Practical

PROGRAMMABLE LOGIC CONTROLLERS (PLCs)

for Automation and Process Control

YOU WILL LEARN:

- **Fundamentals of PLC hardware and software**
- **How to write a simple PLC program**
- **How to troubleshoot a PLC system**
- **How to engineer a complete PLC system**
- **The essentials of IEC 61131-3**

WHO SHOULD ATTEND:

- **Instrumentation and Control Engineers**
- **Electrical Engineers**
- **Design Engineers**
- **Consulting Engineers**
- **Instrumentation Technicians**
- **Process Control Engineers**
- **Engineering Managers**

IDC
TECHNOLOGIES

Technology Training that Works

THE WORKSHOP

This workshop is designed to benefit you with **practical up-to-date information** on the application of PLCs to the automation and process control of plants and factories. It is suitable for people who have little or no exposure to PLCs, but expect to become involved in some or all aspects of PLC installation. **It aims to give practical advice from experts in the field, to assist you to correctly plan, program and install a PLC with a shorter learning curve and more confidence.**

While the workshop is ideal for electricians, technicians and engineers who are new to PLCs, much of the workshop and additional material in the extensive manual will be of value to those who already have some basic skills, but need a wider perspective for larger and more challenging tasks ahead.

The accompanying manual includes contributions from a number of experts and will become a valuable reference document in your work.

The information contained in this workshop advances from the basics to challenge even the most experienced engineer in the industry today.

PRACTICAL SESSIONS

You will undertake a series of practical hands-on sessions, ranging from elementary to advanced, based on the PLCs supplied. Full working solutions will be distributed to you after you have attempted the practicals.

The practicals are:

• Write simple ladderlogic programs
• Creation and use of a single scan 'pulse'
• Developing a simple program:
  - valve limit switch monitoring
  - pushbutton steps around a loop
  - simple timers - (a 'reticulation' timer)
  - sequential startup
• Multiple recipe batch selection
• PID control loop

The emphasis on the practicals is so as to be as useful as possible to you in your work.

ON-SITE TRAINING

✔ **SAVE** over 50% by having an IDC workshop presented at your premises.

✔ Customise the training to **YOUR** workplace.

✔ Have the training delivered when and where you need it.

Contact us for a **FREE** proposal.

THE PROGRAM

DAY ONE

INTRODUCTION
• Introduction and brief history of PLCs
• Alternative control systems - where do PLCs fit in?
• Why PLCs have become so widely accepted
• Lingering concerns about PLCs

FUNDAMENTALS OF PLC HARDWARE
• Block diagram of typical PLC
• PLC processor module - memory organisation
• Input/output section - module types
• Power supplies

FUNDAMENTALS OF PLC SOFTWARE
• Methods of representing Logic, Boolean Algebra, instruction code, graphical presentation i.e. functional logic diagrams and ladder logic
• Fundamental ladder logic instruction set
• Comparison of different manufacturers, memory and data representation and Instruction code

USING LADDER LOGIC FOR SIMPLE DIGITAL FUNCTIONS
• The basic rules
• Comparison of relay ladder diagrams
• The concept of the 'scan' and how to apply it
• Infinite fan-out
• Contact 'normal' states
• Positive and negative logic
• Basic Boolean functions
• The usefulness of DeMorgan's Law

USING REGISTERS (WORDS)
• Number systems
• Types of register data
• Timers
• Counters
• Bit shift/rotate
• Table functions
• Register (Matrix) logic functions

DAY TWO

GOOD PROGRAMMING HABITS
• Keeping track of addresses and data used
• Looking ahead - how will programs be maintained?
• Practical methods to improve quality: organisation of code, thorough documentation and simplifying changes

GOOD INSTALLATION PRACTICE
• Location of hardware
• Good wiring practice
• Cable spacing, power distribution and wire numbering
• Reducing noise and interference
• Screening and shielding

DAY TWO continued

ADVANCED CONTROL WITH PLCs
• The concept of reusable logic
• Examples, drive logic and alarm handling
• Use of advanced programming functions
• Matrix logic
• Table functions and indirect addressing
• Example: simple display driver

BATCH PROCESSES AND SEQUENTIAL CONTROL
• Remembering the program state
• Creating a 'stepper'
• Step advance
• Fault detection and recovery
• Operator intervention
• Multiple recipes or alternative paths
• Sequential function charts

PID CONTROL
• Discontinuous vs continuous control
• The PID control algorithm
• The importance of timing and scan time
• When PID is not always appropriate:
  - intermittent measurements
  - long transport delays

DAY THREE

SAFETY PROGRAMMABLE SYSTEMS
• Why regular PLCs should not be used for safety functions
• Programmable electronic logic solvers
• Safety certification
• Certified programming systems
• Application examples
• Growth of networked safety devices and certified networks
• Integrated safety systems

DATA COMMUNICATIONS
• Interface standards, RS-232, RS-422/423 and RS-485
• Protocols, Modbus and DH+
• Local area networks, Ethernet and Token Bus
• Monitoring communication links and simple watchdog timers

INTRODUCTION TO IEC 1131-3
• Concepts
• Common elements
• Programming languages: structured text
• Function block diagrams
• Ladder diagrams
• Instruction list
• Sequential function chart

OPC
• Introduction to OPC
• What is OPC?
• Architecture

SYSTEM CHECKOUT AND TESTING
• Development and verification of code
• Factory acceptance testing
• Testing procedures
• Emulating missing hardware
• Emulating process responses