



COURSE BROCHURE 2024



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INTRODUCTION TO PROGRAMMABLE CONTROLLERS (LOGO!)

Course Code - MA-INTRO

Duration - 3 Days

Prerequisites

Attendees must be computer literate and have basic electrical engineering skills. Knowledge of digital electronics would be an advantage.

Course Outcomes

The training outcomes are set up to teach attendees basics of a Programmable Logic Controllers.

A strong element of practical hands-on simulation of industrial related circuits will give attendees the knowledge required to understand the advantages of a PLC and how it provides effective productivity within a domestic or industrial environment.

The course is paced to suit all learners but is not for people with prior knowledge of PLC implementation and programming.

All practical exercises will be completed on the **Siemens LOGO!**

Content

- Introduction to Programmable Logic Controllers
- PLC control principles.
- Basic PLC instructions.
- Wiring instructions.
- Input / Output devices.
- Data Types
- Open and closed contacts.
- The AND function.
- The OR function.
- Timers.
- Counters.
- Internal relays (Markers / Flags).
- Basic ladder diagram design.
- Sequential interlock programming.

Practical Application

The learner will be able to complete the following practical tasks on successful completion of this course.

- Test and commission a basic PLC
- Read a simple linear program
- Write a simple linear program

INTRODUCTION TO TIA PORTAL (S7-1200)

Course Code - MA-INTRO-TIA

Duration - 3 Days

Prerequisites

Attendees must be computer literate and have basic electrical engineering skills. Knowledge of digital electronics would be an advantage.

Course Outcome

Successful outcome of this course will provide knowledge of the SIMATIC S7-1200 PLC and the engineering system SIMATIC STEP 7 Basic.

All theory is demonstrated with practical examples and exercises using the SIMATIC S7-1200 PLC and a Basic Operators Panel.

On completion of the course attendees will be able to offer 1st line maintenance on SIMATIC S71200 PLC's.

Content

- Introduction to Programmable Logic Controllers
- PLC control principles.
- Basic PLC instructions.
- Wiring instructions.
- Input / Output devices.
- Data Types
- The SIMATIC S7-1200 PLC family and SIMATIC STEP 7 Basic in the TIA Portal.
- Configuration of devices and networks.
- Working with a tag list.
- Working with Functions and Organization Blocks.
- Understanding the Program structure.
- Binary and Digital Operations.
- Tools for troubleshooting.
- Integration of HMI.
- Saving and documenting programs.



SIEMENS SERVICE & MAINTENANCE – PART 1

Course Code - FA-PLC-ONE

Duration - 5 Days

Prerequisites

Attendees must be computer literate and have basic electrical engineering skills. Involvement in PLC maintenance will be an advantage.

Course Outcomes

This course is directed at 1st line maintenance for the Siemens SIMATIC S7 programmable controllers.

Content

- The SIMATIC STEP 7 System Family.
- STEP 7 installation techniques & components.
- PLC installation & wiring techniques.
- Hardware handling.
- From process to project with the SIMATIC Manager
- Hardware configuration & addressing of Signal Modules.
- CPU Properties.
- Symbolic notation & symbols table handling.
- LAD / FBD / STL Editor.
- Commissioning & Monitoring /. Modifying Variables.
- Linear / Structured Programming Techniques.
- Debugging a program.
- Binary operations & gates.
- Flip Flops.
- Edge Detection.
- Number formats / Load and Transfer operations.
- Counters / Timers.
- Rewiring of programs.
- Documentation functions, saving and archiving.
- Copying a program to a memory card.



SIEMENS S7 SERVICE & MAINTENANCE PART 2

Course Code - FA-PLC-TWO

Duration - 5 Days

Prerequisites

Successful completion of the FA-PLC-ONE course.

Course Outcomes

This course teaches the delegate fault finding techniques required for maintenance. All theoretical learning is reinforced by practical examples making use of a hard PLC simulator and the STEP 7 software.

Content

Hardware commissioning.

