

1391 Digital AC Servo Drive

1391 Digital Servo Drive

This three-day course introduces technicians to the 1391 Digital AC Servo Drive, which is generally used with computer aided, closed loop-positioning systems. These systems control the position and rotary motion of various machine members on an automated machine.

I. 1391 Drive Introduction

- Standard Features
- Options/Modifications
- Drive Layout
- Operation

II. Inputs, Outputs, and Switch Settings

- Terminal Block - TB1
- Terminal Block - TB2
- Terminal Block - TB3 (A Quad B Board)
- Terminal Block - TB4
- Terminal Block - TB5
- Switch Settings

III. Programming

- Display Description
- Keypad Description
- Up/Arrow Keys
- Enter Key
- Parameter Levels
- Programming

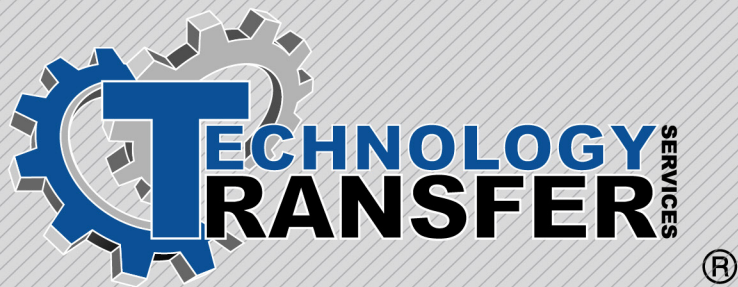
IV. Startup

- Auto Tune Procedure
- Manual Tuning Procedure
- System Compensation Procedure

V. 1326 AC Servomotors

VI. Troubleshooting

- System Troubleshooting
- Fault Codes and Troubleshooting Tables



Allen Bradley 1336 Variable Frequency Drives

Allen Bradley 1336 Variable Frequency Drives

This four-day course provides technicians with an understanding of variable frequency drives. The course covers the major parts of variable frequency drives, including programming and display panel, control inputs, drive functions, and troubleshooting faults.

I. AC Drive Section

- Power Section
- Logic Section
- Variable Frequency Drive Parameters

II. Variable Frequency Drive Overview

- Drive and Option Identification
- Drive Firmware Identification
- Drive Schematic Overview

III. Variable Frequency Drive Operation

- HIM Programming and Display Panel
- Control Inputs
- Drive Functions

IV. Variable Frequency Troubleshooting

- Fault Information
- Fault Troubleshooting

Advanced Protective Relaying

This five-day course is designed to provide the participant with an advanced background of differential relaying, distance relaying, directional control relays, relay system testing, instrument transformers used for relay applications, and rotating machinery protection.

I. Differential Relaying

- Operating Principles
- Transformers
- Generators
- Construction of Differential Relays
- Relay Operation
- Relay Characteristics

II. Distance Relaying

- R-X Diagrams
- MHO Unit
- Step Distance Relaying
- Distance Measurement
- Distance Relays and Loss of Potential
- General Electric CEY51 MHO Distance Relay
- Compensator Type Distance Relay
- General Electric CEH-52A

III. Directional Control Relays

- ICW Power Directional Relay
- Westinghouse CRN-1 Relay
- Basic Relay Connections to CT'S and PT'S
- Directional Supervision vs. Directional Control
- Operating Principles of Directional Control
- Ground Directional Relays
- Westinghouse IRQ Relay
- Westinghouse CWC/CWP Relays
- General Electric IBCG Relay
- General Electric IBCG Relay

IV. Relay System Testing

- Safety
- Testing Cycles

- Types of Testing
- Current and Voltage Relay Testing
- Installation Tests
- Time Overcurrent Relays
- Target and Seal In Units
- Directional Overcurrent Relays
- Differential Relay Testing
- Distance Relay Testing
- Instrument Transformer Testing

V. Instrument Transformers for Relay Applications

- Potential Transformers
- Current Transformers
- Interpretation of Instrument Transformer Nameplate Data
- Instrument Transformer Accuracies, Burdens, and Relay Performance
- Auxiliary Transformers
- Polarity of Instrument Transformers
- Installation Considerations for Instrument Transformers
- Wiring Considerations for Installing Instrument Transformers
- Testing of Instrument Transformers

VI. Rotating Machinery Protection

- AC Motor Protection
- Protective Categories
- Motors Rated Below 1500 HP
- Motors Rated 1500 HP and Above
- Synchronous Motors
- Synchronous Generator Protection

Bailey 820 Common Controller Circuits

Bailey 820 Common Controller Circuits

This five-day course covers the various controller circuits used in the Bailey 820 control system.

I. Summer Plus Bias Plus Integral Module

- Description of Operation
- Circuit Description

II. Summer Plus Proportional

III. Plus Integral Action Unit

- Description of Operation
- Circuit Description

IV. Summer Plus Bias Action Module

- Summing Circuit
- Operational Amplifier
- Bias Circuit
- Inverter Circuit
- Tie-Back Circuit

V. Summer Extension Module

- Circuit Description
- External Wiring

VI. Derivative Action Module

- Description of Operation
- Circuit Description

VII. Signal Lag Action Module

- Description of Operation
- Circuit Description

VIII. Rate Limited Signal Follower Module

- Description of Operation
- Circuit Description

IX. Multiplier Module

- Description of Operation
- Circuit Description

X. Function Generator

- Description of Operation
- Circuit Description

XI. Signal Generator

- Description of Operation
- Circuit Description

XII. Auctioneer Module

- Description of Operation
- Circuit Description

XIII. Signal Limiter

- Description of Operation
- Circuit Description

XIV. Signal Monitor

- Description of Operation
- Circuit Description

XV. Pulser Module

- Description of Operation
- Circuit Description

XVI. Square Root Extractor

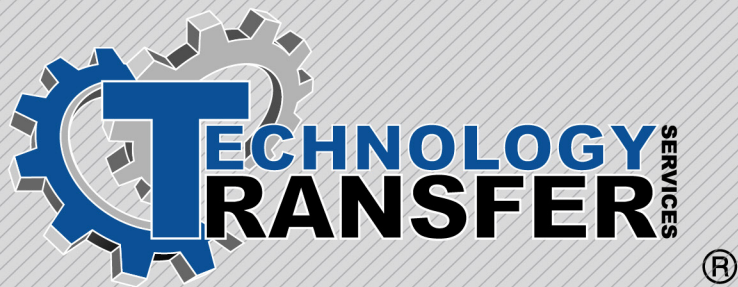
- Description of Operation
- Circuit Description

XVII. Tri-Stable Relay

- Description of Operation
- Circuit Description

XVIII. Transfer Relay

- Description of Operation
- Circuit Description



Bailey Infi-90 Controls

Bailey Infi-90 Controls

This four-day course provides technicians with an understanding of Bailey Infi-90 controls. Topics include a system overview, system modules, configuring modules, architecture, and lab exercises.

I. Overview

- System Description
- System Configuration
- Site Specific Usage
- Nomenclature
- EWS Setup

II. System Modules

- Power Supply Modules
- Communications Modules
- Processor Modules
- I/O Modules
- Interface Modules

III. Configuring Modules

- Dip Shunts
- Switch Settings
- Types of Inputs and Outputs

IV. Architecture

- Loops
- PCU's
- Modules (Master and Slave)
- Control Blocks
- Troubleshooting
- DBDOC
- Software Interface
- Lab Exercises

Basic Computers

This two-day course provides students with an understanding of the IBM-compatible PC and its associated support equipment. The course covers the major parts of the PC including hard drives, floppy drives, disk sizes, disk capacities, and COM ports/parallel ports. In addition, the course covers PC memory types such as RAM, ROM, hard disk memory, expanded memory, and extended memory.

I. Introduction

- Overview of PC Components
- Important Computer Terms and Syntax
- Bits, Bytes, and Megabytes

II. Disk, Files, and Directories

- What is a Hard Disk?
- Floppy Disks
- High Density Disks, Low Density
- Files, Directories and Folders

III. Introduction to MS-DOS

- What is MS-DOS?
- Common MS-DOS 6.0 Commands
- Using MS-DOS 6.0 Commands
- Copying and Backing up Data

IV. Memory

- Random Access Memory (RAM)
- Read Only Memory (ROM)
- Extended and Expanded Memory
- MS-DOS 6.0 and the High Memory Area
- CMOS Setup

V. Batch Files

- Batch Files
- Autoexec.bat and Config.sys
- Batch File Commands
- Creating Batch Files
- DOS Editor

VI. Serial and Parallel Ports

- What is a Port?
- Common Uses for Serial and Parallel Ports
- Setting up the Baud Rate for a COM Port
- Using Test Devices to Troubleshoot Ports

VII. Printers

- Dot Matrix
- Laser Jet
- Basic Installation

VIII. Performance Requirements

- Installation of Floppy and Hard Drives
- Serial and Parallel Port Setup
- Installation of RAM
- Installation of I/O and Common Conflicts
- Replacement of XT and AT Power Supplies
- Common Motherboard Jumper Configurations

IX. MS Windows

- What is Windows
- The Windows Explorer
- Copying, Cutting and Pasting
- Screen Captures
- The Windows Control Panel
- Troubleshooting Windows

Basic Electronics

This five-day course provides technicians with an understanding of basic electronic theory and concepts. The course begins with a review of direct current fundamentals then explains semiconductors, diodes, bipolar transistors, silicon controlled rectifiers, and triacs.

