Lab manual assists XBee experimenters

"**The Hands-On XBee Lab Manual**," By Jonathan A. Titus, Newnes/Elsevier, Waltham, MA, 2012. ISBN: 978-0-12-391404-0. List price: $US 44.95. 301 pages, paperback.

This book supplies 22 hands-on experiments for engineers, product designers, students, and electronic enthusiasts who want to use the popular Digi International XBee modules and need to know how to:

- Perform basic wireless communications
- Use free X-CTU configuration software
- Configure and use digital and analog I/O ports
- Set up communications with modem-like AT commands
- Create command packets with the XBee application programming interface (API)
- Communicate digital and analog signals
- Use XBee modules to discover each other
- Set up small networks of XBee modules
- Take advantage of low-power sleep modes
- Work with an unknown number of modules in a network
- Use Arduino-Uno or ARM-mbed microcontroller boards, or other microcontrollers, with XBee modules

The inexpensive XBee-family modules provide many capabilities for people who want to communicate information as well as digital and analog signals over distances of several hundred feet. Applications include remote sensing, data communications, robotics, sprinkler controls, HVAC equipment, lighting controls, and so on. Documentation for the XBee devices, though, lacks details and application examples. "The Hands-On XBee Lab Manual," fills those gaps with 22 experiments that provide knowledge needed to perform everything from point-to-point serial communications to the set up of a wireless network of modules.

Author Jon Titus starts with experiments that explain how to use the free Digi X-CTU software to configure modules and how modem-like AT commands also configure and control modules from a PC via a USB connection. The Lab Manual gives readers step-by-step exercised that let them experiment with remote-control operations and discover how to obtain analog and digital information from remote XBee modules. Analog outputs at receiving modules have some quirks, which Titus explains how to overcome. Experiments include many diagrams, screen images, and photographs of the author's lab setups.

Because XBee communications occur in serial packets, users must pay careful attention to how they extract digital, analog, message-length, source-address, destination-address, command, error, and checksum values. Several experiments show how to interpret this information and how to use it. Readers use the interpretation formats throughout experiments that follow.

Five experiments use either an Arduino-Uno or an ARM-mbed module to control XBee operations that range from point-to-point transfer of 8-bit values to a complete network setup with an unknown number of remote XBee modules. Readers can use other MCU modules if they wish. The book includes flow charts and C-language code listings, and readers can download open-source code and X-CTU configuration files. The author even offers help directly by email.

Appendices include logic-level-conversion circuits needed for 5-volt microcontrollers, default XBee-module settings, an Excel spreadsheet used to create communication packets, a bill of materials for experiments, XBee resources, troubleshooting, and blank tables for use in experiments.

The XBee modules operate in the 2.4 GHz license-free Industrial, Scientific, and Medical (ISM) frequency band available worldwide. Experiments use the basic IEEE 802.15.4 radio protocol and DO NOT include ZigBee communications.

About the author: Jonathan A. Titus works as a freelance writer and editor and lives in the Salt Lake City, Utah area. Since the early 1970's he has written about and designed with microprocessors and microcontrollers. Jon now writes for Design News, EDN, and ECN magazines and creates weekly blogs that cover electronics, mechatronics, and measurement topics. He has an Amateur Extra Class license (KZ1G) and received a Ph.D. in chemistry from Virginia Tech. Jon designed and built the "Mark-8 Minicomputer," the first "hobby computer," in 1974.