- Memory reset. Variable tables.
- Modifying outputs in STOP state.
- STEP7 project structure.
- Cyclic program execution.
- Data storage in Data Blocks.
- Complex Data types.
- Functions & Function Blocks.
- The Multiple Instance Model.
- Trouble shooting.
- B, I, and L stack handling.
- Cross reference.
- Break points in a program.
- Organization blocks.
- Analog processing.
- Documentation & printing.
- Archiving a project.
- Communication via MPI with GD table and NETPRO.

S7 300 & S7 400 PLC Troubleshooting

Course Code - FA-PLC-TROUBLE

Duration - 5 Days

Prerequisites

Attendees must be computer literate and have basic electrical engineering skills. Involvement in PLC maintenance the completion of the MA-INTRO course or the FA-PLC-ONE course will be an advantage.

Course Outcomes

The aim of this course is to provide participants with the tools to build effective Fault-finding strategies (Troubleshooting) on automated factory applications

Content

- The MCC – Motor Control Centre
- Introduction to Generic PLC Theory
- The SIMATIC STEP 7 System Family.
- The SIMATIC Manager
- Hardware configuration.
- Hardware Commissioning.
- Block Architecture & Editor.
- Binary operations.
- Digital Operations
- Flip Flops.

PROGRAMMING FOR S7 300 & S7 400 PLC - 1

Course Code - FA-PROG-ONE

Duration - 5 Days **SAIMC_CPD_L_675**

Prerequisites

Advanced knowledge and experience working with Siemens SIMATIC S7 300 and S7 400 PLC's or successful completion of the FA-SEMA-CLASSIC course.

Course Outcomes

This course is directed at users with engineering experience in the fields of configuring, design & commissioning of SIMATIC S7 programmable controllers. The course provides an optimal entry level to the product-specific & in-depth supplementary courses.

Content

- The SIMATIC S7 family.
- Programming devices.
- The SIMATIC Manager & customizing options.
- Configuration & addressing of modules.
- CPU properties, symbols tables.
- Creating projects in LAD/STL/FBD.
- Cyclic program execution.
- Basic functions & jumps.
- Number formats, Timers & Counters.
- Data handling including arrays & structures.
- Functions & Function Blocks with assignable parameters.
- The Multiple Instance Model.
- Diagnostics with B, I, L stacks.
- Monitor/modify variables & debugging.
- Testing program execution using breakpoints.
- OB's & startup considerations.
- Analog Value processing.
- Documenting, Saving, Archiving.
- Totally Integrated Automation principles.



PROGRAMMING FOR S7 300 & S7 400 PLC – 2

Course Code - FA-PROG-TWO

Duration - 5 Days **SAIMC_CPD_L_676**

Prerequisites

Advanced knowledge and experience working with Siemens SIMATIC S7 300 and S7 400 PLC's and successful completion of the FA-PROG-ONE course.

Course Outcomes

Advanced programming techniques. This course is directed at users with engineering experience in the fields of configuring, design & commissioning of SIMATIC S7 programmable controllers. The knowledge & skills acquired in the RCL-PLC-PROG-ONE course will be consolidated & extended to enable the participant to structure & generate & put into operation complex programs.

Content

- Status Bit-Dependent Instructions.
- Accumulator Functions & Word logic.
- Instruction with REAL numbers.
- Indirect addressing & Address Register Instructions.
- Structure of Pointers with Memory indirect Addressing.
- STEP7 Data types & Variables.
- Data Block ARRAY's & STRUCTURES.
- Using Libraries & System Functions.
- Handling Synchronous & Asynchronous Errors.
- Basic & Expanded S7 Communication.
-

More Information:

- S7-GRAPH, S7-HIGRAPH software packages.
- Engineering Tools for S7/M7.
- Connection to PTP, PROFIBUS, Industrial Ethernet, Internet.
- SIMATIC S7-400 & 400H.
- State Graphs, SCL structures.
- CFC & SFC editor.

