Xbee®/XBee-PRO® 802.15.4 (Legacy) Professional Kit

Getting Started Guide

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Using this Guide

Conventions used in this Guide

This icon indicates a hint, or concept that is learned.

This icon indicates that a goal of the kit has been completed.

This icon indicates a warning of the potential for confusion or danger.

Contact Information

For more information about your Digi products, or for customer service and technical support, contact Digi International.

To Contact Digi International	Use
Mail	Digi International World Headquarters 11001 Bren Road East Minnetonka, MN 55343
Phone 8:00 AM - 5:00 PM (U.S. Mountain Time)	1-866-765-9885 toll-free USA and Canada 1-801-765-9885 Worldwide
Online Support	*http://www.digi.com/support/eservice/login.jsp*
Email	support.wizards@digi.com

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Introduction

Thank you for purchasing an Xbee®/XBee-PRO® 802.15.4 Professional Kit. This kit is designed to make it easy to set up an XBee network, send data from one XBee to another, and adjust the XBee settings. Before you start working with the kit, let's cover some basics.

Goals of the Kit

As you go through the steps in this kit, you will:

1. Set up your XBee 802.15.4 Professional Kit.
2. Download and install X-CTU configuration software.
3. Perform a range test.
4. Establish a network.
5. Configure the modules.

Requirements of the Kit

System Requirements

To install the software mentioned in this guide, you will need a PC running Microsoft Windows 2000, XP, Vista or Windows 7.

Additional Documentation

For more information about the software, API operations, AT command modes, or the form factor please refer to the *Xbee®/XBee-PRO® 802.15.4 Product Manual* available on the Digi Support website.

For more information on configuring and using the X-CTU utility, please refer to the *X-CTU Configuration & Test Utility Software User's Guide*.

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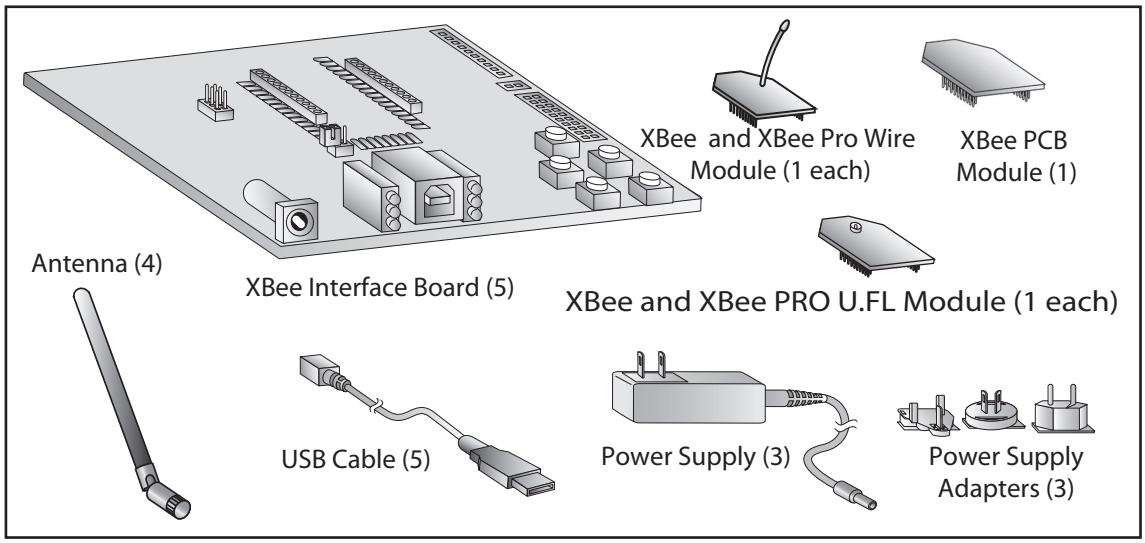
Part 1: Set up your XBee-PRO 802.15.4 Professional Kit

Identify Kit Components

Carefully unpack and verify the contents of your kit. Your kit should include the following:



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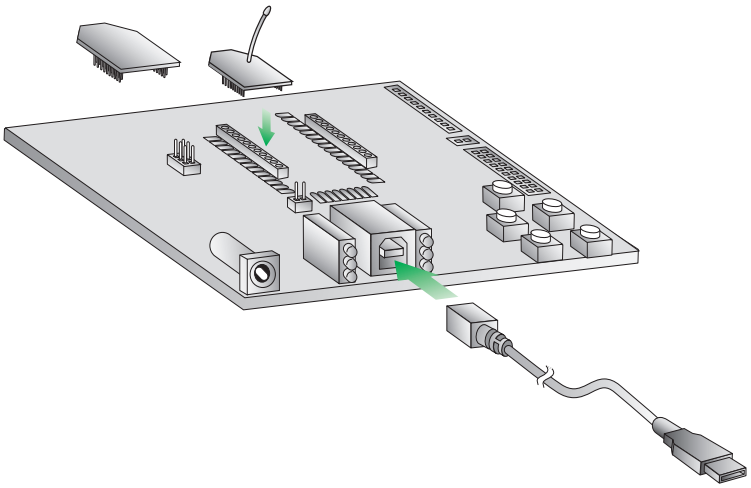
Assemble your Kit

