Drop-in Networking Professional Development Kit

GETTING STARTED GUIDE

90000917-88_A

OBJECTIVES

Upon completing this kit, you will be able to:

- Set up a Drop-in Network
- Perform a range test of the XBee™ radios in the kit
- Discover wireless devices in a ZigBee® network
- Run Python®-authored applications on a ConnectPort™ X gateway and PC
- Retrieve and send data from wireless devices over an Ethernet/IP network
- Use resources to develop embedded applications
- Use resources to plan, deploy, and manage Drop-in Networks

QUESTIONS?

For technical assistance with your Drop-in Network, call:

1-800-903-8430 (US Only)

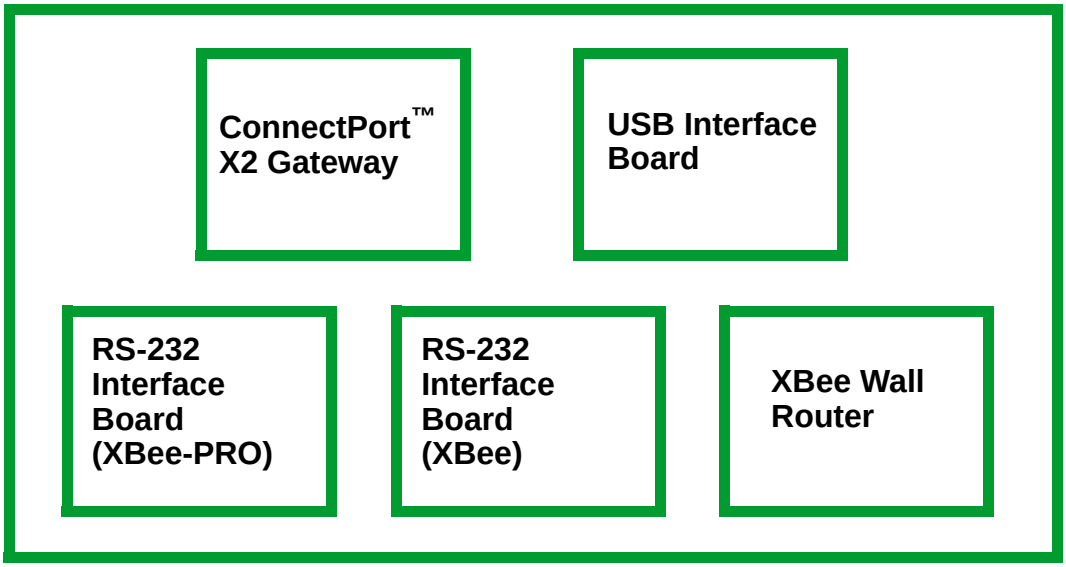
Digi contact numbers outside US:

Country	Toll Free Number
Argentina	00-800-3444-3666
Australia	0011-800-3444-3666
Brazil	0021-800-3444-3666
China North	00-800-3444-3666
China South	00-800-3444-3666
France	00-800-3444-3666
Germany	00-800-3444-3666
Hong Kong	001-800-3444-3666
India	000-800-100-3383
Israel	00-800-3444-3666
Italy	00-800-3444-3666
Japan	For calls from KDD fixed land-line phones: 010-800-3444-3666 From KDD public and mobile phones: 001-010-800-3444-3666 For non-KDD phones: 122-001-010-800-3444-3666
Korea	002-800-3444-3666
Mexico	001-800-903-8430
Netherlands	00-800-3444-3666
New Zealand	00-800-3444-3666
South Thailand	001-800-3444-3666
Spain	00-800-3444-3666
United Kingdom	00-800-3444-3666

Contents

Connect the gateway and USB interface board

The Drop-in Networking Professional Development Kit contains several boxes:



To run the kit, you will also need:

A PC, configured to obtain an IP address automatically

Hardware and Software Setup CD

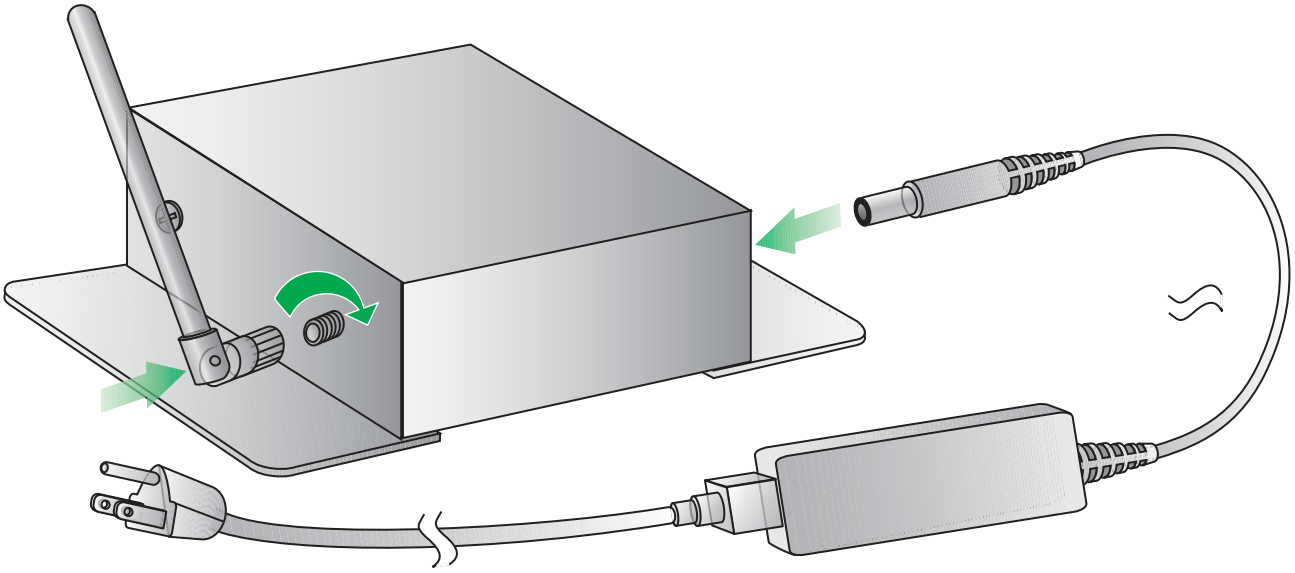
Digi ConnectPort X gateways are available in multiple configurations: ZigBee®-to-Ethernet, ZigBee-to-WiFi, and ZigBee-to-Cellular. The latter two configurations enable end-to-end wireless device connectivity.

