

## **Hands-On Industrial Automation Training for the Maintenance Troubleshooter**

### **Training Available On:**

- PLC's
- AC & DC Drives
- HMI
- Fluid Power
- Allen-Bradley/Rockwell
- Fanuc CNC
- Process Control & Instrumentation
- Siemens

### **Your Choice:**

Training On-Site, Remote or at Our Training Center

- Practical
- Customized
- Effective

### **Now Offering Remote Training!**

2205 Plantside Drive ▪ Louisville, KY 40299 ▪ (502) 499-7522

[www.intellectcontrols.com](http://www.intellectcontrols.com)



# INTELLECT CONTROLS GROUP, INC

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## ABOUT US!



### ABOUT US!

Intellect Controls Group, Inc. was founded in 1983. We are an independent training company, and our only business is providing hands-on training programs on factory automation control systems. Since our inception we have delivered more than one million man-hours of training to Fortune 500 companies, allowing them to streamline their manufacturing processes and meet and exceed their productivity objectives.

We deliver training on-site at our customer's manufacturing facilities throughout the United States and Canada. Our focus is providing practical, hands-on training programs that allow factory maintenance and engineering personnel to become better troubleshooters thus reducing both down time and manufacturing costs. On any given week, our shipping crews and instructors are crisscrossing the country to deliver turnkey, on-site training solutions to our customers.

### NOW OFFERING REMOTE TRAINING!

Our exceptionally talented instruction staff has leveraged their years of experience in the classroom to create a smooth and effective series of remote training programs. Although we do not think this format is the same as a live presentation, it is close and more importantly, it is effective. It is hard to replace a face-to-face interaction and the transfer of knowledge that occurs in face-to-face training programs.

### CONTACT INFO!

#### INTELLECT CONTROLS GROUP, INC

2205 Plantside Drive  
Louisville, KY 40299

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Email: [Contact@intellectcontrols.com](mailto:Contact@intellectcontrols.com)

Phone: (502) 499-7522



# NOW OFFERING REMOTE TRAINING!

## Allen-Bradley PLC's, Drives, & HMI's

### NOW OFFERING REMOTE TRAINING!

As a response to the COVID-19 pandemic, Intellect Controls has begun offering many of our Industrial Automation Training Programs in a Remote/On-Line format.

Here at Intellect Controls, we have always believed that the Hands-On component of our training programs is the most important element in our training programs. Through our Zoom/Zoho format we are able to effectively maintain the hands-on labs and interactions of our traditional On-Site, Live Presentation Training Programs. Our exceptionally talented instruction staff has leveraged their years of experience in the classroom to create a series of smooth and effective, live, face-to-face, remote training programs.

Our exceptionally talented instruction staff has leveraged their years of experience in the classroom to create smooth and effective series of remote training programs. Although we do not think this format is the same as a live presentation, it is close and more importantly, it is effective. It is hard to replace a face-to-face interaction and the transfer of knowledge that occurs in face-to-face training programs.

### Highlights

- **Zoom Meeting** Format with **Zoho Assist** for Hands-On Lab Exercises
- On-Line access to Intellects' state of the art PLC, AC Drive and HMI Training Systems
- Experienced Automation Specialists as your Instructors
- Interactive Training/Live Presentations
- Proven Training Materials and Tests
- A dedicated Workstation for each participant
- Individuals or Groups – *Customization training is available for groups*

### On-line Courses Available

- A-6100R: Allen-Bradley Control Logix Intermediate
- A-6200R: Allen-Bradley Control Logix Advanced
- A-760R: Allen-Bradley PanelView Plus HMI
- A-6450R: Allen-Bradley Control Logix/Motion with Kinetix 5700 & 5500 Servo Drives
- MC-755R: Allen-Bradley PowerFlex 755 AC Drives
- MC-700R: Allen-Bradley PowerFlex 70 & 700 AC Drives

## NOW OFFERING REMOTE TRAINING!

### Allen-Bradley PLC's, Drives, & HMI's

#### On-line Demonstration Available

**We are excited to bring you these new training offerings!** To date, we have delivered several of these On-Line training programs. Based on the customer feedback, all of the training programs have been very well received. We look forward to offering this new training format to new and current customers. We encourage anyone who is interested to schedule an On-Line Demonstration to call (502) 499-7522.

# Judge Us by the Company we Keep

## JUDGE US BY THE COMPANY WE KEEP

|                            |                             |                              |
|----------------------------|-----------------------------|------------------------------|
| A.O. Smith                 | Ford Motor Company          | Merck & Company              |
| Abbott Labs                | General Electric Company    | MillerCoors                  |
| Advics                     | General Motors Corporation  | Nissan Motor Manufacturing   |
| Alcoa                      | General Motors Canada, Ltd. | Norbord                      |
| Aleris                     | Georgia-Pacific Corporation | Nucor Steel Corporation      |
| American Electric Power    | GKN Sinter Metals           | Pepsi Cola                   |
| Anheuser-Busch InBev       | Goodyear Tire Company       | Pfizer, Inc.                 |
| Borg-Warner Automotive     | Harley Davidson             | PPG Industries               |
| Bridgestone-Firestone Inc. | Haynes International        | Pratt Industries             |
| Caterpillar, Inc.          | Hubbell Power Systems       | Procter & Gamble             |
| Chevron USA                | International Paper         | Quaker Oats                  |
| Chrysler                   | J.M. Smucker                | Ralcorp                      |
| Coca-Cola Company          | Jim Beam Brands             | Raytheon Corporation         |
| Colgate Palmolive          | John Deere Inc.             | Resolute Forrest Products    |
| Cooper Tire Company        | Johnson Controls            | Reynolds Metals              |
| Cummins Engine Company     | Johnson & Johnson           | Rohm & Haas Corporation      |
| Dana Corporation           | Kerry Ingredients           | Rolls Royce                  |
| Domtar                     | Kraft Foods                 | S.C. Johnson Wax             |
| Dow Corning Corporation    | Lear Corporation            | Toyota Motor Manufacturing   |
| R.R. Donnelley             | Logan Aluminum              | Tropicana Products           |
| Dofasco Steel, Inc.        | Louisville Gas & Electric   | U.S. Army Corp. of Engineers |
| Domino Sugar               | Kimberly Clark Corporation  | Universal Studios Orlando    |
| Duracell                   | Libbey-Owens-Ford           | Wausau Paper                 |
| East KY Power              | Maker's Mark                | West Fraser                  |
| Folgers Coffee             | Mercedes Benz USA Inc.      | Weyerhaeuser Company         |



*"If you want to train your employees in maintenance troubleshooting for industrial automation equipment, come to the leader in the industry. These companies chose an organization that specializes in employee training. They chose Intellect Controls Group."*

*We customize our courses to fit our individual clients' specific needs and target our classes to the individuals who run and maintain the equipment at their locations or at our Kentucky Training Center."*

*Edward Jay,  
President*



# Intellect Controls Group, Inc Training Options

## TRAINING OPTIONS

Use your Intellect. Other industry leaders learned why we are the best choice.

- Intellect Controls Group, Inc. responds to our customers by delivering practical training to improve on-the-job productivity.
- We offer a turn-key on-site training product, including logistics, materials, equipment, and all travel arrangements.
- All of our instructors are highly skilled product experts.
- Training programs are customized to address your manufacturing applications.
- Our one-on-one attention helps your people understand the material fully.



*"If you have been depending on the manufacturers, smaller training companies or local technical colleges to train your people, we're offering you a reputable alternative with proven results. We deliver practical, individual training to improve on-the-job productivity."*

*The on-site training we offer is completely "turn-key." All we need is a room in which to set up our hands-on training lab. In addition, all our instructors have factory troubleshooting experience and go through extensive continuing education to maintain their expert status. Give us a call at (502) 499-7522 and we'll explain how we can customize a class just for your employees."*

*Leno Pederson,  
Chief Instructor*

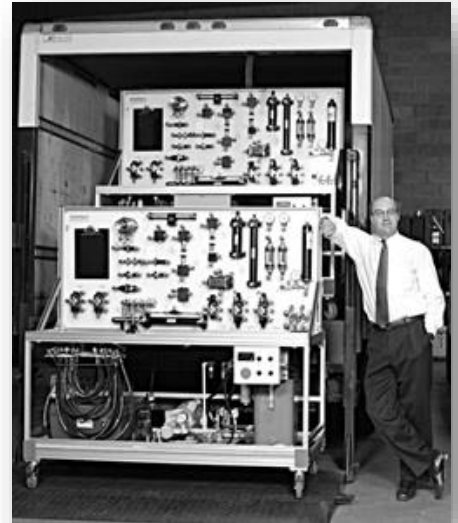
# Intellect Controls Group, Inc Training Options

## CHOOSE TRAINING YOUR WAY

### On-site Training at Your Facility

- Customized Courses
- Flexible Schedule
- Eliminates Travel Costs

Call (502) 499-7522 to talk about your training requirements or visit our web site at [www.intellectcontrols.com](http://www.intellectcontrols.com) for Training Center course schedule and tuition information.



### Classes at our Kentucky Training Center in Louisville, KY

- Individual Enrollment (as many or as few as you like)
- Schedule Availability
- Convenient Travel Destination to Louisville, KY

Call (502)-499-7522 to talk about your training requirements or visit our web site at [www.intellectcontrols.com](http://www.intellectcontrols.com) for Training Center course schedule and tuition information.

### Remote Training

- Individual Enrollment (as many or as few as you like)
- Flexible Schedule
- Eliminates Travel Costs

Call (502) 499-7522 to talk about your training requirements or visit our web site at [www.intellectcontrols.com](http://www.intellectcontrols.com) for Training Center course schedule and tuition information.

### How to Enroll for Classroom or Remote Training

Call (502) 499-7522 to check available course dates or visit us at [www.intellectcontrols.com](http://www.intellectcontrols.com) to view or training center schedule, download maps and directions.

Enrollments can be confirmed upon receipt of a purchase order or can be paid for by a credit card.

## CUSTOMIZED TRAINING ASSESSMENT

Intellect Controls Group, Inc. is now offering Customized Training assessment services for your employees. Our approach to assessing your personnel involves Customized Performance Testing. The components of this performance testing consist of the following:

- pre-assessment testing
- classroom lecture and instruction
- hands-on performance testing
- one-on-one assessment with instructor
- instructor evaluation and recommendation
- a training plan for each person assessed

Having your personnel properly assessed before you start the training process will result in a more targeted and effective learning experience. Assessment also provides a baseline from which you can measure progress on specific skills that are important to your operations.

Performance Assessments are available on:

- Basic Electrical
- PLC's
- HMI's
- Drives
- Hydraulics
- Pneumatics
- Siemen's

Please contact us to inquire further about our assessment services at (502) 499-7522.

*The knowledge instructor has made the class easy to understand as well as keeping up with the course. Great class!*

*(Employee of MillerCoors)*

*This was a great course, very informative, very constructive. The instructor was knowledgeable and funny. He set the tone and I was very comfortable. I learned a great deal.*

*(Employee of Georgia Pacific)*

### FREQUENTLY ASKED QUESTIONS

#### *What type of qualifications do your instructors have?*

We only hire instructors that have significant factory maintenance and troubleshooting experience. We believe that this is the critical qualification for someone to become an Intellect Controls Group Instructor. We have a rigorous internal training program that prepares each instructor to communicate effectively with technicians as well as engineers. Our instructors are subject matter experts on any product on which they train.

#### *How do you customize your training programs to meet my requirements?*

The first step in this process is to have you review a detailed outline of our course and let us know the critical topic areas for your manufacturing applications. We will produce a customized course outline that addresses your specific needs. Additionally, we can incorporate examples from your control programs and applications into the coverage of the course topics.

#### *How many students do I need to have for an on-site course?*

The maximum class sizes for our on-site training programs range from 6-12 students. Many of our customers find that with as few as four students to train, on-site delivery is more economical than sending students off-site for training.

#### *What type of room and what supplies do I need to provide for an on-site training program?*

A room with seating and tables for the students is all that is required. We transport our complete training lab to your facility, including hands-on training equipment, computers, controls software, audio-visual equipment and all necessary classroom materials.

#### *What type of payment is required to order an on-site class or to enroll a student at the Louisville Training Center?*

We need only a purchase order to confirm enrollment in a training program or to order on-site training services. Our payment terms are Net 30 days from the starting date of any class. We also accept Visa MasterCard and American Express.

## Frequently Asked Questions

### *How do I make hotel arrangements for employees I am sending to the Louisville Training Center?*

We will recommend a selection of several hotels that are located very close to our Training Center. Lodging costs are very reasonable, which is one of the reasons we chose Louisville, Kentucky as the location of our headquarters and Training Center. The enrollment confirmation letter will contain maps and directions to our facility.

### *I am not sure of my employees' skill levels. Can you assist me in assessing the skills of my employees so I can develop a training plan?*

Intellect Controls Group, Inc. can provide basic placement testing to determine on which level your employees begin their training. Intellect is now offering hands-on performance assessments that will provide you with a measurable base line for each employee.



### *Trademark Acknowledgement Statement*

PLC, PLC-5, SLC, SLC-500, RSLogix, RSLogix5, RSLogix500, RSLogix5000, Studio 5000 Logix Designer, GuardLogix, DriveExplorer, DriveExecutive, PanelView, PanelView Plus, PanelBuilder, ControlNet, RSNetworkx, PowerFlex, FactoryTalk View ME, FactoryTalk View SE, Logix 5000, Kinetix, 1394 GMC and Data Highway are trademarks and/or registered trademarks of Allen-Bradley Company, Inc. and/or Rockwell International, Inc. All other brand names and product model names mentioned are trade names, service marks, trademarks or registered trademarks of their respective owners. Intellect Controls Group, Inc. is not associated with any manufacturer mentioned herein and the use of any product names is for descriptive purposes only.

## FUNDAMENTAL COURSES

### IC-100: Basic Electrical & Controls Training (NEW COURSE)

#### COURSE DESCRIPTION

This 64-hour, 8-day training program is designed to familiarize entry-level electricians, equipment operators and other skilled trades with electrical control fundamentals, electric terminology, and basic troubleshooting techniques.

#### TOPICAL OUTLINE

- What is Electricity?
- Digital Multimeter (DMM)
- Wiring Mechanics
- Troubleshooting Keys – Kirchhoff's Law
- Machine Control & Control Devices
- Protective Devices
- Introduction to Electrical Safety
- Poly-Phase Circuits
- Three-phase AC Motors
- Troubleshooting Tips and Techniques
- NEC Review
- Generic PLC Concepts
- Using the SLC to Demonstrate PLC Concepts
- The PLC as an Advanced Troubleshooting Tool

#### AUDIENCE

This course is designed for entry-level electricians, equipment operators and other skilled trades who need to broaden their understanding of industrial control fundamentals. IC-100 is also ideal for anyone who has a need to familiarize himself/herself with basic control fundamentals.