To assemble your kit, perform the following steps:

1. Install the modules on the XBee Interface Boards (XBIB) by lining the pins up with the headers and pressing the module into place.
2. Attach the dipole antennas to the modules.
3. Connect the first XBIB to your computer using a USB cable. This first device will be designated as your base radio.
4. Connect the remaining modules and interface boards, and set them aside for now.

You are now ready to run the X-CTU software and to begin configuring your XBee network.



You have just completed Goal #1 - setting up your XBee-PRO 802.15.4 Professional Kit.

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Part 2: Download and Install X-CTU Software

For proper kit configuration and operation X-CTU software (version 5.15 or later) must be downloaded and installed. A copy of X-CTU software and USB drivers will need to be installed on each computer used in conjunction with this guide.

Installing USB Drivers

The XBee USB interface board is a "plug-and-play" device that should be detected by the PC automatically. If you are using Windows 7 or Vista, the USB drivers should automatically install and a notification will appear in the lower right portion of your screen indicating success or failure.

If the USB drivers fail to install, please follow the USB driver installation instructions found here: *http://www.digi.com/support/kbase/kbaseresultdetl.jsp?id=3214.*

If you are using Windows 2000 or XP, download and install the driver as per the following directions.

To install the USB driver:

1. Download the driver setup file at: *http://ftp1.digi.com/support/driver/FTDI_Windows_Driver_Setup.exe.*
2. Double-click on the setup file. A window will pop up during installation and automatically close when the process is complete.

Installing X-CTU Software

1. Download X-CTU at *www.digi.com/xctu.*
2. Browse to the folder to which you saved the above install file.
3. Double-click on the installer file and follow the X-CTU Setup Wizard.
4. When asked if you would like to check Digi's web site for firmware updates, click **Yes**.
5. After the firmware updates are complete, click **Close**. Updates may take a few minutes, please be patient.
6. Start X-CTU by double-clicking on the X-CTU icon on your desktop, or by selecting **Start > Programs > Digi > X-CTU**.

The X-CTU software is now ready to be used.

You have just completed Goal #2 - downloading and installing the X-CTU configuration software.

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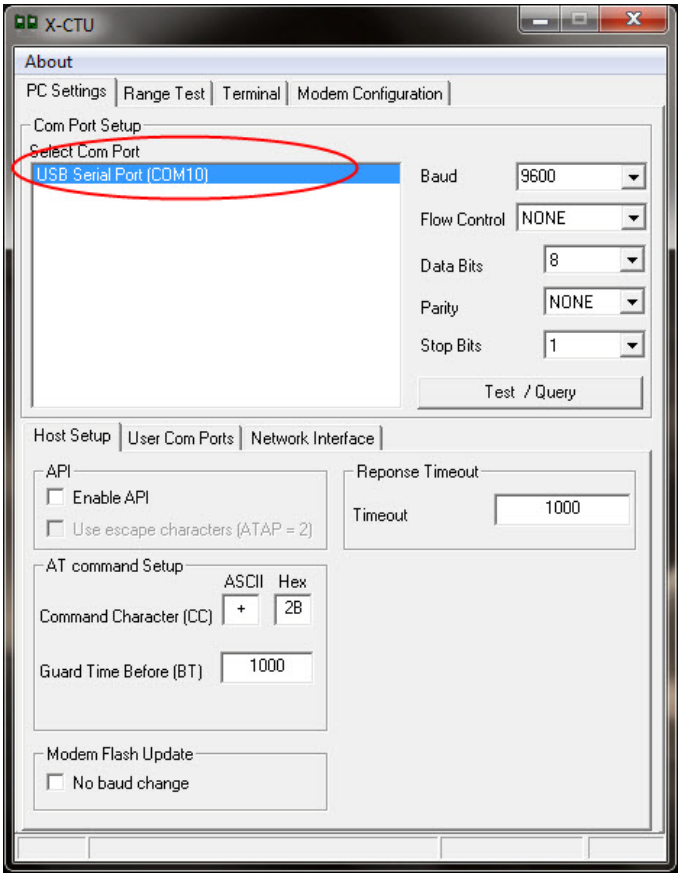
Part 3: Test Communications Link and Establish a Network

Perform a Range Test

Before running a range test, you will need to establish a connection with the X-CTU software:

1. Double-click the X-CTU shortcut on your desktop.
2. Under the PC Settings tab, select the serial COM port associated with the development boards you have just attached to your computer.