Connect and power on gateway

1. Open and unpack the box labeled **ConnectPort X2 Gateway**.
2. Connect the power supply to the ConnectPort X2 gateway and turn the connector clockwise to tighten. Connect the power supply to an outlet.

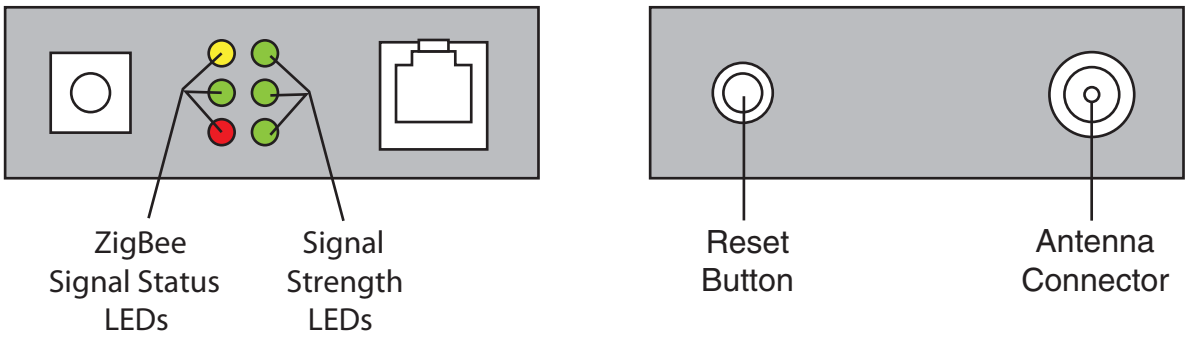
   Note (International version only): Connect the power supply to a power cord (not included), and the power cord to an outlet.
3. Connect the antenna to the barrel connector on the gateway. Turn the connector clockwise to tighten.

Note: Do **not** connect the cross-over Ethernet cable at this time.



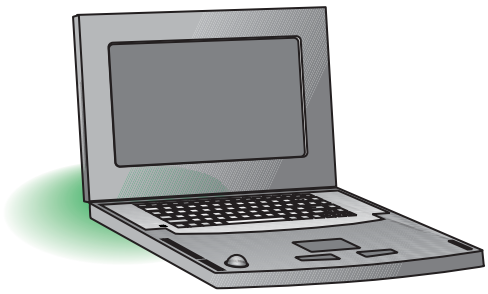
LEDs and buttons

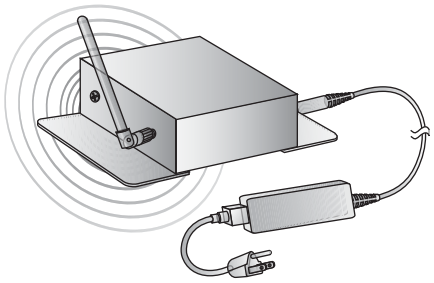
The gateway has several LEDs that indicate activity, and a Reset button.



LED/button	Description
ZigBee Signal Strength LEDs	Indicate RF module activity: • **Yellow (top LED)**: Serial Data Out (to host) • **Green (middle)**: Serial Data In (from host) • **Red (bottom)**: Associate/Power Indicator. Indicates both power to the interface board and the network association status for the XBee module in the interface board. **Solid red**: XBee module powered and not associated to a ZigBee network. **Blinking red**: XBee module has associated to a ZigBee network. For more information on this indicator, see the description of the D5 (DIO5 Configuration) parameter in the product manual for the XBee module.
Signal Strength LEDs	Indicate the amount of fade margin present in an active wireless link. The fade margin is the difference between the incoming signal strength and the module's receiver sensitivity. • **3 LEDs on**: Very Strong Signal (> 30 dB fade margin) • **2 LEDs on**: Strong Signal (> 20 dB fade margin) • **1 LED on**: Moderate Signal (> 10 dB fade margin) • **0 LED on**: Weak Signal (< 10 dB fade margin)
Reset button	Performs equivalent of a power-cycle.

Now, your network looks like this:

