



Practical

Embedded Controllers

Design and Troubleshooting with the Motorola 68HC11



John Park

Practical Embedded Controllers: Design and Troubleshooting with the Motorola 68HC11

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Practical Embedded Controllers: Design and Troubleshooting with the Motorola 68HC11

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Preface

From microwave ovens to alarm systems to industrial programmable logic controllers (PLCs) and distributed control systems (DCSs), embedded controllers are running our world.

Embedded controllers are used in most items of electronic equipment today. They can be thought of as intelligent electronic devices used to control and monitor devices connected to the real world. This can be a PLC, 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.

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 repairs done quickly.

This book will help technicians, engineers and even the casual user understand the workings of microcontrollers, along with the most common problems and their solutions.

This book covers all aspects of embedded controllers but is biased towards troubleshooting and design. The book also covers design, specification, programming, installation, configuration and troubleshooting.

After reading this book we hope you will have learnt how to:

- Design, set up and program a complete embedded controller development system
- Apply the latest techniques in programming these versatile devices
- Apply troubleshooting tips and tricks for microcontrollers
- Apply the best techniques for installation of microcontrollers
- Fix problems due to electrical noise and interference
- Design correctly the first time to avoid grounding and EMC problems
- Choose and configure the correct software

Typical people who will find this book useful include:

- Electronic technicians and engineers
- Instrumentation and control engineers and technicians
- Process control engineers and technicians
- Electrical engineers
- Consulting engineers
- Process development engineers
- Design engineers
- Control systems sales engineers

A basic knowledge of electrical principles is useful in understanding the concepts outlined in the book, but the contents are of a fundamental nature and are easy to comprehend.

The structure of the book is as follows.

Chapter 1: Introduction. This chapter gives a brief overview of the main components of a microcontroller.

Chapter 2: Microcontroller basics. A review of the basics of this device with a discussion on number systems, Boolean logic, accumulators, registers, data communications, power systems, crystals and oscillators, is done in this chapter.

Chapter 3: Microcontroller programming. A review of the simple techniques involved in programming a microcontroller with a discussion on the various programming issues such as programming structures, addressing modes, operations and finally a short comparison of C++ and BASIC, is done in this chapter.

Chapter 4: Microcontroller memory. The main types and techniques in the effective use of memory such as user RAM, BUFFALO routines, interrupts, control registers, and EEPROM are assessed here.

Chapter 5: Microcontroller inputs and outputs. Analog and digital inputs, keypad and LCD interfacing are described here.

Chapter 6: Data communications. This important topic is broken down into a discussion on the fundamentals, the OSI model, modes of communication and RS-232 and RS-485.

Chapter 7: Noise reduction. This chapter gives an overview of noise reduction and a discussion on conductive, capacitive, and magnetically coupled noise.

Chapter 8: EMC grounding solutions. The most important features of grounding (and protection from lightning) to protect the microcontroller from the effects of EMC are discussed here.

Chapter 9: Installation and troubleshooting. This chapter is a short discussion on connections, cable runs and trays, wire management and troubleshooting techniques.

Chapter 10: End notes. A wrap discussion on the issues discussed in the earlier chapters with a few words on assembly language programming, memory, inputs and outputs, data communication, noise reduction and grounding solutions and finally installation techniques.

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