#### CEU's 6.0

#### OBJECTIVES

Persons successfully completing this course will be able to:

- Solve for the missing variable - I E or R - using Ohm's Law.
- Use a DMM to measure voltage, current and resistance.
- Find opens and shorts in circuit using Kirchhoff's Law.
- Wire up and find problems in relay logic. Understand the operation of and repair/replace defective input devices such as: limit switches, proximity sensors, photo eyes & reed switches. Understand the operation of and repair/replace defective output devices such as: timers, motor starters, contactors & solenoids.
- Find and use the correct documentation needed to troubleshoot and repair machine breakdowns.
- Safely analyze and repair faults detected by protective devices such as: fuses, circuit breakers & GFIs.
- Know what a "Qualified Person" is and what the requirements are to become one.
- Explain how 3-phase electricity is generated and distributed to a plant.
- Troubleshoot 3-phase motors using a DMM and a megger - find shorts, opens and insulation breakdown.
- Develop a step by step troubleshooting plan to find the root cause of a shutdown. Implement countermeasure that will prevent the reoccurrence of a problem.
- Explain what the NEC code is and what it's intended purpose is.
- Explain how real world (field) devices interface with a PLC.
- Read a PLC program and explain how it relates to relay logic.
- Use a PLC as the starting point for troubleshooting problems.



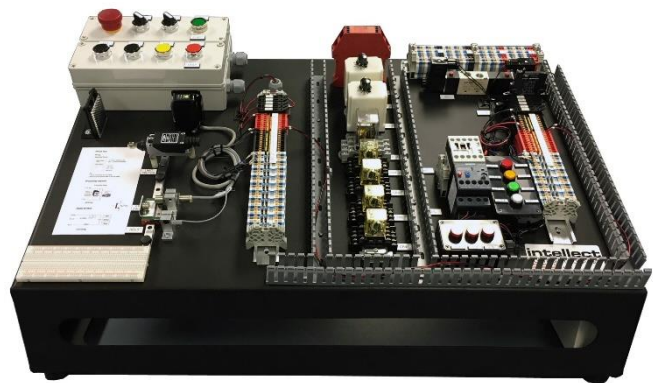
## IC-101: Troubleshooting Industrial Controls & Ladder Logic (NEW COURSE)

### COURSE DESCRIPTION

This 32-hour, 4-day training program is designed to familiarize electricians with industrial control components such as relays, timers, proximity switches, limit switches, sensors and other control devices. Participants will also work with protective devices such as fuses, circuit breakers and overloads. Participants will troubleshoot Ladder Logic circuits using a DMM (Digital Multimeter). Participants will also learn and work with Polyphase Circuits including single phase and three phase wiring of motors. Participants will then transition from troubleshooting hardwired ladder logic circuits to PLC Ladder Logic.

### TOPICAL OUTLINE

- Electrical Review
- Machine Control and Control Devices
- Documentation for Troubleshooting
- Protective Devices
- Polyphase Circuits
- Three Phase Motors
- Troubleshooting Tips and Techniques
- PLC Concepts
- Use the PLC to Demonstrate Basic Concepts
- The PLC as an Advanced Troubleshooting Tool



### AUDIENCE

This class is only for experienced maintenance personnel who already know Ohm's Law, Kirchhoff's Law, and can use a DMM.

CEU's 2.9

### OBJECTIVES

Persons successfully completing this course will be able to:

- Wire up and find problems in relay logic. Understand the operation of and repair/replace defective input devices such as: limit switches, proximity sensors, photo eyes & reed switches. Understand the operation of and repair/replace defective output devices such as: timers, motor starters, contactors & solenoids.
- Find and use the correct documentation needed to troubleshoot and repair machine breakdowns.
- Safely analyze and repair faults detected by protective devices such as: fuses, circuit breakers & GFIs.
- Explain how 3-phase electricity is generated and distributed to a plant.
- Troubleshoot 3-phase motors using a DMM and a megger - find shorts, opens and insulation breakdown.
- Develop a step by step troubleshooting plan to find the root cause of a shutdown. Implement countermeasure that will prevent the reoccurrence of a problem.
- Explain how real world (field) devices interface with a PLC.
- Read a PLC program and explain how it relates to relay logic.
- Use a PLC as the starting point for troubleshooting problems

## MC-100: AC and DC Variable Speed Motor Drives

### COURSE DESCRIPTION

This 32-hour, 4-day training program is designed to provide maintenance electricians with a thorough understanding of AC and DC motor construction, operation and variable speed control. Hands-on lab exercises are used throughout the training program to simulate actual plant conditions. Course hardware will include Variable Frequency AC and DC Motor Drive Workstations, Circuit Test Workstations, Oscilloscopes and Multimeter test equipment. Hands-on labs will explain operation and troubleshooting of diodes, transformers, SCR's, transistors and other electrical control devices.

### TOPICAL OUTLINE

- Electrical Review
- Electronics Review
- Motor Fundamentals
- DC Motors
- DC Motor Control
- AC Motors
- AC Motor Control
- Introduction to VFD Control
- Identifying PowerFlex 70/700 Drive Components
- Wiring power to the Drive
- Wiring I/O to the Drive
- Configuring Digital and Analog I/O
- Configuring the Drive for Start-Up
- Performing PowerFlex 70/700 Drive Pre-Power and Power-On Checks
- Modifying and Monitoring PowerFlex 70/700 Drive Parameters
- Configuring Drive Parameters Using the LCD HIM
- Configuring Drive Parameters Using Drive Explorer Software
- Connected Components Workbench
- Uploading and Downloading Drive Data
- Autotuning the Drive and Entering Motor Nameplate Data
- Using S.M.A.R.T. Start and Autotuning on a PowerFlex 70/700 Drive
- Configuring the Drive for the Application
- Controlling Drive Operation
- Drive to PLC Communications
- Installing and Configuring a Communications Adapter
- Establishing Communications with a PLC Processor
- Troubleshooting PowerFlex 70/700 Drive System Problems
- Diagnosing and Troubleshooting Drive Problems
- Troubleshooting Drive System Problem

### PREREQUISITE

A basic understanding of electrical principles of voltage, power, current and resistance.

### AUDIENCE

This course is designed for plant maintenance personnel and other technicians who need to broaden their understanding of fundamentals of AC & DC motor troubleshooting and operation. MC-100 answers the prerequisite requirements of our Drives courses.

### CEU's 2.9



## OBJECTIVES

Persons completing this course will be able to:

- Explain basic AC and DC motor operation.
- Identify motor parts and function.
- Use a megohmmeter to determine the integrity of a motor.
- Describe variable speed motor control.
- Explain main drive units operation and function.
- Understand basic theory of SCR's, diodes, transistors, triacs, and other electrical control devices.
- Troubleshoot circuits using a multimeter.
- Use prints to isolate drive and motor problems.
- Read and Set Drive Parameters.

*"The materials, presentation & hands-on were very good, I particularly like having the opportunity to do hands-on training as it allows me to bring what's discussed/learned during the lecture into real life."*

*(Employee of Procter & Gamble)*

## ALLEN-BRADLEY CONTROLLOGIX 5000 SERIES

### A-6000: ALLEN-BRADLEY ControlLogix Basic Maintenance & Troubleshooting

#### COURSE DESCRIPTION

This 32-hour, 4-day training program is designed to challenge technician's troubleshooting skills. The training begins with an introduction to the Logix5000 Hardware, Software, addressing schemes and basic Ladder Instructions. Following this introduction is a series of Hands-on troubleshooting projects using real world interfaces such as conveyors, pick & place robots, remote I/O communications, Ethernet I/O and 1734 interfaces. The participants are assigned to evaluate and troubleshoot a series of equipment problems using a variety of scenarios. Each participant will be challenged to solve hardware problems, software problems, communication conflicts, and other issues that arise when troubleshooting PLC related problems.

#### TOPICAL OUTLINE

- Overview of Programmable Controllers
- Hardware Description, Hardware Troubleshooting
- I/O Configurations, Addressing
- Programming Terminal Operation including navigating through Studio 5000 Software
- RSLinx Driver Creation Overview/Hands-on Demonstration
- Instruction Familiarization: Ladder Diagram, Timer and Counter, Data Manipulation & Program Control
- Use Software Utilities to aid in the troubleshooting Process: Trend Charts, Search, Cross Reference & Forcing
- Program Editing
- Troubleshooting: Hardware & Software with emphasis on finding root cause
- Troubleshooting real world Hardware equipment using DMM and indicator lights

#### PROGRAM SOFTWARE

Training utilizes Rockwell Software Studio 5000 Logix Designer, Microsoft Windows.

#### PREREQUISITE

Intellect Controls Group training program IC-101 or a working knowledge of electromechanical control devices, relay ladder logic and Windows Operating System.

**CEU's 2.9**

#### OBJECTIVES


Persons successfully completing this course will be able to:

- Identify hardware components of a ControlLogix Programmable Controller System.
- Configure I/O Modules
- Use a programming terminal for entering, editing, and troubleshooting basic programs.
- Isolate processor and I/O faults to the module level by interpreting status indicators.
- Troubleshoot simple programs using ladder instructions of the ControlLogix Programmable Controller.
- Successfully troubleshoot 5 different scenarios of malfunctioning equipment. *Four stations with a laptop, drawing, and a meter. One station with a meter and drawing only.*

## A-6100: ALLEN-BRADLEY ControlLogix Programmable Controllers Intermediate Maintenance & Troubleshooting

### COURSE DESCRIPTION

This 32-hour, 4-day training program is designed to be the “next step” in building competence around the troubleshooting and maintenance of the Allen-Bradley ControlLogix Programmable Controller Systems. The first day is dedicated to reviewing and practicing the skills developed in our A-6000 class. This course will provide students with a deeper understanding of the topics covered in the Fundamentals class. Students will improve their troubleshooting skills by learning to program ladder logic projects from functional specifications rather than merely understanding ladder logic provided to them. The course is designed to be a deep dive into the most common ladder logic instructions, a challenging approach to deciding which instructions to use in projects they create and meet the criteria spelled out in the hands-on exercises. This deeper understanding of the instructions and how they function will enhance the end users troubleshooting efficiency.



**Now offering  
Remote  
training!**

### TOPICAL OUTLINE

- Review Fundamentals of ControlLogix Maintenance & Troubleshooting
- Intermediate Ladder Logic Instruction Utilization & Interpretation
- Additional Intermediate Ladder Logic Instruction Utilization & Interpretation
- Troubleshooting ControlLogix Projects

### PROGRAM SOFTWARE

Training utilizes Rockwell Software Studio 5000 Logix Designer, Microsoft Windows.

### PREREQUISITE

Completion of Intellect Controls Group A-6000: *Allen-Bradley ControlLogix 5000 Basic Maintenance & Troubleshooting Course* (or equivalent ControlLogix experience & knowledge).

### CEU's 2.9

### OBJECTIVES

Persons successfully completing this course will be able to:

- Know & understand the relationships between Controllers, Chassis, Power Supplies, IO Modules, Terminology, Indicator Lights, Key Switch
- Recognize & understand Common Communication Modules
- Be able to use status indicator lights on controllers and I/O modules to troubleshoot ControlLogix hardware
- Be able to use RSLink, RSWho, Communication Drivers, Set IP Addresses
- Create a ControlLogix project from scratch
- Be able to interpret and use Digital & Analog Base Tags, Alias Tags
- Know when to use (and how to find/monitor/edit) Controller Scoped vs. Program Scoped Tags

## OBJECTIVES - *continued*

- Use correct Data Types & Data Structures with ladder logic tags
- Create and use Tasks, Programs, Routines
- Program & Troubleshoot Bit Level Ladder Logic (XIC, XIO, ONS, OSR, OSF, OTL, OTU) Instructions
- Program & Troubleshoot Ladder Logic Timer Instructions (TON, TOF, RTO, RES)
- Program & Troubleshoot Level Ladder Logic Counter Instructions (CTU, CTD, RES)
- Program & Troubleshoot Data Transfer Ladder Logic (MOV, MVM) Instructions
- Program & Troubleshoot Boolean Ladder Logic (AND, OR, XOR, NOT, CLR) Instructions
- Program & Troubleshoot Mathematical Ladder Logic (ADD, SUB, MUL, DIV, MOD, SQR, NEG, ABS, TRN, CPT, FRD, TOD, DEG, RAD) Instructions
- Program & Troubleshoot Comparison Ladder Logic (EQU, NEQ, LES, GRT, LEQ, GEQ, LIM, MEQ, CMP) Instructions
- Program & Troubleshoot Program Control Ladder Logic (MCR, JSR, SBR, RET, AFI) Instructions
- Program & Troubleshoot Data Exchange Between Controllers (Produce, Consume, MSG)
- Program & Troubleshoot System Instructions (GSV, SSV)
- Effectively Use Software Utilities (Searching, Bookmarks, Trending, Toggling, Forcing)
- Utilize Predictive & Preventative Maintenance Measures
- Identify and Resolve Common Controller Faults
- Use & Interpret Fault Routines Effectively
- Identify Root Cause of I/O Connection Errors and Problems.

*"Excellent class. I have attended drive classes before and have left with a lot of questions still unanswered. I do not feel this way after this class. The instructor did an excellent job of teaching and answering questions. The labs then re-enforced what we went over in class. If we did encounter problems, the instructor did an excellent job of responding and helping us".*

*(Employee of MillerCoors)*


## A-6200: ALLEN-BRADLEY ControlLogix Programmable Controllers Advanced Maintenance & Troubleshooting

### COURSE DESCRIPTION

This 32-hour, 4-day training program provides students with hands-on experience using the advanced control and diagnostic capabilities of the Allen-Bradley ControlLogix Programmable Controller and the Studio5000 programming software package. Application troubleshooting exercises are used throughout the course to give students hands-on experience solving typical problems encountered in the factory.

### TOPICAL OUTLINE

- Review of ControlLogix Hardware and Basic Concepts
- Memory Organization Review
- Addressing: Direct and Indirect
- Instruction Familiarization: File Arithmetic and Logic, File Search and Compare, Bit Shift and FIFO, Sequencer Input/Output, FBD Diagnostic Instruction
- Analog I/O Configuration and Scaling
- Overview: PID Instruction
- Add on Instructions



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### PROGRAM SOFTWARE

Training utilizes Rockwell Software Studio 5000 Logix Designer, Microsoft Windows.