I. Direct Current Review

- Basic Series Circuits
- Basic Parallel Circuits
- Series/parallel Circuits
- Ohms and Kirchoff's Law
- Calculating Current and Voltage

II. Semiconductors - Diodes

- Semiconductor Materials and Characteristics
- Semiconductor Rectifier Diodes
- Diode Biasing, Ratings and Types
- Use of Diode Data Sheets and Cross Reference Manuals
- Power Rectification in AC Circuits
- Diode Application in DC Power Supplies
- Other Types of Diodes - Light Emitting Diodes, Tunnel Diodes Gunn Diodes, Shockley Diodes
- Protection of Diode Circuits from Over Voltage and Over Current
- Testing, Troubleshooting and Repair of Diode Circuits

III. Semiconductors - Bipolar Transistors

- Transistor Construction
- Transistor Biasing, Ratings, and Types
- Use of Transistor Data Sheets and Cross- Reference Manuals
- Typical Transistor Circuit Arrangements
- Common Base Transistor Circuits
- Common Emitter Transistor Circuits
- Common Collector Transistor Circuits
- Special Considerations for Power

Transistors

- Protection of Transistor Circuits from Over Voltage and Over Current
- Transistor Applications in Transistors Regulated Power Supplies
- Testing, Troubleshooting, and Repairing Transistor Circuits

IV. Semiconductors - Other Types of Transistors

- Field Effect Transistors (FETs)
- Metal Oxide Field Effect Transistors
- Special Considerations for Handling MOSFETS
- Power Mosfets and Their Applications
- Unijunction Transistors and Their Applications
- Testing, Troubleshooting, and Repairing Non- Bipolar Semiconductor Circuits

V. Silicon Controlled Rectifiers and Triacs

- SCR Construction and Theory of Operation
- Triac Construction and Theory of Operation
- Triggering of SCR and Triac Circuits
- Dv/Dt and Snubber Network Protection and Triac Circuits
- Special Considerations for Current-Limiting Fuses Used for SCR and Triac Protection
- Use of SCR and Triac Data Sheets and Cross-Reference Manuals
- Special Considerations for Power SCR's & Triacs

- Heat Sinking of Power SCR's and Triacs
- Special Considerations for Water Cooled SCR's and Triacs
- Testing, Troubleshooting, and Repair of SCR and Triac Circuits.

Basic Electronics and DC Motors

Basic Electronics and DC Motors

This five-day course provides technicians with an understanding of basic electronic theory and concepts and DC motors.

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- Basic Series Circuits
- Basic Parallel Circuits
- Series/parallel Circuits
- Ohms and Kirchoff's Law
- Calculating Current and Voltage

II. Semiconductors - Diodes

- Semiconductor Materials and Characteristics
- Semiconductor Rectifier Diodes
- Diode Biasing, Ratings and Types
- Use of Diode Data Sheets and Cross Reference Manuals
- Power Rectification in AC Circuits
- Diode Application in DC Power Supplies
- Other Types of Diodes - Light Emitting Diodes, Tunnel Diodes Gunn Diodes, Shockley Diodes
- Protection of Diode Circuits from Over Voltage and Over Current
- Testing, Troubleshooting and Repair of Diode Circuits

III. Semiconductors - Bipolar Transistors

- Transistor Construction
- Transistor Biasing, Ratings, and Types
- Use of Transistor Data Sheets and Cross- Reference Manuals
- Typical Transistor Circuit Arrangements
- Common Base Transistor Circuits
- Common Emitter Transistor Circuits
- Common Collector Transistor Circuits
- Special Considerations for Power Transistors

- Protection of Transistor Circuits from Over Voltage and Over Current
- Transistor Applications in Transistors Regulated Power Supplies
- Testing, Troubleshooting, and Repairing Transistor Circuits

IV. Semiconductors - Other Types of Transistors

- Field Effect Transistors (FETs)
- Metal Oxide Field Effect Transistors
- Special Considerations for Handling MOSFETS
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Basic Instrumentation

Basic Instrumentation

This five-day course provides technicians with an understanding of basic instrumentation theory and application.

I. Fundamentals of Electronic Instrumentation

- Electronic Transmitters
- Electronic Controllers
- Common Electronic Circuits
- Power Supplies
- Oscillators

II. Instrumentation Amplifiers

- Noise and Drift
- Discrete Component Instrument Amplifiers
- Chopper Input DC Amplifier
- Integrated Circuit Instrument Amplifiers

III. Electronic Transmitters

- LVDT Motion to Current Transmitters
- Force Balanced Motion to Current Transmitters
- Capacitive Motion to Current Transmitters
- Resistance to Current Transmitters
- Motion to Resistance to Current Transmitters
- EMF to Current Converters

IV. Transmission of Control Signals by Wire

- Electric Signal Noise
- Capacitive Coupled Noise
- Inductive Coupled Noise
- Directly Coupled Noise
- Noise Elimination
- Single Ended Grounded
- Single Ended Floating
- Balanced Floating
- Noise Reduction

- Common Mode Rejection Ratio
- Electronic Signal Ranges
- Instrument Supply Voltages
- Signal Cable Installation
- Intrinsic Safety

V. Electronic Controllers

- Physical Arrangements-Front
- Physical Arrangements-Side
- Controller Block Diagram
- Controller Proportional Response
- Controller Proportional plus Integral Response
- Controller Proportional plus Integral plus Derivative Response
- Controller Output
- Characteristics of Commercial Controllers
- Bailey Type 701
- Westinghouse Type 7300
- Foxboro Spec. 200 Series Control Unit

VI. Electronic Control Arrangements

- Basic Control Channel
- Control Valves
- Pneumatic Control Valve Actuators
- Electro-Hydraulic Actuator
- Manual Actuators
- Valve Positioners
- Electric Proportional Valve Actuators
- Solenoid Actuators
- Electrical Power Control
- Process Control Loops
- Temperature Control Loops
- Pressure Control Loops
- Flow Control Loops
- Level Control Loops

- Cascade Control
- Ratio Control
- Feedforward Control

VII. Transducers and Converters

- Pneumatic to Current Voltage Converter
- Electronic to Pneumatic Transducers

Basic MS-DOS

This two-day course provides students with an understanding of MS-DOS and its associated computer applications.

I. DOS Prompt

- Break
- Changing Prompt
- Special Prompt Codes

II. DOS Key

- Purpose of DOS Key
- Installing DOS Key
- Practical Uses of DOS Key

III. Config.sys File

- Purpose of Config.sys File
- Creating a Config.sys File
- Device Drivers
- Common Problems
- Using Multiple Config.sys Files

IV. Autoexec.bat File

- Purpose of Autoexec.bat File
- Creating a Autoexec.bat File
- Device Drivers
- Common Problems
- Using Multiple Autoexec.bat Files

V. Basic File Structure

- File Types
- TSR's
- Naming Files
- Wildcards

VI. Directories and Subdirectories

- Purpose
- Rules on Directories and Subdirectories
- Creating Directories and Subdirectories

- Deleting Directories and Subdirectories
- Using the Deltree Command

VII. Copying and Moving Files

- Using the Copy Command
- Using the Xcopy Command
- Using the Move Command
- Using Wildcards While Copying

VIII. Deleting and Un-deleting Files

- Using the Del Command
- Using the Erase Command
- Using Un-erase

IX. Batch Files

- Purpose of Batch Files
- How to Write Batch Files
- Using Different Editors to Write Batch Commands

X. DOS Environment

- Environment Defined
- Setting the Environment
- Using the Set Command

XI. I/O Redirection and Filters

- Redirecting the Output
- Using the Append Command
- Using the Pipe Command
- Using the More Command
- Using the Sort Command
- Using the Find Command

XII. ANSI Command

- Description of ANSI
- Changing Prompts Using ANSI
- ANSI Keyboard Commands

XIII. Hard Disk Management

- Setting the Root Directory
- Making Subdirectories
- Setting the Path
- Tips on Using Directories

XIV. Disk Compression

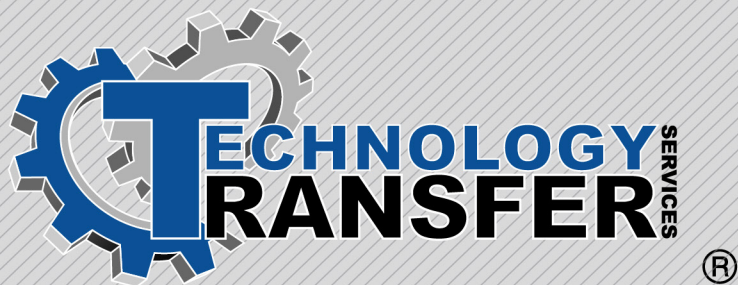
- Why Use Disk Compression?
- Different Types of Compression
- Installing Doublespace
- Tips on Using Doublespace

XV. Memory Management

- Importance of Using Memory Manager If Extended Memory Exists
- Types of Memory Managers
- Installing a Memory Manager
- Using Memmaker
- Using QEMM
- Setting Parameters with Memory Manager

XVI. Windows

- Windows Environment
- Getting Around in Windows
- Common Problems With Windows



Beta 512 Annunciators

Beta 512 Annunciators

This four-day course begins with a look at fundamentals of annunciators. A review of common annunciator digital circuits is provided. An overview of the NSSS is also presented. The detailed operation of the scanners, main controllers, auxiliary controllers, and annunciator output modules is emphasized. The operation and programming of the system via the Remote Configuration Workstation is also covered. The troubleshooting techniques used on the system are described in detail.