ANALOG VALUE PROCESSING & PID

Course Code - FA-ANALOG

Duration - 5 Days

Pre-requisites: Successful completion of the FA-PROG-ONE or the FA-TIA-PROG-ONE courses.

Aims and Objectives: This course will enable Service and Commissioning personnel to work with analogue signals and effectively setup and optimize control loops on an S7-300/S7-400 or S7-1200/S7-1500 PLC.

Content

- Fundamentals of analogue value processing
- Fundamentals of closed-loop control
- Fundamentals of Cascade Control
- Controller selection
- PID algorithm for digital control
- Practical PID setup and tuning on S7-300/S7-400 PLC
- Practical PID setup and tuning on S7-1200/S7-1500 PLC



PROGRAMMING FOR TIA PORTAL - 1

Course Code - FA-TIA-PROG-ONE

Duration - 5 Days **SAIMC_CPD_L_677**

Prerequisites

Advanced knowledge of Siemens TIA industrial automation technology or completion of the FA-SEMA-TIA course.

Course Outcomes

This course is directed at 1st line maintenance for the Siemens SIMATIC S7 1500 programmable controllers.

Content

- Overview and performance characteristics of the SIMATIC S7 system family
- The components of the TIA Portal: STEP 7, WinCC, & Communication
- Program execution for S7 1500 automation systems
- Binary and digital operations in the function block diagram (FBD)
- Hardware Configuration
- Addressing and wiring of the signal modules
- Hardware and software commissioning of the SIMATIC S7 1500 with the TIA Portal
- CPU properties.
- Cyclic program execution.
- Monitor/modify variables & debugging.
- Tag Tables.
- Creating projects in LAD/STL/FBD.
- Basic functions & jumps.
- Number formats, Timers & Counters.
- Data handling including arrays & structures.
- Functions & Function Blocks with assignable parameters.
- The Multiple Instance Model.
- OB's & start-up considerations.
- Analog Value processing.
- Introduction to HMI
- Setup and parameterization of PROFINET
- Saving and documentation



PROGRAMMING FOR TIA PORTAL – 2

Course Code - FA-TIA-PROG-TWO

Duration - 5 Days **SAIMC_CPD_L_678**

Prerequisites

Successful completion of the FA-TIA-PROG-ONE course and relevant SIMATIC S7 1500 knowledge.

Course Outcomes

This course is directed at 1st line maintenance for the Siemens SIMATIC S7 1500 programmable controllers.

Content

- Hardware diagnostic functions of the TIA Portal on the SIMATIC S7 1500
- Software diagnostic functions of the TIA Portal on the SIMATIC S7 1500
- Block types (FC – Function, FB - Function block, OB Organization block, DB - Data block (DB))
- Principles of Analog Value Processing
- Sequence control with S7-Graph
- Commissioning of distributed I/O on PROFINET
- Alarm configuration in WinCC
- Parameterization of the Variable Speed Drive
- Structured Control Language (SCL)



SCADA CONTROL SYSTEM - WINCC

Course Code - HMI-SCADA-SYS

Duration - 5 Days

Prerequisites

Successful completion of the FA-SEMA-CLASSIC course.

Course Outcomes

This course will enable engineering and maintenance personnel to design and configure automation systems using Siemens Windows Control Center (WINCC)

Content

- WINCC System Overview
- Creating a project, AS connection, creating tags
- Totally Integrated Automation
- Creating process pictures with the Graphics Designer
- Graphics Designer Part 2
- User Administration
- Block technique – Tag Prefixes and Faceplates
- Tag Logging and trends
- Alarm-Logging and Message Display
- Report System (Reports Designer)
- Recipes (User Archive)



SCADA FOR TIA PORTAL

Course Code - HMI-SCADA-TIA

Duration - 5 Days

Prerequisites

Knowledge of SIMATIC WinCC flexible and TIA Portal for SCADA

Course Outcome

Delegates will learn about the Totally Integrated Automation Portal (TIA Portal), which works in the environment for integrated engineering with SIMATIC STEP 7 and SIMATIC WinCC.