### PREREQUISITE

Students should have successfully completed Intellect Controls Group training program A-6100 or have knowledge equivalent to the course description and be familiar with Windows Operating System. A-6200 IS NOT INTENDED FOR BASIC LEVEL ENTRY STUDENTS WHO HAVE NOT ACQUIRED THE BACKGROUND DESCRIBED ABOVE.

### CEU's 2.9

### OBJECTIVES

Persons successfully completing this course will be able to:

- Troubleshoot programs utilizing all commonly used instructions of the ControlLogix Programmable Controller.
- Effectively use a programming terminal for entering, editing, and troubleshooting programs.
- Utilize the diagnostic capabilities of the ControlLogix system to aid in systems troubleshooting.
- Properly connect and establish communications over an Ethernet network.
- Setup and configure Analog Input and Output cards for 0-10VDC and 4-20mA applications.
- Setup BSL instructions for parts tracking.
- Setup FIFO/LIFO File instructions to track part numbers.
- Diagnose PID faults to find bad thermocouples, RTD's and actuators.
- Make small changes to PID loops to increase system efficiency.
- Create and test an AOI instruction.

## **A-6300: ALLEN-BRADLEY ControlLogix Programmable Controllers/Level Three - Advanced Communications: DeviceNet, ControlNet & Ethernet**

### **COURSE DESCRIPTION**

This 32-hour, 4-day training program provides participants with hands-on experience in the troubleshooting and maintenance of the Allen-Bradley ControlNet, DeviceNet and Ethernet communications networks. Hardware and Software troubleshooting techniques are heavily emphasized throughout the course.

### **TOPICAL OUTLINE**

- Advanced ControlLogix
- Instruction Review: Base & Alias Tag Address
- Instructions: Array Instruction Concepts & File, Arithmetic and Logic
- ControlNet Unscheduled Communications
- ControlNet Scheduled Communications
- RS Network Software
- DeviceNet Communications: Hardware, Addressing, Mapping & Node Commissioning
- Ethernet Communications
- Hardware
- Message Instruction

### **PROGRAM SOFTWARE**

Training utilizes Rockwell Software Studio 5000 Logix Designer, Microsoft Windows and RSNetworkx for DeviceNet and ControlNet.

### **PREREQUISITE**

Students should have successfully completed Intellect Controls Group training program A-6000 or have knowledge equivalent to the course description and be familiar with Windows NT software. A-6200 is recommended, but not required. THIS IS NOT AN ENTRY LEVEL TRAINING PROGRAM.

### **CEU's 2.9**

### **OBJECTIVES**

Persons successfully completing this course will be able to:

- Identify Hardware components of three ControlLogix Communication Networks.
- Establish communications and troubleshoot a DeviceNet Network
- Establish communications and troubleshoot a ControlNet Network
- Establish communications and troubleshoot an Ethernet Network
- Work effectively with RS Network Software.

*Enjoyed the course. It was very informative for my first time seeing a PLC. The instructor was very knowledgeable on the subject which really helped.*

*(Employee of Bridgestone-Firestone)*

# Allen-Bradley ControlLogix 5000 Series

## A-6350: ALLEN-BRADLEY ControlLogix 5000 Level Three Advanced Ethernet Communications **(NEW COURSE)**

### COURSE DESCRIPTION

This 32-hour, 4-day training program provides participants with hands-on experience in the troubleshooting and maintenance of the Allen-Bradley Ethernet communications networks and Managed Ethernet networks using the Allen-Bradley Stratix 5700 Switch. Hardware and Software troubleshooting techniques are heavily emphasized through hands-on exercises during the duration of the training program.

### TOPICAL OUTLINE

- Advanced ControlLogix
- Instruction Review: Base & Alias Tag Address
- Instructions: Array Instruction Concepts & File, Arithmetic and Logic
- Ethernet Communications
- Hardware
- Message Instruction
- Produced and Consumed Tags
- Stratix 5700 Industrial Ethernet Switch
- Stratix Setup (Troubleshooting Topics)
- Assigning an IP Address
- Pinging IP Addresses
- Assigning IP Addresses Using Software & Hardware
- Using BOOTP to Assign IP Addresses
- Troubleshooting Ethernet Problems (Hardware, Network)
- Stratix 5700 Managed Network

### PROGRAM SOFTWARE

Training utilizes Rockwell Software Studio 5000 Logix Designer, Microsoft Windows.

### PREREQUISITE

Students should have successfully completed Intellect Controls Group training program A-6000 or have knowledge equivalent to the course description and be familiar with Windows NT software. A-6200 is recommended, but not required. THIS IS NOT AN ENTRY LEVEL TRAINING PROGRAM.

### CEU's 2.9

### OBJECTIVES

Persons successfully completing this course will be able to:

- Identify Hardware components of a ControlLogix Ethernet Communication Network
- Establish communications on an Ethernet Network
- Assign an IP address, Ping and IP address
- Use BOOTP to assign an IP address
- Identify hardware components of the Stratix 5700 switch
- Configure and setup a Stratix 5700 switch
- Troubleshoot hardware, software and configuration issues on an Ethernet Network

## A-6110: Allen-Bradley GuardLogix Safety I/O Systems

### COURSE DESCRIPTION

This 16-hour, 2-day training program covers installing and troubleshooting GuardLogix Safety I/O Systems. Coverage is primarily on Ethernet, Safety Modules.

### TOPICAL OUTLINE

- Safety Level Overview
- GuardLogix Safety Modules
- Wiring Options
- Safety Module LED Indicators
- GuardLogix I/O Configuration
- Ethernet Configurations
- Safety Signature
- Safety Task, Safety Routine
- Safety Instructions: ESTOP, LC, ROUT, FPMS, RIN, EN PEN, DIN & THRS
- Explicit Messaging
- Safety Tag Mapping
- GSV/SSV Instructions with Safety Routines
- Produced/Consumed Safety Tags

### PROGRAM SOFTWARE

Training utilizes Rockwell Software Studio 5000 Logix Designer, Microsoft Windows.

### PREREQUISITE

A-6000: Allen-Bradley ControlLogix Programmable Controllers/Level One Maintenance & Troubleshooting or equivalent.

### CEU's 1.4

### OBJECTIVES

Persons successfully completing this course will be able to:

- Troubleshoot and repair GuardLogix Control Systems
- Locate and reset Safety I/O related faults
- Replace Safety I/O Modules
- Determine a Safety Instruction's input requirements and output response
- Configure Safety I/O Modules



# Allen-Bradley ControlLogix 5000 Series

## A-6120: RS-5000 ControlLogix Function Block Diagrams

### COURSE DESCRIPTION

This 16-hour, 2-day training program is for those familiar with Allen-Bradley ControlLogix controllers, but not familiar with Function Block Diagrams. In this course students will learn how to program, interpret, and troubleshoot ControlLogix programs written with Function Block diagrams.

### TOPICAL OUTLINE

- Definition of a Function Block
- Function Block Diagrams in ControlLogix
- FBD Basic Boolean Functions & Basic Boolean Function Exercise
- FBD Timers and Counter Functions & Timer and Counter Exercise
- FBD Math Functions & Math Function Exercise
- FBD Compare Functions & Entering a Simple LIM Compare Exercise
- FBD Filter Functions
- FBD Enhanced PIDE Function & PIDE Simulation Exercise
- FBD Software Utilities

### PROGRAM SOFTWARE

Training utilizes Rockwell Software Studio 5000 Logix Designer, Microsoft Windows.

### PREREQUISITE

Students should have successfully completed Intellect Controls Group training program A-6000 or have knowledge equivalent to the course description and be familiar with Windows operating system. It is also recommended that the A-6200 training program be completed as well.

### CEU's 1.4

### OBJECTIVES

Persons successfully completing this course will be able to:

- Enter routines using Function Diagram Blocks
- Interpret Function Block Diagram Routines
- Troubleshoot Function Block Diagrams and I/O associated with them.

*"I felt the course was very well constructed and taught. I enjoyed every minute of it!"*

*(Satisfied Customer)*

# Allen-Bradley ControlLogix 5000 Series

## A-6130: RS-5000 ControlLogix Structured Text

### COURSE DESCRIPTION

This 16-hour, 2-day training program is for those familiar with Allen-Bradley ControlLogix controllers, but not familiar with the Structured Text. In this course students will learn how to program, interpret, and troubleshoot ControlLogix programs written using Structured Text.

### TOPICAL OUTLINE

- Definition of Structured Text
- Structured Text Routines in ControlLogix
- ST If...Then Construct & If...Then Exercise
- ST Case...Of Construct & Case...Of Exercise
- ST For...Do Construct & For...Do Exercise
- ST While...Do Construct & While...Do Exercise
- ST Repeat...Until Construct & Repeat...Until Exercise
- Structured Text Instructions & ST Instruction Exercise
- ST Software Utilities

### PROGRAM SOFTWARE

Training utilizes Rockwell Software Studio 5000 Logix Designer, Microsoft Windows.

### PREREQUISITE

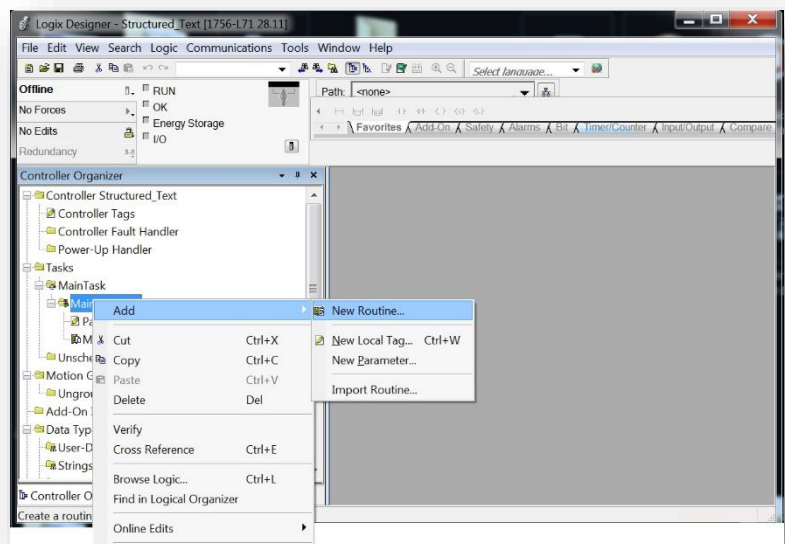
Students should have successfully completed Intellect Controls Group training program A-6000 or have knowledge equivalent to the course description and be familiar with Windows operating system. It is also recommended that the A-6200 training program be completed as well.

### CEU's 1.4

### OBJECTIVES

Persons successfully completing this course will be able to:

- Enter Routines using Structured Text
- Interpret Constructs found in Structured Text
- Navigate and Troubleshoot Routines using Structured Text



## A-6140: ControlLogix RS-5000 Sequential Function Chart

### COURSE DESCRIPTION

This 16-hour, 2-day training program will enable a student to create, enter, and troubleshoot a Sequential Function Chart. Topics covered include Sequential Chart Layout, Entering and an SFC, and Troubleshooting and SFC.

### TOPICAL OUTLINE

- Definition of a Sequential Function Chart
- Sequential Function Chart Routines in ControlLogix
- SFC Steps
- SFC Actions
- SFC Transitions: SFC Step, Action & Transition Exercise
- SFC Selective Branches
- SFC Simultaneous Branches: SFC Branch Exercise
- SFC Features including Stopping, Pausing and Restarting SFC: SFC Stopping, Pausing and Restarting Exercise
- SFC Troubleshooting
- SFC Forcing: SFC Troubleshooting & Forcing Exercise
- SFC Software Utilities

### PROGRAM SOFTWARE

Training utilizes Rockwell Software Studio 5000 Logix Designer, Microsoft Windows.

### PREREQUISITE

Students should have successfully completed Intellect Controls Group training program A-6000 or have knowledge equivalent to the course description and be familiar with Windows operating system. Training program A-6130: Structured Text course would be helpful but not required.

### CEU's 1.4

### OBJECTIVES

Persons successfully completing this course will be able to:

- Design a simple SFC based on equipment sequence of operation.
- Enter a simple SFC
- Troubleshoot equipment controlled by an SFC by locating the active step, and active action and then the transition condition preventing the sequence from advancing to the next step.

## A-6150: RS-5000 ControlLogix Function Block Diagrams, Structured Text & Sequential Function Chart Programming

### COURSE DESCRIPTION

This 4.5 day, 36-hour training program will enable a student to create, enter, and troubleshoot Function Block Diagrams, Structured Text programs, and Sequential Function Charts. Topics covered include the Enhanced PID (PIDE) instruction, structured Text loop Constructs, and Sequential Function Chart layout and Troubleshooting.

### TOPICAL OUTLINE

- Definition of a Function Block
- FBD Basic Boolean Functions & Basic Boolean Function Exercise
- FBD Timers and Counter Functions & Timer and Counter Exercise
- FBD Enhanced PIDE Function & PIDE Simulation Exercise
- FBD Software Utilities
- Definition of Structured Text
- Structured Text Routines in ControlLogix
- ST If...Then Construct & If...Then Exercise
- ST Case...Of Construct & Case...Of Exercise
- ST For...Do Construct & For...Do Exercise
- ST While...Do Construct & While...Do Exercise
- ST Repeat...Until Construct & Repeat...Until Exercise
- ST Software Utilities
- Definition of a Sequential Function Chart
- SFC Steps, Actions & Transitions & SFC Step, Action & Transition Exercise
- SFC Selective Branches
- SFC Simultaneous Branches & SFC Branch Exercise
- SFC Features including Stopping, Pausing, Restarting SFC & SFC Stopping, Pausing and Restarting Exercise
- SFC Troubleshooting, Forcing & SFC Troubleshooting & Forcing Exercise
- SFC Software Utilities

### Program Software

Training utilizes Rockwell Software Studio 5000 Logix Designer, Microsoft Windows.

### PREREQUISITE

Students should have successfully completed Intellect Controls Group training program A-6000 or have knowledge equivalent to the course description and be familiar with Windows operating system.