I. Introduction to Annunciators

- Purpose of Annunciators
- General Annunciator System Operation

II. Overview of the Beta 512 System

- Scanner Cards
- Main Controller
- Auxiliary Controller
- Logic Backplane
- Code Operated Switch
- Auto Transfer Switch
- Printer Strip Panel
- Ground Detector
- Annunciator Output Modules
- Window Boxes and Joysticks

III. Scanner Cards

- Block Diagram
- Point Numbering
- Power Supplies and Connections
- Scanning
- Signal Processing and Flowpaths

IV. Main Controller Card

- Block Diagram
- Power Supplies and Connections
- Signal Processing and Flow Paths
- Synthesized Points

V. Auxiliary Controller Card

- Block Diagram
- Power Supplies and connections
- Signal Processing and Flowpaths

VI. Annunciator Output Modules

- Block Diagram
- Power Supplies and connections
- Signal Processing and flowpaths
- Window and Lamp Numbering
- Window Boxes
- Joysticks

VII. Remote Configuration Workstation

- Connecting the Workstation
- Programming, Setup and Configuration
- Major Commands

VIII. Troubleshooting Techniques

- Use of Schematics
- Error and Reset LED's
- Ground Isolation Switches
- Strip Printer Panel Use
- Remote Configuration Workstation
- Joysticks and Test switches

Two-Axis CNC Lathe Programming

Two-Axis CNC Lathe Programming

This three-day course teaches students the two-axis CNC lathe programming functions.

I. Computer Numerical Control

- Identify Major Components of CNC
- Describe Motion in Terms of X and Z Axis
- Identify Basic Capabilities of CNC Lathe
- Machine Reference Points
- CNC Control Keyboard Functions

II. Preparing for Programming

- Identify Required Operations
- Methods of Holding a Workpiece
- Tool Selection Factors
- Safety Practices
- Establish an Origin Point
- Programming Alarms

III. Programming Configurations

- Preparatory (G Code) Functions and Selections
- M-S and T Codes
- Miscellaneous Codes
- Dimensional Configuration

IV. Absolute and Incremental Positioning

- Identify X and Z Axis Dimensions of Cartesian Coordinate System
- Describe Absolute Positioning and Incremental Positioning
- Program Rapid Traverse Movements in the Absolute and Incremental Systems

V. Cutter Radius Compensation

- Enter Compensation Data Into the Control
- Write a G41 Statement to Establish Cutter Compensation to the Left of Part
- Write a G42 Statement to Establish Cutter Compensation to the Right of Part
- Write a G40 Statement to Terminate Compensation

VI. Tooling

- Identification System for Throwaway Inserts
- Tool Nose Radius Compensation
- Tool Offset Compensation
- Tool Length Compensation
- Tool Geometry Offset
- Tool Wear Offset

VII. Diameter and Radius Programming

- Spindle Functions
- Tool Functions
- Miscellaneous Functions

Control Equipment

This ten-day course starts with an introduction and basic working knowledge of PLCs, progresses to advanced PLC programming, and ends with Variable Frequency Drive theory and troubleshooting using the SLC-5, PLC-5, and 1305/1336 VFDs for hands-on. This course is designed to prepare those personnel who are technically proficient, but have not previously been exposed to PLCs. It is also useful when presented in module format for a mixture of experience brought in different segments of the course. This works since this course is progressive in nature. The first module introduces PLCs, the second module presents advanced concepts, and the last module discusses VFD controls.

I. Basic Overview

- Purpose of Using PLCs in Industry
- Advantages/Disadvantages
- Plant Applications
- Safety Precautions

II. Basic SLC-500 Components

- Processor
- I/O
- Power Supply
- Programmer
- Chassis

III. Basic PLC-5 Components

- Processor
- I/O
- Power Supply
- Programmer
- Chassis

IV. Number/Addressing Systems Used in PLCs

- Binary
- Octal
- Hexadecimal
- BCD

V. Processors

- PLC 5
- Memory Capacity
- Scan Times

- Indicator Lights
- Power Requirements
- Mounting Instructions
- Adding CMOS Memory
- SLC 5/00 Series
- Memory Capacity
- B. Scan Times
- C. Indicator Lights
- Power Requirements
- Mounting Instructions
- Adding CMOS Memory

VI. Input/Output Modules

- Basic Operation
- Various Operating Voltages
- Power Requirements
- Mounting Instructions
- Wiring the Modules
- Identifying Faulty Modules

VII. Chassis

- PLC 5
- SLC 5/00 Series

VIII. Information Found in SLC-500/PLC5 Data Files

- Output File
- Input File
- Status File
- Bit File
- Timer File
- Counter File
- Control File
- Integer File

IX. Adding Memory to AB SLC-5/00 Series

- Extending Base Memory
- Adding CMOS

X. Adding Memory to AB PLC-5S

- Extending Base Memory
- Adding CMOS

XI. Programming and Editing Basics

- Clearing Memory
- Setting and Editing a Ladder File
- Using Various Ladder Logic Commands
- Exercises on all Commands

XII. Interfacing the SLC with the PLC-5

XIII. Configuring “Smart” Modules (Functional Overview)

- Analog Input Modules
- Analog Output Modules
- Thermocouple Modules

XIV. PLC Communications

- Communications on the Data Highway +
- Communication via the Ethernet Port
- Communication with PLCs in Adapter Mode

XV. Advanced Searching

- Searching Across Ladders
- Searching for “Strings”
- Searching for symbols

XVI. RSLogix5 Main View Screen

- Main Program Area
- Main Menu Bar
- Instruction Bar
- Icon Bar
- Status Bar
- File Area

XVII. Starting RSLogix5

- Main View Screen
- Off-line Operations
- Going Online

XVIII. Loading a Program

- Connecting the Laptop
- Loading Program from Hard Drives
- Loading Program from Floppy Disks
- Downloading to the Processor
- Comms Menu
- Program Mode

XIX. Saving Programs and Directories

- Saving a Program to a Disk
- Saving a Program to a Directory
- Downloading and Saving a Ladder File

XX. Editing

- Making Edits On-line
- Testing Edits
- Assembling the Edits
- Using Searches

XXI. Ladder File Operations

- Forcing Points
- Enabling/Disabling Forces

XXII. Printing Files

- Printing a Ladder File
- Printing I/O Tables

XXIII. Basic Ladder Logic Commands

- The Help Screen
- Contacts and Coils (XIC, XIO, OTE, OTL)
- Latching Coils (OTL, OTU)
- Timers (TON, TOF, RTO, RES)
- Counters (CTU, CTD)
- Move Commands
- Math Commands
- Master Control Relay
- Subroutines

XXIV. Troubleshooting Basics

- Basic 7 step principals
- Typical I/O faults
- Using Module Indicator Lights
- Exercises (Guided Discussion)

XXV. On-Line Troubleshooting

- Using Forces
- Using the AFI Command
- Diagnostic Tools

XXVI. AC Drive System

- Power Section
- Logic Section
- Variable Frequency Drive Parameters

XXVII. Variable Frequency Drive Overview

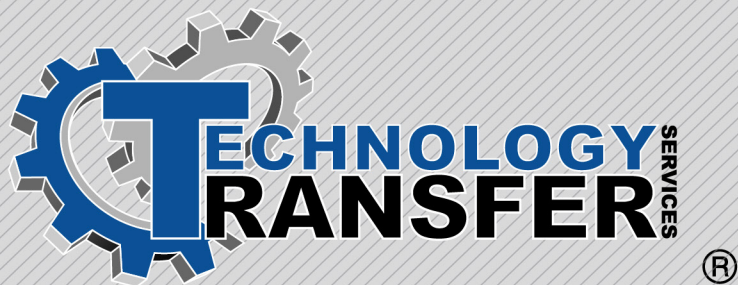
- Drive and Option Identification
- Drive Firmware Identification
- Drive Schematic Overview

XXVIII. Variable Frequency Drive Operation

- Programming and Display Panel
- Control Inputs
- Drive Functions

XXIX. Variable Frequency Troubleshooting

- Fault Information
- Fault Troubleshooting



COSS Training for Technicians

COSS Training for Technicians

This five-day course provides technicians with an understanding of basic electronic theory and concepts.

