

**Using
Microprocessors
and
Microcomputers**

**The
6800
Family**

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USING MICROPROCESSORS AND MICROCOMPUTERS:
THE **6800** FAMILY

Using Microprocessors and Microcomputers

The 6800 Family

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Preface

Microcomputers (μ Cs) and their principal component, the microprocessor (μ P), have generated a great deal of interest and enthusiasm among students, teachers, and practicing engineers. Writing a book on this subject is difficult, however, because students need to know both digital hardware and software techniques to thoroughly understand the μ C.

The object of this book is to explain the uses and operation of the **6800** family of microcomputer components to electronic technology and engineering students. We have assumed that students have had some introduction to digital electronics, but we cover programming as needed, so one need not have had a prior programming course to understand this book. We have also assumed that the μ C will be used primarily in applications where it controls external “real world, real time” devices and that “number crunching” still remains the province of larger computers. Therefore, we have included several chapters on hardware, interfacing, and interrupts. Our goal is to familiarize readers with all aspects of the μ C, so that they can assume responsibility for a complete μ C project and debug both the hardware and software to get it running.

Some earlier textbooks tried to cover several μ Ps. We rejected this approach feeling that it led to a summary description with no depth. Indeed, some of these texts were merely a rehash of the manufacturer’s literature. We have strived to improve upon this approach by giving detailed explanations and many examples. We have selected the popular and widely used **6800** family of μ C components and, as Mr. Wray works for Motorola on projects involving the **6800** and its compatible relatives—the **6801**, **6809**, and **6805**—our information is correct and authentic.

The first four chapters are a general introduction to computers for students who have no prior experience with them. Students conversant with computers can read these chapters very rapidly.

In Chapters 5 and 6 the **6800** instruction set is discussed in detail. Many examples are presented to illustrate the use of each instruction. As with many computer texts, however, seemingly simple problems

sometimes lead to long programs. We tried to keep the programs as short and compact as possible.

Chapter 7 introduces assembly language programming as a software aid, and it is used with examples presented in the later chapters of the book. A machine language program from Chapter 6 is converted to an assembly language program so the student can thoroughly examine the process.

Chapters 8, 9, and 10 are hardware oriented. These chapters cover the bus structure and control signals for the **6800** μ P; the two most commonly used interfacing ICs, the PIA and ACIA; and the use of interrupts. Timing circuits and time control of events are also discussed. These chapters explain how to interface the μ C to external peripherals so that it can communicate with the outside world.

Chapter 11 discusses rudimentary and advanced development systems. For the simple systems, we emphasized the MEK6800-D2 kit that is used by many schools. The EXORciser, an advanced μ C development system widely used in industry, is also discussed in detail.

Chapter 12 discusses other microprocessors such as the **6809** and introduces microcomputers such as the **6801**. The newer more powerful μ Ps, like the **6809**, seem to be destined to replace the **6800** in new designs in the coming years. The newer μ Ps, while more powerful, are also more complex. Since these new designs are extensions of the **6800**, we feel the background and concepts gained by studying the **6800** are indispensable for any understanding of the newer μ Ps. A thorough introduction to the most promising of these μ Ps, the **6809**, is presented so that the student may understand its advantages and incorporate it in new designs.

Chapter 13 presents some of the problems that the student may encounter when interfacing a μ P in a real world environment. It also introduces A/D and D/A converters and gives several commercial applications of the μ Ps.

Chapter 14 is devoted to a typical CRT terminal application of a μ P. We feel we have given a balanced presentation of the hardware, software, and interfacing in this book.

We thank Dr. Irving Kosow for his help and encouragement. We also thank the critics who reviewed the book before publication. Many of their constructive comments were incorporated in the final text.

We are grateful for the cooperation of the Motorola Technical Information Center, Phoenix, Arizona. With their permission we

have reproduced many figures found in this book from manuals and other literature. We would like to acknowledge that many of the terms used in the text are trademarks of Motorola Inc.; These include EXORciser[®], EXORterm, EXbug, MINIBug, JBUG, MICRObug, MIKBUG, MDOS, EXORdisk, and Micromodule. We also thank Lothar Stern, Manager of the Technical Information Center, for his encouragement, and Bill Crawford, of Motorola Microsystems Marketing, and Don Kesner, Engineering Manager, for their criticism. Above all, we thank our wives, Gladys and Dorothy, for their understanding, their sympathy, and their typing. Without them nothing would be possible.

Joseph D. Greenfield
William C. Wray

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