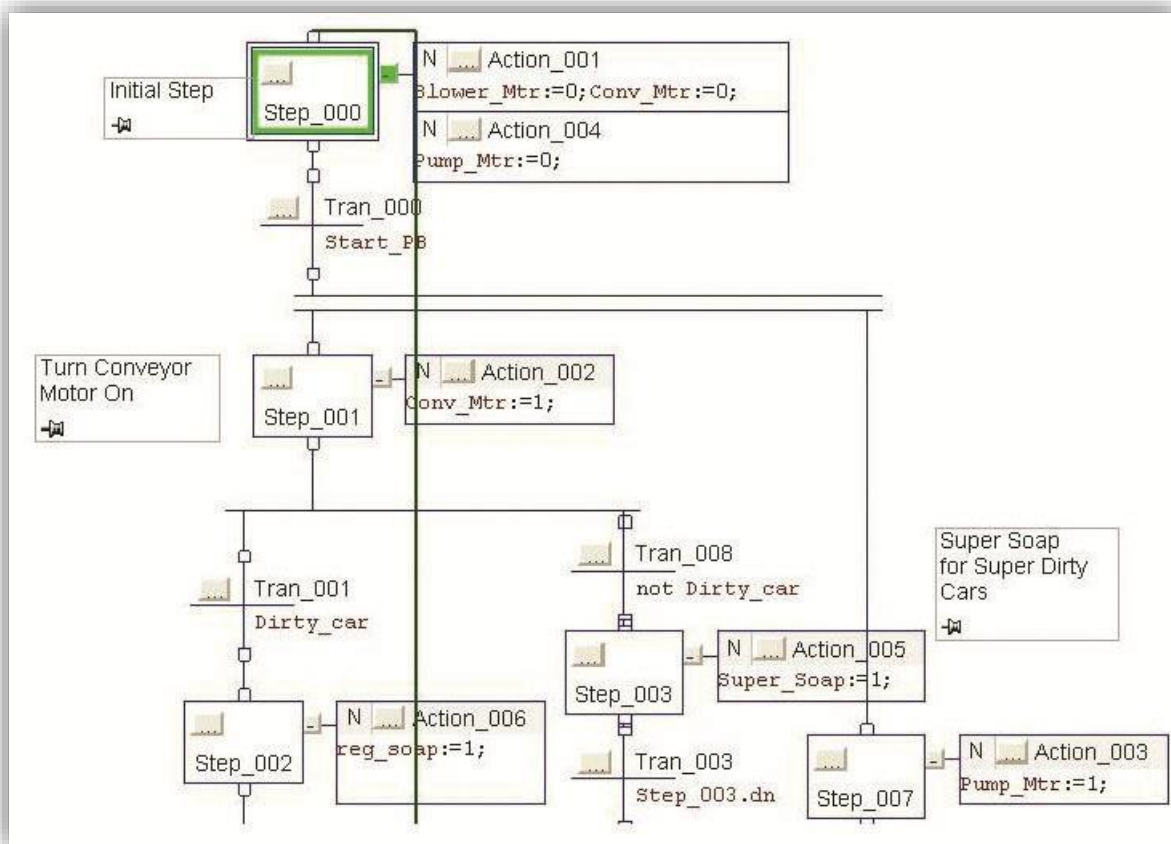
CEU's 3.3

# Allen-Bradley ControlLogix 5000 Series

## OBJECTIVES

Persons successfully completing this course will be able to:

- Enter and Interpret Function Block Diagrams
- Troubleshoot FBD's
- Enter and Interpret Structured Text Programs
- Interpret Structured Text Constructs
- Design a simple SFC based on equipment sequence of operation.
- Enter a simple SFC
- Troubleshoot equipment controlled by an SFC by locating the active step, and active action and then the transition condition preventing the sequence from advancing to the next step



*"Instructor was very thorough and not only explained what something did, but how you would use it."*

*(Employee of Bridgestone Firestone)*

## ALLEN-BRADLEY DRIVES & MOTION

### MC-525: Allen-Bradley PowerFlex 525 AC Drives with Connected Components Workbench

#### COURSE DESCRIPTION

This 16-hour, 2-day training program, is designed to provide the basic knowledge necessary - to enable maintenance personnel in troubleshooting, maintaining, replacing, start-up, and interfacing the Allen-Bradley PowerFlex 525 drive.

Students will learn how to use the front panel and Connected Components Workbench (CCW) to access parameters and diagnose faults. Communications using both EtherNet I/P and USB ports will be covered. The most commonly used parameters will be explained, and students will practice using them.

Students will locate power, signal and control terminals, monitor drive conditions, clear faults, gain the ability to troubleshoot drive problems and perform preventative maintenance.

#### TOPICAL OUTLINE

- VFD Construction & Operating Modes
- PowerFlex 525 Hardware and Wiring
- Control Module Display and Navigation
- Basic Display Group Parameters
- USB Communications
- EtherNet I/P Communications
- Monitoring Parameters
- Connected Components Workbench (CCW)
- Entering Start-Up Parameters
- CCW Wizard
- Advanced Parameters
- Faults, Diagnostics & Troubleshooting
- Logix Interfacing

#### PREREQUISITE


A basic understanding of AC motor operation, computer skills, electrical control and safety, Allen-Bradley PLC ladder logic and Ethernet.

#### CEU's 1.4

#### OBJECTIVES

Persons successfully completing this course will be able to:

- Identify the major components of a PowerFlex 525 drive (parts, purpose, and location)
- Wire or verify wiring on I/O and power terminals
- Install/Replace and perform initial start-up of a drive
- Monitor and set drive parameters using front panel keyboard
- Use USB port to upload/download files.
- Use Connected Components Workbench to monitor and change parameters
- Set-up a drive for startup using the Wizard
- Troubleshoot control inputs, outputs, drive and motor faults
- Set Automatic Device Configuration (ADC) to auto configure a drive




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## MC-700: Allen-Bradley PowerFlex 70/700 Variable Frequency Motor Drives

### COURSE DESCRIPTION

This 32-hour, 4-day hands-on training program is designed to provide maintenance electricians and engineers with the required knowledge and skills to install, start-up and troubleshoot Allen-Bradley PowerFlex 70/700 Variable Frequency AC Drive systems. Emphasis is on using the Human Interface Module and DriveExplorer software to set and check parameters used in normal operation and for troubleshooting. Students will locate power, signal and control terminals, monitor drive conditions, clear faults and be able to troubleshoot drive and motor problems.



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### TOPICAL OUTLINE

- Introduction to AC Motor Speed Control: Motor Characteristics & Variable Frequency Inverters
- Power and Signal Wiring
- Drive Installation/Replacement: Motor Feedback Polarities
- Control Options: Interface Modules & Input Modules
- Human Interface Module: Control and Display Panel, Operating Modes, Start-up Parameters & Advanced Parameter Operation
- Troubleshooting
- Fault Identification and Clearing
- Troubleshooting Charts and Corrective Action
- PLC Operation
- SCANport Communication
- Discrete Inputs and Outputs
- Block Transfer of Data
- Other Allen-Bradley Drives
- Connected Components Workbench (CCW) Software
- DriveExecutive Software

### PREREQUISITE

A basic understanding of AC motor operation, electrical control and safety, Allen-Bradley PLC ladder logic and remote I/O.

### CEU's 2.9

### OBJECTIVES

Persons successfully completing this course will be able to:

- Recognize drives in the PowerFlex 70/700 family
- Identify input and output power, control and signal terminals
- Install/Replace and perform initial start-up of the drive system
- Monitor and set drive parameters using the Human Interface Module
- Troubleshoot control inputs, outputs, drive and motor faults
- Correlate Drive-PLC inputs, outputs and data transfers
- Use troubleshooting charts to isolate drive problems
- Use CCW or DriveExecutive software to monitor and set parameters and troubleshoot problems



## MC-755: Allen-Bradley PowerFlex 753/755 Variable Frequency Motor Drives

### COURSE DESCRIPTION

This 32-hour, 4-day hands-on training program is designed to provide maintenance electricians and engineers with the required knowledge and skills to install, start-up and troubleshoot Allen-Bradley PowerFlex 750 Series (the 753 & the 755) Variable Frequency AC Drive systems.


Skills to interface with these drives are developed with the use of the Human Interface Module, DriveExplorer & DriveExecutive software.

In addition to learning how to set up and replace a drive, students will learn how to check & set parameters for normal operation and for troubleshooting.

Students will locate power, signal and control terminals, monitor drive conditions, clear faults and be able to troubleshoot drive problems and perform preventative maintenance procedures.

### TOPICAL OUTLINE

- Variable Frequency Drive Theory Review
- PowerFlex 750 Drive Hardware
- Using the A6 H.I.M.
- Setting Up Ethernet Communications
- Using Drive Software
- Troubleshooting PowerFlex 750 Drives
- Using Safety Module Options in the PowerFlex 750 Drives
- Understanding Control Block Diagrams
- PowerFlex 750 Drives Predictive Maintenance Tools



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### PREREQUISITE

A basic understanding of AC motor operation, electrical control and safety, Allen-Bradley PLC ladder logic.

### CEU's 2.9

### OBJECTIVES

Persons successfully completing this course will be able to:


- Install or replace a drive
- Configure the drive to meet your application needs
- Identify and replace hardware components
- Diagnose and correct faults and alarms
- Perform preventative maintenance on the drive
- Use Connected Components Workbench (CCW) software to monitor and set parameters and troubleshoot problems



## A-6400: ALLEN-BRADLEY ControlLogix Servo Motion with Kinetix Drives

### COURSE DESCRIPTION

This 32-hour, 4-day training program will provide the student with the knowledge and skills to identify, install, configure and troubleshoot a closed loop motion control system in the Logix 5000 architecture. In addition, students will learn specific programming instructions used for motion control in ControlLogix ladder logic programs. Students will also learn how to interface ControlLogix 5000 system with either Kinetix 350, or Kinetix 6000 Servo Drives.



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### TOPICAL OUTLINE

- Overview of Motion Control Concepts
- Hardware Description
- Hard wiring of 1756 Motion Components
- Configuring an Axis
- Tuning and Testing an Axis
- Motion Instructions Control Structures
- Basic Motion Instructions
- Advanced Motion Instructions
- Kinetix 6000 or Kinetix 350 Servo Drives
- Fault Routines
- System Troubleshooting

### PROGRAM SOFTWARE

Training utilizes Rockwell Software Studio 5000 Logix Designer, Microsoft Windows.

### PREREQUISITE

Students should have successfully completed Intellect Controls Group training program A-6000 or have knowledge equivalent to the course description and be familiar with Microsoft Windows functions.

### CEU's 2.9

### OBJECTIVES

Persons successfully completing this course will be able to:

- Identify the motion control components of a Control Logic System.
- Configure an Axis of a ControlLogix System.
- Tune and test an Axis of a ControlLogix System.
- Interpret and edit basic and advanced motion instructions.
- Troubleshoot both software and hardware related problems.
- Troubleshoot SERCOS interface to Kinetix 6000 Servo Drive
- Troubleshoot Ethernet interface to Kinetix 350 Servo Drive


*"Instructor is a great instructor who actually cares if his students learn the material. I never doubted his knowledge of the course material once".*

*(Employee of J.M. Smucker)*

## **A-6450: ALLEN-BRADLEY ControlLogix CIP Servo Motion with Kinetix 5500/5700 Drives (NEW COURSE)**

### **COURSE DESCRIPTION**

This 32-hour, 4-day training program will provide the student with the knowledge and skills to identify, install, configure and troubleshoot a closed loop motion control system in the Studio5000 architecture. In addition, students will learn specific programming instructions used for motion control in Studio5000 ladder logic programs. Students will also learn how to interface Studio5000 systems with the Kinetix 5500 Servo Drives, as well as an overview of the Kinetix 5700 Servo Drives.



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### **TOPICAL OUTLINE**

- Overview of Motion Control Concepts
- Hardware Description & Wiring Connections of Kinetix 5500/5700 Servo Drives
- Adding Drives and Configuring Axes for Integrated Motion on an CIP EtherNet/IP Network
- Tuning and Testing an Axis
- Motion Instructions Control Structures
- Basic Motion Instructions (MSO, MSF, MASD, MASR, MAFR, MAH, MAS, MAJ, MRP, MAG)
- Advanced (Camming) Motion Instructions (MCCP, MAPC)
- Safe-Torque Off Feature and Uses
- System Troubleshooting

### **PROGRAM SOFTWARE**

Training utilizes Rockwell Software Studio 5000 Logix Designer, Microsoft Windows.

### **PREREQUISITE**

Students should have attended the Intellect Controls Group A-6000 course (or equivalent experience). It is strongly recommended that the student has also attended the Intellect Controls Group A-6200 course (or equivalent experience).

### **CEU's 2.9**

### **OBJECTIVES**

Upon completion of this class, the student will be able to apply their new Studio5000 Kinetix CIP motion servo control skills to complete the following for the family of Rockwell Kinetix CIP Servo drives. We use the Rockwell Kinetix 5500 drives & Compact GuardLogix controllers in the classroom, but students will discover that the Studio5000 products share common features and a common operating system so the student will be able to apply their new motion control skills in most any Studio5000 motion project, with most any Rockwell Kinetix CIP Servo drive.

- |                |             |
|----------------|-------------|
| ➤ Program      | ➤ Modify    |
| ➤ Interpret    | ➤ Install   |
| ➤ Troubleshoot | ➤ Configure |

## ALLEN-BRADLEY HMI


### A-760: ROCKWELL FactoryTalk View ME HMI Software

#### COURSE DESCRIPTION

This 32-hour, 4-day training program is designed for the maintenance troubleshooter to enable them to use PanelView Plus terminals, FactoryTalk View ME and FactoryTalk View Studio to assist in correcting line stoppages and errors. Emphasis is on troubleshooting rather than on programming, although exposure to the many software features is included. It is assumed that the technician will be using existing FactoryTalk View ME, Communications, and PLC programs.

#### TOPICAL OUTLINE

- Saving and Restoring Projects
- Adding and Revising Tags in the Database
- Configuring Communication
- Adding Objects to Graphic displays
- Attaching Controls to Graphic displays
- Configuring Animation on Graphic Objects
- Configuring Events, Alarms & Logging
- Creating Macros
- Configuring Trends & Project Security
- Running a FactoryTalk View ME Project



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#### PREREQUISITE

Students should have a thorough knowledge of Basic Windows Skills, Level One PLC (for specific PLC they will be using with FactoryTalk ViewME), one of the PanelView families and the corresponding Panel Builder software as well as knowledge of RSLinx Configuration and Troubleshooting.