I. COSS Overview

- What is COSS?
- COSS Function
- Effects on Plant Personnel
- Integration into General Assembly
- Roles and Responsibilities

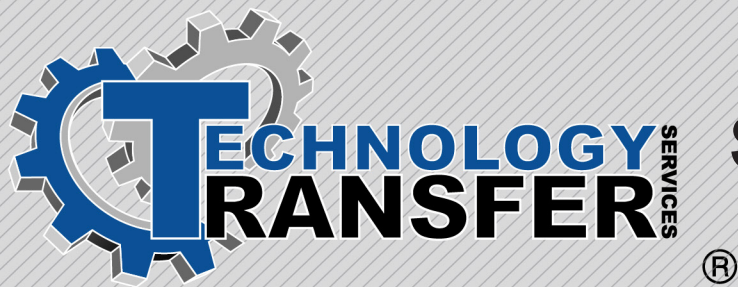
II. CQIS

- Parts in the COSS system
- Going On-line to the ControlLogix Backplane
- Defining Tasks, Programs, and Routines
- Creating Tags, Structures, and Arrays
- Ladder Logic
- Sharing Data Between Logix5550 Controllers
- Establishing Data Transfers over a ControlNet Network
- Establishing Fault Handling
- Configuring DH+/RIO Communications
- Motion Instructions
- Configuring a 1203 for DeviceNet Communication to the 1394
- Defining a DeviceNet Network
- Planning Physical Layout
- Connecting Devices to the Network
- Configuring
 - Network
 - Devices
 - DeviceNet Bridge
- Designing the ControlNet Cable System
- Configuring ControlNet Networks

III. COSS Troubleshooting

- Stacklight Overview
- Line Tracking Console (LTC) Troubleshooting
- Line Tracking System Troubleshooting
- Adding a Tool
- Moving a Tool
- Adding Part Pick
- Moving Part Pick
- Adding Process Tools
- Moving Process Tools
- Adding a Footprint
- Deleting a Footprint
- Adding an EPS Pendant
- Moving an EPS Pendant
- Adding a QAS Pullswitch
- Deleting a QAS Pullswitch
- Changing Warning Point within a Footprint
- COSS to CQIS Troubleshooting
- How Softstart works

NOTE: This course requires the customer to supply ControlLogix training units with DeviceNet, Panelview 1000s and Adaptascan Barcode Readers



Common Operator Support System (COSS) Overview

Common Operator Support System (COSS) Overview

This four-hour course provides technicians with an overview of the Common Operator Support System (COSS).

I. COSS OVERVIEW

- What is COSS?
- COSS Function
- Effects on Plant Personnel
- Integration into General Assembly

II. Controls Integration

- COSS Area
- COSS Systems
- ID Zones
- Track Zones
- Footprint
- Operation
- Actions
- Andon

III. COSS Description

- Detailed System Description
- PLC Logix5000
- DeviceNet
- ControlNet

IV. COSS and Error Proofing

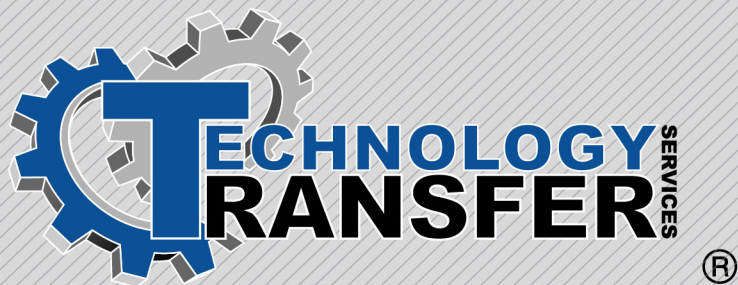
- VCVS
- Parts Selection
- Process Equipment
- Torque Tools

V. COSS Interfaces

- VCVS
- CQIS
- Flex/SFE

VI. COSS Roles and Responsibilities

- IS&S
- Competitive Manufacturing
- General Assembly Engineering
- Industrial Engineering
- Contractors
- Plant Engineering
- Plant EDS
- Plant Production
- Plant Maintenance



DeviceNet Network: Maintaining and Troubleshooting

DeviceNet Network: Maintaining and Troubleshooting

This two-day course provides the necessary resources and practice to maintain and troubleshoot a DeviceNet network. Throughout the course; your instructor will demonstrate procedures such as calculating cable system lengths, supplying power, connecting to the network, clearing scanner error codes, and diagnosing device faults. Demonstrations on adding and configuring devices and modifying scan lists using DeviceNetManager™ software is also covered. After each instructor demonstration, you will be presented with a real-world situation to solve using your DeviceNet workstation. The course culminates in an integrated practice that will require use of each skill to return a malfunctioning network to normal operation.

Participants will learn how to return a malfunctioning DeviceNet network to normal operation by determining the cause of cable system faults, connecting to the network to troubleshoot and configure devices, clear scanner faults and error codes, and interpret and modify scan lists.

- I. Maintaining and Troubleshooting the DeviceNet Cable System**
- II. Navigating Through the DeviceNetManager Software**
- III. Connecting to the DeviceNet Network and Devices**
- IV. Clearing Scanner Fault Indications and Error Codes**
- V. Diagnosing Device Faults and Adding and Configuring Devices**
- VI. Interpreting and Modifying Scan Lists**
- VII. Verifying Normal Network Operation**

Electronics for Electricians

Electronics for Electricians

This five-day course begins with a fundamental review of basic series and parallel circuits, Ohm's and Kirchhoff's Laws, and methods for calculating current and voltage. AC circuit fundamentals are also covered including inductive and capacitive circuits. Other topics include test equipment, semiconductors and diodes, transistors, silicon controlled rectifiers and triacs, and finally, analog integrated circuits and systems.

I. Direct Current Review

- Basic Series Circuits
- Basic Parallel Circuits
- Series/parallel Circuits
- Ohms and Kirchhoff's Law
- Calculating Current and Voltage

II. AC Circuit Fundamentals

- Inductive and Capacitive Reactance
- Inductive Alternating Current Circuits
- Capacitive Alternating Current Circuits
- Inductive and Capacitive Circuits in Combination
- Resonant and Non-Resonant AC Circuits

III. Test Equipment Used in Electrical/Electronic testing

- Volt-Ohm Meters
- Digital Multimeters
- Analog vs. Digital Measuring Instruments
- Signal Sources
- Oscilloscopes
- Interpreting Test Instrument Specifications
- Practical Applications of Test Instruments

IV. Semiconductors - Diodes

- Semiconductor Materials and Characteristics
- Semiconductor Rectifier Diodes
- Diode Biasing, Ratings and Types

- Use of Data Sheets and Cross-Reference Manuals
- Power Rectification in AC Circuits
- Diode Application in DC Power Supplies
- Other Types of Diodes - Light Emitting Diodes, Tunnel, Gunn, and Schottky Diodes
- Protection of Diode Circuits
- Testing, Troubleshooting, and Repair

V. Semiconductors - Bipolar Transistors

- Transistor Construction
- Transistor Biasing, Ratings, and Types
- Use of Data Sheets and Cross-Reference Manuals
- Typical Transistor Circuit Arrangements
- Common Base Transistor Circuit Applications
- Common Emitter Transistor Circuit Applications
- Common Collector Transistor Circuit Applications
- Special Considerations for Power Transistors
- Protection of Transistor Circuits from Over Voltage and Over Current
- Transistor Applications in Transistors Regulated Power Supplies
- Testing, Troubleshooting, and Repair

VI. Semiconductors - Other Types of Transistors

- Field Effect Transistors (FETS)
- Metal Oxide Field Effect Transistors
- Special Considerations for Handling MOSFETS
- Power MOSFETS and Their Applications
- Unijunction Transistors and Their Applications
- Testing, Troubleshooting, and Repair of Non-Bipolar Semiconductor Circuits

VII. Silicon Controlled Rectifiers and Tracs

- SCR Construction and Theory of Operation
- Triac Construction and Theory of Operation
- Triggering of SCR and Triac Circuits
- dV/dt and Snubber Network Protection of SCR and Triac Circuits
- Special Considerations for Current Limiting Fuses Used for SCR and Triac Protection
- Use of SCR and Triac Data Sheets and Cross- Reference Manuals
- Special Considerations for Power SCR's and Triacs
- Heat Sinking of Power SCR's and Triacs
- Special Considerations for Water Cooled SCR's and Triacs
- Testing, Troubleshooting, and Repair

VIII. Analog Integrated Circuits and Systems

- Operational Amplifier Applications
- Operational Amplifier Summer Applications
- Operational Amplifier Integrator Applications
- Operational Amplifier Differentiator Applications
- Special Considerations for the Frequency
- Response of Operational Amplifier Circuits
- Testing, Troubleshooting, and Repair
- Integrated Circuit Voltage Regulator Applications
- Use of Integrated Circuit Op-Amp and Voltage Regulators to Regulate Series Pass Transistor Output Power Supplies
- Use of Analog Integrated Circuit Data Sheets and Cross-Reference Manuals
- Testing, Troubleshooting, and Repair of Integrated Circuit Voltage Regulators
- Other Types of Analog Integrated Circuits

I&C Advanced

This ten-day course begins with a review of process measurement fundamentals followed by a review of the measurement means: pressure, temperature, flow, and level. Next, process control systems are explained. The final portion of the course instructs the fundamentals of calibration and programmable logic controllers.

