



Course Outline - Advanced Programmable Controller Application

Course Topic: Advanced Programmable Controller Application

Recommended Contact Hours: 75 hours

Course Description:

The course will be structured to provide the student with an understanding of the relationship between "real time" control systems and industrial devices and machines. The advanced instruction set of programmable controllers will be studied relevant to concepts and structures of automated control systems. Various applications will be defined in which the student will develop the written programs for each hardware and software specification of the process problems, including field devices, data networks, and Human Machine Interfaces (HMI). The use of the Robotics Lab equipment will give the student practical programming and troubleshooting skills used in the maintenance of automated systems.

Course Outcomes and Objectives

PLC- 1 Create programs in Ladder Logic using the following instructions in an application

1. Program Control Instructions
2. One-shot Instructions
3. Move Instructions
4. Logical Instructions
5. Arithmetic Instructions
6. Comparison Instructions
7. Sequencer Instructions
8. Bit Shift and rotate instructions
9. File Manipulation Instructions
10. Given a ladder listing and input conditions, predict the output status. This ladder listing will include the following instruction types: XIC, XIO, OTE, OTL, OUT, TON, TOF, RTO, CTU, CTD, RES, MOV, COP, MVM, EQU, GEQ, GRT, LEQ, LES, LIM, MEQ, NEQ, SQO, JMP, LBL, JSR, SBR, MCR, ONS
11. Identify what appears to be program anomalies when the program is running with Program Control Instructions (i.e. MCR, JMP, and LBL)
12. The student will load a bit pattern into the Tag database and control real world outputs with this bit pattern using Move and Sequencer (SQO) instructions
13. Given a ladder listing and input conditions, predict the output status. This ladder listing will include the following instruction types: a. MVM, JSR, SBR, FAL, CPT, CMP, GSV, SSV





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PLC- 2 Explain and demonstrate the use of analog data in PLCs

1. Explain the concepts of electrical signal conversion to digital values
2. Explain resolution of the analog signals
3. Identify the use of data for the scaling of analog inputs
4. Identify the use of data for the scaling of analog outputs
5. Create programs with analog signals in ladder logic applications
6. Provided a screen shot from the Device Configuration Properties Dialog Box, Match the Module Properties for an Analog Module to a given list
 - Output Type (Voltage / Current)
 - Output Range
 - Smoothing (weak, medium, strong)
 - Substitute value for channel on a change from Run to Stop (output)

PLC- 3 Demonstrate the programming of Function Block instructions in a PLC application

1. Explain the format of Function Block instructions.
2. Define the use parameters with Function Block instruction.
3. Create application programs using Function Block instructions
4. Using the RSLogix5000 software and two controllers, create and program Producer/Consumer tags to interlock the two controllers
5. Install DeviceNet hardware including cables, T-taps, power supplies, terminators, nodes, scanner module. Using RSNetWorx for DeviceNet software, configure the module with a scan list and node map. Write logic using the I/O on the DeviceNet network. Note: Apply DeviceNet wiring standards related to baud rate, trunk & drop cable lengths, thick & thin cable installations, ampere load limits, termination, refresh power, shielding, etc.
6. Interpret diagnostic indicators on common Devicenet I/O nodes, identifying the corrective action to be taken if a fault is indicated.
7. Identify & interpret diagnostic indicators on a DeviceNet Bridge Module, identifying the corrective action to be taken if a fault is indicated.
8. Using the RSNetWorx for DeviceNet software, go On-line to a DeviceNet Bridge module and display a graphical view of the network for node status.
9. Using the RSNetWorx for DeviceNet software, view specific active node parameters.
10. Using the RSNetWorx for DeviceNet software, view the scan list for actively scanned nodes and specific node mapping.
11. Using the RSNetWorx for DeviceNet software, commission a new node by adding it to an existing network, and mapping its address in the scanner module.





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12. Using the RSNetWorx for DeviceNet software, print to a file a list of all network nodes with their respective mapping and parameters.
13. Using the RSNetWorx for DeviceNet software, save & restore a scan list file to/from the DNB module
14. Using the TIA Portal Software, insert a new Function Block into an existing Network. Define 3 inputs and 1 output
15. Using the TIA Portal Software, demonstrate Adding An Input to an existing Function Block
16. Using Tia Portal Software, demonstrate using Drag And Drop to Assign Interface Signals to an existing Function Block
17. Using TIA Portal Software, switch the Language display of OB1 between LAD, FBD and STL
18. Given three example sections of logic, match each to the associated programming language (LAD, FBD and STL)

PLC- 4 Demonstrate the programming of the Structured Text instructions in a PLC application.

1. Explain the format of syntax of Structured Text instructions
2. Define the use parameters with Structured Text instruction
3. Create application programs using Structured Text instructions

PLC- 5 Explain and demonstrate the User Defined Data in a PLC application.