They will learn about the function of Human Machine Interface (HMI) systems and how they integrate to handle processes within a plant. Further to this they will learn how HMI systems work and what makes a good HMI system. All topics discussed and applied in practical examples are to ensure that the delegate understands the benefits of HMI?

Content

- System overview TIA Portal, SIMATIC WinCC (machine-level)
- Advantages of SIMATIC WinCC based on TIA Portal on machine level.
- Definition of basic operating and monitoring terms
- Working with WinCC flexible:
 - Creating projects,
 - Configuring display images,
 - Parameterizing messages,

DISTRIBUTED CONTROL SYSTEM (PCS 7)

Course Code - **RCL-DCS**

Duration - **10 Days**

Prerequisites

Basic knowledge of electrical engineering, control and feedback control systems and process control engineering

Course Outcomes

Create a proper PCS 7 multi-project and configure the hardware of AS and PC stations. Create user programs compliant to PCS 7 standards using the most important tools like CFC, SFC and graphical tools of the PCS 7 engineering toolset. Bulk engineering using the Import/Export-Assistant

Content

- System design and component specification
- Project setup
- Station and network configuration
- Connection to the process
- Basics control functions
- Basics Operating and Monitoring
- Implementation of Automatic and Manual Mode Control
- Customizing the OS
- Archiving System
- Locking functions and operating modes
- Mass data engineering
- Final steps of configuration
- User block V attributes and visualization
- Demonstration Server-Client System
- Syntax Rules
- PCS 7 Documentation and Support

DISTRIBUTED CONTROL SYSTEM – PCS7 MAINTENANCE

Course Code - **DCS MAINT**

Duration - **5 days**

Prerequisites

Successful completion of the FA-SEMA-CLASSIC or the FA-PROG-ONE courses.

Course Outcomes

The aim of the course is to enable the experienced PCS7 system engineer to maintain, a control system based on PCS7 version 7, version 8 or Version 9 features

Content

- Initial activities when servicing a running system
- SIMATIC PCS 7 documentation and online support
- Basics of SIMATIC PCS 7
- Basics of fieldbus systems used
- Procurement of diagnostics data with the SIMATIC diagnostics tool
- Introduction to integrated asset management with SIMATIC PCS 7
- Reading out diagnostics data on the SIMATIC PCS 7 hardware
- Exchanging modules and components during running operation
- Handling data and project backups and creating and importing backup images

AC VARIABLE SPEED DRIVE ESSENTIALS

Course Code - DRV-ESS

Duration - 2 Days

Prerequisites

Electrical or Instrumentation background. Some Power Electronics knowledge helps, but is not essential.

Course Outcome

Throughout the course, demonstrations are carried out on a VSD including showing voltage and current waveforms at important parts of the drive. Demonstrations include the effect of changing the switching (modulation) frequency; inertia in action and its effect on acceleration & braking; auxiliary items such as shaft encoders; and problems regarding the measurement of voltages and currents around a VSD. The group also works through calculations around the sizing of motors for particular loads, and there is a group discussion.

Content

Providing a thorough understanding of

- AC induction motors working through:
- DC motor fundamentals, DC Drives, Speed/torque and speed/power relationships, Induction motor operation, Induction motor starting methods
- AC Variable Speed Drives:
- Rectifiers and the DC link, V/f relationships, Pulse Width Modulation, Vector vs V/f mode
- Load braking using the drive, including
- DC Injection braking, Dynamic braking, Regenerative braking
- Drive downsides, including:
- Harmonics, and ways of reducing these, including, Supply-side chokes, 12-pulse rectifiers, Active Front Ends, Motor-side voltage overshoots and reducing these through Output chokes, dV/dt filters/terminators, Sinusoidal filters.
- Cooling problems at low motor speeds, EMC problems and solutions, Torque problems at low speeds: mitigation through, Torque boost, Vector control correctly implemented
- Torque problems at speeds above 50 Hz (field weakening), and solution through
- Use of 87/29 Hz
- Load/Motor/Drive interaction, with reference to
- Constant torque and variable torque loads, Calculation of inertia and acceleration times, Choice of motors
- Project planning for success
- Drive configuration

DANFOSS VARIABLE SPEED DRIVE SETUP

Course Code - DRV-DANFOSS

Duration - 1 Day

Prerequisites

Successful completion of the DRV-ESS – Drives Essentials course.