3. Verify that the baud rate and data settings match the internal settings of the devices:
   - Baud Rate: 9600
   - Flow Control: NONE
   - Data Bits: 8
   - Parity: NONE
   - Stop Bits: 1
4. On the **Modem Configuration** tab, click **Read**.

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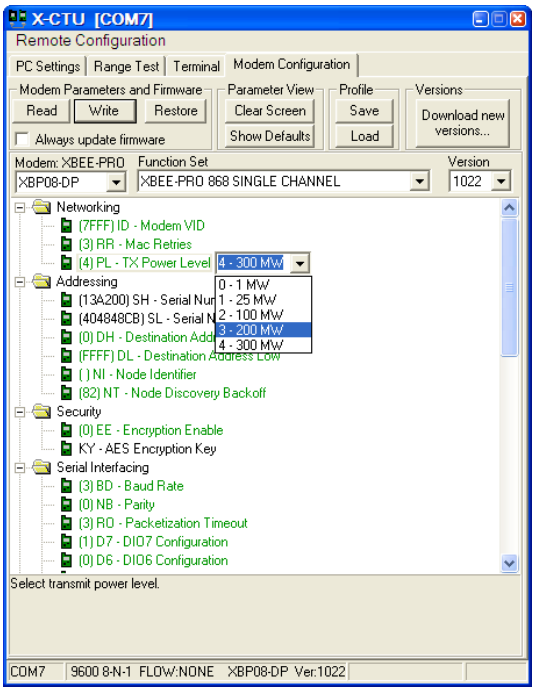
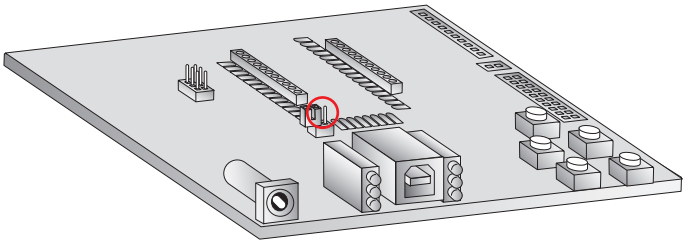
5. Select the PL parameter and choose the appropriate power level from the drop-down menu Please follow these guidelines:
   - PL = 1 (25 mW) or lower is required in Italy.
   - PL = 3 (200 mW) or lower is required when using the enclosed USB interface board from Digi, due to current draw limitations of <400 mA.
6. Click **Write** to save to non-volatile memory.
7. Remove the modules from each interface board and swap interface boards. Repeat steps 4-6 to configure the second RF module with the correct PL setting.



8. Click the **Test/Query** button to verify communication with the radio. A pop-up will be displayed showing status and some basic information.
9. Apply power to the second radio using a power supply in a fixed location. This will be designated as your remote radio.

Note: You will need to have a jumper at P8 on the loopback header on the XBIB for the remote radio.

Ensure that the P8 jumper is not bridging the two pins together on the base radio. This could cause X-CTU to stall if the jumper is populated and requests are sent to the radio.



10. Select the **Range Test** tab.
11. (Optional) Check the **"RSSI" check box** to enable Received Signal Strength Indicator.

