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Microprocessor and Microcomputer Technology

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Foreword

Microprocessors and microcomputers have had far-reaching effects on education, commerce and industry. The technology associated with them has influenced every section of the community. As is often the case with a rapidly developing technology, early textbooks on the subject were written either for the narrow technical specialist or for those with a broad general interest in the subject. This book provides sound coverage of both the hardware and software of microcomputers, since a knowledge of both is vital to those wishing to understand microcomputer operation. The book should be of value to students following degree and TEC courses in electronics, computing, physics and related topics. It will also be of value to others dealing with microprocessors and microprocessor-based systems.

Rather than invent a microprocessor for use in the book, I have chosen to use one of the most popular family of microprocessors as the basis of the book, namely the 8080 family. A few additions to the architecture of the central processing unit and to the instruction set of this family have been necessary to introduce features which are not normally available in it. These features are introduced to the reader as the book unfolds.

The book begins logically by introducing the reader to the basic requirements of a microprocessor in chapter 1. Chapter 2 deals with binary arithmetic procedures; a knowledge of these processes is necessary to a full understanding of data manipulation by the microprocessor. A wide range of logic devices used in microcomputer systems is covered in chapter 3, including logic gates, three-state logic, flip-flops, integrated circuits, decoders and basic input/output ports. Chapters 4 and 5 outline a microcomputer system together with its basic architecture and the bus system used throughout the microcomputer.

Chapter 6 deals with the important aspects of the memory organisation of the microcomputer. This chapter has sections on ROM (also PROM and EPROM), RAM, memory maps and DMA. The work in chapter 7 covers input/output ports, which are the means by which the central processing unit communicates with the 'outside world'; it includes discussions on accumulator I/O, memory-mapped I/O, on-chip I/O, handshaking, programmable I/O and serial data transmission.

The interrelated topics of subroutines, stacks, interrupts and polling are covered in chapters 8 and 9. Chapter 10 is devoted to a detailed description of the microprocessor instruction set and addressing modes. Finally, in chapter 11, applications are considered, ranging from simple binary addition, to multiplication and a range of advanced applications including traffic light control, digital-to-analog con-

version, waveform generation and analog-to-digital conversion. References for further study are provided at the end of the book, and problems (with solutions) are included.

I would like to express my thanks to the individuals and organisations who have materially contributed to the book. Particular thanks are due to Mr S. Rakowski, MSc, Senior Lecturer at the North Staffordshire Polytechnic, who has provided much of the support which has made this book possible. The manufacturers who have contributed to the book include Intel Corporation, Zilog Corporation, Advanced Micro Devices, Quarndon Electronics Ltd, and Hewlett-Packard Ltd. I am also indebted to my wife for her help in the preparation of the typescript, and for her patience and understanding during its writing.

Noel M. Morris