#### CEU's 2.9

#### OBJECTIVES

Persons successfully completing this course will be able to:

- Open FactoryTalk View Studio and select the correct project for the troubleshooting task at hand.
- Trace communications between FactoryTalk View ME objects and tags to and from PLC programs.
- Use RSLinx Enterprise and OPC communications drivers to troubleshoot communications problems.
- Use the Tag Database to add and make minor edits to memory and device tags.
- Open the Graphic Display Editor and identify tags associated with objects.
- Use the Graphic Display Editor to add and make minor edits to objects.
- Open, evaluate, and make minor edits to Expressions used in object dialog boxes.
- Track and make minor edits to display Navigation commands.
- Use the Alarm Monitor to view and acknowledge alarms.
- Use the Alarm Editor to add and make minor edits to alarms.
- Setup and edit data Trends.

## A-770: ROCKWELL FactoryTalk View SE HMI Software

### COURSE DESCRIPTION

This 32-hour, 4-day training program is designed for the maintenance troubleshooter to enable him or her to use FactoryTalk View Studio programs and FactoryTalk View Client to assist in correcting line stoppages and errors. Emphasis is on troubleshooting rather than programming. It is assumed the technician will be using existing FactoryTalk View SE projects, Communications and PLC programs.

### TOPICAL OUTLINE

- Saving and Restoring Projects
- Adding and Revising Tags in the Database
- Configuring Communication
- Adding Objects to Graphic displays
- Attaching Controls to Graphic displays
- Configuring Animation on Graphic Objects
- Configuring Events, Alarms, Activity Logs & Data Logging Files
- Creating Macros and Symbols
- Configuring Trends & Project Security
- Running a FactoryTalk View Project

### PREREQUISITE

Students should have a thorough knowledge of Basic Windows Skills, Level One PLC (for specific PLC they will be using with FactoryTalk ViewSE), One of the PanelView families and the corresponding Panel Builder software as well as the knowledge of RSLinx Configuration and Troubleshooting.

### CEU's 2.9

### OBJECTIVES

Persons successfully completing this course will be able to:

- Open FactoryTalk View Studio and select the correct project for the troubleshooting task at hand.
- Trace communications between FactoryTalk View SE objects and tags to and from PLC programs.
- Use RSLinx Enterprise and OPC communications drivers to troubleshoot communication problems.
- Use the Tag Database to add and make minor edits to memory and device tags.
- Open the Graphic Display Editor and identify tags associated with objects.
- Use the Graphic Display Editor to add and make minor edits to objects.
- Open, evaluate, and make minor edits to Expressions used in object dialog boxes.
- Track and make minor edits to display Navigation commands.
- Use the Alarm Monitor to view and acknowledge alarms.
- Use the Alarm Editor to add and make minor edits to alarms.
- Evaluate the effect of Event commands and make minor edits to Events.
- Setup and edit data Trends & Use System Tags to help correct problems

## ALLEN-BRADLEY SLC

### A-5000: ALLEN-BRADLEY SLC-500 Programmable Controllers/Level One

#### COURSE DESCRIPTION

This 32-hour, 4-day training program provides students to gain hands-on experience in the troubleshooting and maintenance of the Allen-Bradley SLC-500 programmable controller. Hardware and software troubleshooting techniques are heavily emphasized throughout the course. The instructor will use example of actual troubleshooting experiences to enhance the learning process.

#### TOPICAL OUTLINE

- Introduction to Programmable Controllers
- Hardware Description/Configuration: CPU Processor Module & Input/Output Modules
- Safety Considerations
- Programming Terminal Operation
- Program Entry and Interpretation: Ladder Diagram Instructions, Timers and Counters, Data Manipulation Instructions & Program Control Instructions
- Use of Software Utilities in Troubleshooting (Force, Search, Histograms)
- Program Editing
- Troubleshooting: Software & Hardware Components Including Processor and I/O
- Peripheral Operations: Program Loading & Program Printing

#### PROGRAM SOFTWARE

Training is available utilizing Rockwell RSLogix500 software.

#### PREREQUISITE

This course is designed to meet the needs of both plant maintenance and engineering personnel. Students should be familiar with relay ladder logic.

#### CEU's 2.9

#### OBJECTIVES

Persons successfully completing this course will be able to:

- Identify the hardware components of the SLC-500 programmable controller.
- Configure and install a SLC-500 programmable controller system.
- Develop and interpret simple programs utilizing a programming terminal.
- Troubleshoot programs and isolate faults within the SLC-500 system.
- Properly use peripheral devices to store, copy and print programs.

*"Thanks for the great week. I hope to go through more training like this. Great job".*

*(Employee of The Dannon Company)*

## A-5200: ALLEN-BRADLEY SLC-500 Programmable Controllers/Level Two Advanced

### COURSE DESCRIPTION

This 32-hour, 4-day training program allows students to gain hands-on experience using the advanced program instructions and communications features of the Allen-Bradley SLC-500 programmable controller. Application projects emphasizing hardware and software troubleshooting techniques are used throughout the course to create a hands-on learning environment.

### TOPICAL OUTLINE

- Review of SLC-500 Hardware
- Advanced Programming Terminal Techniques: Specialized Edit Keys, Documentation & Utilities
- Instruction Familiarization: Indirect Addressing, File Fill, File Copy, FIFO/LIFO, Sequencer & Bit Shift
- Processor Communications
- Message (MSG) Instruction
- SLC-500 Network Communications: RS 232 Serial, DH 485, DH Plus & Ethernet
- Analog I/O: Module Configuration and Scaling
- Program Interrupt Instructions: Discrete Input Interrupt & Selectable Timed Interrupt
- Overview Topics (Time Permitting): PID Instruction

### PROGRAM SOFTWARE

Training is available utilizing Rockwell RSLogix500 software.

### PREREQUISITE

Students should have successfully completed Intellect Controls Group course A-5000 or have knowledge equivalent to the course description. THIS IS NOT AN ENTRY LEVEL TRAINING PROGRAM.

### CEU's 2.9

### OBJECTIVES

Persons successfully completing this course will be able to:

- Enter and interpret programs utilizing the advanced file instructions of the SLC-500
- Troubleshoot control programs utilizing all available instructions of the SLC-500
- Troubleshoot hardware, communications and process faults using indicators, message displays and a programming terminal.
- Properly connect and establish communications over a SLC-500 network.

*If you are looking for instructors who know their courses and are willing to go the distance to help you advance your knowledge, this group is for you. I have taken several classes and they have only improved over the years; I can't wait to see what's next. From beginners to "experts" there is something here for you.*

*(Employee of Norbord)\*

## ALLEN-BRADLEY PLC

### A-510: ALLEN-BRADLEY PLC-5 Family Programmable Controllers/Level One

#### COURSE DESCRIPTION

This 32-hour, 4-day training program provides students with hands-on experience in the troubleshooting and maintenance of the Allen-Bradley PLC-5 family of programmable controllers. Hardware and software troubleshooting techniques are heavily emphasized throughout the course. Troubleshooting techniques include interpretation of status indicators, diagnostic messages and use of the programming terminal to quickly isolate faults and take proper corrective actions. The instructor will use examples of actual PLC-5 troubleshooting experiences to enhance the learning process.

#### TOPICAL OUTLINE

- Introduction to Programmable Controllers
- Hardware Description
- I/O Configurations
- Installation
- Windows Based Programming Terminal Operation
- Addressing
- Instruction Familiarization: Ladder Diagram, Timer and Counter, Data Manipulation & Program Control
- Use Software Utilities to aid in the Troubleshooting Process (Histograms, Search, Force)
- Program Editing
- Peripheral Operations: Program Loading & Program Printing
- Troubleshooting: Hardware & Software
- Application Projects Using Industrial Hardware
- Remote I/O Rack & Network Setup
- Data Highway Plus Overview/Hands-on Demonstration
- ControlNet Overview (Time Permitting)

#### Program Software

Training is available utilizing Rockwell Software, RSLogix5 and other software products.

#### PREREQUISITE

Intellect Controls Group, Inc. training program IC-101 or a working knowledge of electromechanical control devices and relay ladder logic.

#### CEU's 2.9

#### OBJECTIVES

Persons successfully completing this course will be able to:

- Identify hardware components of all PLC-5 Family controllers.
- Distinguish the features and capabilities of the different PLC-5 products.
- Configure and install a PLC-5 system.
- Use a Windows based programming terminal for entering, editing and troubleshooting programs.

## **OBJECTIVES – cont.**

- Isolate processor and I/O faults to the module level.
- Troubleshoot simple programs using all ladder instructions of the PLC-5.
- Properly use peripheral devices to store, copy and print programs.
- Properly connect and establish communications over a Data Highway Plus network or an ethernet network.



## A-520: ALLEN-BRADLEY PLC-5 Family Programmable Controllers/Level Two Advanced

### COURSE DESCRIPTION

This 32-hour, 4-day training program allows students to gain hands-on experience using the advanced control & diagnostic capabilities of the PLC-5 programmable controller. Application troubleshooting exercises are used throughout the course to give students actual hands-on experience solving typical problems encountered in the factory.

### TOPICAL OUTLINE

- Review of PLC-5 Hardware and Basic Concepts
- Memory Organization Review
- Addressing: Direct, Indirect & Indexed
- Instruction Familiarization: File Arithmetic Logical, File Search and Compare, Shift Registers, Sequencers & BTW and BTR with Analog Module Configuration
- Communications: Data Highway Plus Communications, Remote I/O Communications, Discreet Data Transfer, Block Transfer & Message Instruction
- Overview: SFC Overview (Upon Request) & PID Instructions
- Peripheral Operations: Program Loading & Program Printing

### PROGRAMMING SOFTWARE

Training is available utilizing Rockwell Software RSLogix5 and other software products.

### PREREQUISITE

Students should have successfully completed Intellect Controls Group training program A-510 or have knowledge equivalent to the course description. A-520 IS NOT INTENDED FOR BASIC LEVEL ENTRY BY STUDENTS WHO HAVE NOT ACQUIRED THE BACKGROUND DESCRIBED ABOVE.

**CEU's 2.9**

### OBJECTIVES

Persons successfully completing this course will be able to:

- Troubleshoot programs utilizing all available instructions of the PLC-5.
- Effectively use a programming terminal for entering, editing, and troubleshooting programs.
- Utilize the diagnostic capabilities of the PLC-5 system to aid in systems troubleshooting.
- Utilize the remote I/O communications capabilities of the PLC-5.
- Properly connect and establish communications over a Data Highway Plus network or an ethernet network.

*"Excellent instructor! Highly recommend. Very knowledgeable and enthusiastic about course material. Thank you for the valuable training".*

*(Employee of Toyota)*

## SIEMENS PLC


### S-700: Siemens S7-300 Programmable Controllers with STEP 7 Software/Level One

#### COURSE DESCRIPTION

This 32-hour, 4-day training program provides students with hands-on experience in the troubleshooting and maintenance of the Siemens S7-300 Programmable Controller. Hardware and software troubleshooting techniques are heavily emphasized throughout the course. Troubleshooting techniques include interpretation of status indicators, diagnostic messages, and use of the programming terminal to quickly isolate faults and take proper corrective actions. The instructor will use examples of actual troubleshooting experiences to enhance the learning process.

#### TOPICAL OUTLINE

- Introduction to Programmable Controllers
- Hardware Description, I/O Configurations & Installation
- Programming Terminal Operation
- Instruction Familiarization: Ladder Diagram, Timer and Counter, Data Manipulation & Program Control
- Use Software Utilities to aid in the troubleshooting Process: Trend Charts, Search, Cross Reference & Force
- Program Editing
- Peripheral Operations: Program Loading & Program Printing
- Troubleshooting: Hardware & Software
- Application Projects Using Industrial Hardware
- Communications Overview/Hands-on Demonstration



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Remote  
training!**

#### PROGRAM SOFTWARE

Training utilizes Siemens Software SIMATIC Manager STEP 7 ver. 5.5 and Microsoft Windows OS.

#### PREREQUISITE

Intellect Controls Group, Inc training program IC-100 or a working knowledge of electromechanical control devices, relay ladder logic and Windows Operating System.

#### CEU's 2.9

#### OBJECTIVES

Persons successfully completing this course will be able to:

- Identify hardware components of a S7-300 Programmable Controller System.
- Configure and install a S7-300 Programmable Controller System.
- Use a programming terminal for entering, editing and troubleshooting programs.
- Isolate processor and I/O faults to the module level.
- Troubleshoot simple programs using ladder instruction of the S7-300 Programmable Controller.
- Properly use peripheral devices to store, copy & print programs.
- Properly connect and establish communications over an MPI/RS485 cable.


## S-710: Siemens S7-300 Programmable Controllers with TIA Software/Level One

### COURSE DESCRIPTION

This 32-hour, 4-day training program provides students with hands-on experience in the troubleshooting and maintenance of the Siemens S7-300 Programmable Controller. Hardware and software troubleshooting techniques are heavily emphasized throughout the course. Troubleshooting techniques include interpretation of status indicators, diagnostic messages and use of the programming terminal to quickly isolate faults and take proper corrective actions. The instructor will use examples of actual troubleshooting experiences to enhance the learning process.

### TOPICAL OUTLINE

- Introduction to Programmable Controllers
- Hardware Descriptions
- I/O Configurations
- Installation
- Programming Terminal Operation
- Instruction Familiarization: Ladder Diagram, Timer and Counter, Data Manipulation & Program Control
- Use Software Utilities to aid in the troubleshooting Process: Symbol Table, Search, Cross Reference, Watch & Force Tables
- Program & PLC Tag Editing, Block Descriptions
- Peripheral Operations: Program uploading & downloading
- Troubleshooting: Hardware & Software
- Application Projects Using Industrial Hardware
- Communications Overview/Hands-on Demonstrations



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### PROGRAM SOFTWARE

Training utilizes Siemens Software TIA Portal ver. 15 and Microsoft Windows OS.

### PREREQUISITE

Intellect Controls Group, Inc training program IC-100 or a working knowledge of electromechanical control devices, relay ladder logic and Windows Operating System.

### CEU's 2.9

### OBJECTIVES

Persons successfully completing this course will be able to:

- Identify hardware components of a S7-300 Programmable Controller System.
- Configure and install a S7-300 Programmable Controller System.
- Use a programming terminal for entering, editing, and troubleshooting programs.
- Isolate processor and I/O faults to the module level.
- Troubleshoot simple programs using ladder instruction of the S7-300 Programmable Controller.
- Properly use peripheral devices to store, copy & print programs.
- Properly connect and establish communications over PROFINET and MPI/RS485 cables.

