Practical Embedded Controllers: Troubleshooting and Design
LIVE ONLINE COURSE

THE COURSE

From microwave ovens to alarm systems to industrial PLC and DCS control systems, embedded controllers are controlling our world. The microcontrollers that are at the heart of these and many more devices are becoming easier and simpler to use. But when these devices fail, the solution to the problem needs to be found and the repairs have to be done quickly.

This course will help the technician, engineer and even the most casual user understand the inter-workings of microcontrollers along with the most common problems and their solutions.

Embedded controllers are used in most electronic equipment today. Embedded controllers are intelligent electronic devices used to control and monitor devices connected to the real world. This can be a Programmable Logic Controller (PLC), Distributed Control System (DCS) or a Smart Sensor. These devices are used in almost every walk of life today. Most automobiles, factories and even kitchen appliances have embedded controllers in them.

This online course covers all aspects of embedded controllers but focussing specifically on troubleshooting and design. The workshop covers design, specification, programming, installation, configuration and of course troubleshooting.

YOU WILL LEARN HOW TO

- Provide an overview of the best current practice for installation of microcontrollers for instrumentation and control systems in the industrial environment
- Specify the most up-to-date hardware and software requirements of the data communications system for instrumentation and control
- Competently explain the RS-232 and RS-485 interface standards
- Provide a working explanation of assembly language programming and how it should be structured and applied
- Troubleshoot using a valuable software package – IDC's Protocol Analysis Tool (PAT)
- Demonstrate a working knowledge of "smart" microcontroller systems
- Outline the practices for the successful installation and commissioning of cables for microcontrollers

WHO SHOULD ATTEND?

This workshop is designed for personnel with a need to understand the techniques required to use and apply microcontroller technology as productively and economically as possible. This includes engineers and technicians involved with:

- Consulting
- Control and instrumentation
- Control systems
- Maintenance supervisors
- Process control
- Process development

- Design
- Electrical installations
- Instrumentation
- Project management
- SCADA and telemetry systems

PRE-REQUISITES:

A basic working knowledge of industrial communications and applications is useful.

COURSE OUTLINE

This is an intensive online course. The course is split up in to two sections – Live sessions and recorded lectures. All 8 hours will be provided upon course completion for review.

LIVE SESSIONS
SESSION ONE
OUTLINE OF COURSE OBJECTIVES AND BACKGROUND TO MICROCONTROLLERS

- Microcontrollers
- CPU design and functions
- Inputs and outputs
- Noise reduction
- Installation techniques

SESSION TWO
CPU DESIGN AND FUNCTIONS

- Number systems – binary, hexadecimal and decimal
- Accumulators A and B
- Power systems – reset and brownouts

SESSION THREE
PROGRAMMING

- Load, stores and transfers
- Shifts and rotates
- Programming structure and specifications

SESSION FOUR
MEMORY MAPPING

- User ram
- Buffalo stack and variables
- Control registers
- EEPROM
- RAM and EPROM socket

SESSION FIVE
SUMMARY

- CPU design and functions
- Assembly language programming
- Memory mapping
- Inputs and outputs
- Noise reduction
- Data communication
- Grounding solutions
- Installation techniques

RECORDED LECTURES
RECORDING ONE
INPUTS AND OUTPUTS

- Single ended vs. differential inputs
- Digital inputs
- Digital outputs
- Analog onputs
- Digital control of analog devices – i.e. stepper motors
- Keyboard interfacing
- LCD interfacing
- Timers

RECORDING TWO
NOISE REDUCTION

- Conductive noise on PCB's and in the field
- Electrostatic noise on PCB's and in the field
- Magnetic noise on PCB's and in the field
- Noise reduction techniques in PCB's
- Noise reduction techniques in cable installation
- Out going radio frequency noise reduction
- Incoming radio frequency noise reduction
- Analog and digital filtering

RECORDING THREE
DATA COMMUNICATIONS

- Basics of serial data communication
- ASCII
- RS 232
- RS 422
- RS 485
- Fibre optic cables
- USB
- Fieldbus protocols used in controllers
- OSI model

RECORDING FOUR
GROUNDING SOLUTIONS

- Grounding on a PCB
- Protecting PCB from lightning
- Controller equipment grounds
- Protecting controllers from lightning
- Enclosure grounds
- Spiked earth grounds
- Cable trench grounds
- Tower lightning protection

RECORDING FIVE

INSTALLATION TECHNIQUES

- Connections – screw, crimp and solder
- Cable runs and trays
- Cable ties and mounting
- Cooling, heating and air conditioning
- Solar power
- Fitting PCB's in the box
- Designing for reparability
- Conduit installation
- Safety considerations

OPEN FORUM

CLOSING