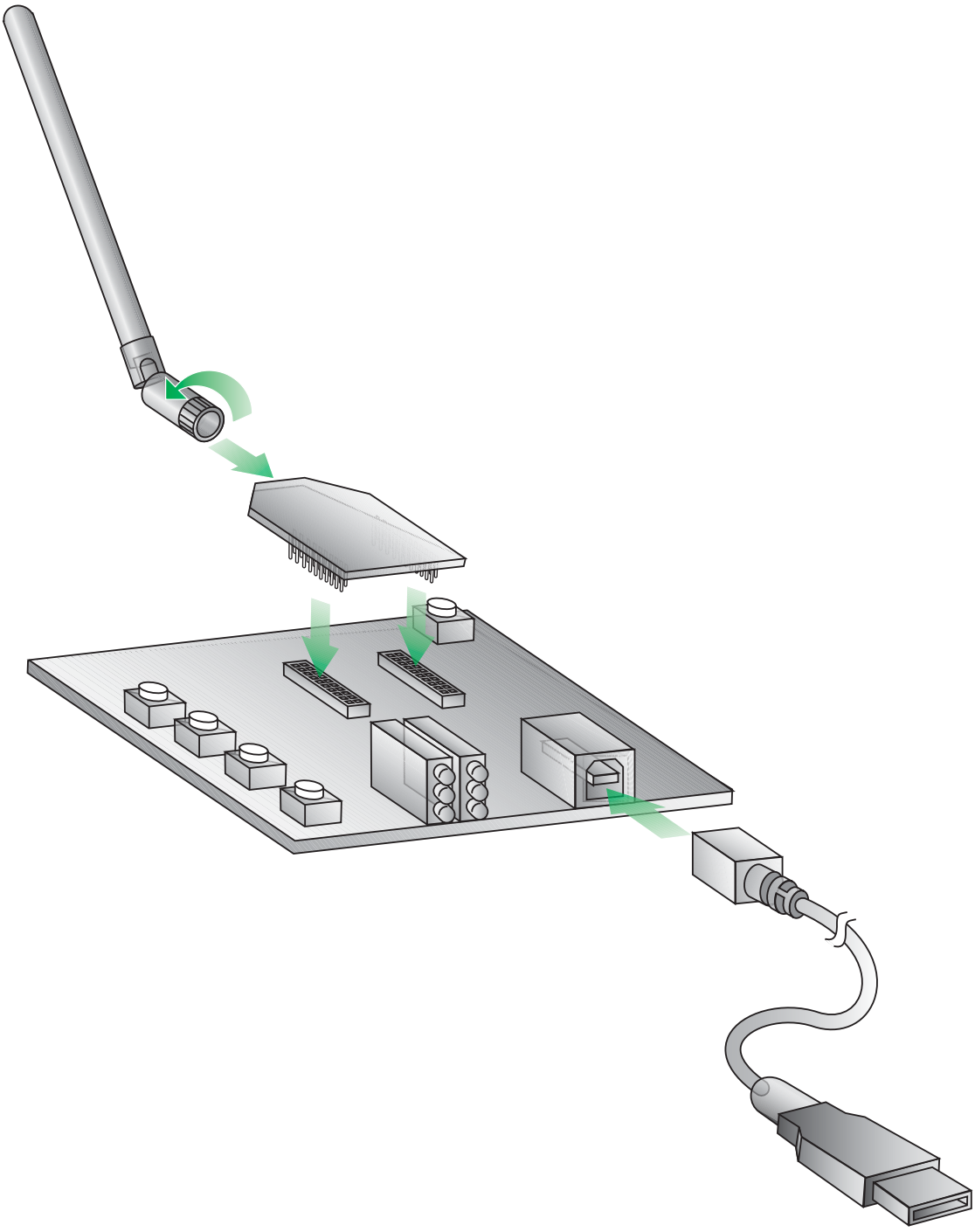




Gateway connected to power only

Connect and power on USB interface board

1. Open and unpack the box labeled **XBee USB Interface Board**.
2. Connect the XBee-PRO module to the connectors on the interface board. Orient the board and connector pins as shown in the diagram.
3. Connect the antenna to the RPSMA antenna connector on the XBee-PRO module. Turn the connector clockwise to tighten.
4. Connect the USB cable to the USB port on the interface board and PC.



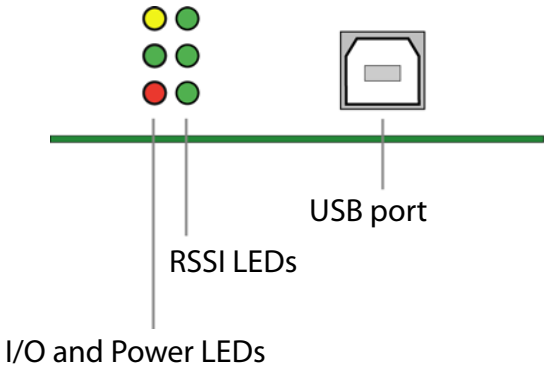
Install USB driver

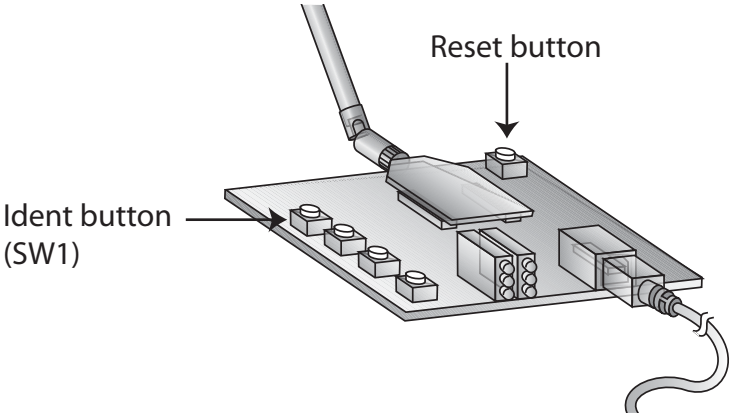
The USB interface board is a "plug-and-play" device that should be detected by the PC automatically. After the USB interface board is detected, a wizard for installing USB drivers is launched. To interface between the modem and a PC, two drivers must be installed: a USB driver, and a virtual COM port driver that makes the USB port look and perform like a physical COM port. The USB drivers are included on the Hardware and Software Setup CD.

1. Connect the XBee-PRO RF module to a PC using a USB cable. The **Found New Hardware Wizard** dialog box is displayed.
2. Verify that the Hardware and Software Setup CD is inserted into the drive.
3. Select **Install from a specific list or location (Advanced)**; then click **Next**.
4. Select **Search for the best driver in these locations** and **Search removable media (CD-ROM...)**. Then click **Next**.

