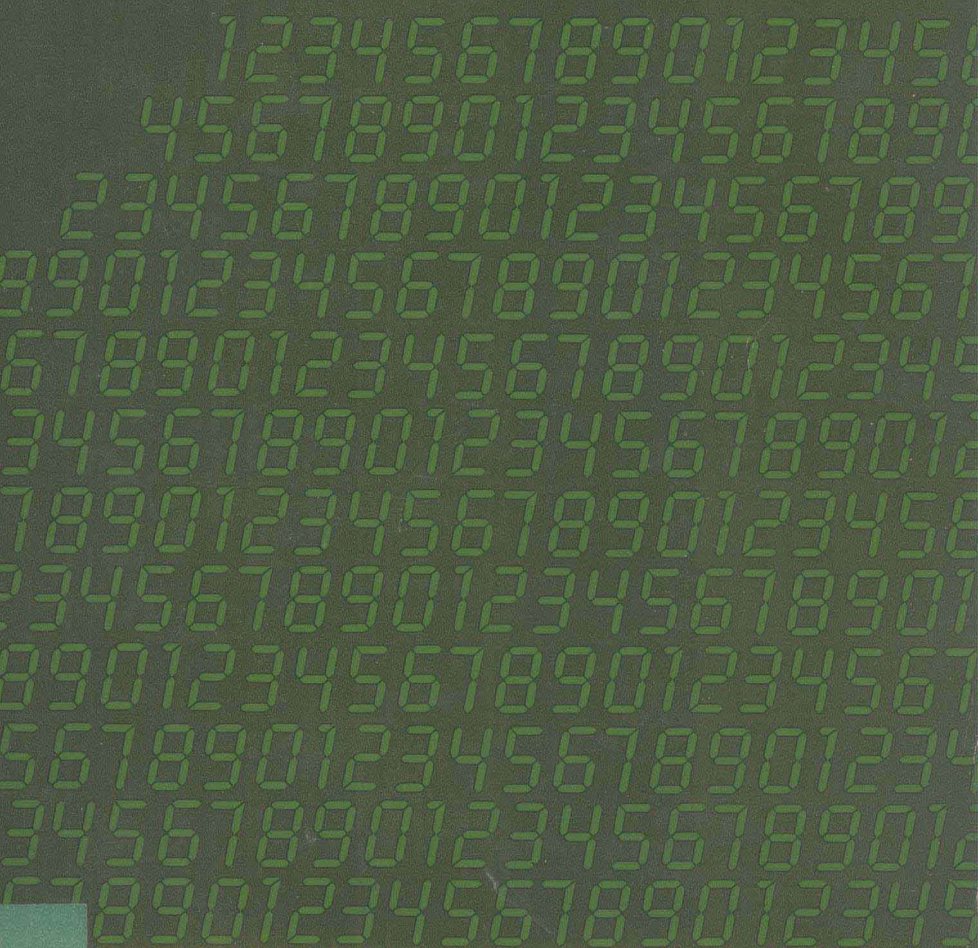


DIGITAL LOGIC CIRCUITS:

TESTS AND ANALYSIS
ROBERT G. MIDDLETON



*DIGITAL LOGIC
CIRCUITS: TESTS
AND ANALYSIS*

Bob Middleton has been a professional free-lance technical writer in the electronic field for many years. His many books and magazine articles have proved invaluable to students, technicians, and engineers, because they have all been based on his own practical experience. His home workshop is filled with test equipment, receivers, and other equipment that he uses to check out every detail in preparing his many books.

Other Sams books by Mr. Middleton include *101 Ways to Use Your VOM, TVM & DVM*, *Know Your Oscilloscope*, *Troubleshooting With the Oscilloscope*, *Effectively Using the Oscilloscope*, and many others.



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BY
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PREFACE

Troubleshooting digital logic circuits is now an activity of major concern to electronic technicians. A *digital revolution* has occurred and has irreversibly changed the structure of consumer electronics. For example, television receiver tuning is often accomplished by digital arrangements, and specialized models provide for extensive digital pre-programming of receiver operation. Digital controlled readout of the operating channel and the time may also be provided. Digital filtering techniques are utilized for optimum separation of chroma and Y signals. Scanner-monitor radio receivers employ automatic digital tuning techniques. A frequency readout is provided on am, fm, and communications receivers. Digital control techniques and programming routines have made significant entry in the high-fidelity scene. Personal computers have found widespread acceptance in homes and offices. Automobiles are becoming computerized to an ever-increasing extent.

This book emphasizes practice—not theory. Its purpose is to show you how to make basic digital tests and measurements as efficiently as possible. The techniques are presented without frills or double talk. Most digital servicing is done with logic probes and logic pulsers. These instruments are in the category of go/no-go testers, although they also provide general test data concerning frequency, transient occurrences, and logic levels. Logic probes and pulsers are voltage-operated devices. They are supplemented advantageously by the current tracer which senses current flow in the circuit. Logic clips, comparators, and oscilloscopes are also used in practical test procedures. Sometimes malfunction in a digital system results merely from a marginal power-supply voltage—here, the dvm does yeoman service. Even the ohmmeter finds occasional application.

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In this book, no previous experience with digital circuitry is assumed. The coverage starts with simple gates, illustrates commercial IC package pinouts, and introduces the reader to truth tables. Test procedures are initially concerned with verifying device input/output relations as specified in the associated truth table. Of course, not all digital trouble symptoms are caused by IC faults—poor contacts, solder “whiskers,” or broken pc conductors may also cause trouble symptoms. Suitable follow-up tests are often required to pinpoint the trouble to device failure or to external circuitry. We have attempted to anticipate all of the pitfalls that lie in wait for the beginner. It is sometimes remarked that a digital troubleshooter need pay attention only to the IC package pinout and to its truth table. However, this is somewhat of an oversimplification. As in television troubleshooting procedures, the technician will be called upon to reason back from symptom to cause, and to systematically eliminate various possibilities on the basis of tests and measurements.

Electronics technology is becoming increasingly advanced and sophisticated. We must keep up with these advances if we are to remain competitive. Unless the full capabilities of the logic probe, pulser, current tracer, logic clip, comparator, and oscilloscope are clearly understood, it will become much more difficult in the future to properly service modern electronic circuitry.

In preparing this new working handbook, I have recognized the current need, and have made a dedicated effort to meet it. It is my firm belief and sincerest hope that this book will be a valuable addition to the libraries of all present and future electronic service technicians.

ROBERT G. MIDDLETON

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