I. Process Measurement Fundamentals

- Fundamentals of Measurement for PID Loops

II. Pressure Measurement

- Pressure
- Basic Troubleshooting
- Pressure Measurement Devices
- Troubleshooting Help for Pressure Transmitters
- Common Conversions

III. Temperature Measurement

- The Basics of Temperature Measurement
- Temperature Measurement Devices
- Troubleshooting Help for Temperature Transmitters

IV. Flow Measurement

- Units of Flow
- Physical Properties of Fluids
- Basic Flow Measurement Devices
- Primary Elements
- Secondary Elements
- Troubleshooting Help for Flow Transmitters
- Example IE Problem

V. Level Measurement

- Methods of Level Measurement
- Troubleshooting Help for Level Transmitters

VI. Process Control Systems

- Process Control Systems
- Modes of Control
- Control Loop Tuning
- Cabling
- Pneumatic Instruments
- Pneumatic Controllers

VII. Calibration Techniques

- Review of Instrument Loops
- Smart Transmitter Overview
- Rosemount Smart Transmitter
- Rosemount Pressure Transmitter
- Rosemount 3144 Temperature Transmitter

VIII. Programmable Logic Controllers

- PLC Construction
- Special Considerations for Power SCR's & Triacs
- Heat Sinking of Power SCR's and Triacs
- Special Considerations for Water Cooled SCR's and Triacs
- Testing, Troubleshooting, and Repair of SCR and Triac Circuits
- Special Considerations for Water Cooled SCR's and Triacs
- Testing, Troubleshooting, and Repair of SCR and Triac Circuits.

Introduction to Programmable Logic Controllers

Introduction to Programmable Logic Controllers is a three-day course that provides participants with an introduction and basic working knowledge of PLCs. This course is designed not for those personnel directly responsible for maintaining PLCs, but those workers whose equipment is controlled by them and who must troubleshoot that equipment. A key element of this course is a guided discussion between the two groups as to their responsibilities surrounding the PLCs in their facility.

I. Basic Overview

- Purpose of Using PLCs in Industry
- Advantages/Disadvantages
- Plant Applications
- Safety Precautions

II. Basic SLC-500 Components

- Processor
- I/O
- Power Supply
- Programmer
- Chassis

III. Number Addressing Systems Used in A-B PLC-500 Series

IV. SLC-500 Processor

- Memory Capacity
- Scan Times
- Indicator Lights
- Power Requirements
- Mounting Instructions
- Adding CMOS Memory

V. Input/Output Modules

- Basic Operation
- Various Operating Voltages
- Power Requirements
- Mounting Instructions
- Wiring the Modules
- Identifying Faulty Modules

VI. Chassis

- Basic Description of Chassis
- Addressing Rules
- Power Requirements
- Mounting Instructions

VII. SLC-500 Troubleshooting

- Basic 7-Step Principals
- Typical I/O Faults
- Using Module Indicator Lights
- Exercises (Guided Discussion)

Ovation DCS

This four-day course covers the Westinghouse Ovation DCS. Hardware and software are covered in detail.

I. Hardware

- Controller Cabinet Components
- Controller Cabinet
- Extended I/O Cabinets
- Remote I/O Cabinets

II. Communications

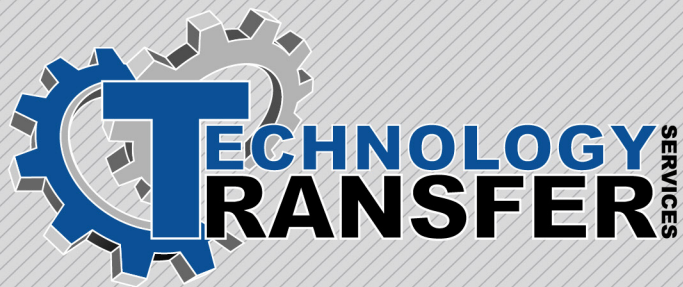
- Addressing Points
- PCRL Module
- PCRR Module
- Media Attachment Module
- Remote Node Controller
- I/O Modules
- Module Types
- Signal Tracking Algorithms
- Loop Sheets

III. Operator Station

- Point Information
- Base Alarm
- Process Diagram
- Trend display
- Highway Utilities
- Point review
- Shift Log

IV. Engineering Workstation

V. Historian Station



PanelView 1200e and 1400c: Developing Applications Using PanelBuilder 1400e Configuration Software

PanelView 1200e and 1400c: Developing Applications Using PanelBuilder 1400e Configuration Software

This two-day hands-on course teaches participants how to develop graphic screen displays that are used to control a plant floor application. The application example used in this course is a Proportional, Integral, Derivative (PID) application that realistically simulates as operator interface used to control the level and temperature of two separate tanks. Using the PanelBuilder 1400e configuration software in a Windows environment, participants will operate the operator interface screens and then download the application to the enhanced PanelView 1200e or 1400c terminal, then demonstrate proper operation of graphic screens. Functionality that participants will incorporate into graphic screens includes push-button controls, status indicators, numeric and bar graph displays, and alarm messaging.

Participants will learn how to produce a fully operational PanelView 1200c/1400e application by configuring the PanelView 1200e or 1400e to communicate via the Data Highway Plus™ or remote I/O network, create application screens using the PanelBuilder 1400e configuration software, create a tag editor worksheet to define screen objects, run a control panel application on the PanelView 1200c or 1400e terminal, and test the PanelView 1200e or

I. Getting Started with the PanelView 1200e Terminal

II. Getting Started with the PanelView 1400c Terminal

III. Testing the PanelView 1200c/1400e Terminal

IV. Creating an Application File Using the PanelBuilder 1400e Configuration Software

V. Planning a Remote I/O Application

VI. Creating a Tag Database

VII. Adding Screen Selectors and Titles

VIII. Downloading an Application

IX. Creating Controls and Displays

X. Integrated Practice: Running a PID Application

XI. Creating Menages

XII. Importing Bitmap Graphics

XIII. Creating a Report

XIV. Converting a PanelBuilder DOS or 1200 Application to a PanelBuilder 1400c Application

Prerequisite: A working knowledge of programmable controllers, experience in using 6200 Series PLC-5r programming software, and competency with the Microsoft Windows environment.

Programmable Logic Controllers

This five-day course provides participants with hands-on instruction on the setup, operation, and maintenance of PLCs. The course uses the Allen Bradley PLC-5 to demonstrate the installation, programming, maintenance, and troubleshooting of PLCs. The class consists of 1½ days of classroom instruction and 3½ days hands-on.

I. Basic Overview

- Purpose of Using PLCs in industry
- Advantages/Disadvantages
- Applications

II. Basic SLC-500 Components

- Processor
- I/O
- Power Supply
- Programmer
- Chassis

III. Number and Addressing Systems

- Binary
- Hexadecimal
- BCD

IV. Information Found in PLC Data Files

- Output File
- Input File
- Status File
- Bit File
- Timer File
- Counter File
- Control Files
- Integer Files

V. PLC Processor

- Memory Capacity
- Scan Times
- Indicator Lights
- Power Requirements
- Mounting Instructions
- Adding CMOS Memory

VI. Input/Output Modules

- Basic Operation
- Various Operating Voltages
- Power Requirements
- Mounting Instructions
- Wiring the Modules
- Identifying Faulty Modules

VII. Chassis

- Basic Description of Chassis
- Addressing Rules
- Power Requirements
- Mounting Instructions

VIII. Adding Memory to the Allen Bradley PLC

- Extending Base Memory
- Adding CMOS

IX. PLC Programming and Editing Basics

- Clearing Memory
- Setting and Editing a Ladder File
- Using Various Ladder Logic Commands
- Exercises

X. PLC Troubleshooting Basics

- Basic Seven Step Principals
- Typical I/O Faults
- Using Search Function to Troubleshoot
- Using Module Indicator Lights
- Using the Status File
- Exercises

Advanced Programmable Logic Controllers

This course teaches the student how to use the Allen Bradley software to edit, document, maintain, and troubleshoot the Allen Bradley PLC. The course is consist of 1 day lecture and 2 days hands on training.