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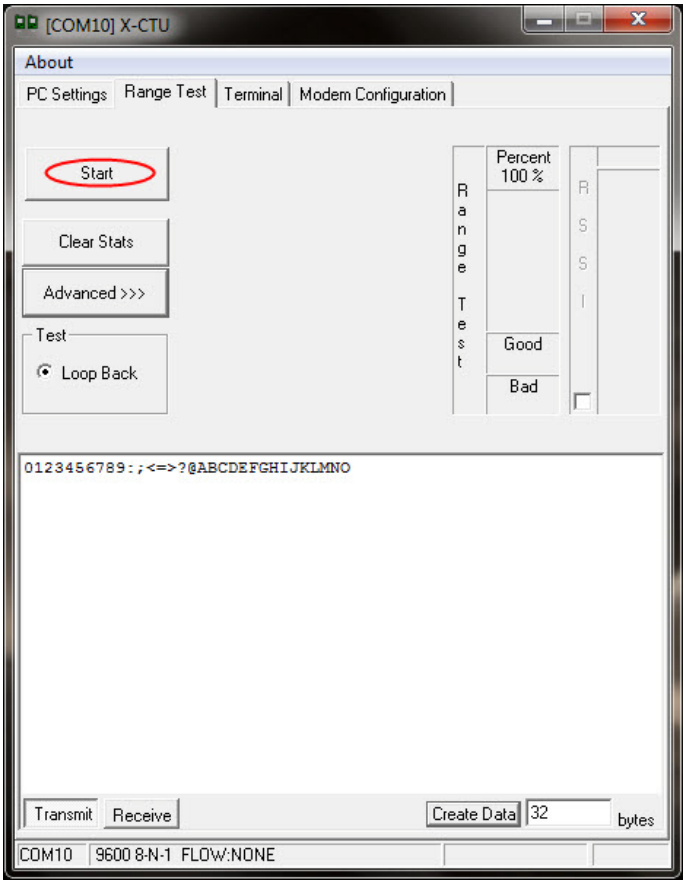
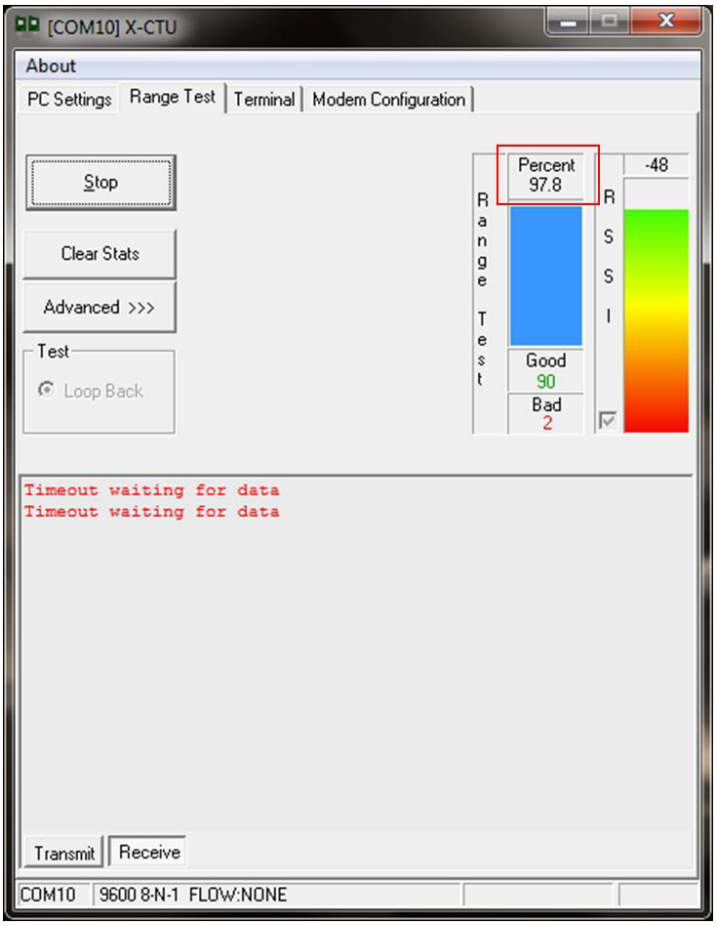
12. Click **Start** to begin the range test.



13. Monitor the link quality by reading the Percent section on the Range Test tab. This section displays the running percentage of good packets sent to the receiving radio and looped back to the base.



As your distance increases beyond the maximum range of the modules, you will start seeing greater packet loss.

14. Click **Stop** to end the range test.

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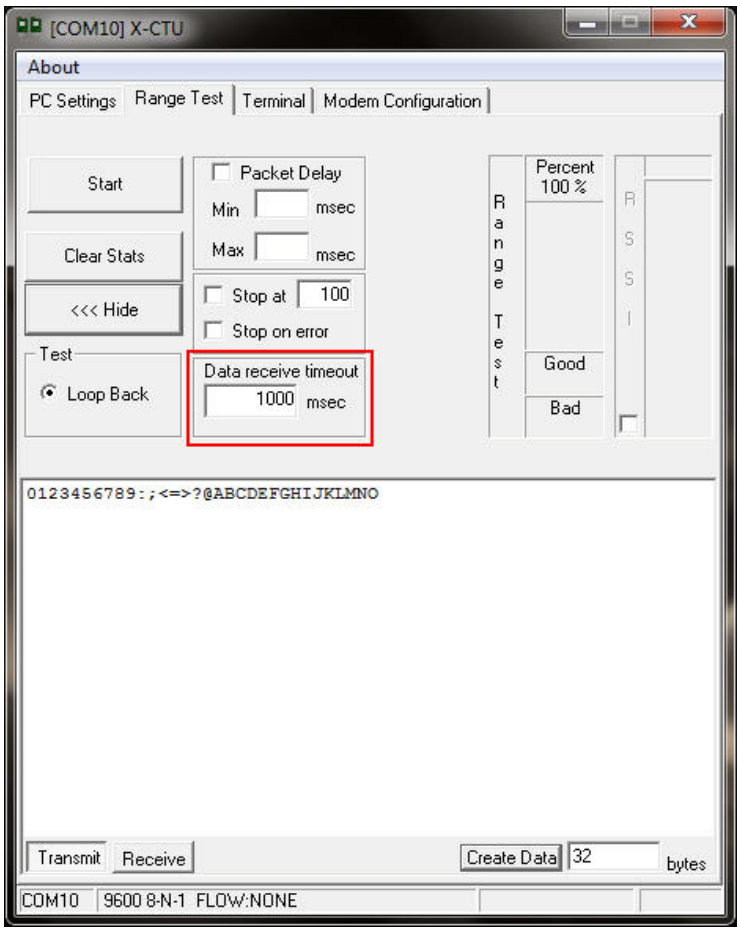
The **Advanced** tab allows you the ability to increase the data receive time out. which defaults at one second. Because of regulatory requirments, you will need to increase the time out to ten seconds (10,000ms).