## FLUID POWER

### H-100: Troubleshooting Industrial Hydraulics/Level One

#### COURSE DESCRIPTION

This 32-hour, 4-day training program focuses on industrial hydraulic systems. We place emphasis on understanding the basic hydraulic fundamentals utilized in all industrial hydraulic systems; the participant will learn effectively to setup, adjust and troubleshoot industrial hydraulic systems. The participant will apply practical hands-on exercises for each basic principle covered in the class. These hands-on exercises will be executed utilizing real world hydraulic adjustments and calibrations as used in actual systems. We focus heavily on teaching proper safety procedures, and strictly enforce these procedures to assure participants learn and practice safe work habits. ISO 1219 Industrial hydraulic symbology will be taught and used throughout the class. The participant will utilize this symbology throughout the class and learn from case history hydraulic prints. Proper adjustment procedures for pressure, flow, and directional control valves will be emphasized and applied.

#### CEU's

2.9

#### OBJECTIVES

Persons successfully completing this course will be able to:

- Demonstrate and identify good safety procedures when working with industrial hydraulic systems.
- Match system components with appropriate ISO 1219 symbols.
- Assemble hydraulic circuits and verify their operation in a lab setting.
- Determine why certain components are required in specific circuits.
- Adjust and calibrate system components in a predetermined sequence.
- Understand sources of heat in a hydraulic system.
- Understand the different types of flow controls and applications of each.
- Understand how to control a suspend load.
- Understand the purpose of accumulators and how to properly charge them.
- Identify the symptoms, causes, and prevention of shock in a hydraulic circuit.
- Diagnose failure of components that affect efficiency, but not operation.
- Successful completion of this program should adequately prepare the participant to successfully pass the written portion of the Fluid Power Societies Industrial Hydraulic Mechanic certification examination.

## H-200: Troubleshooting Industrial Hydraulics/Level Two

### COURSE DESCRIPTION

This 32-hour, 4 day training program focuses on advanced troubleshooting of industrial hydraulic systems using in-plant schematics. The participant will practice hands on troubleshooting skills on our industrial hydraulic trainers. This course is designed to raise the skill level of the hydraulic mechanic to the hydraulic technician level. The participant will calculate proper sizing of hydraulic pumps, actuators, valves, and piping. Hydraulic servo and proportional valve function, operation, terminology, and setting procedures will be covered; a background in electronics is not necessary. Topics covered will also include pressure intensifiers, air-over-oil, and pressure compensated pumps. ISO 1219 Industrial hydraulic symbology will be used and reinforced. Course can be customized to meet specific client needs, ie, researching in-plant equipment specs, updating in-plant schematics, hands on testing preparation, basic electronic control of hydraulic systems, or covering plant specific topics or equipment.

### Prerequisite

Successful completion of H-100 Troubleshooting Industrial Hydraulic/Level One

CEU's 2.9

### OBJECTIVES

Persons successfully completing this course will be able to:

- Demonstrate and identify good safety procedures when working with industrial hydraulic systems.
- Calculate proper hydraulic component sizing.
- Understand the operation and adjustment of servo and proportional hydraulic valves.
- Understand the operation and setting of pressure compensated pumps.
- Troubleshoot in-plant hydraulic systems with schematic diagrams.

Successful completion of this program and review of the International Fluid Power Society (IFPS) study guide should adequately prepare the participant to pass the written portion of the IFPS "Industrial Hydraulic Technician" certification examination. For more information visit <http://ifps.org/>

*"I had the same instructor for the basic hydraulics class and I was hoping he would be back. He's a very good teacher".*

*(Employee of Logan Aluminum)*

## **PN-100: Introduction to Industrial Pneumatics & Air Logic**

### **COURSE DESCRIPTION**

This 32-hour, 4-day training program focuses on industrial pneumatics systems. We use proven troubleshooting methods in this course. This course will teach the student to troubleshoot down to the component level. Course does not cover individual component repair.

This course introduces air logic in the forms of; attached Symbology (logic symbols) and detached Symbology (ladder logic).

Students are welcome to bring schematics into the class for coverage. Please have them provide schematics on 8 ½ x 11 paper if possible so copies can be made for the entire class and to provide a transparency for the instructor.

### **CEU's 2.9**

### **OBJECTIVES**

Persons successfully completing this course will be able to:

- To effectively troubleshoot pneumatic equipment, and controls.
- To properly build common pneumatic circuits.
- To identify and read typical pneumatic schematics.
- To identify and understand the operation of pneumatic components.
- To use proper pneumatic terminology.
- To identify safety related issues relating to pneumatics including safety circuits and the dangers of misapplication.
- The do's and don'ts of pneumatics.
- About oilless pneumatic components.
- The importance of clean air and preventive maintenance.
- The proper precautions to be taken when removing, repairing, or replacing pneumatic components

## MECHANICAL

### CB-100: Industrial Troubleshooting Methodologies and TCA Standards

#### COURSE DESCRIPTION

ITM is a 32-hour workshop that explores the principles and application of effective troubleshooting methods. This workshop begins with a review of Safety and upset condition hazards. Participants then explore some of the basic troubleshooting methods used to streamline the problem-solving process including the 7 step troubleshooting methods used and perfected by the Navy Nuclear Technical Training Division. We will explore differential comparison methods and then move into future failure avoidance by examining RCA methods designed to prevent repeat failures.

#### PREREQUISITES

No course pre-requisites. The course is suitable for all maintenance personnel and leadership roles.

##### Safety

- Hazards of Electricity
- Human/Electrical consequences
- Alternative Energy Isolation
- Lock-Out-Tag-Out
- Live Dead Live (New OSHA requirements)

##### Basic Troubleshooting Review

- Logical Elimination
- Symptom Review
- Half-splitting
- Documentation
- Practical Exercises – Simple circuit troubleshooting

##### Critical Thinking Theory

- Fact from Fiction (Everyone says so is still not fact)
- Context (Machine History and Operator Bias)
- Assumptions (Well...you know)
- Alternatives (Address the problem not the symptom)

Practical Exercises – (William of Ockham Vs. Sherlock Holmes)

##### Seven Step Method

- Gather Information (Symptom Recognition)
- Understand the Malfunction (Symptom Elaboration)
- Identify what can be Measured (List Probable Faulty Functions)
- Identify the Faulty Function (Verify Goes Ins and Goes Outs)
- Verify the Fault (Can/Will this cause my symptoms)
- Correct the Fault
- Document and RCA the Fault (Prevention of failure defeats Rapid Repair Time)
- Practical Exercises – (Complete a Seven Step Process for Failure)



## Root Cause Analysis

- Ishikawa Diagram (Getting to the Fishbone)
- 5 Why Analysis (Not 5 Who)
- Keep Digging (You are NOT done yet)
- Documentation for Prevention (Institutionalize your Knowledge)
- Practical Exercises – (Use the company template for a class member's example)

*This course was revised February 8, 2023*

## CB-200: Bearings, Seals & Lubrication

### COURSE DESCRIPTION

This 24-hour, 3-day training program covers bearing operation, types of bearings and their usage, proper installation and adjustments, and lubrication. It provides the methods to properly install and maintain all major types of bearings and seals. Oil and grease lubrication properties, methods, and intervals are also covered in detail.

### TOPICAL OUTLINE

- Bearing types and application
- Proper Shaft to Bore & Housing Fits
- Bearing handling procedures, Installation of Press Fit Bearings
- Proper Bearing Heating Techniques
- Bearing Preventative Maintenance
- Preloading Bearings – Taper and Spherical Roller
- Purpose of Lubrication and Types of Grease, Oil, and Additives
- Lubricant storage and handling and filtration
- Proper Lubrication Amount to Use Based on Bearing Size
- Proper Re-lubrication Intervals Based on Hours of Operation
- Greasing electric motor bearings
- Methods to check bearing operation
- Symptoms of Bearing Failures
- Causes of bearing failures, including:
  - Handling and Installation Damage, Wear, Overheating, Inadequate lubrication / Over lubrication, Corrosion, Brinelling and false brinelling, Equipment misalignment, Fretting, Electrical arcing, and Activity – identifying and interpreting actual failures
- Improper Fit

### HANDS-ON ACTIVITIES

Removal and installation of loose fit bearings and press fit bearings, measuring shafts and bores, Installing and adjusting taper roller bearings in gearboxes, Installing and adjusting spherical roller bearings, Greasing bearings and effects of improper lubrication.

### OBJECTIVES

Persons successfully completing this course will be able to:

- Participants successfully completing this course will be able to:
- Identify various types of bearings and their applications
- Explain how bearing lubrication works
- Explain proper handling and storage procedures to prevent premature bearing failure
- Select and use the proper tools to remove bearings
- Clean and visually inspect bearings prior to use
- Select the proper tools and install press fit bearings
- Properly install and adjust adjustable bearings
- Determine lubrication requirements and lubrication intervals
- Select and properly install various types of contact and non-contact seals
- Identify major causes of bearing failures through visual inspections

## CB-300: Industrial Pump Repair

### COURSE DESCRIPTION

This 32-hour, 4-day training program offers intensive insight into industrial pump troubleshooting and repair. The participant will gain knowledge in pump maintenance, alignment, and disassembly as well as predictive and preventive maintenance of industrial pumps. The workshop includes instructor led student labs on instructor's trainers as well as pumps provided by the participants from their plants.

### TOPICAL OUTLINE

- **Types of Industrial Pumps**
  - Positive Displacement Pumps
    - Gear Pumps, Lobe Pumps, Piston Pumps, Vane Pumps, Diaphragm Pumps, & Non-Positive Displacement Pumps
- **Introduction to Positive Displacement Pumps**
  - Gear Pump Basics
    - Pressure and suction sides, Pressure regulation, Sizing, HP and GPM, and Disassembly for troubleshooting and repair
  - Lobe Pumps
    - Pressure and suction sides, Pressure regulation, Sizing, HP and GPM, and Disassembly for troubleshooting and repair
  - Piston Pumps
    - Reciprocating pump basics, Reciprocating pump operation, Single and multiple stage piston pumps, and Disassembly for troubleshooting and repair
  - Vane Pumps
    - Vane pump usage, Vane pump operational basics, and Troubleshooting and repair of diaphragm pump
  - Diaphragm Pumps
    - Usage of the diaphragm pump, Diaphragm pump basics, and Troubleshooting and repair of diaphragm pumps
  - Screw Pumps
    - Applications and usage of screw pumps, Operation of a screw pump, and Troubleshooting and repair of a screw pump.
- **Centrifugal Pumps**
  - Single Stage Centrifugal Pumps
    - Pump laws of operation, What is Pump Head Pressure, Sizing a pumps impeller, Speed and diameter required to do the job, and Disassembly, troubleshooting and repair of centrifugal pumps
  - Types of Centrifugal Pumps
    - Radial Flow, Axial Flow, and Combination Flow
- **Basic Pump Alignment**
  - Effects of Misalignment
  - Indicators of Misalignment
  - Causes of Misalignment
  - Correcting Pump Alignment

- **Pump Bearings**
- **Pump Terminology**
- **Instructor led labs**

## OBJECTIVES

Persons successfully completing this course will be able to:

- Troubleshoot failed pumps and prevent recurrence of failure.
- Have a better understanding of predictive and preventative maintenance of pumps.
- Be able to select the best type of packing or mechanical seals for application.
- Understand the lubrication needs of the pump bearings.
- Be able to set up a pump for maximum efficiency.
- Understand the impeller relationship to pump head pressure.
- Be able to correct pump misalignment.

## CB-400: Mechanical Drives Training

### COURSE DESCRIPTION

This 4-day/32-hour workshop covers mechanical drives operation, selection, installation, and maintenance. It provides the methods to properly install and maintain all major types of belts, roller chain, and coupling drives. Measurement and inspection techniques are also covered in detail. Basic bearing installation and maintenance is also covered with an emphasis on setting clearances for spherical roller bearings.

### TOPICAL OUTLINE

- Safety
- Shop Math – Fractions and Decimals
- Precision Measurement – Micrometers, Calipers, Indicators, and Machinists Level
- Fasteners and Torque
- Belt Types and Identification
- Belt Numbering Systems
- Belt Length Calculations
- Belt Drive Ratio Calculations
- Safety and Guarding Design
- Pulleys and Sheaves Inspection
- Pulley and Sheave Installation
- Roller Chain Types, Size, and Identification
- Sprocket Types and Identification
- Chain Drive Ratio Calculations
- Chain Lubrication
- Troubleshooting Chain Failures
- Belt and Chain Alignment and Tensioning – Rough Alignment and Precision Alignment
- Drives with Multiple Speed Reductions
- Types of Couplings and Alignment Requirements
- Elastomeric Couplings, Jaw Couplings, Chain Couplings, and Grid Couplings
- Coupling Alignment Methods
- Run-out, End Play, and Soft Foot Checks and Corrections
- Straightedge and feeler gauge alignment methods
- Rim and Face and Reverse Dial Alignment
- TIR and Validity Rule
- Shim Formula

### OBJECTIVES

Persons successfully completing this course will be able to:

- Describe safety guidelines and OSHA requirements for mechanical drives
- Add and subtract decimals and fractions
- Convert fractions to decimals and decimals to fractions
- Properly measure various dimensions using micrometers, calipers, indicators, and machinist levels
- Identify various fastener grades and demonstrate proper torquing techniques
- Identify various belts, sheaves, roller chain, and sprockets

## OBJECTIVES - *continued*

- Perform belt and chain drive ratio calculations on single and multiple drives
- Align belt and chain drives using straightedge and precision alignment techniques
- Install various types of shaft couplings
- Perform rim and face coupling alignment
- Perform reverse dial indicator alignment
- Describe various bearing installation procedures
- Describe various types of lubricants and their properties
- Install spherical roller bearings and properly set clearances

## PROCESS CONTROLS

### PCI-100: Understanding Industrial Process Control/Level One Process Measurement & Control Fundamentals

#### COURSE DESCRIPTION

This 36-hour, 4.5-day training program uses a hands-on approach providing students with a fundamental understanding of industrial process measurement & control systems. Participants will learn the basic measurement & control principles, terminology, symbols & documentation standards. In addition, students will perform hands-on exercises with actual industrial temperature, pressure, flow & level measurement & control devices to gain experience in how to set up & troubleshoot a control system.

