

Data Acquisition Techniques Using Personal Computers



Howard Austerlitz

Contents

Preface xi

CHAPTER 1

Introduction to Data Acquisition

CHAPTER 2

Analog Signal Transducers

- 2.1 Temperature Sensors 7
- 2.2 Optical Sensors 8
- 2.3 Force and Pressure Transducers 12
- 2.4 Magnetic Field Sensors 15
- 2.5 Ionizing Radiation Sensors 17
- 2.6 Position (Displacement) Sensors 19
- 2.7 Humidity Sensors 22
- 2.8 Fluid Flow Sensors 23

CHAPTER 3

Analog Signal Conditioning

- 3.1 Signal Conditioning Techniques 24
- 3.2 Analog Circuit Components 25
- 3.3 Analog Conditioning Circuits 31

CHAPTER 4

Analog/Digital Conversions

- 4.1 Digital Quantities 40
- 4.2 Data Conversion and DACs 44
- 4.3 ADCs 50

CHAPTER 5

The Personal Computer

- 5.1 IBM PC/XT/AT and Compatible Computers 65
- 5.2 The IBM PC/XT 66
- 5.3 The IBM PC/AT 73
- 5.4 The BIOS 78
- 5.5 PC Peripherals 78

CHAPTER 6

Interfacing Hardware to the PC Bus

- 6.1 I/O Data Transfers 83
- 6.2 Memory Data Transfers 85
- 6.3 A Simple 8-Bit I/O Port Design 86
- 6.4 DMA 89
- 6.5 Wait State Generation 90
- 6.6 Analog Input Card Design 91
- 6.7 16-Bit Data Transfers on ISA Computers 92

CHAPTER 7

Interfacing Software to the PC

- 7.1 PC Software Layers 95
- 7.2 Software Interrupts 97
- 7.3 Polled versus Interrupt-Driven Software 100
- 7.4 Device Drivers 104
- 7.5 TSR Programs 104
- 7.6 DOS 105
- 7.7 Non-DOS Operating Systems and Software Environments 106
- 7.8 Overcoming DOS Memory Limitations 107
- 7.9 Software Support for a Mouse 110

CHAPTER 8

Standard Hardware Interfaces

- 8.1 Parallel versus Serial Digital Interfaces 112
- 8.2 Parallel Interfaces 114
- 8.3 Serial Interfaces 127

Data Storage and Compression Techniques _____

- 9.1 DOS Disk Structure and Files 143
- 9.2 Common DOS File Types 147
- 9.3 Data Compression Techniques 151

Data Processing and Analysis _____

- 10.1 Numerical Representation 171
- 10.2 Data Analysis Techniques 178

Commercial Data Acquisition Products _____

- 11.1 Commercial Data Acquisition Hardware Products 199
- 11.2 Commercial Data Acquisition Software Products 216
- 11.3 How to Choose Commercial Data Acquisition Products 228

Other Personal Computer Systems and Hardware _____

- 12.1 IBM PS/2 Personal Computers with MCA 231
- 12.2 Apple Macintosh II Computers with NuBus 237
- 12.3 Math Coprocessors 243
- 12.4 Other Processor Cards 247
- 12.5 Specialized Personal Computer Systems 248

Computer Programming Languages _____

- 13.1 Assembly Language 254
- 13.2 BASIC 257
- 13.3 C Programming Language 261
- 13.4 FORTRAN 265
- 13.5 Pascal 267
- 13.6 Considerations for Writing Computer Programs 270

PC-Based Data Acquisition Applications _____

- 14.1 Ultrasonic Measurement System 274
- 14.2 Electrocardiogram (ECG) Measurement System 281
- 14.3 Commercial Equipment Using Embedded PCs 286
- 14.4 Future Trends in PC-Based Data Acquisition 292

APPENDIX **A**

Data Acquisition Hardware _____

Manufacturers 295

APPENDIX **B**

Data Acquisition Software _____

Manufacturers 301

Bibliography 305

Index 307