Course Outcome

This course, run over one day, covers the process of transforming a Danfoss FC 301 or FC 302 VSD from the way it is set up in the factory, to a situation where it is custom tailored to the process requirements.

Firstly, we cover entry of motor parameters. Without these, the drive and the motor are unprotected. The factors that a Factory Reset doesn't restore, are corrected so that the motor can be run Forward and Reverse, to the full speed the motor is capable of, using Factory-selected inputs. The Automatic Motor Adaptation is run.

Delegates are introduced to the conditions necessary for the VSD to run; setting of Ramp times, and also types (Linear and S-shaped ramps are described; as well as the option of selecting multiple ramps).

From here, delegates are introduced to the way in which Source and Sink inputs are selected, followed by exercises which cover the range of the most common functions which can be selected using **digital inputs**.

Content

Selection of different Ramps and Ramp Types, also multiple Ramp selection

Addition of a 'Jog' input

Provision of a 'Quick-Stop' input, and a discussion of the relative merits of an e-stop vs a quick stop

Selection of Preset Speeds

Using DigiPot as a reference source

Adding DC Injection braking

Changing to a Latched Start (as opposed to the Run/No Run as factory supplied)

Digital Output function exercises are given, including changing some of the Digital Inputs so that they can function as Digital Outputs.

Alternative reference sources are discussed, and the way in which **Analog** Voltage Reference Inputs are changed to Current inputs.

Analog Output exercises are carried out, with the output representing various VSD parameters.

Over-temperature protection is discussed, and Thermistor protection is introduced and tested. The Electronic Thermal Relay function is pointed out, along with how it is implemented.

Exercises are given in how the **Display** can be tailored to show the most desired values in the VSD.

Considerable time is spent on **Fault-finding**, both using a multi-meter, and using the built-in monitoring functions in the Local Control Panel LCP).

Delegates also spend time setting up the VSD using a laptop rather than the LCP.

A part of the course is a quality **Manual**, which graphically describes the set-up process, and also includes a comprehensive, one-page A3 block diagram, which includes the most relevant set-up features on a single page.

Delegates leave with a very good understanding of the Danfoss 301/302 VSDs.

NOTE: The course does not currently include serial data communication control (e.g. Profibus).
This will be added later.

Torque problems at speeds above 50 Hz (field weakening), and solution through

Use of 87/29 Hz

Load/Motor/Drive interaction, with reference to

Constant torque and variable torque loads, Calculation of inertia and acceleration times, Choice of
motors

Project planning for success

Drive configuration

INTRODUCTION TO INDUSTRIAL NETWORKS

Course Code - NET-INTRO

Duration - 3 Days

Prerequisites

Successful completion of the FA-SEMA-CLASSIC or FA-SEMA-TIA courses.

Course Outcomes

This course provides an introduction to PROFIBUS, PROFINET and Actuator-Sensor Interface (AS-i) networks within an automation system.

Delegates will enhance skills with basic network installations, configurations and troubleshooting.

This course covers sensor, field networks including hardware and software requirements, and installation rules.

Specific network protocols are discussed and are used to learn of configuration and parameterization requirements.

Specific Communication Processors (CPs) and their functions are reviewed, including project and subnet creations with the Software interfaces.

