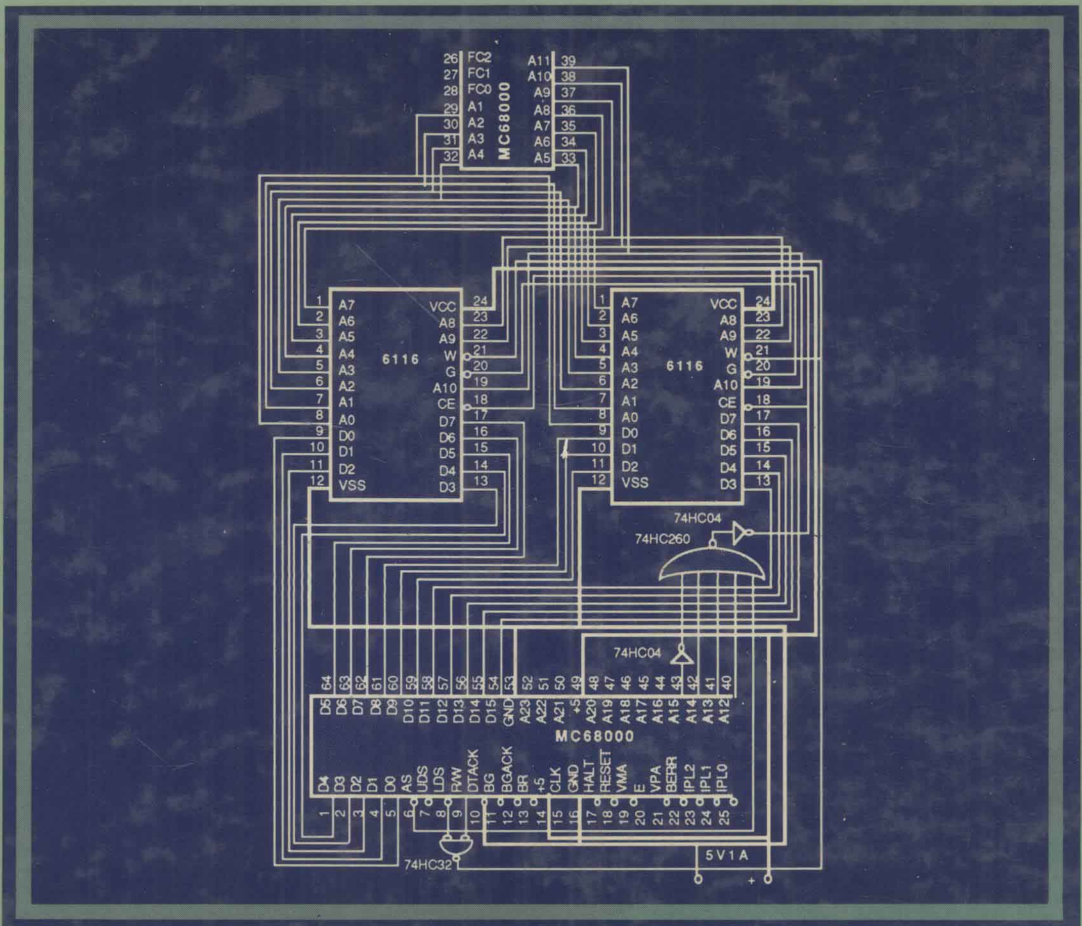
16-AND 32-BIT MICROCOMPUTER INTERFACING

Programming Examples in C and M68000 Family Assembly Language



G.J. LIPOVSKI

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Dedicated to my father

Joseph Lipovski

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Preface

Microcomputer interfacing is a significant part of computer scientists' and computer engineers' backgrounds. They should understand the fundamental and pervasive notion of the hardware-software tradeoff. They should be familiar with operating systems and their handling of input/output. Finally, because they might have to interface a microcomputer to external equipment, to monitor or control external processes, some computer scientists or computer engineers should be capable of doing this. Microcomputer interfacing - the subject of this book - covers these concepts.