   A Hardware Installation **Windows Logo Testing** alert box is displayed.
5. Click **Continue Anyway**.
6. Click **Finish**.
7. You are prompted to install another driver, the virtual COM port driver. Repeat steps 3 through 6 to install this driver.

LEDs and buttons





<table>
<tr><th>LED/button</th><th>Description</th></tr>
<tr><td>I/O and Power LEDs</td><td>Indicate RF module activity:
• Yellow (top LED): Serial Data Out (to host)
• Green (middle): Serial Data In (from host)
• Red (bottom): Associate/Power Indicator. Indicates both power to the interface board and the network association status for the XBee module in the interface board.
Solid red: XBee module powered and not associated to a ZigBee network.
Blinking red: XBee module has associated to a ZigBee network.
For more information on this indicator, see the description of the D5 (DIO5 Configuration) parameter in the product manual for the XBee module.</td></tr>
<tr><td>RSSI (signal strength) LEDs</td><td>Indicate the amount of fade margin present in an active wireless link. The fade margin is the difference between the incoming signal strength and the module's receiver sensitivity.
• 3 LEDs on: Very Strong Signal (> 30 dB fade margin)
• 2 LEDs on: Strong Signal (> 20 dB fade margin)
• 1 LED on: Moderate Signal (> 10 dB fade margin)
• 0 LED on: Weak Signal (< 10 dB fade margin)</td></tr>
<tr><td>Reset button</td><td>Performs equivalent of a power-cycle.</td></tr>
<tr><td>Ident button (SW1 on the interface board)</td><td>Performs actions for commissioning the XBee module in a ZigBee network. Consecutive button presses must occur within 800ms second of each other to perform desired actions.
<table>
<tr><th>Button press</th><th>Network association</th><th>Action</th></tr>
<tr><td>Single</td><td>Associated</td><td>• If unit is asleep, wakes unit for 30 seconds.
• Sends a Node Identification broadcast transmission. All devices receiving this transmission blink their Associate LED rapidly for 1 second. All API devices that receive this transmission send a Node Identification frame out their UART (universal asynchronous receiver/transmitter) (API ID 0x95).</td></tr>
<tr><td></td><td>Unassociated</td><td>• If unit is asleep, wakes unit for 30 seconds.
• Blinks a numeric error code on the Assc LED, indicating the cause of join failure.
1 blink: Scan found no PANs.
2 blinks: Scan found no valid PANs based on current SC (Scan Channel) and ID (PAN ID) settings.
3 blinks: Valid Coordinator or Routers found, but they are not allowing joining (NJ expired).
7 blinks: Node Joining attempt failed.
10 blinks: Coordinator Start attempt failed.</td></tr>
<tr><td>Two</td><td>Associated</td><td>Temporarily enables joining on the unit and the entire ZigBee network for 1 minute (if the XBee module’s NJ command setting is less than 255). If joining is permanently enabled on a module (NJ = 255), joining remains permanently enabled, and this button press has no effect.</td></tr>
<tr><td>Four</td><td>Associated/ Unassociated</td><td>Unit leaves PAN, if associated, and issues a factory reset to restore default parameters. Default PAN ID is 0x234.</td></tr>
</table>
</td></tr>
</table>

Perform a range test

What is a range test?

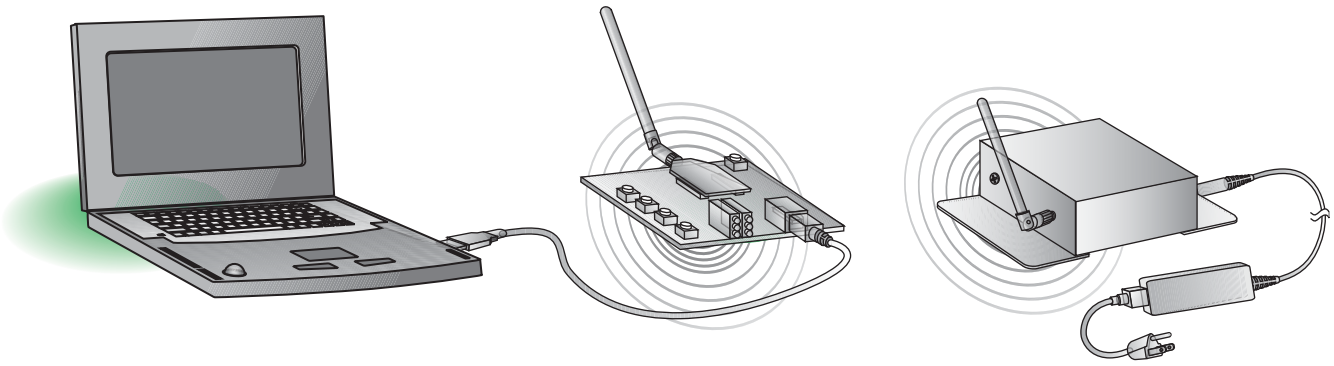
A range test identifies RF range of the XBee embedded modules in the Drop-in Networking Professional Development Kit.

This range information is useful when planning for and deploying an actual network.

