

BOOK

21851

2

*Introductory*  
**EXPERIMENTS IN  
DIGITAL ELECTRONICS**

*and*  
**8080A**

**MICROCOMPUTER PROGRAMMING  
AND INTERFACING**

by

David G. Larsen, Peter R. Rony,  
and Jonathan A. Titus



**BLACKSBURG** CONTINUING EDUCATION SERIES™  
edited by Titus, Titus, Rony & Larsen

C1548

# **Introductory Experiments in Digital Electronics and 8080A Microcomputer Programming and Interfacing—Book 2**

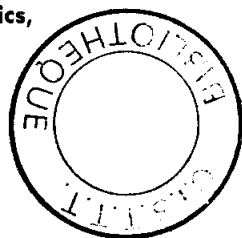
by

**David G. Larsen, Peter R. Rony,  
and Jonathan A. Titus**

Also Published as

**Introductory Experiments in Digital Electronics,  
8080A Microcomputer Programming,  
and 8080A Microcomputer Interfacing**

by E & L Instruments, Inc.



**Howard W. Sams & Co., Inc.**  
4300 WEST 62ND ST. INDIANAPOLIS, INDIANA 46268 USA

BIBLIOTHEQUE DU CERIST

# Contents

## UNIT 16

<b>WHAT IS INTERFACING? . . . . .</b>	<b>11</b>
Introduction—Objectives—The Smart Machine Revolution—Microprocessor vs Microcomputer—Hardware vs Software—What Is a Controller?—Where Microcomputers Fit—Computer Hierarchies—A Typical 8080 Microcomputer—Address Bus—Bidirectional Data Bus—Control Bus—What Is Interfacing?—What Is an I/O Device?—Review Questions	

## UNIT 17

<b>DEVICE SELECT PULSES . . . . .</b>	<b>31</b>
Introduction—Objectives—What Is a Device Select Pulse?—Uses for Device Select Pulses—Generating Device Select Pulses—I/O Instructions—The Fetch, Input and Output Machine Cycles—First Program—Second Program—Introduction to the Experiments—Experiments—Review Questions	

## UNIT 18

<b>THE 8080A INSTRUCTION SET . . . . .</b>	<b>81</b>
Introduction — Objectives — Microcomputer Programming — Sources of 8080 Programming Information—8080 Instruction Set Summaries—8080 Microprocessor Registers—What Types of Operations Does the 8080A Microprocessor Perform?—8080 Mnemonic	

Instructions—The Instruction Set—The 8080 Instruction Set—Data Transfer Group—Arithmetic Group—Logical Group—Rotate Instructions—Branch Group—Stack, I/O and Machine Control Group—Instruction Set—Introduction to the Experiments—Experiments—Octal/Hexadecimal Listing of the 8080 Instruction Set—8080 Instruction Set Summary—Review Questions

## UNIT 19

### DATA BUS TECHNIQUES USING THREE-STATE DEVICES ..... 173

Introduction—Objectives—What Is a Bus?—Three-State Bussing—Examples of Simple Bus Systems—74125 Three-State Buffer—74126 Three-State Buffer—8095 Three-State Buffer—Other Three-State Devices—Introduction to the Experiments—Experiments—Review Questions

## UNIT 20

### AN INTRODUCTION TO ACCUMULATOR INPUT/OUTPUT TECHNIQUES ..... 191

Introduction—Objectives—What Is Input/Output?—Microcomputer Output—Some Output Latch Circuits—Output Drive Capability—Microcomputer Input—Some Three-State Buffer Input Circuits—Accumulator I/O Instructions—First Input/Output Program—Second Program—Third Program—Fourth Program—Fifth Program—Introduction to the Experiments—Experiments—Listing of Subroutine KBRD—Listing of Subroutine TIMOUT—Experiment No. 3. Characteristics of the DAA Instruction—Review Questions

## UNIT 21

### AN INTRODUCTION TO MEMORY-MAPPED INPUT/OUTPUT TECHNIQUES ..... 227

Introduction—Objectives—Memory-Mapped I/O vs Accumulator I/O—Generating Memory-Mapped I/O Address Select Pulses—Memory-Mapped I/O: Use of Address Bit A-15—Memory-Mapped I/O Instructions—The Memory Read and Memory Write Machine Cycles—First Program—Some Input/Output Circuits—Second Program—Third Program—Fourth Program—Fifth Program—Sixth Program—Seventh Program—Eighth Program—Introduction to the Experiments—Experiments—Review Questions

**UNIT 22****SOME EXAMPLES OF MICROCOMPUTER INPUT/OUTPUT . . . . . 261**

Introduction—Objectives—Data Logging With an 8080 Microcomputer—First Program: Logging Sixty-Four 8-Bit Data Points—Second Program: Logging Slow Data Points—Third Program: Output From a Data Logger—Fourth Program: Detecting an ASCII Character—Other Methods of Generating Time Delays—Introduction to the Experiments—Experiments—Additional Information—Experiment No. 9, A Staircase-Ramp Comparison Analog-to-Digital Converter—Review Questions

**UNIT 23****FLAGS AND INTERRUPTS . . . . . 309**

Introduction—Objectives—What Is a Flag?—First Example: Interfacing a Keyboard—Second Example: Solvent-Level Control—Polled Operation—What Is an Interrupt?—Types of Interrupts—Restart: RST X—Enable and Disable Interrupt: EI and DI—Third Example: Interrupt-Driven Keyboard Interface—Priority Interrupts—Hardware Priority Interrupts—Interrupt Software—Introduction to the Experiments—Experiments—Review Questions

**APPENDIX A****REFERENCES . . . . . 385****APPENDIX B****DEFINITIONS . . . . . 387****APPENDIX C****OCTAL/HEX CONVERSION TABLE . . . . . 391****APPENDIX D****ANSWERS TO REVIEW QUESTIONS . . . . . 393****INDEX . . . . . 401**