1. Explain the concept of structuring data.
2. Demonstrate the creation User Defined Data structure
3. Identify and demonstrate the use of User Defined Data in an application
4. Create a User-defined Data Type, and write a program using the UDT

PLC- 6 Demonstrate the programming of the Add On Instructions in a PLC application

1. Explain the concept of Add On Instructions
2. Demonstrate the creation Add On Instructions
3. Identify and demonstrate the use of Add On Instructions in an application

PLC- 7 Demonstrate the programming of the SIEMENS TIA Step7 Reusable Data Blocks in an application

1. Explain the concept of Reusable Data Blocks
2. Define the use parameters with Reusable Data Blocks
3. Create an application with Reusable Data Blocks

PLC- 8 Develop and implement Human Machine Interfaces (HMI)

1. Configure the HMI to communicate with the Programmable Logic Controller (PLC)





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2. Define the parameters for the following objects to interact with the programmable controller applications:
 - Drawing
 - Pushbutton
 - Indicators
 - Numeric and String
 - Gauge and Graph
 - Navigation
3. Construct and transfer the runtime file for the HMI applications.
4. Construct an alarm screen to list process errors.
5. Construct message screens for the PLC/HMI applications.
6. Define passwords for the PLC/HMI applications.

PLC- 9 Analyze a problem with a systematic approach to troubleshoot an automated system.

1. Demonstrate a systematic approach using observations, test instruments, and software to determine the source of the problem
2. Identify using a systematic approach specific to mechanical troubleshooting as to the cause and resolution of the problem
3. Identify using a systematic approach specific to fluidic troubleshooting as to the cause and resolution of the problem
4. Identify using a systematic approach specific to electrical troubleshooting as to the cause and resolution of the problem
5. Identify using a systematic approach the cause and resolution of a control problem
6. Demonstrate the use of on-line editing to correct a system problem

Course Outline:

SESSION 1: [Click here to enter a date.](#)

LECTURE:

Move and Move with Mask Instructions and Usage
RSlogix 500
RSLogix 5000
Move Instructions and Usage
Siemens

SESSION 2: [Click here to enter a date.](#)





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LECTURE:

HMI: Move

Allen-Bradley Objects

Siemens Equivalent Objects

SESSION 3: [Click here to enter a date.](#)

LECTURE:

Compute Instructions and Usage

RSLogix 500

RSLogix 5000

Math Instructions and Usage

Siemens

HMI: Timed Process Output

Allen-Bradley Objects

Siemens Equivalent Objects

SESSION 4: [Click here to enter a date.](#)

LECTURE:

Compare Instructions and Usage

RSLogix 500

RSLogix 5000

Siemens

One-Shot Instructions and Usage

RSLogix 500

RSLogix 5000

Siemens

HMI: Temperature Conversion with Indicators

SESSION 5: [Click here to enter a date.](#)

LECTURE:

Logical Instructions and Usage

RSLogix 5000

Siemens

SESSION 6: [Click here to enter a date.](#)

LECTURE:

Bit Shift Instructions and Usage





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RSLogix 500
Shift and Rotate Instructions and Usage
Siemens
HMI: Robot Index Table
Allen-Bradley Objects
Siemens Equivalent Objects

SESSION 7: [Click here to enter a date.](#)

LECTURE:

File Instructions and Usage
RSLogix 5000
Siemens
File Shift Instructions and Usage
RSLogix 5000
File Shift Logic Constructed Equivalent
Siemens
Move with Mask and Bit Field Distribute Robot Example
RSLogix 5000
Siemens Constructed Logic Equivalent

SESSION 8: [Click here to enter a date.](#)

LECTURE:

Analog Signals
Analog Wiring
Analog Instructions and Usage
RSLogix 5000
Siemens
Analog Modules RSLogix 5000

SESSION 9: [Click here to enter a date.](#)

LECTURE:

Function Block Format, Instructions, and Usage
RSLogix 5000
Siemens
HMI: Analog Input
Allen-Bradley Objects
Siemens Equivalent Objects





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SESSION 10: [Click here to enter a date.](#)

LECTURE:

Structured Text Syntax, Instructions, and Usage

RSLogix 5000

Siemens

HMI: Alarms and Local Messages

Allen-Bradley Objects

Siemens Equivalent Objects

SESSION 11: [Click here to enter a date.](#)

LECTURE:

Add On Instructions RSLogix 500

HMI: Passwords

Allen-Bradley Objects

Siemens Equivalent Objects

SESSION 12: [Click here to enter a date.](#)

LECTURE:

Reusable Data Block Siemens

SESSION 14: [Click here to enter a date.](#)

Lab Only

SESSION 15: [Click here to enter a date.](#)

FINAL EXAM





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