You have just completed Goal #3 - performing a range test.

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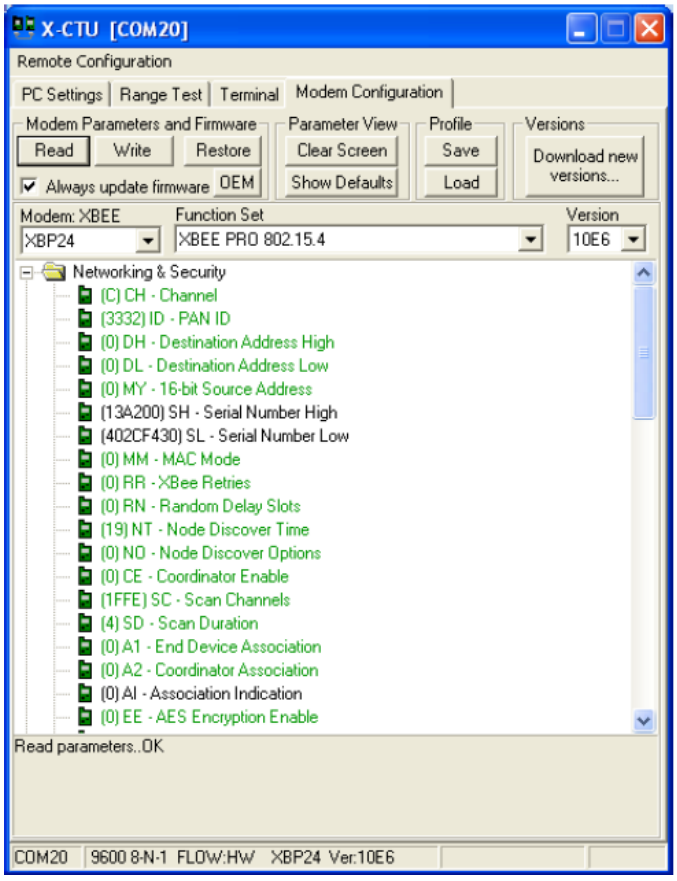
Part 4: Configure the Modules

Set up a Point-to-Multipoint Network

To configure and set up your XBee network, perform the following steps:

1. In the **X-CTU Modem Configuration** tab, click **Read**.
2. Select any ofthe module parameters you want to change (e.g. Address, Encryption, etc.) and type in or select the desired value.
3. Then click **Write** to save the changes to non-volatile memory.
4. To restore the module back to defaults, click **Restore**.

Refer to the product manual for more information.



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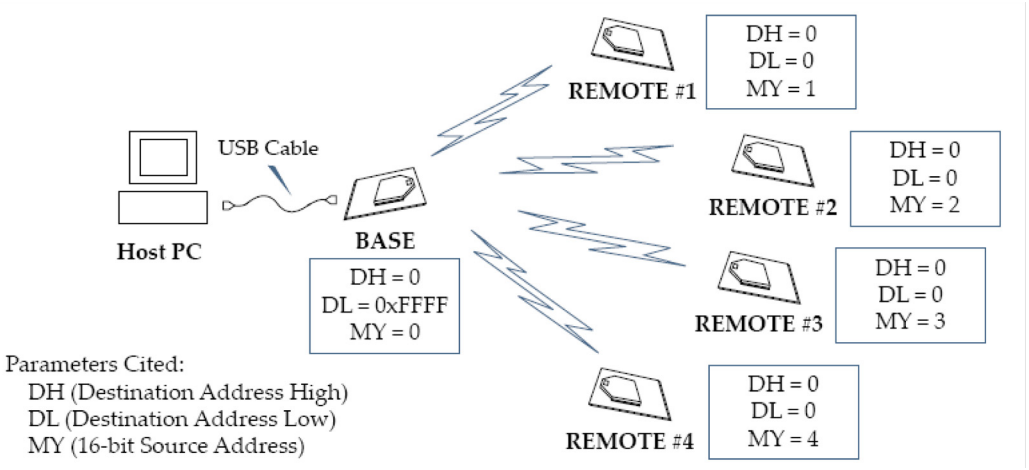
Point-to-Multipoint Addressing

Point-to-multipoint topologies require one base module to be configured to operate in Broadcast mode (DL= 0xFFFF). This allows the module to broadcast messages to all devices in the network.

