- \* Explore different processes within a tracking system.
- \* Explore adjustments, alignments, and operational checks.

**7281-114-130 – BAR CODE, DOT CODE, AND OTHER OPTICAL SYSTEMS.....TBD**

- \* Explore hardware and software standards and protocols.
- \* Determine inputs, outputs, and process components.
- \* Compare different types of interconnections and interfaces.
- \* Identify displays and indicators.

**7281-114-160 – RFID SYSTEM LABELS, TAGS, READERS, AND ANTENNAS .....TBD**

- \* Explore hardware and software standards and protocols.
- \* Determine inputs, outputs, and process components.
- \* Compare different types of interconnections and interfaces.
- \* Identify displays and indicators.

**7281-116-130 – RFID SYSTEM MALFUNCTIONS AND TROUBLESHOOTING .....TBD**

- \* Initialize an RFID system.
- \* Validate proper operation of an RFID system.
- \* Identify improper symptoms of a RFID System
- \* Use a digital multimeter and oscilloscope to take measurements.
- \* Troubleshoot system malfunctions.
- \* Identify malfunctioning subsystems in an RFID system.