I. Basic Programmable Controller Review

- PLC Components
- PLC Addressing
- PLC Ladder Logic Basics

II. Configuring “Smart” Modules (Functional Overview)

- Analog Input Modules
- Analog Output Modules
- Thermocouple Modules

III. PLC Communications

- Communications on the Data Highway +
- Communication via the ethernet port
- Communication with PLC's in Adapter mode

IV. Advanced Searching

- Searching across ladders
- Searching for “Strings”
- Searching for symbols

V. Online Troubleshooting

- Using forces
- Using the AFI Command
- Diagnostic Tools



Programmable Logic Controllers

Programmable Logic Controllers

This five-day course provides participants with hands-on instruction on the setup, operation, and maintenance of PLCs. The course uses the Allen Bradley PLC-5 to demonstrate the installation, programming, maintenance, and troubleshooting of PLCs. The class consists of 1½ days of classroom instruction and 3½ days hands-on.

I. Introduction to PLCs

- PLC Overview
- Number Systems Review

VI. SLC-100

- Hardware
- Programming

II. PLC Hardware

- Power Supply
- Input/Output Modules
- Processor Module

III. PLC Software

- PLC Languages
- PLC Software to Hardware Correlation

IV. Allen Bradley PLC-5

- Hardware
- Input/Output Modules
- Processor Module
- Universal Chassis
- Addressing
- Software to Hardware Correlation
- Industrial Terminals
- Allen-Bradley 6200 Series Software
- Processor Functions
- Force
- Search

V. Maintenance and Troubleshooting

- System Troubleshooting
- I/O Troubleshooting
- Program Troubleshooting

Advanced SLC 500

This five-day course teaches students how to use the Allen Bradley software to edit, document, maintain, and troubleshoot the Allen Bradley SLC 500 Series of PLC. It covers more advanced commands than the basic course, and takes an in-depth look at communications and communication drivers used with the PLC. The course consists of approximately one and 1/2 days of lecture and three and 1/2 days hands-on training.

I. SLC Review

- SLC Components
- SLC Addressing
- SLC Ladder Logic Basics

II. Configuring an SLC System

- Initial Connection
- Setting Up Communication Ports
- Configuring I/O

III. SLC Communications

- Serial Communications
- Communications on the Data Highway+
- Communication Via the Ethernet Port
- Communications in Scanner Mode
- Communication with PLC's in Adapter Mode
- Using an SLC as a rack in a PLC system
- Transferring Data to Other Control Systems

IV. Advanced Searching

- Searching Across Ladders
- Searching for "Strings"
- Searching for Symbols
- Searching for Edits
- Search and Replace

V. Advanced Commands

- Bit Shift
- Masked Moves
- Indirect Addressing
- Indexed Addressing
- File Shift
- Block Transfers
- Message Commands
- Advanced JSR
- Computation Commands
- Complex Comparisons

VI. On-Line Troubleshooting

- Using Forces
- Using the AFI Command
- Diagnostic Tools
- Using Single Scan
- Using the S2 File
- Using the M0 and M1 files

Programmable SLC-200 Series

This five-day course provides participants with hands-on instruction on the setup, operation, and maintenance of Programmable Logic Controllers (PLCs). The course uses the Allen Bradley SLC-200 Series PLC to demonstrate the installation, programming, maintenance, and troubleshooting of PLCs.

I. Basic Programmable Controller Overview

- Purpose of Using PLC's in Industry
- Advantages/Disadvantages
- Plant Applications

II. Basic SLC-200 Components

- Processor
- I/O
- Power Supply
- Programmer
- Chassis

III. Number and Addressing Systems Used in Allen Bradley PLC-200 Series

- Binary
- Octal
- Hexadecimal
- BCD

IV. SLC-200 Data Files

- Output File
- Input File
- Status File
- Bit File
- Timer File
- Counter File
- Control File
- Integer File

V. SLC-200 Processor

- Memory Capacity
- Scan Times
- Indicator Lights
- Power Requirements
- Mounting Instructions
- Adding CMOS Memory
- Identifying Hardware and Software Problems

VI. Input/Output Modules

- Basic Operation
- Various Operating Voltages
- Power Requirements
- Mounting Instructions
- Wiring the Modules
- Identifying Faulty Modules

VII. Chassis

- Basic Description of Chassis
- Addressing Rules
- Power Requirements
- Mounting Instructions

VIII. Adding Memory

- Extending Base Memory
- Adding CMOS

IX. SLC-200 Programming and Editing

- Clearing Memory
- Setting and Editing a Ladder File
- Using Various Ladder Logic Commands
- Exercises on all Commands

X. Interfacing the SLC with the PLC-5

XI. SLC-200 Troubleshooting

- Basic 7 Step Principals
- Typical I/O Faults
- Using "Search" Function to Aid Troubleshooting
- Using Module Indicator Lights
- Using the Status File
- Exercises

XI. SLC-200 Troubleshooting

- Basic 7 Step Principals
- Typical I/O Faults
- Using "Search" Function to Aid Troubleshooting
- Using Module Indicator Lights
- Using the Status File
- Exercises

Programmable Logic Controllers SLC-500 Series

Programmable Logic Controllers SLC-500 Series

This five-day course provides participants with hands-on instruction on the setup, operation, and maintenance of Programmable Logic Controllers (PLCs). An Allen Bradley SLC-500 Series PLC is used to demonstrate the installation, programming, maintenance, and troubleshooting of PLCs

I. Basic Programmable Controller Overview

- Purpose of Using PLC's in Industry
- Advantages/Disadvantages
- Plant Applications

II. Basic SLC-500 Components

- Processor
- I/O
- Power Supply
- Programmer
- Chassis

III. Number and Addressing Systems Used in Allen Bradley PLC-500 Series

- Binary
- Octal
- Hexadecimal
- BCD

IV. SLC-500 Data Files

- Output File
- Input File
- Status File
- Bit File
- Timer File
- Counter File
- Control File
- Integer File

V. SLC-500 Processor

- Memory Capacity
- Scan Times
- Indicator Lights
- Power Requirements
- Mounting Instructions
- Adding CMOS Memory
- Identifying Hardware and Software Problems

VI. Input/Output Modules

- Basic Operation
- Various Operating Voltages
- Power Requirements
- Mounting Instructions
- Wiring the Modules
- Identifying Faulty Modules

VII. Chassis

- Basic Description of Chassis
- Addressing Rules
- Power Requirements
- Mounting Instructions

VIII. Adding Memory to AB PLC-500 Series

- Extending Base Memory
- Adding CMOS

IX. SLC-500 Programming and Editing

- Clearing Memory
- Setting and Editing a Ladder File
- Using Various Ladder Logic Commands
- Exercises on all Commands

X. Interfacing the SLC with PLC-5

XI. SLC-500 Troubleshooting

- Basic 7 Step Principals
- Typical I/O Faults
- Using "Search" Function to Aid Troubleshooting
- Using Module Indicator Lights
- Using the Status File
- Exercises

Process Measurement and Control

This five-day course begins with a look at fundamentals of electronic instrumentation. Instrument amplifiers, electronic transmitters, transmission of control signals by wire, electronic measuring instrument arrangements are thoroughly describe

I. Electronic Instrumentation Fundamentals

- Electronic Transmitters and Controllers
- Common Electronic Circuits
- Power Supplies
- Oscillators

II. Instrument Amplifiers

- Noise and Drift
- Discrete Component Instrument Amplifiers
- Chopper Input DC Amplifier
- Integrated Circuit Instrument Amplifiers

III. Electronic Transmitters

- LVDT Motion to Current Transmitters
- Force Balanced Motion to Current Transmitters
- Capacitive Motion to Current Transmitters
- Resistance to Current Transmitters
- Motion to Resistance to Current Transmitters
- EMF to Current Converters

IV. Transmission of Control Signals by Wire

- Electric Signal Noise
- Capacitive Coupled Noise
- Inductive Coupled Noise

- Directly Coupled Noise
- Noise Elimination
- Single Ended Grounded and Floating
- Balanced Floating
- Noise Reduction
- Common Mode Rejection Ratio
- Electronic Signal Ranges
- Instrument Supply Voltages
- Signal Cable Installation

V. Electronic Measuring Instrument Arrangements

- Process Connections
- Instrument Mounting
- Basic Measurement Loops
- Temperature Measuring Channel
- Pressure Measuring Channel
- Flow Measuring Channel
- Level Measuring Channel
- Analytical Measurement Channel
- The Electronic Recorder and Alarm

VI. Electronic Controllers

- Physical Arrangements (Front and Side)
- Controller Block Diagram
- Controller Proportional Response
- Controller Proportional plus Integral Response

- Controller Proportional plus Integral plus Derivative Response
- Controller Output
- Characteristics of Commercial Controllers
- Bailey Type 701
- Westinghouse Type 7300
- Foxboro Spec. 200 Series Control Unit

Process Measurement Fundamentals

This five-day course begins with a look at fundamentals of measurement. A brief review of basic electronics is provided. An overview of the modern techniques of measuring pressure, temperature, flow, and level is covered. The use of these instruments in PID process control loops is emphasized. Troubleshooting and tuning of controllers and the calibration of the loop transmitters is also included in the course.