Remote modules can operate either in Broadcast or Unicast mode. Unicast mode is used when you want to send a message directly from one module to another. To do so, you set the Destination Address High (DH) of the sender to zero and the Destination Address Low (DL) of the sender to match the 16-bit Source Address (MY) of the recipient. The figure below depicts a typical point-to-multipoint network that contains one base and four remotes and their associated settings.



You have just completed Goal #4 - configuring the modules.

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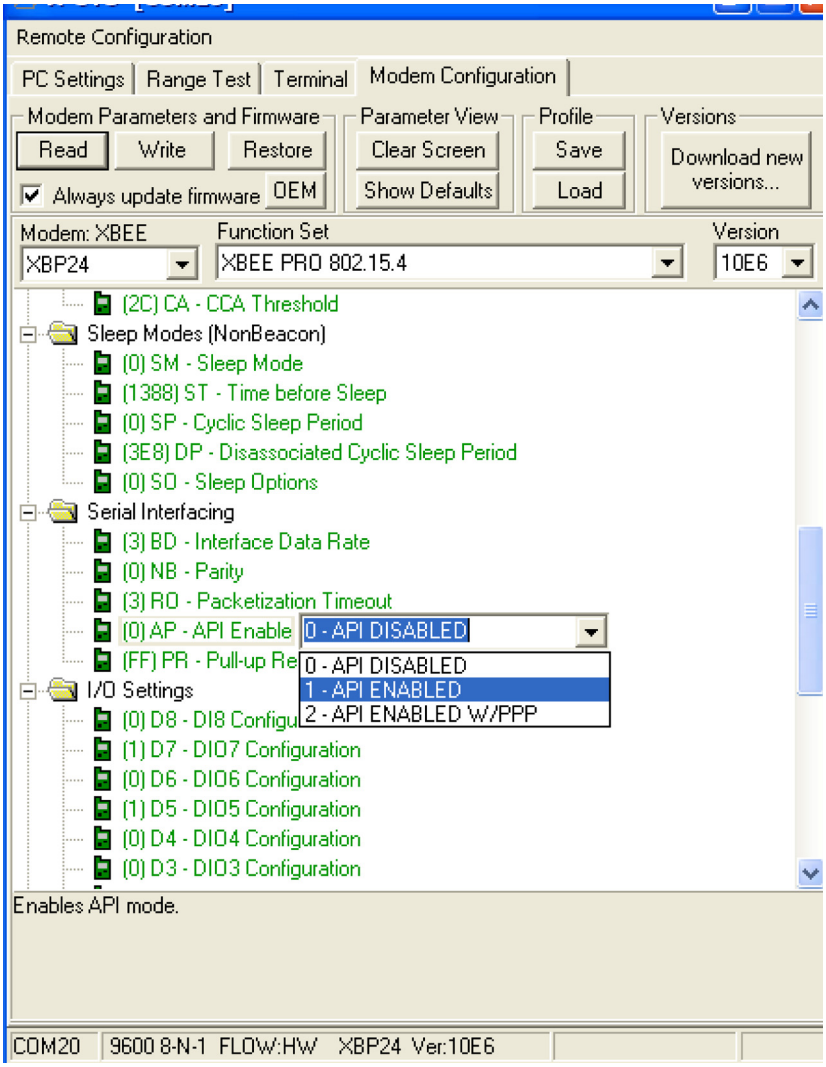
Part 5: Explore Advanced Configurations

Configure Remote Modules

The XBees can also be configured "over-the-air" using X-CTU. In order to use this feature, your base device must be configured for API mode.



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Note: To configure parameters on a remote radio, set AP = 1 on your base radio. For more information about the different AP settings, see the API section of the product manual.

To send “over-the-air” commands:

1. Go to the **Modem Configuration** tab and click the **Remote Configuration** option at the top of the window.
2. Click **Open Com Port** and **Discover** from the menu bar at the top of the **Network** window. A list of all of the nodes in the network will populate the screen.
3. Select a particular node from the list. You can interact with it as if it was connected to the PC directly.
4. Click **Read**, **Write**, or **Restore** parameters on the main X-CTU window and those changes will occur over the air on the remote module selected in the Network window.
5. Close the **Network** window when you have finished with remote configuration.