Equipment used in range test

The range test uses this equipment:

- The PC
- The USB interface board, connected to the PC via the USB cable
- The ConnectPort X2 gateway

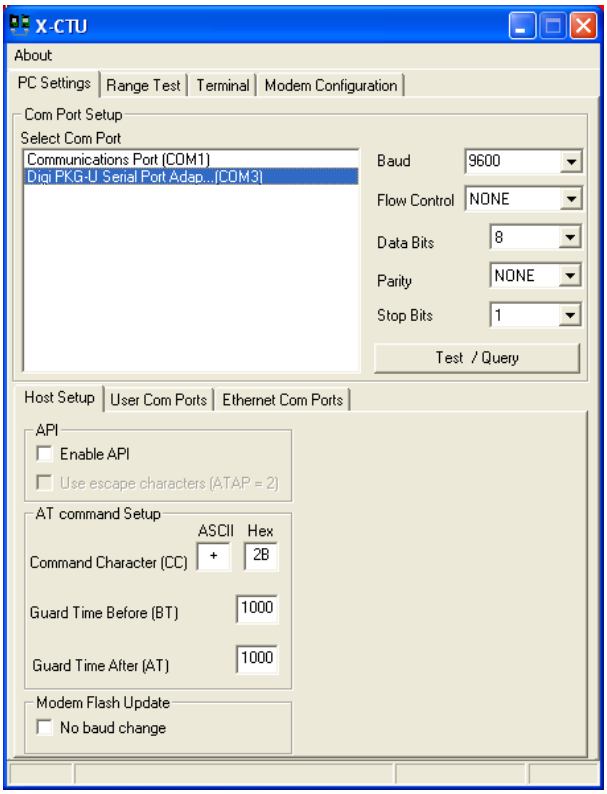


Install and start X-CTU software

X-CTU is a software tool for configuring XBee modules. It is included on the Hardware and Software Setup CD and will be used to run the range test. To install X-CTU:

1. Insert the **Hardware and Software Setup CD** in the PC's CD/DVD drive.
2. On the Home page, click **Adapters, Sensors, Modules Documentation/Software**.
3. Click **XBee ZNet 2.5 Module**.
4. Click **Install X-CTU**.
5. When prompted to check for updates, click **Yes** only if your PC is connected to the Internet. Otherwise click **No**.
6. When installation completes, to start X-CTU, select **Start > Programs > Digi-Maxstream > X-CTU**.

   The X-CTU software interface is displayed.



X-CTU user interface

The X-CTU interface has several tabs:

- **PC Settings**: Sets up PC serial COM ports to interface with the XBee module.
- **Range Test**: Tests the range of wireless links under varying conditions.
- **Terminal**: Reads and sets communications parameters on the XBee module and monitors data communications.
- **Modem Configuration**: Reads and sets configuration parameters on the XBee module.

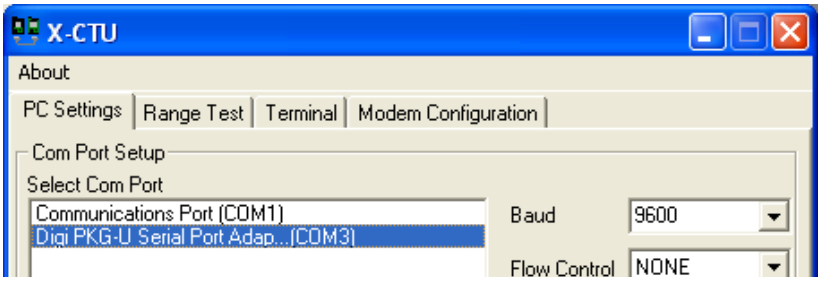
For more information on X-CTU functions, features, and controls, see the X-CTU Configuration Test Utility Software manual, available for downloading at **www.digi.com**.

Discover ZigBee nodes

This kit demonstrates discovering ZigBee nodes from a variety of interfaces. This first node discovery is done through the X-CTU software.

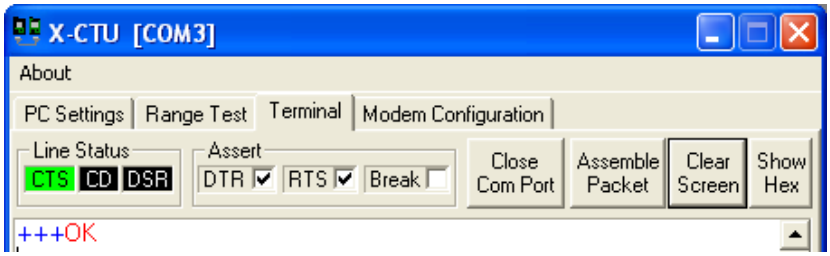
This procedure involves entering command mode and sending AT commands. If you are unfamiliar with either concept, see the XBee module's product manual, in the Command Mode section.

1. In the X-CTU interface, on the **PC Settings** tab, select the COM port to which the USB interface board is attached (this is the COM port created during USB driver installation): **DIGI-PKG-U (Serial Port Adap...)**



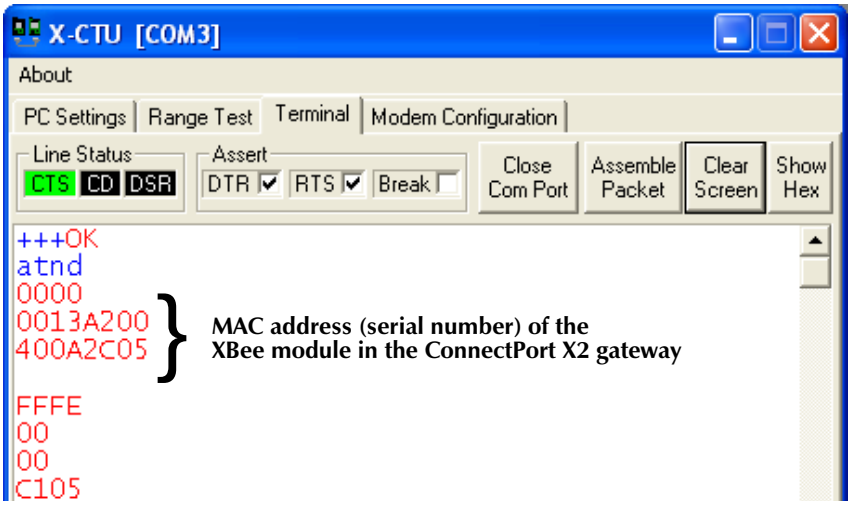
2. On the **Terminal** tab, enter command mode. This mode eliminates over-the-air communications for the XBee module, and allows internal communication with the XBee module parameters. If command mode is entered, an **OK** message is displayed. There is a one-second “guard time” before and after entering command mode, and a ten-second timeout.