#### TOPICAL OUTLINE

- Introduction to ISA documentation standards: Process Flow Diagrams (PFD's), Piping & Instrument Diagrams (P&ID's), Loop Diagrams, Location Plans & Installation Details
- Test Equipment: Calibrators, Digital Multimeters & Power Supplies
- Signals: Analog – voltage & milliamps, Digital - on/off & digital data, Wiring basics
- Elements of a Process Control Loop: PV-Process Variable, MV-Manipulated Variable & C-Controller
- Temperature Measurement: Thermocouples, RTDs, Thermometers, Infrared, Characteristics, Thermowell & Transmitters
- Pressure Measurement: Gauges, Transmitters & Block & Bleed Valves
- Flow Measurement: DP Meters, Turbine Meters, Pd Meters & Variable Area Meters
- Level Measurement: Float Gauges, Static Head Gauges & Sounding Gauges
- Control Valves: Types, Accessories, Sizing & Basic Troubleshooting

#### PREREQUISITE

This is an entry level course & requires only those participants be familiar with industrial manufacturing processes.

#### CEU's 3.3

#### OBJECTIVES

Persons successfully completing this course will be able to:

- Construct a block diagram of a closed loop control system utilizing feedback.
- List the four most common process variables found in industry.
- List and describe the three modes of control.
- List the units of measurement of pressure, temperature, level, and flow.
- Convert from one unit to another.
- List and describe the terms that are common to all closed loop feedback control systems.
- List various methods used to measure pressure, temperature, level, and flow.
- Determine the action of a controller to obtain if given the characteristics of the other devices in a control loop.
- Describe the operation of the transmitters used to measure the process variables.
- List the requirements for stability in a closed loop control system.



## OBJECTIVES – Continued

- Describe the proper procedure for calibrating measurement transmitters.
- Explain the procedures for tuning a controller using either closed loop or open loop testing.
- Configure a microprocessor-based controller to specifications given by the instructor.
- List the three common inherent characteristics of control valves.
- Explain the difference between inherent and installed characteristics of control valves
- Determine whether a control loop is utilizing cascade, ratio, or feedforward schemes, if given a block diagram of the control loop.
- Calculate the Cv rating of a valve if given the maximum flow rate, the specific gravity of the liquid, and the differential pressure across the valve.
- Trace the electrical and pneumatic connections of the lab process plant.
- Explain the difference between direct and reverse acting actuators.
- Tune a controller to obtain good control, which will be determined by the instructor.
- Calibrate various types of transmitters.
- Construct basic temperature transmitters using thermocouples.
- Identify analytical equipment and their applications.

## PCI-200: Understanding Industrial Process Control/Level Two Advanced Process Measurement & Control Fundamentals

### COURSE DESCRIPTION

This 36-hour, 4.5-day training program uses a hands-on approach providing students an in-depth understanding of industrial process measurement & control systems. Participants will learn to apply more comprehensive measurement & control principles, terminology, symbols & documentation standards. In addition, students will perform hands-on exercises in which they will build, test, tune & troubleshoot temperature, pressure, flow & level control systems.

### TOPICAL OUTLINE

- Application of ISA documentation standards
- Elements of a Process Control Loop: PV-Process Variable, MV-Manipulated Variable & C-Controller
- Other Process Measurements: Weight, pH, Density, Viscosity, Moisture & Others
- Process Dynamics: Open Loop Response, Process Gain, Process Time Constant & Process Dead Time
- Control Methods: Open Loop control (Self-regulating), Manual control, ON/OFF control, Feedback control, Feedforward control & Cascade control
- Control Tuning: Open vs. Closed loop methods, Stability vs. responsiveness,  $\frac{1}{4}$  decay ratio, Simplex tuning method, Zeigler-Nichols tuning method & Auto-tuning
- Special Cases: pH control & Nonlinear systems
- Control Valve Selection & Sizing: Valve types (Globe, Ball, Butterfly & Gate), Valve Characteristic (Quick opening, Linear, Equal Percentage) & Other Control Valve Topics (Positioners, Materials, Configuration, Actuators & Accessories)
- Installation Best Practices: Wiring, Shielding & Isolation
- Control System Troubleshooting: Experience Based & Trial & Error

### PREREQUISITE

PCIC-101: Understanding Industrial Process Control/Level One Process Measurement & Control Fundamentals or a fundamental understanding of industrial process measurement & control system design & operation.

### CEU's 3.3

### OBJECTIVES

Persons successfully completing this course will be able to:

- Create the documents used to define instruments & control systems.
- Apply the principles, equipment & techniques for the primary industrial process measurements of temperature, pressure, level & flow.
- Understand & process response & how it affects controller operation.
- Know & apply the proper controller tuning method.
- Select & size the proper control valve.
- Build, test, operate tune & troubleshoot a various feedback control loops.

## FANUC CNC

### NC-150: Fanuc CNC Troubleshooting

#### COURSE DESCRIPTION

This 36-hour 4-day hands-on training program is designed for technicians who will be troubleshooting CNC equipment with Fanuc controls. We will emphasize the importance for technicians to fully understand how the electronics and mechanics interact in order to troubleshoot a problem. The course will cover the three primary areas of CNC troubleshooting:

- Electrical: Motors, servos, encoders, ladder logic and diagnostics
- Mechanical: The major components that make up a machine tool
- Environmental: Outside factors such as leveling, power, tooling

This class is available on site or at our location. If done on site, the customer will provide a classroom suitable for training purposes. A 220VAC supply will be needed for the simulator.

#### TOPICAL OUTLINE

During the course the students will assemble a CNC machine. This includes items such as box and linear guide rails, gibbs, ballscrews and a lubrication system. Once this is complete, the students will add the motors, servo drives and all of the necessary wiring. In the next step they will install the control, operator panel, parameters and ladder logic. As they assemble the machine we will discuss each component, how to adjust it, and how it can fail.

We will cover the interface between the CNC and the machine tool in detail. After the assembly, errors will be introduced into the machine. The students will use what they have learned in class to diagnose the problems. The students will also be presented with various scenarios dealing with machine failures. They will discuss potential causes for the failure and determine a logical series of tests in order to quickly isolate the problem.

If you wish to add, remove or concentrate on any of the topics please let us know. We will accommodate any special requests.

#### PREREQUISITE

Participants should have a good basic knowledge of electronics and the ability to use test instruments such as multi-meters.

**CEU's 3.3**

## NC-200: Fanuc CNC Advanced Machine Troubleshooting

### COURSE DESCRIPTION

This 36-hour 4-day hands-on training program provides the advanced training needed by CNC service technicians to fully understand the workings of a Fanuc controlled CNC machine. The students will use a hands-on approach to create ladder logic programs, install and remove scale feedback systems and modify parameter settings. The students will be using a simulator equipped with a Fanuc i-series control. This is a fully functional machine using alpha series drives, motors and scale feedback.

In this class the students are divided up into teams. These teams will work together to create errors that are introduced into the simulator. Each team will then debug the other team's errors. All of our classes can be tailored to the specific issues that you wish to address.

This class is available on site or at our location. If done on site, the customer will provide a classroom suitable for training purposes. A 220VAC supply will be needed for the simulator.

### TOPICAL OUTLINE

- Establishing servo parameter settings
- Enabling and disabling of scale feedback system
- Parameter details
- Data Registers
- Creating M-Codes, timers and alarms
- Adding additional I/O to a Fanuc control
- Using ladder logic and diagnostics
- Using custom macros for troubleshooting

If you wish to add, remove or concentrate on any of the topics please let us know. We will accommodate any special requests.

### PREREQUISITE

This is an advanced course. The students should have prior experience with troubleshooting CNC equipment. An advanced understanding of diagnostic procedures is recommended.

### CEU's 3.3

## NC-250: Fanuc CNC Advanced Machine & Ladder Logic Troubleshooting

### COURSE DESCRIPTION

This 36-hour 4-day hands-on training program provides the advanced training needed by CNC service technicians to understand and modify the ladder logic on their machines. Using the Fanuc NC Guide software, we will recreate one or more of your machine tools. The class will then diagnose all of the errors that show up. Since there are no switches being made on the initial startup, almost every alarm the machine can generate will appear. The students will reverse engineer every alarm and find the resolution to the problem. Once they have completed this course, they will be very familiar with all aspects of the machine.

### TOPICAL OUTLINE

- Creation of the machine I/O Configuration
- Chasing Alarm Messages through the Ladder
- Using Schematics and Diagnostics
- Using Function Statements and Tables
- PMC Navigation
- Ladder Editing Techniques

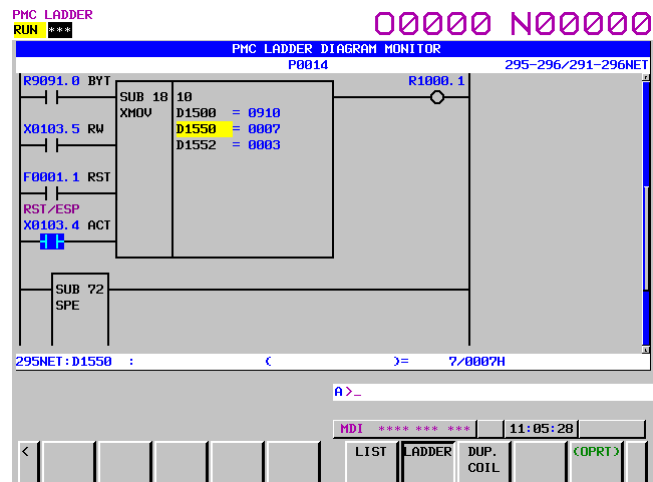
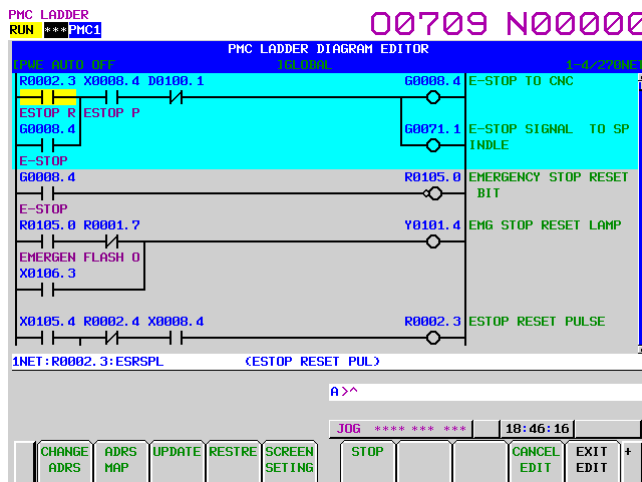
If you wish to add, remove or concentrate on any of the topics please let us know. We will accommodate any special requests.

We will need a copy of certain backup information from the machines you wish to be trained on. Not all machines will qualify for this type of training. Control types can vary from the 16 model B and up. The machines will use the Fanuc 0i or 31i control and operator panel as the test subject.

### PREREQUISITE

It is recommended that the students have completed the Advanced Fanuc Training class or have comparable experience.

### CEU's 3.3



## NFPA-70E-ARC-FLASH

### **EH-100: Low Voltage Electrical Safety/Level One**

#### **COURSE DESCRIPTION**

This 8-hour 1-day training program is used by more NFPA 70E committee members. The training will provide the participant with a thorough knowledge of the dangers and recommended safe behaviors for those who work daily around electrical hazards. This course goes beyond the theoretical to give attendees a complete understanding of regulations regarding electrical and arc flash safety and how to apply them in real-world situations. The course also details differences contained in the 2015 NFPA 70E standard from the 2012 version. Our arc flash training is the most complete in the industry without spending hours reading through OSHA and NFPA 70E regulations. We digest the information critical to the electrical worker and safety professional and put it in a concept-based, adult-learner friendly format that makes it easy to understand, remember and apply.

#### **Governmental Regulations & Standards**

- Personal Safety
- Safety for your fellow workers
- Comply with applicable regulations
- OSHA Regulations and Requirements
- NFPA 70E Standard

#### **Electrical Hazards & Protection**

- Type of Hazards: Electric Shock, Fire Ignition, Arc Flash, Arc Blast
- Associated Hazards: Falls, Smoke Inhalation

#### **Personal Protective Equipment**

- Gloves
- Clothing
- Equipment
- Care & Maintenance
- PPE Levels
- Standards

#### **Flash Hazard Assessment**

- Identify Hazards
- Remove or reduce possibility of contact through engineering controls
- Establish mandatory safe work practices
- Task Assessments

#### **Safety Related Work Practices**

- Job Briefing
- De-energize & Isolate
- Using Tools
- GFCI
- Cords & Cables

## Workplace Safety

- Mobile Equipment
- Working Overhead
- Flammable Liquids & Gas
- Shock Assistance
- Inspections
- Record-Keeping
- Audits
- Special Equipment
- Boundaries

## General Rules

- Material Storage
- Lock Out/ Tag Out
- One Hand Rule
- General Rules
- Voltage Detectors
- Meters
- Grounding
- Alerting
- Barricading
- Barriers
- Seven Electrical Safety Habits

## Staying Safe

- Recognizing Hazards
- Unqualified
- Task Qualified
- Qualified
- Management
- Classroom vs. On-the-job



## **EH-200: High Voltage Electrical Safety/Level Two**

### **COURSE DESCRIPTION**

This 8-hour 1-day training program provides electrical safety instruction for those who work on or around 1 to 138kV industrial high voltage systems. Working on or around these types of systems require the electrical worker to be qualified for the task and trained on the hazards. In this training, attendees learn what it means to be HV Qualified, the potential hazards, and what electrical tasks may only be performed by a qualified person.

### **Regulations and Training**

- OSHA
- NESC
- NFPA 70E
- NEC

### **Work Practices and Responsibilities**

- Qualified Persons
- General Rules
- Creating an Electrically Safe Work Environment
- Barricading
- Lock and Tag
- Grounding
- Fall Protection
- Safety Signs
- Inspections

### **HV Safety Equipment**

- PPE and Live-Line Tools
- Insulating Equipment & Grounds
- Rules & Policies for HV Safety

### **HV Mobile Equipment**

- Mobile Equipment & High Voltage Hazards
- Mobile Equipment & HV Hazards for Non-Electrical Work
- Mobile Equipment Qualified HV Operations

### **Hands On Exercises**

- Develop Work Plan
- Determine PPE Required
- Demonstrate Tool/Equipment Inspections
- Execute Work Plan

### **Course Prerequisite**

- Low Voltage Qualified 8-hour course.

### LEGACY SERIES COURSES

We offer hands-on training on the following legacy control systems, which are not regularly included in our published course schedules. You can obtain training on these products at our Kentucky Training Center or have training delivered on-site. Please contact us for a quote and schedule availability for any of these specialized legacy series courses.

