

Introduction to Digital and Data Communications

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Introduction to Digital and Data Communications

This book is dedicated to two very important people in my life: my wife, Ann, who had the patience to provide me the freedom and time to write it, and my good friend and colleague, Ivan Plotnick, for supplying me with the incentive and support to undertake this project.

Preface

This text on the data and digital communications field is intended to be a junior- or senior-level text in an Electronics Technology curriculum with one or two courses on the topic. A community college or proprietary school with a Communications specialty could easily teach this text to sophomores, after a course in basic communication. In order to do justice to the numerous facets of the data and digital communications field, no one area is treated with the kind of depth necessary to produce telecommunications engineering technologists. It is intended, rather, to provide the electronics technician and technologist with sufficient background in data and digital communications so that a solid, thorough understanding of what is in the field is achieved.

It is expected that the student has had or is familiar with the topics in courses that cover the following material:

1. AM and FM radio
2. Basic communications
3. Basic electronic circuits and devices
4. Basic digital electronic circuits and devices
5. Microprocessors and basic computer architectures.

Chapter 1 starts by giving the student a general overview of the data communications area. It lays the basis for future chapters by establishing some necessary fundamentals.

Chapter 2 deals with the telephone system from the standpoint of data transfer usage. Electrical specifications and impairments that require consideration when using telephone system facilities are also covered.

Chapter 3 provides details on some common error-detection and error-correction methods used in data, digital, and network communications systems.

Chapter 4 introduces the concept of data link protocols which are illustrated by exploring widely used data link protocols.

Chapter 5 is concerned with the hardware of low speed data communications as interfaced through the telephone system. Use of breakout boxes to test communications interfacing is also discussed.

Chapter 6 extends the basics of the data communications system up through phase shift and quadrature amplitude modulation schemes.

Chapter 7 introduces the student to multiplexing communications channels into a single entity. Here the line between data and digital communications begins to be crossed. The concepts of T1 digital lines and the equipment used to monitor and test them are included in this chapter.

Chapter 8 presents the two most common network layer models for data and digital communications networks, open systems interconnection (OSI) and systems network architecture (SNA) models.

Chapter 9 covers a wide variety of communications networks including local area networks (LANs) and private branch exchange (PBX) systems. The IEEE 802 standard is discussed in detail in this chapter.

Chapter 10 deals with the integrated services digital network, or ISDN. ISDN services are provided for combined services such as voice, video, and data to be transmitted simultaneously across the public services network. Protocol analyzers used to test and emulate many of the networks discussed to this point are explored in this chapter.

Chapter 11 discusses fiber optics and fiber-optic networks. In a text of this nature, a single chapter on fiber optics cannot cover this vast subject, which usually requires a separate tome, in its entirety. However, it is the author's intent to provide enough material on the subject so that the student obtains a good background on the subject.

Chapter 12 discusses two data communications applications—facsimile and satellite communications. Both of these services make worldwide communications possible and rapid.

The Appendix provides a list of the abbreviations and acronyms used in this text and in the data and digital communications field.

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One • Introduction to Digital and Data Communications

OBJECTIVES

The purpose of this first chapter is to introduce basic concepts of a communications system involving the transfer of digital information between two stations. The specific topics discussed are

1. Historical background
2. Functional system blocks
3. System and network topologies
4. Character codes
5. Data types and rates
6. Binary data formats

ACRONYMS

ACK—**A**CKnowledge

bps—**B**its **P**er **S**econd

ASCII—**A**merican **S**tandard **C**ode for **I**nformation **I**nterchange

BS—**B**ack **S**pace

CMOS—**C**omplementary **M**etal **O**xide **S**emiconductor

CODEC—**C**ODEr/**D**ECode

CR—**C**arriage **R**eturn

CWK—**C**ontinuous **W**ave **K**eys

DC—**D**evice **C**ontrol

DCE—**D**ata **C**ommunications **E**quipment or **D**ata **C**ircuit **T**erminating **E**quipment
DLE—**D**ata **L**ink **E**scape
DLE—**D**e**L**imit**E**r
DTE—**D**ata **T**erminal **E**quipment
DTFM—**D**ual **T**one **M**ultiple **F**requency
EBCDIC—**E**xtended **B**inary **C**oded **D**ecimal **I**nterchange **C**ode
EIA—**E**lectronic **I**ndustries **A**ssociation
ENQ—**E**N**Q**uiry
EOT—**E**nd **O**f **T**ransmission
ETB—**E**nd of **T**ransmission **B**lock
ETX—**E**nd of **T**e**X**t
FAX—**F**A**C**S**i**m**i**le
FF—**F**orm **F**eed
IC—**I**ntegrated **C**ircuit
ISDN—**I**ntegrated **S**ervices **D**igital **N**etwork
LAN—**L**ocal **A**rea **N**etwork
LCU—**L**ine **C**ontrol **U**nit
LF—**L**ine **F**eed
LSB—**L**east **S**ignificant **B**it
MAN—**M**etropolitan **A**rea **N**etwork
NAK—**N**egative **A**cknowledge
NRZ—**N**on-**R**eturn to **Z**ero
NRZB—**N**R**Z** **B**ipolar
NRZI—**N**R**Z** **M**ark **I**nversion
PCM—**P**ulse **C**oded **M**odulation
RZ—**R**eturn to **Z**ero
RZB—**R**eturn to **Z**ero **B**ipolar
SOH—**S**tart **O**f **H**eading
SP—**S**P**a**ce
sps—**S**ymbols **P**er **S**econd
STACO—**S**T**a**tion **C**ontroller
STX—**S**tart of **T**e**X**t
SYN—**S**YNchronization
TELCO—**T**E**L**ephone **C**ompany
TTL—**T**ransistor-**T**ransistor **L**ogic
UART—**U**niversal **A**synchronous **R**eceiver **T**ransmitter