   To enter command mode, enter **+++** with no carriage return:



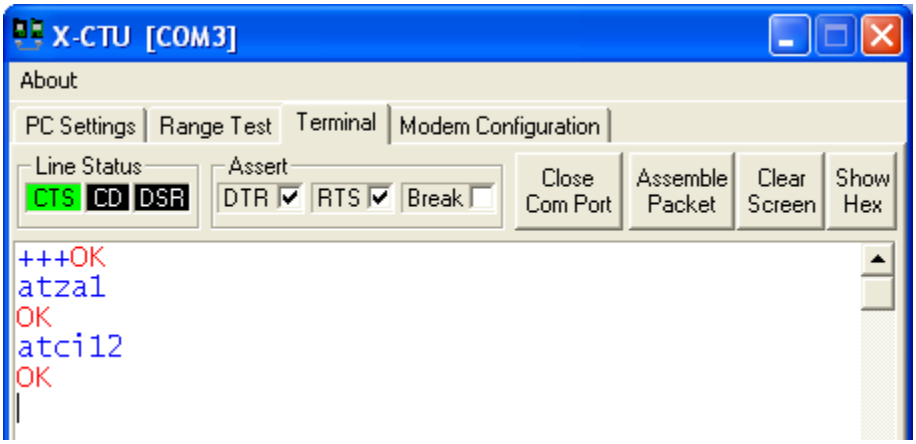
3. Enter the **atnd** (Node Discover) command followed by a carriage return. This command discovers and reports all modules on its current operating channel and PAN ID (ID parameter). All powered routers/end devices that have joined the ZigBee network respond to this command with their device information.

   One router/end device should be returned: the ConnectPort X2 gateway. The second field returned from the **atnd** command is the 64-bit MAC address (serial number) of the XBee module on each router/end device. This address/serial number is split over two lines, as shown:



Run range test

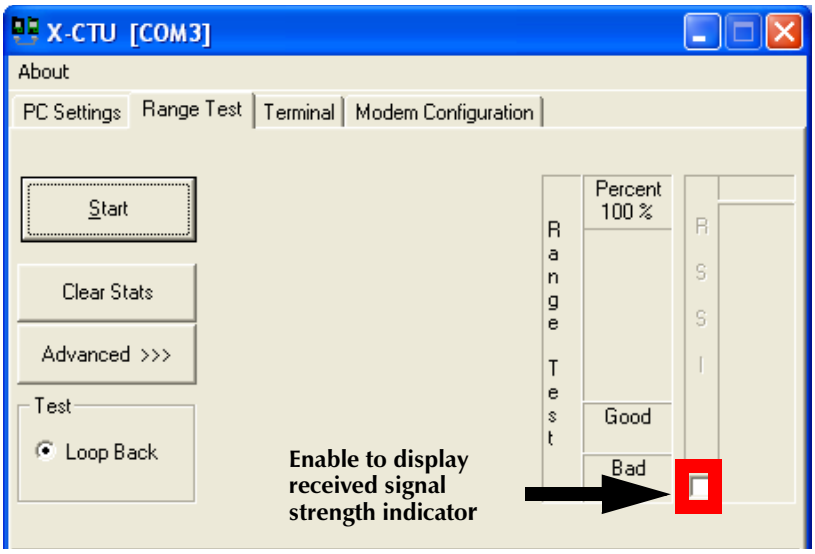
1. On the **Terminal** tab, re-enter command mode by typing **+++** with no carriage return.
2. Set loopback mode for the XBee module on the gateway. Enter these commands:
   - **atza1**
   - **atci12**



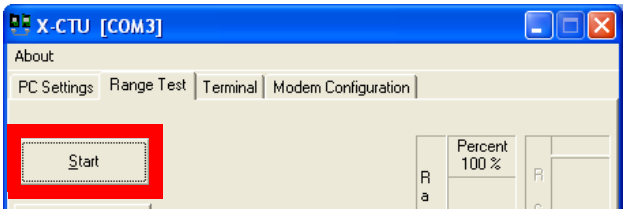
The **atza1** command (ZigBee Application) enables ZigBee application-layer addressing, allowing you to use the cluster ID (CI) parameter.

The **atci12** command (Destination Cluster ID=12, Loopback) sets the cluster ID on packets transmitted from the XBee module. Packets sent with this cluster ID value are sent back to the originator when received by the recipient (the XBee module in the gateway).

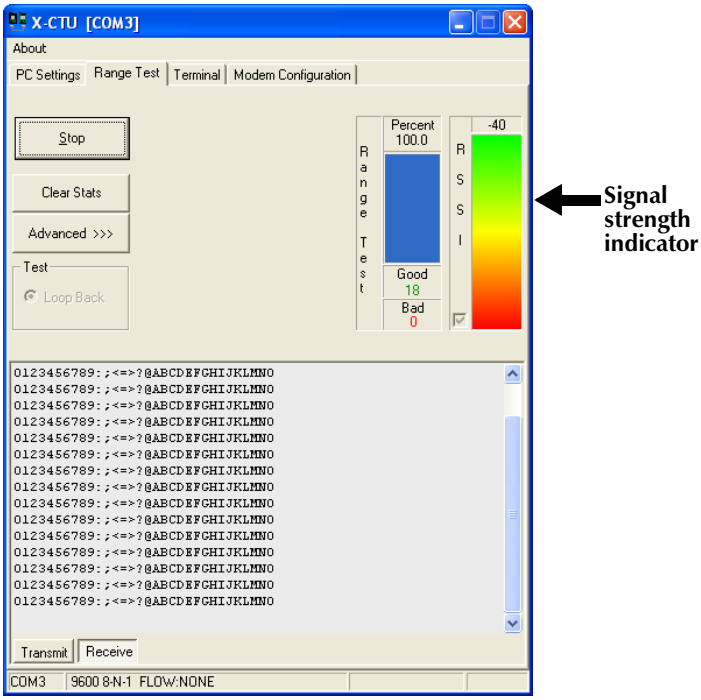
3. Click the **Range Test** tab.
4. Optional: Enable the checkbox in the RSSI part of the display to display the received signal strength indicator.