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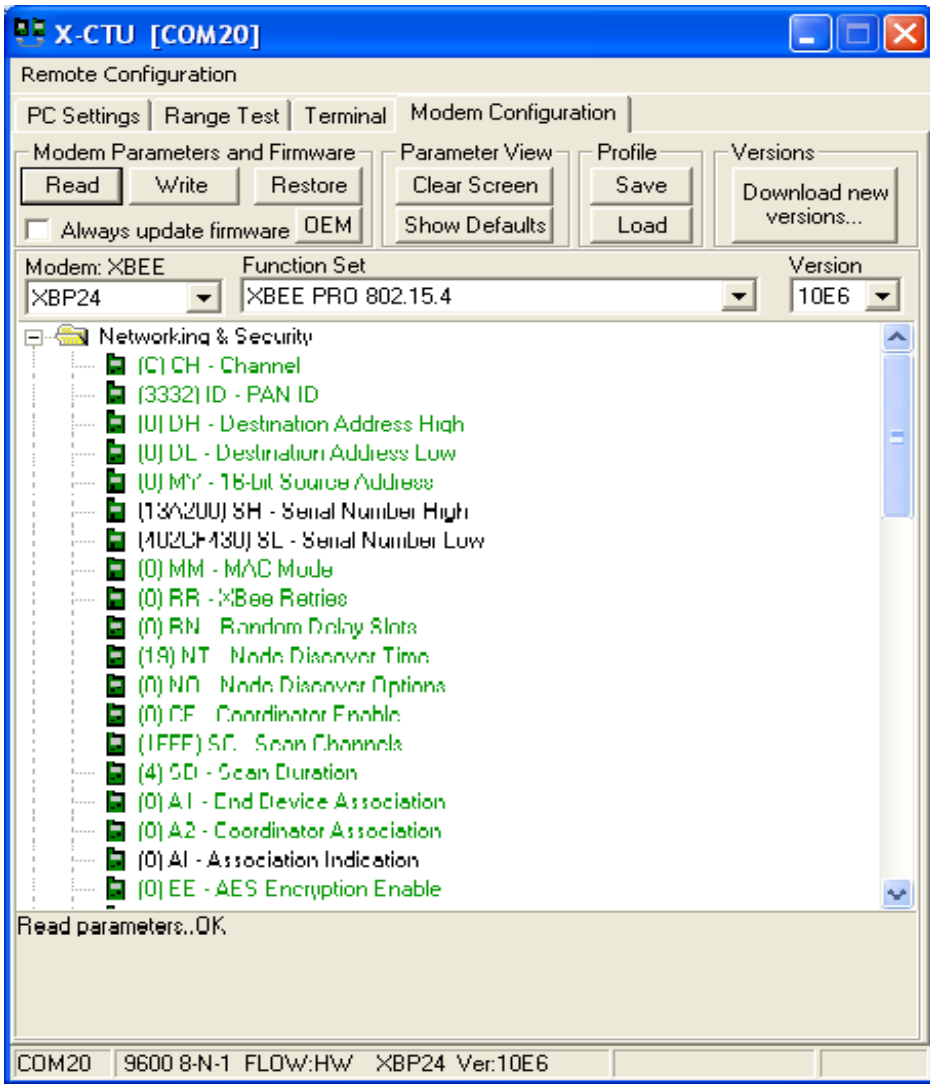
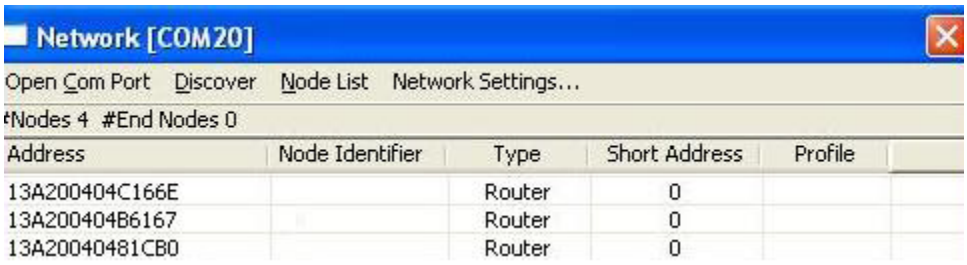

