Microprocessors and Microcomputers

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Microprocessors and Microcomputers

their use and programming

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Foreword

Technological progress has nowhere been more rapid than in the fields of electronics, electrical, and control engineering. The *Macmillan Basis Books in Electronics Series* of books have been written by authors who are specialists in these fields, and whose work enables them to bring technological developments sharply into focus.

Each book in the series deals with a single subject so that undergraduates, technicians and mechanics alike will find information within the scope of their courses. The books have been carefully written and edited to allow each to be used for self-study; this feature makes them particularly attractive not only to readers approaching the subject for the first time, but also to mature readers wishing to update and revise their knowledge.

Noel M. Morris

Preface

In no other industry in the history of mankind have prices fallen as rapidly as they have in the computer industry. Use of the first digital electronic computers was limited to a few universities and to large commercial and government establishments. A quarter of a century later they are being used (in the form of microprocessors and microcomputers) by schools and colleges for classroom use, by engineers for incorporation into products ranging from nuclear power plants to washing machines, by even the smallest businesses for accountancy and automatic typing and by home-construction enthusiasts for an ever increasing variety of applications. The limit to the market is no longer the price but the ability of the user to understand the operation and programming of the equipment.

No longer is a working knowledge of the high level languages, ALGOL, FORTRAN, COBOL, BASIC etc., sufficient. To get value from a microprocessor the user has to know how a computer works and to understand binary arithmetic and programming at machine level. He has, for example, to know what to do with the carry bit and to appreciate the implications of two's complement overflow. This book aims to meet these needs.

My introduction to this problem arose in two ways. As an engineer I have been using computers occasionally, as my work has required, for nearly 20 years. It is part of my job to keep up-to-date with the state of the art and microprocessors will play an increasingly important role in this.

Quite separately I saw potential for building a small microprocessing system at home to use for statistical purposes and to amuse my grandchildren by playing noughts and crosses and more sophisticated computer games. (It must be admitted that Grandpa was not without hopes of amusing himself with the project!) Before buying the hardware, I realised that I must investigate the programming aspects. I therefore sent for the programming manual of the microprocessing unit (MPU) I intended to use. It did not give me the information I was seeking. The authors assumed a level of understanding that I, for one, did not possess—and I am not exactly a greenhorn. At different times I have written programs in half-a-dozen different programming languages and successfully run them on computers or numerically controlled machine tools, but this stuff was beyond me. I looked in vain for a textbook that would tell me in simple English what, for example, the FORTRAN statement

$$I = J * (K + L)$$

would look like in machine code. In desperation I sent for literature and manuals from other MPU manufacturers. I also found in the attic two 20-year-old books (now probably out of print) on programming the early computers.

Slowly I pieced all the information together and I made notes as I did so. In the belief that there may be other potential users of microprocessors who find themselves in the same position as I was in, I have assembled these notes, added a little I already knew--and this book is the result. I offer it to fellow engineers, students and home-construction enthusiasts in the hope that it will help them to enjoy the exciting opportunities microprocessors now offer.

The book is dedicated to Dorothy, whose patience, understanding and encouragement have particularly helped me during its writing. I know she will never be able, nor will she ever wish, to write a program or even to use a pocket calculator. She will continue, very happily, doing decimal arithmetic on her pretty fingers!

My thanks also to Miriam who, over the years, has always succeeded in transforming my appalling and deteriorating handwriting into exemplary typescript and to the Director of the Urwick Management Centre, Slough, on whose computer terminal the programs in this book were prepared.

Stoke Poges

ERIC HUGGINS