5. Click the **Start** button to start the range test.



The range test runs indefinitely until you click **Stop**. The **0123…LMNO** data is the default data packet that is being transmitted and received between the radios. The **Percent** field indicates true link quality by showing the percentage of successful packet transmissions. If the **RSSI** checkbox is enabled, the signal strength of packets received by the XBee module on the USB interface board is displayed



6. Test the range of the wireless link between the XBee modules on the USB interface board and gateway. Move the PC and USB interface board away from the gateway, or remove the antenna from the USB interface board's XBee module. Click **Start** again. Observe how the signal strength indicator changes.
7. Click **Stop** to end the range test.

What does this test show you?

The range test gives a sense of the range of the kit's XBee modules. When deploying an actual network, run another range test. If it indicates there is not enough range in an area where network devices must reside, you can install XBee Wall Routers to extend the range. The XBee Wall Router is designed primarily to "patch" areas within a ZigBee network where signal erosion or loss occurs due to distance limitations or interference.

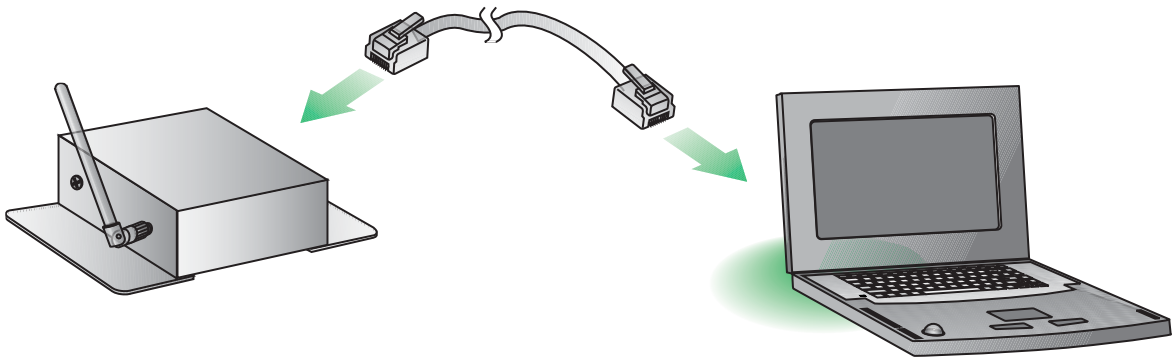
Use gateway to discover ZigBee nodes

In this task, you will connect the rest of the kit's units, use another interface, the gateway's web interface, to find and view the ConnectPort X2 gateway and the rest of your Drop-in Network.

Connect the gateway to the Ethernet and discover it

Up to this point, you have been working from the point of view of the embedded XBee modules in a ZigBee network. Now, you will change to viewing and managing the network from the PC-Ethernet-gateway side.

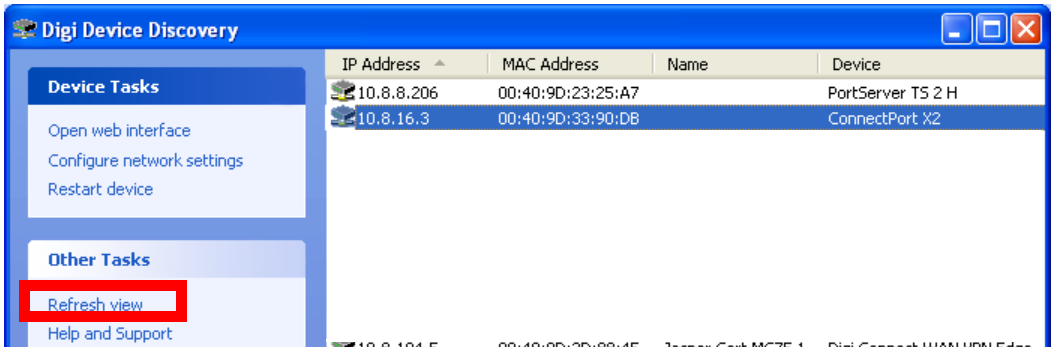
1. Connect the Ethernet crossover cable to the ConnectPort X2 gateway.



2. To find the gateway in the Ethernet network, run the Digi Device Discovery application, included on the Hardware and Software Setup CD.
   Insert the CD into the PC's CD/DVD drive.
3. Click **Gateway, Host PC & Enterprise Documentation Software**.
4. Click **ConnectPort X**.
5. Click **Configuration**.