X-CTU [COM20]
Remote Configuration
PC Settings
Range Test
Terminal
Modem Configuration
Modem Parameters and Firmware
Read
Write
Restore
Always update firmware
OEM
Parameter View
Clear Screen
Show Defaults
Profile
Save
Load
Versions
Download new versions...
Modem: XBEE
XBP24
Function Set
XBEE PRO 802.15.4
Version
10E6
Networking & Security
(C) CH - Channel
(3332) ID - PAN ID
(0) DH - Destination Address High
(0) DL - Destination Address Low
(0) MY - 16-bit Source Address
(13A200) SH - Serial Number High
(4052D13D) SL - Serial Number Low
(0) MM - MAC Mode
(0) RR - XBee Retries
(0) RN - Random Delay Slots
(19) NT - Node Discover Time
(0) NO - Node Discover Options
(0) CE - Coordinator Enable
(1FFF) SC - Scan Channels
(4) SD - Scan Duration
(0) A1 - End Device Association
(0) A2 - Coordinator Association
(0) AI - Association Indication
(0) EE - AES Encryption Enable
Read parameters..OK
COM20
9600 8-N-1 FLOW:HW
XBP24 Ver:10E6



Change Firmware Version

These modules can also be set up for mesh communications. In some cases, a mesh solution may be a better option. DigiMeshTM is better for networks needing routing capabilities. Also, DigiMesh provides the option for all the modules in the network to sleep synchronously. If you want to try mesh mode, you can simply load different firmware on your XBees.

These steps can also be used to update to the latest version of point-to-multipoint firmware.

1. Launch X-CTU and select the corresponding COM Port.
2. Set the PC settings back to default:
   - Baud Rate: 9600
   - Flow Control: HARDWARE
   - Data Bits: 8
   - Parity: NONE
   - Stop: Bits 1.
3. Click on the **Modem Configuration** tab.
4. Select the modem type. Choose XB24-DM or XBP24-DM to convert an XBee or XBee-PRO 802.15.4 module into a DigiMesh XBee or XBee-PRO 2.4 module. Leave the modem type as XB24 or XBP24 to just update the point to multipoint firmware.
5. Choose the Function Set and firmware Version desired.
6. Click the **Show Defaults** button. This helps to avoid out of range errors since some parameters have different limits based on the firmware type.
7. Check the **Always update firmware** box.
8. Click **Write**.

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You have just completed Goal #5 - exploring advanced configurations.

Note: When you select XBP24-DM, the function set that automatically loads is the standard DigiMesh one. The version that automatically loads is the newest firmware in X-CTU's database. You can click Download new versions… then-download the latest firmware available from Digi's ftp site into XCTU's data-base on your PC.

End-to-End Connectivity

These XBee modules are part of a family of cohesive devices. Digi's Drop-in Networking solutions are designed to provide end-to-end wireless connectivity to distributed electronic devices so those devices

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can be accessed and managed from anywhere. Specifically Digi offers RF-to-Internet gateways that allow remote monitoring and control of an RF network. For more information about Digi gateways, see http://www.digi.com/products/wireless-routers-gateways.

On a larger scale, multiple gateways controlling separate RF networks can be managed through our iDigi cloud services. The image above shows a secure connection to your devices through an iDigi account. Learn more about managing your remote devices at www.idigi.com.

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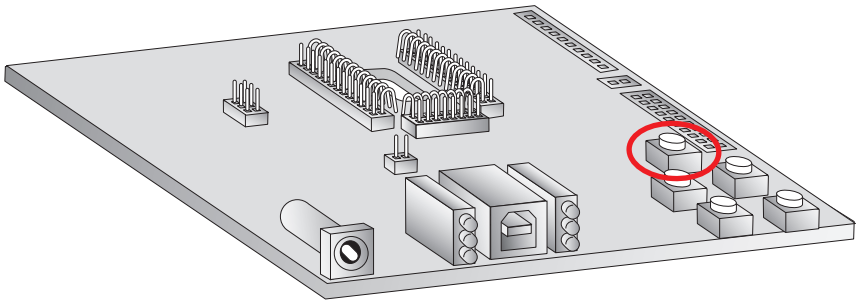
Appendix A: Troubleshooting

Resetting the Xbee®/XBee-PRO® 802.15.4 Modules

Each XBee USB Development Board has a reset button (located as shown below):



Pressing this button power cycles the module, but will not clear any changes written to the module. This is useful if you are having issues accessing the COM port. This will also reset any parameters that were changed but not written into memory.

> **Note:** The remaining buttons are connected to various I/O lines and are not used in this kit. See the product manual for more details relating to this functionality.

Why are the Modules no longer communicating with one another?

Network settings that can cause loss of communication include Baud Rate (BD), Parity (NB), and Encryption Enable (EE) among others. Check to see if these parameters are set appropriately. If you are unsure if your settings are affecting your communication, you might want to try setting your modules back to their default settings. To do so, go to the Modem Configuration tab in X-CTU and click Restore.

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