#### **A-750: Allen-Bradley 550, 600, 1000 & 1400 Non-Enhanced Operator Terminal Editing & Troubleshooting**

This 32-hour, 4-day training program provides students with hands-on experience using Allen-Bradley PanelView 300, 550, 600, 900, 1000 and 1400 Operator terminals with the PanelBuilder32 windows-based software package. Students receive hands-on experience creating fully functional operator interface applications and downloading the applications to PanelView terminals. Emphasis is placed on interaction of the PanelView and the PLC in an integrated process environment.

#### **MC-200: Allen-Bradley 1336 Plus/Plus II Variable Frequency Motor Drives**

This 32-hour, 4-day training program will provide maintenance electricians and engineers with the required knowledge and skills to install, start-up and troubleshoot Allen-Bradley 1336 Plus AC Drive systems. Emphasis is on using the Human Interface Module and DriveTools software to set and check parameters used in normal operation and for troubleshooting. Students will locate power, signal and control terminals, monitor drive conditions, clear faults and be able to troubleshoot drive and motor problems.

#### **MC-300: Allen-Bradley 1394 GMC Digital Motion Controller**

This 32-hour, 4-day training program is designed for technicians, electrical maintenance personnel and engineers responsible for installing, troubleshooting and maintaining the Allen-Bradley 1394 GMC Digital Motion Controller. Students will learn the basics of motion control and AC servo drive systems. Using Allen Bradley's GML Commander software, students will be required to setup, tune, program motion, and diagnose 1394 system faults. They will understand hardware variations, power and control wiring, and interface methods for the 1394 GMC Digital Motion Controller family. Hardware and software troubleshooting are heavily emphasized in this course and hands on labs provide real world experience for the individual student.

#### **M-910: Modicon 984/Quantum Family Programmable Controllers/Level One**

This 32-hour, 4-day training program allows students to gain hands-on experience in the troubleshooting and maintenance of the Modicon 984 family of programmable controllers. Hardware and software troubleshooting are heavily emphasized throughout the training program. Troubleshooting techniques cover interpretation of status indicators, diagnostic messages, error codes and use of the programmable terminal to quickly isolate faults and take proper corrective actions.

#### **M-920: Modicon 984/Quantum Family Programmable Controllers/Level Two Advanced**

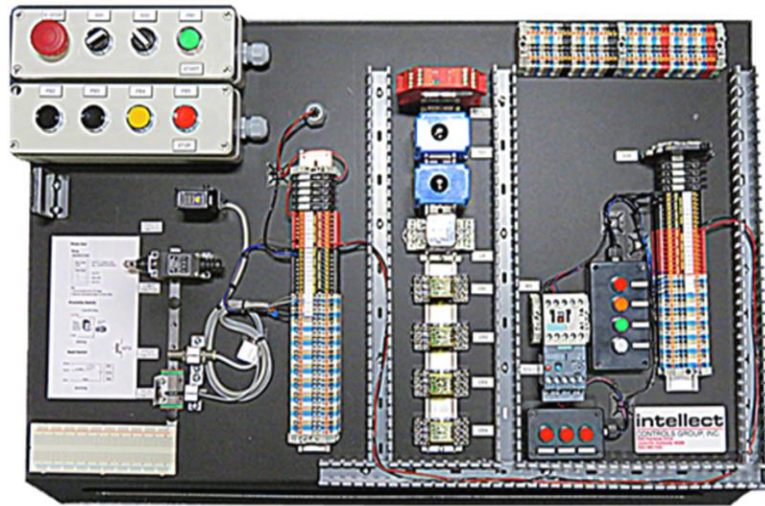
This 32-hour, 4-day training program provides a thorough introduction to the Advanced instruction and Enhanced instruction set capabilities of the 984 family programmable controllers. Application exercises are used throughout the course to create a hands-on learning environment.

## TRAINING SIMULATORS

### Fundamentals

**IC-100:** Basic Electrical  
& Controls Training

**IC-101:**  
Troubleshooting  
Industrial Controls &  
Ladder Logic



# Training Simulators

## PLC's - Allen-Bradley ControlLogix Programmable Controllers

**A-6000:** Allen-Bradley  
ControlLogix Level  
One

**A-6100:** Allen-Bradley  
ControlLogix 5000  
Fundamentals &  
Troubleshooting

**A-6200:** Allen-Bradley  
ControlLogix & Two



**A-6300:** Allen-Bradley ControlLogix/Level  
Three Advanced Communications:  
DeviceNet, ControlNet & Ethernet



## Training Simulators

**A-6400:** Allen-Bradley ControlLogix Motion Control Maintenance & Troubleshooting



**A-6450:** Allen-Bradley ControlLogix CIP Servo Motion with Kinetix 5500/5700 Drives





# Training Simulators

## GUARDLOGIX - Allen-Bradley GuardLogix

### A-6110: Allen-Bradley GuardLogix Maintenance & Troubleshooting



## ROCKWELL RS-5000 - RS-5000 ControlLogix

**A-6120:** RS-5000  
ControlLogix Function  
Block Diagrams

**A-6130:** RS-5000  
ControlLogix Structured  
Text

**A-6140:** ControlLogix RS-  
5000 Sequential Function  
Chart

**& A-6150**



# Training Simulators

## SLC-500 - Allen-Bradley SLC-500 Programmable Controllers



**A-5000:** Allen-Bradley SLC-500 Programmable Controllers/Level One Maintenance & Troubleshooting

**A-5200** Allen-Bradley SLC-500 Programmable Controllers/Level Two Advanced Maintenance & Troubleshooting



# Training Simulators

## FACTORYTALK VIEW - Allen-Bradley FactoryTalk View ME & SE

**A-760:** Rockwell  
FactoryTalk View ME  
Maintenance &  
Troubleshooting

**A-770:** Rockwell  
FactoryTalk View SE  
Maintenance &  
Troubleshooting



## DRIVES - Allen-Bradley PowerFlex 70/700

**MC-700:** Allen-Bradley  
PowerFlex 70/700 Variable  
Frequency Motor Drives



# Training Simulators

## Allen-Bradley PowerFlex 755

**MC-755:** Allen-Bradley PowerFlex 753/755 Variable Frequency Motor Drives



## Allen-Bradley PowerFlex 525

**MC-525:** Allen-Bradley PowerFlex 525 AC Drives with Connected Components Workbench

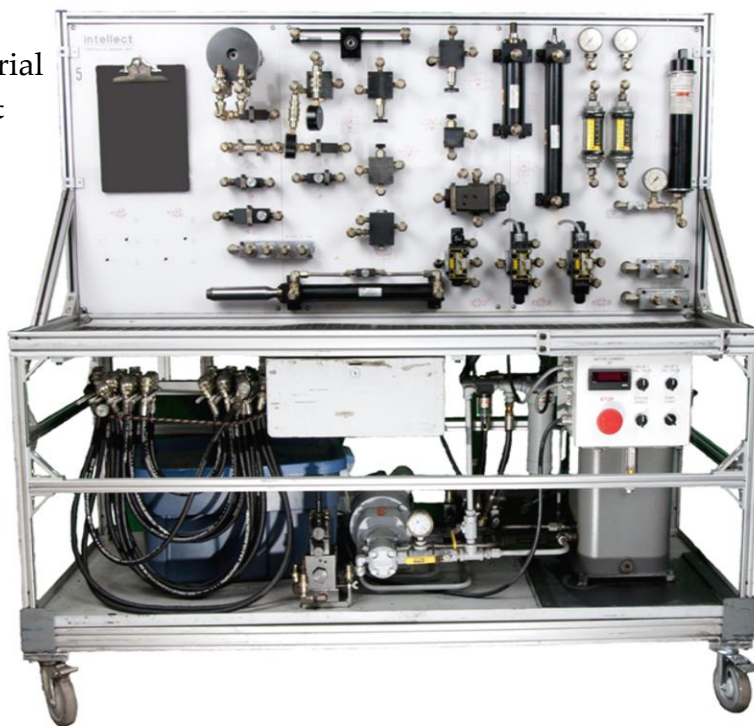


# Training Simulators

## Troubleshooting Industrial Hydraulics

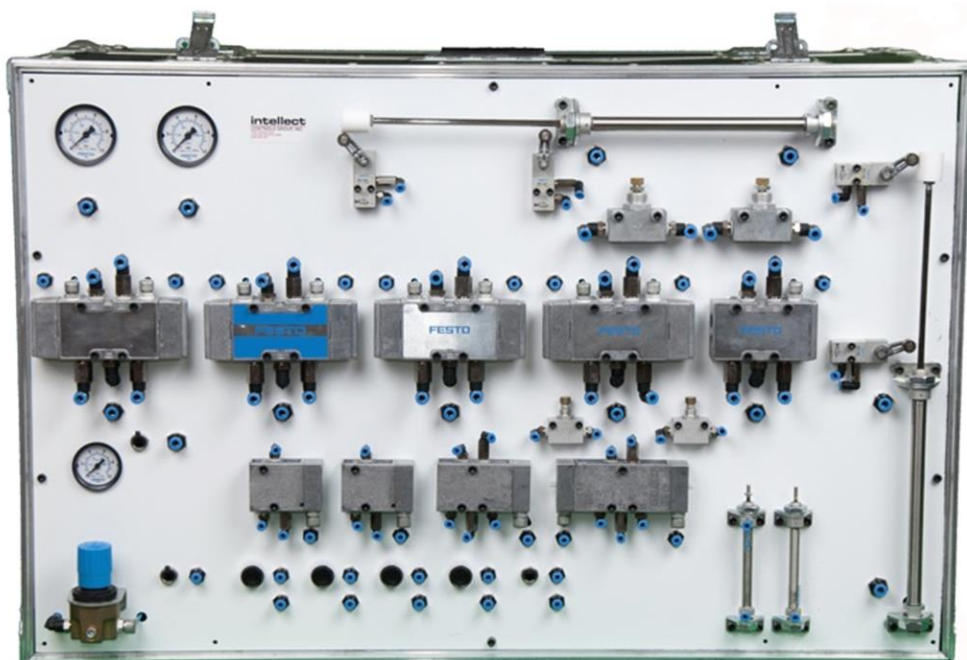
### H-100 & H-200: Troubleshooting Industrial Hydraulics Level One & Level Two

Hydraulic trainers need a minimum of 3 circuits. Each Hydraulic trainer weighs approximately 700lbs and is 5'4"H x 5'5"L x 2'4"D. A total of five trainers are delivered with each on-site training session.



## Introduction to Pneumatics & Air Logic

### PN-100: Introduction to Industrial Pneumatics & Air Logic





## Training Simulators

### FANUC CNC - Fanuc CNC Machine Troubleshooting

**NC-150:** Fanuc CNC  
Basic, **NC-200:** Advanced  
& **NC-250:** Advanced  
Machine & Ladder Logic



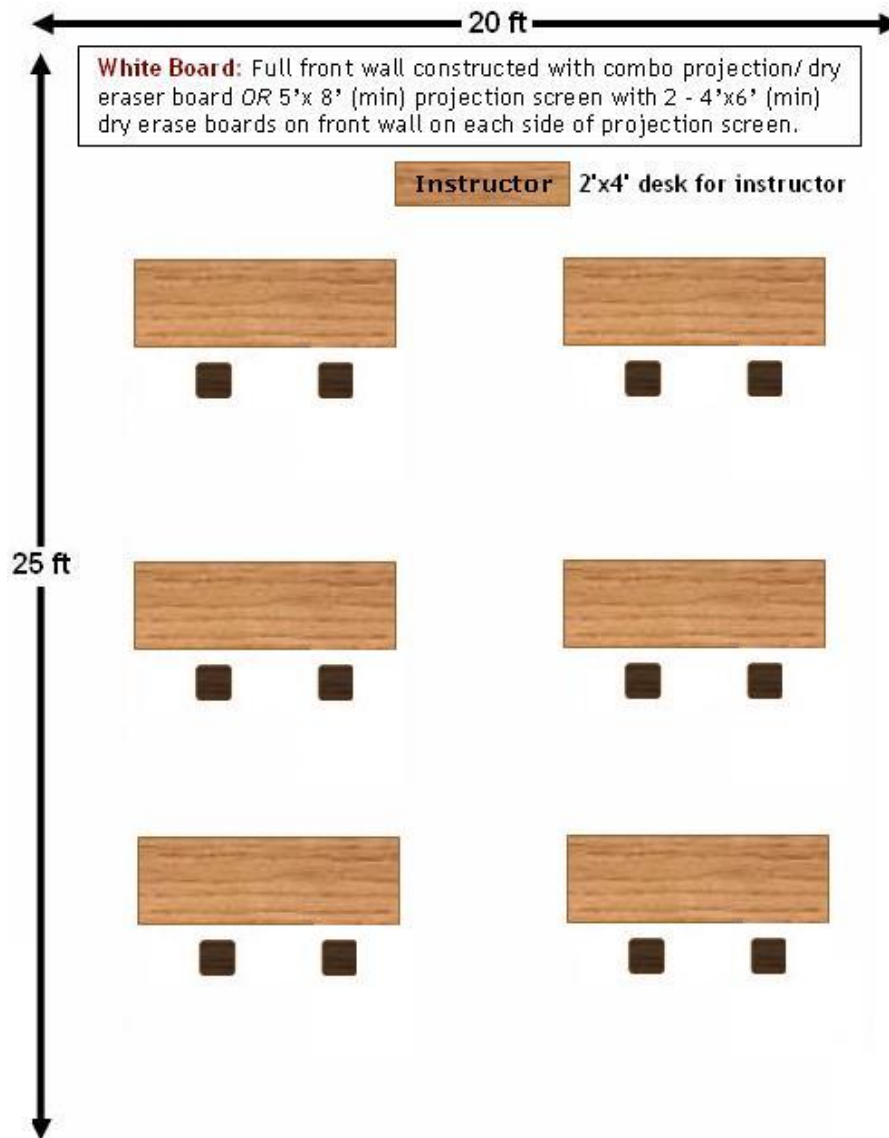
### PROCESS CONTROL - Understanding Industrial Process Control

**PCIC-101 & PCI-200:**  
Industrial Process Control  
Level One & Level Two



# Typical Classroom Setup

## TYPICAL CLASSROOM SETUP



### Typical Classroom set-up for 10 students

- Six 6-foot tables plus a table for the instructor
- Intellect will supply an Infocus if training location does not have one
- Room should be wired: 110 vac with a minimum of 2 circuits
- Exception: Hydraulic trainers need a minimum of 3 circuits. Each Hydraulic trainer weighs approximately 700lbs and is 5'4"H x 5'5"L x 2'4"D. A total of five trainers are delivered with each on-site training session.

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|---|--|---|
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