Of fundamental importance, any computer scientist or computer engineer should understand what can be done effectively in hardware, what is easily done in software, and what alternative approaches in both are worth considering in a design. This understanding of the hardware-software tradeoff is missing in purely hardware electrical engineering courses or purely software computer science courses, but is necessary for the intelligent design of either hardware or software systems. While an understanding of the hardware-software tradeoff pervades many aspects of computer science and engineering, and appears in many courses therein, nowhere is it so clearly seen as it is in interfacing. A course on interfacing is fundamentally a course on hardware-software tradeoffs.

Of secondary but still major importance, most computer scientists or computer engineers must understand operating systems. Many operating systems courses cover time-sharing and performance modeling, which are important in operating systems used in large mainframe computers. Personal computers may become more important than mainframe computers as time goes on. Operating systems in personal computers mainly support high-level languages. Their input/output infrastructure is one of the most important support functions they provide for high-level languages. A course on interfacing is a course on the infrastructure for high-level language input/output.

A third rationale for this course is that some computer scientists or computer engineers have to interface a microcomputer to external equipment. They provide a basic service and command a premium salary. They need to have a thorough knowledge of the principles of interfacing. A comprehensive course should be provided for them.

However, one of the least important aspects of microcomputer interfacing is the detailed understanding of a particular machine. While details are important for you to get hands-on interfacing experience, these details can easily swamp you. Even though we cover the popular 68000/68030, you are likely to interface some other microcomputer. You must keep details in perspective; they are only a means to an end. Another common but unimportant aspect of interfacing is the use of assembler language. High-level languages like C are more efficient and are being more frequently used in industry.

While some books on interfacing put great emphasis on a particular machine, on special techniques used in it, and on assembler language programming, this book puts greater emphasis on hardware-software tradeoffs, operating system and high-level language interfacing, and the principles of interfacing. Because of this, we believe this book offers a better perspective than other interfacing textbooks. Its approach to interfacing provides a significant part of the computer scientists' and computer engineers' background.

Acknowledgments

The author would like to express his deepest gratitude to everyone who contributed to the development of this book. In addition to a number of faculty members, students, and colleagues in industry who helped in no small part, special thanks are due to David Mielke, J. A. Hernandez Jr., Robert Steigerwald, Eugene Gugliemo, Anthony J. Davis, Matthew J. Kohler, and D. Antonopoulis for finding errors in the manuscript. This text was prepared and run off using a Macintosh and LaserWriter, running WriteNow. The cooperation of Motorola in providing chips and information made this book's development a real pleasure. I am pleased to observe that the Motorola 68000, 68020, and 68030 are incredibly powerful components and vehicles for teaching a considerable range of concepts.

About the Author

G. Jack Lipovski has taught electrical engineering and computer science at the University of Texas since 1976, and is currently on leave, occupying the Grace Hopper Chair of Computer Science at the Naval Postgraduate School. He is a computer architect internationally recognized for his design of the pioneering database computer, CASSM, and the parallel computer, TRAC. His expertise in microcomputers is also internationally recognized by his being a past director of Euromicro and an editor of IEEE Micro. Dr. Lipovski has published more than 70 papers, largely in the proceedings of the annual symposium on computer architecture, the IEEE transactions on computers, and the national computer conference. He has authored five books and edited three. He has served as chairman of the IEEE Computer Society Technical Committee on Computer Architecture, member of the Computer Society Governing Board, and chairman of the Special Interest Group on Computer Architecture of the Association for Computer Machinery. He received his Ph.D. degree from the University of Illinois, 1969, and has taught at the University of Florida. He has consulted for Harris Semiconductor, designing a microcomputer, and for the Microelectronics and Computer Corporation, studying parallel computers. His current interests include parallel computing, database computer architectures, artificial intelligence computer architectures, and microcomputers.

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