Content

- Describe the various Industrial Networking options and terminology
- Install and configure simple networks including, interface modules, software and cables Configure and troubleshoot
- Install and address various sensor and field devices including 3rd party devices
- Troubleshoot and repair basic industrial network

CPD POINTS – 3

Validation Number – SAIMC_CPD_L_614



PROFINET SYSTEMS COURSE

Course Code - NET-ETHERNET

Duration - 3 Days

Prerequisites

Attendees must have successfully completed the FA-SEMA-CLASSIC or the FA-SEMA-TIA

Course Outcomes

Course attendees will learn how to design, set-up, commission and troubleshoot an Industrial Ethernet (Profinet) network. The course uses a 'hands-on' practical approach to reinforce the theoretical aspects of the training.

Content

- Introduction to Simatic Net - Industrial Ethernet
- Network Components and Installation Guidelines
- Communications Processors
- TCP/IP and UDP/IP, Ethernet Subnets
- Project Planning and Configuration of the Ethernet CP
- Data Communication with Industrial Ethernet using S7 Connections and ISO-on-TCP Connections
- NCM S7 Ethernet Diagnostics
- Information Security in Industrial Communications, Industrial Wireless LAN
- OPC Basics
- Overview and introduction to PROFINET technology
- PROFINET IO device types: IO controller, IO device, IO supervisor
- Industrial Ethernet Switches
- Installation guidelines for PROFINET systems,
- Configuration of PROFINET IO networks
- Network gateways (IE-PB link) from PROFINET IO to PROFIBUS DP
- Description files of the devices
- Structure, startup and diagnostics of a PROFINET IO network
- Function test of the PROFINET IO network
- Profinet Timing, Profinet Telegram (Frame) interpretation
- Profinet Alarms, Profinet Topologies, ARP, LLDP, SNMP, DCP protocols
- Earthing considerations

CPD POINTS – 3

Validation Number – SAIMC_CPD_L_615

PROFIBUS SYSTEMS COURSE

Course Code - NET-PROFIBUS

Duration - 3 Days

Prerequisites

Successful completion of the NET-INTRO course.

Course Outcomes

The essential theoretical fundamentals of PROFIBUS protocols and services are taught. You will learn how to use the tools for start-up, service, testing and diagnostics.

Learn the different methods of setting up PROFIBUS networks (RS 485 network components, fibre optics). You will reinforce your theoretical knowledge with numerous practical exercises on PLC devices with HMI components.

On completion of this practice-oriented course, you will be able to install and optimize a PROFIBUS DP network, and you can limit and correct faults quickly.

Content

- PROFIBUS fundamentals in accordance with EN50170/IEC 61158
- Overview of PROFIBUS devices and network components
- Class 1 Master, Class 2 Master and Slave devices
- Bus Physics and wiring
- Connectors and tools
- PROFIBUS diagnostics
- Connecting an HMI device to PROFIBUS
- Troubleshooting
- Termination Rules
- Scope Analysis (Reflections, Over-termination, Under-termination, etc.)
- Profibus telegram (frame) interpretation
- Profibus Start-up Sequence
- Bus parameters and Cycle Times
- Shielding, Grounding, Segregation and Installation
- GSD Files

CPD POINTS – 3

Validation Number – SAIMC_CPD_L_613

SIMOCODE PRO V COURSE

Course Code - SG-PROV

Duration - 3 Days

Prerequisites

Attendees should have a background of three phase motors and the protection of motors.

Course Outcomes

The course is aimed at maintenance and engineering personnel who need a detailed knowledge of SIMOCODE-PROV. The Course includes interconnection of the SIMOCODE to PLC via Profibus DP.

Content

- Introduction to SIMOCODE-ProV
- Programming of the unit.
- Basic configuring steps.
- Course exercises.
- Control from various sources.
- Communicating via PROFIBUS-Pro V.
- System designing & interlocking.
- Control of motorized valves.
- Converting from DP – Pro V



COMPANY INFORMATION

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Vat Registration No: 4590263770

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B-BBEE Score: Level Two B-BBEE Contributor

Broad Based Procurement Recognition Level: 125%