I. Fundamentals of Measurement

- Terminology
- Block Diagrams
- Open Loop Control System
- Closed Loop Control Systems
- Feedback

II. Pressure Measurement

- Principals of Pressure Measurement
- Basic Pressure Measurement Devices
- Pressure Transmitters

III. Temperature Measurement

- Principals of Temperature Measurement
- Basic Temperature Measuring Devices
- Thermocouples and RTDs
- Temperature Transmitters

IV. Flow Measurement

- Principals of Flow Measurement
- Primary Flow Measuring Devices
- Flowmeters

V. Level Measurement

- Principals of Flow Measurement
- Hydrostatic Level Measurement
- Electronic Flow Measuring Devices

VI. Control Systems

- Controller Terminology
- Two-Position Control
- Proportional Control
- Integral Control
- Derivative Control
- PID Controllers
- PID Controller Tuning

VII. Pneumatic Controllers

- Basic Mechanical Devices
- Pneumatic Instrument Components and Subassemblies
- Flapper/Nozzle, Pilot Valve, and Pneumatic Relay
- Force Balance Instruments
- Motion Balance Instruments
- Pneumatic Measurement Instruments
- Pneumatic Measuring Arrangements
- Pneumatic Control Instruments
- Control Valves and Actuators
- Pneumatic Control Arrangements
- Transducers and Converters

VIII. Electronic Controllers

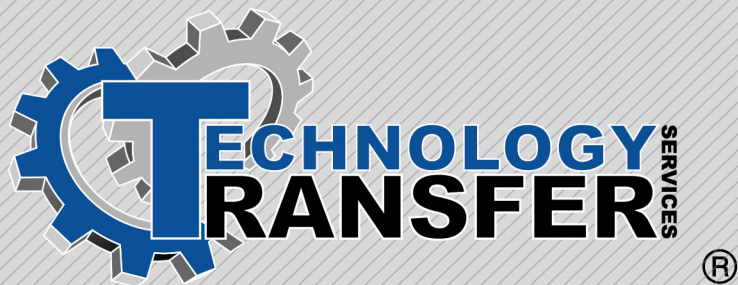
- Analog Controllers
- Digital Controllers
- Stand Alone Controllers

IX. Calibration Techniques

- Terminology
- Use of Electronic Calibrators
- Communicators
- Calibration Procedures

X. Troubleshooting Control Loops

- Troubleshooting Impulse Lines
- Troubleshooting the Transmitter
- Troubleshooting the Power Supply
- Troubleshooting the Loop Setup
- Troubleshooting DCS Interconnections



Regulators and Associated Equipment

Regulators and Associated Equipment

This five-day course provides technicians with an understanding of the function and operation of the various types of regulators used in gas distribution systems. It also describes the operation and maintenance of the various pieces of equipment used in a piping system in conjunction with pressure regulators.

I. Regulators

- Weight Loaded
- Pilot Operated
- Weight and Lever Operated

II. Spring-Operated Regulators

- Function
- Operation
- Fisher S200 Series Regulators

III. Pilot Operated Two-Path Regulators

- Fisher 99 Series Regulator
- Fisher 298 Series Regulator
- Fisher 310 Series Regulator
- Fisher 399A Regulator

IV. Pilot Unloaded Regulators

- Mooney Pilot Unloaded Regulators
- Grove Regulators
- American Meter Axial Flow Regulator

V. Relief Valves

- Spring-Loaded Relief Valves
- Pilot-Operated Relief Valves

VI. Diaphragm Actuator

VII. Valve Controllers

- Principle of Operation
- Calibration Process Pointer Zero and Span Adjustment

VIII. Valve Positioners

- Pneumatic Valve Positioner Principle of Operation
- Electro-Pneumatic Valve Positioner Principle of Operation

IX. Valve Trim for Control Valves

- Equal Percentage
- Linear
- Quick Opening
- Whisper Trim

X. Gas Fuses and Flow Limiters

XI. Security Valves

XII. Valves

- Ball Valves
- Needle Valves
- Plug Valves
- Butterfly Valves
- Identification, Marking, and Symbols

XIII. Strainers

- Wye-Type Strainer
- Basket Strainer
- T-Type Strainer
- Apollo Strainer
- Applications of Strainers in a System

XIV. Valve Actuators

- Hand Gear Operator
- Limitorque Operators

XV. Orifice Fittings

- Daniel Junior Orifice Fittings
- Removing an Orifice Plate on a Daniel Junior Orifice Fitting
- Replacing an Orifice Plate on a Daniel Junior Orifice Fitting
- Daniel Senior Orifice Fittings
- Removing an Orifice Plate on a Daniel Senior Orifice Fitting
- Replacing an Orifice Plate on a Daniel Senior Orifice Fitting
- Orifice Fitting Lubrication

XVI. Metering Devices

- Orifice Plates
- Orifice Plate Inspections
- Orifice Plate Environmental Concerns

Robotics

This three-day course is designed to provide an overview of robotics used in plants today. The course provides the student with an overview of robot operations. As an introduction to robotics, the components of a robot are covered, as well as their function within the system. The course also covers areas of motion control including topics such as axis of motion, controls, servo controls, operator interfaces, and how robots communicate with other control systems, such as PLC's. This course is designed for technicians and engineers who work with and maintain plant robots.

I. Introduction

- Robots
- Applications
- Controllers
- Typical Software Application
- Operator Interfaces

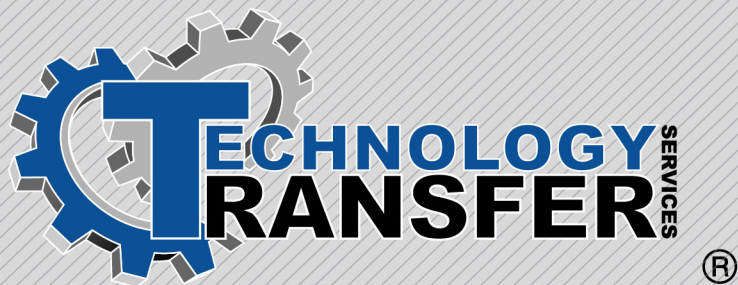
II. Servo Controls

- Motion Controller Fundamentals
- Servos
- Resolvers
- Encoders
- Feedback
- Positioning
- Braking

III. GMF Robots *(can be made to reflect the specific robot used at your facility)*

- Types and Series
- Components
- Power Distribution
- Print Reading
- Limit Switches and Hardstops
- RH Controller
- CRT Displays
- Teach Pendant
- Communications with external PLC's
- Input/Outputs
- Karel Software
- Jogging Robot
- Operations

*This outline can be revised and
course modified to
match the robots used at your facility*



Rosemount Smart Transmitters

Rosemount Smart Transmitters

This two-day course introduces participants to the Rosemount smart transmitter. Topics include the hand-held unit operation, the model 3051 pressure transmitter, and model 3144 temperature transmitter.

I. Review of Instrument Loops

II. Smart Transmitter Overview

- Operation
- General Calibration Points
- General Calibration Routine

III. Rosemount Smart Transmitter Basics

- Hand-Held Unit
- HART Communicator Connections
- Liquid Crystal Display (LCD)
- Action Keys
- Alphanumeric and Shift Keys
- Using the Fast Select Feature
- Using the Shift Keys for Data Entry
- HART Communicator Messages

IV. Rosemount 3051 Pressure Transmitter

- Calibrating the 3051

V. Resistance Temperature Detector Review

VI. Rosemount 3144 Temperature Transmitter

- Transmitter Options
- Calibrating the 3144
- Calibration Procedures
- Reference Charts

RSLogix5

This two-day course provides participants with an introduction to the software.

I. Introduction

II. RSLogix5 Main View Screen

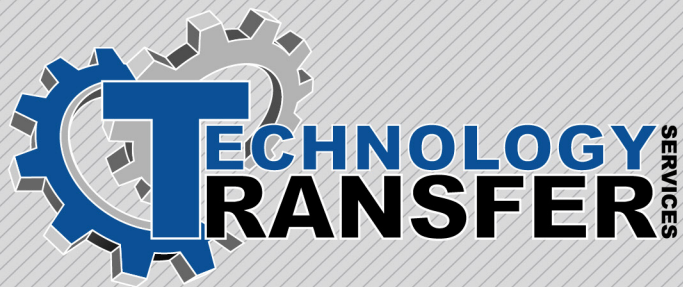
- Main Program Area
- Main Menu Bar
- Instruction Bar
- Icon Bar
- Status Bar
- File Area

III. Starting RSLogix5

- RSLogix5 Main View Screen
- Going Online With The processor
- Who Active Go Online
- RSLinx Screen
- Selecting the Station

IV. Loading and Saving Programs

- Loading a Program from a Hard Drive
- Loading a Program from a Floppy Disk
- Saving a Program to a Default Directory
- Saving a Program to Another Disk or Directory
- Making Edits to a Program On-Line
- Start Run Edits
- Test Edits
- Cancel Rung Edits
- Assemble Rung Edits
- Using Searches
- Tracing a Point
- Cross References to a Point
- Forces
- Help Screen



Allen-Bradley RSLogix500 Software



Allen-Bradley RSLogix500 Software

This two-day course provides participants with hands-on instruction on the setup, operation, and use of Allen-Bradley's RSLogix500 software to configure, troubleshoot, and program the SLC-500. The course uses the Allen Bradley SLC-500 to demonstrate the programming, maintenance, and troubleshooting of an SLC-500. The class consists of 45% classroom instruction and 55% hands-on exercises.

I. Introduction to RSLogix500

- Main Program Area
- Main Menu Bar
- Instruction Bar
- Icon Bar
- Status Bar
- File Area

II. Starting RSLogix500

- Main View Screen
- Off-line Operations
- Going Online
- Entering a Program
- Tag Editor
- I/O Configuration Screen

III. Starting RSLinks

- Connecting the Laptop
- Loading Program from Hard Drives
- Loading Program from Floppy Disks
- Downloading to the Processor
- Comms Menu
- Program Mode

IV. Storing Programs and Directories

- Saving a Program to a Disk
- Saving a Program to a Directory
- Downloading and Saving a Ladder File

V. Editing

- Making Edits On-line
- Testing Edits
- Assembling the Edits
- Custom Data Display Screens
- Mouse Based Field Entry
- Using Searches
- Histograms and Timing Charts

VI. Ladder File Operations

- Forcing Points
- Enabling/Disabling Forces

VII. Printing Files

- Printing a Ladder File
- Printing I/O Tables

VIII. Basic Ladder Logic Commands

- The Help Screen
- Contacts and Coils (XIC, XIO, OTE, OTL)
- Latching Coils (OTL, OTU)
- Timers (TON, TOF, RTO, RES)
- Counters (CTU, CTD)
- Move Commands
- Math Commands
- Master Control Relay
- Subroutines

Toolbox

This three-day course begins with an overview of the TOOLBOX system hardware and software. Next, students learn how to use the toolbox and its various functions, including the Finder function, batch operations, and file check-in and check-out. Lastly, the hardware and I/O interfaces are explained.

I. Overview

- Hardware
- Software

II. Using the Toolbox

- Starting the Toolbox
- Work Area
- Accessing Online Help
- Privilege/Password
- Privilege Level Functions
- Toolbox Options
- General
- Database
- Directories
- Libraries
- Block Diagram
- Print
- Controller
- Innovation Series Drive
- OC2000
- AcDcEx2000/2100
- Trend Recorder
- Connecting the Toolbox

III. Finder

- Using the Finder
- Finder Window
- Target Finds

IV. Batch Operations

- Batch Operations File
- Configuring a Batch Operation
- Running a Batch Operations File
- Open/Save Batch Operations File

V. File Check-in/Check-out

- Initialization

VI. Hardware and I/O

- I/O and Network Interface
- Racks
- Configuring Boards in the Outline View
- Regulators
- Sequence of Events
- Trend Recorder
- DLAN+ Interface
- EGD Interface
- Genius Networks
- Third Party Operator Interfaces
- Monitoring Genius
- Main Board
- Non-Volatile Random-Access Memory
- NOVRAM Points
- Register Network
- Ethernet SRTIP
- Serial Modbus
- Allen-Bradley Data Highway Plus(DH+)
- Custom Register Network

Ultrasonic Flow Meters

Ultrasonic Flow Meters

This five-day course discusses many varieties of ultrasonic meters manufactured by several vendors in use on pipelines. The primary function of ultrasonic meters is to provide a non-intrusive method to measure the flow of gas in a pipe. The following types of ultrasonic flow meters are described in this course: Instromet single path meters (GasSonic 400 and Check Sonic), Instromet Multipath meters (3 & 5 path Q sonic), Daniel Multipath meters (Senior Sonic), and Daniel Multipath meters (Junior Sonic).

I. Introduction to Ultrasonic Meters

II. Terms and Definitions

III. Theory of Operation

- Transit Time Calculations
- Transit Time Example
- General Requirements for Accurate Ultrasonic Flow Measurement
- Example Path Configurations and Uses
- Path Configuration Examples
- General Physical Properties
- Wire Frame Model of Gas Flow Profiles
- Acoustic Path Length
- Electronic Outputs
- Meter Capacity Comparisons
- Dry Calibration
- Ultrasonic Meter Flow Calibration Results 8-30"
- Characteristics of Ultrasonic Flow Meters
- Meter Liabilities
- Installation Considerations or Manufacturer's Recommendations
- Plant Applications

IV. Manufacturers of Ultrasonic Flowmeters

- Instromet Ultrasonic Flow Meters
- Daniel Multipath Ultrasonic Meter (Senior Sonic)

V. Flowmeter Applications

- Using SonicWare Software
- Test Procedures
- Station Inspection Frequencies
- Safe Retraction, Removal, and Replacement of Ultrasonic Transducers

VI. Ultrasonic Meter Monthly Maintenance Requirements

- Long-Term Maintenance
- Maintenance Procedures



Variable Frequency Drives

Variable Frequency Drives

This four-day course provides technicians with an understanding of variable frequency drives. The course covers the major parts of variable frequency drives, including programming and display panel, control inputs, drive functions, and troubleshooting faults.

I. AC Drive Systems Introduction

- Power Section
- Logic Section
- Variable Frequency Drive Parameters

II. Variable Frequency Drive Overview

- Drive and Option Identification
- Drive Firmware Identification
- Drive Schematic Overview

III. VFD Operation

- Programming and Display Panel
- Control Inputs
- Drive Functions

IV. VFD Troubleshooting

- Fault Information
- Fault Troubleshooting

MS Windows NT

This two-day hands-on course prepares students to operate the various functions of Microsoft Windows NT computerized operating system. Topics include startup, multi-tasking, file management, navigating the various applications, control panel settings and functions, task manager, and exiting from the system.

I. Introduction to Personal Computers

- System Definitions
- Platform Definitions
- File Definitions
- Hardware
- Networking
- Other Hardware
- Safety Precautions

- Networking File Management
- Navigating Applications and Windows
- Adding a Printer (Local/Network)
- Control Panel
- Task Manager

II. Introduction to Windows NT

- History of Windows
- Operating Similarities of Windows/Windows NT
- Windows NT Definitions (OS, GUI)

V. Exiting Windows NT

- Shutdown
- Restart
- Log-in as Different User

III. Windows NT Startup

- Log-In
- Passwords
- Desktop Monitor
- Mouse (Click and Wheel)
- Starting Applications

IV. Windows NT Operations

- Multi-Tasking
- Networking File Management
- Objects and Properties
- Arranging/Customizing Desktop
- Object Linking and Embedding (OLE)
- File Management
- Using/Creating Files

Wonderware

This three-day hands-on course is intended to allow the student to use the Wonderware software to operate the equipment controlled from the Wonderware software package.

I. Wonderware In-Touch

- Starting In-Touch
- Window Types

II. Windowmaker Toolbox

- Accessing Toolbox
- Text Tools
- Color Tools
- Object Alignment Tools
- Object Edit Tools
- Object Arrange Tools
- Pasting a .BMP File into a Window
- Resizing Objects

III. Windowmaker Menus

- File Menu
- Edit Menu
- Arrange Menu
- Text Menu
- Special Menu
- Windows Menu

IV. Tagname Dictionary

- Radio Buttons
- Entry Fields, Buttons, and Options to Allow User Input
- Tagname Types
- Tagname Definitions
- Placeholder Tagnames

V. Windowviewer Menus

- Controlling Logic
- WindowViewer
- Special MenuLogic Scripts
- Creating Scripts
- Application Scripts
- Window Scripts
- Key Scripts
- Condition Scripts
- Data Change Scripts
- Pushbutton Action Scripts
- Where Logic is Entered
- Button Descriptions

VI. Security

- Passwords
- Configure Users
- Log Off
- Applying Security to an Application
- Creating a Custom Security Log-On Window

VII. Alarming

- Alarm Hierarchy
- Creating Alarm Groups
- Assigning a Tagname to an Alarm Group
- Displaying Alarms
- Creating an Alarm Event
- Logging Alarms