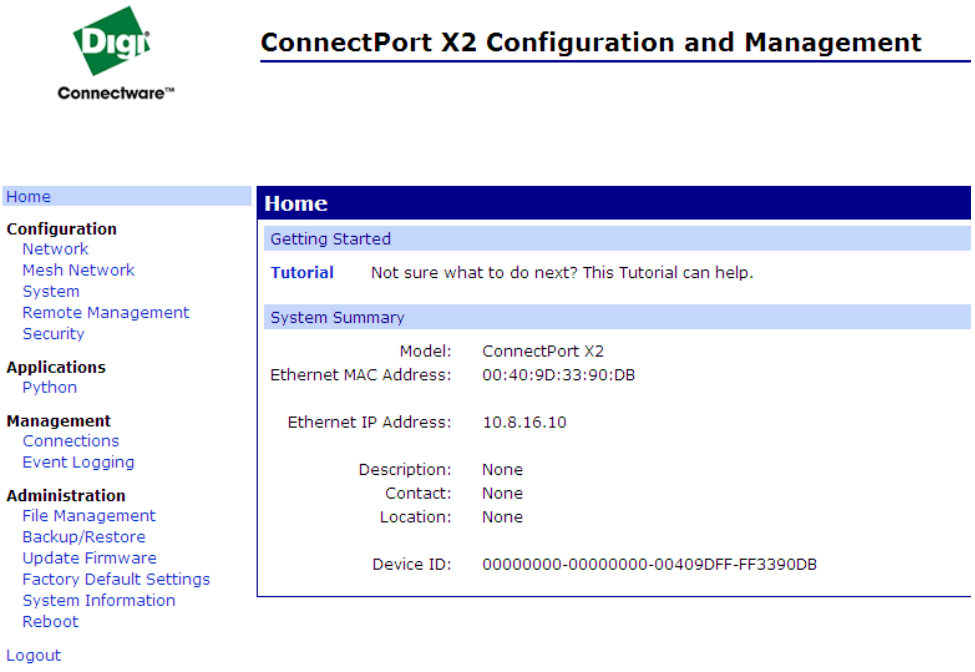
6. Click **Digi Device Discovery (EXE)**.

   The Digi Device Discovery application is opened. It displays all Digi devices on the Ethernet network.



   Note: If the gateway does not display, click **Refresh View**. If it still does not display, make sure any Windows firewalls are disabled.

7. Locate the ConnectPort X2 gateway in the device list by its MAC address or physical address. This address is printed on a label on the bottom of the gateway. The MAC address is for the Digi Connect ME module in the gateway, not the XBee module. Double-click the ConnectPort X2 gateway. The web interface of the gateway is opened.

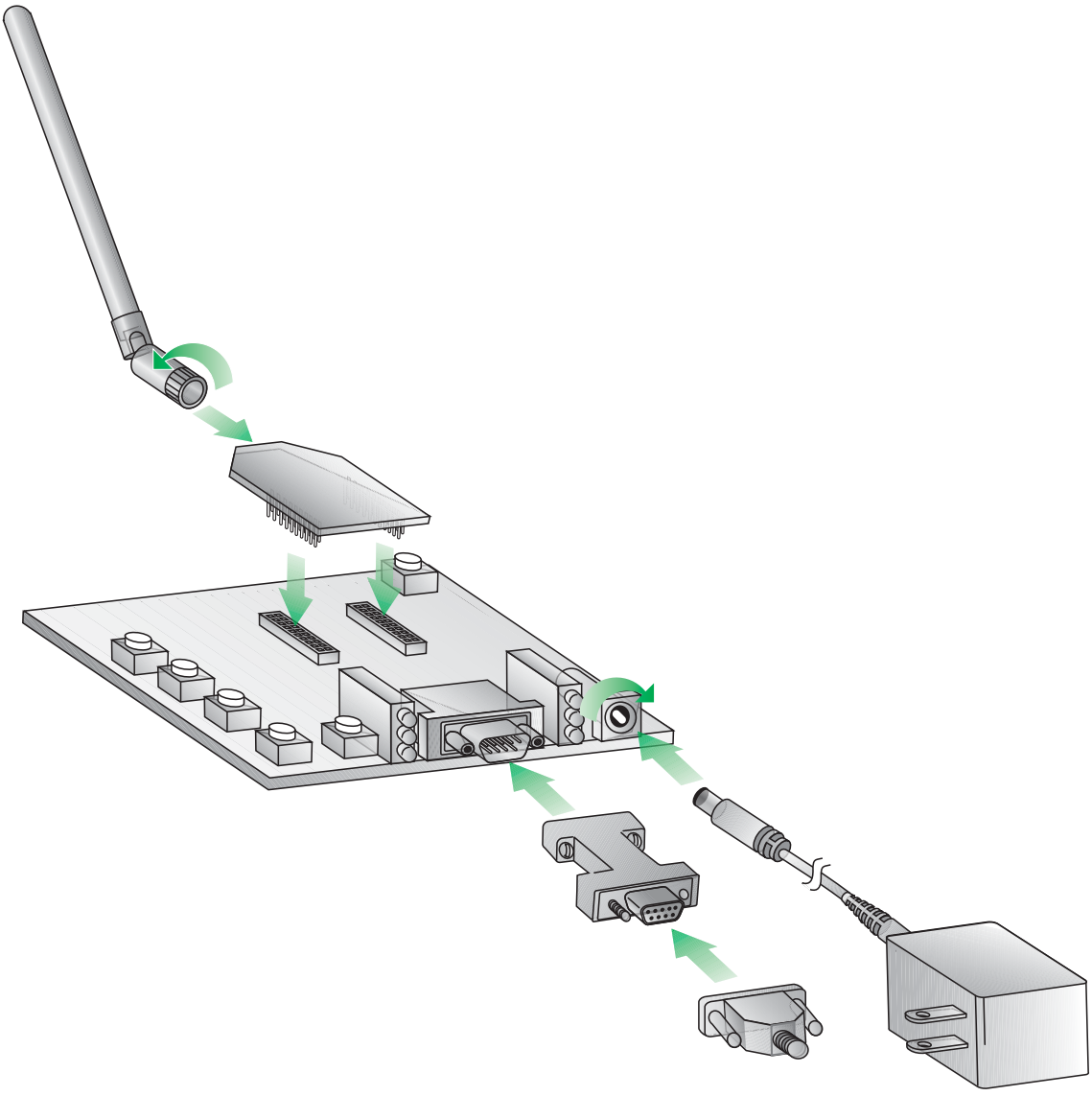


Connect and power on RS-232 interface boards

Now, add the RS-232 interface boards to the ZigBee network.

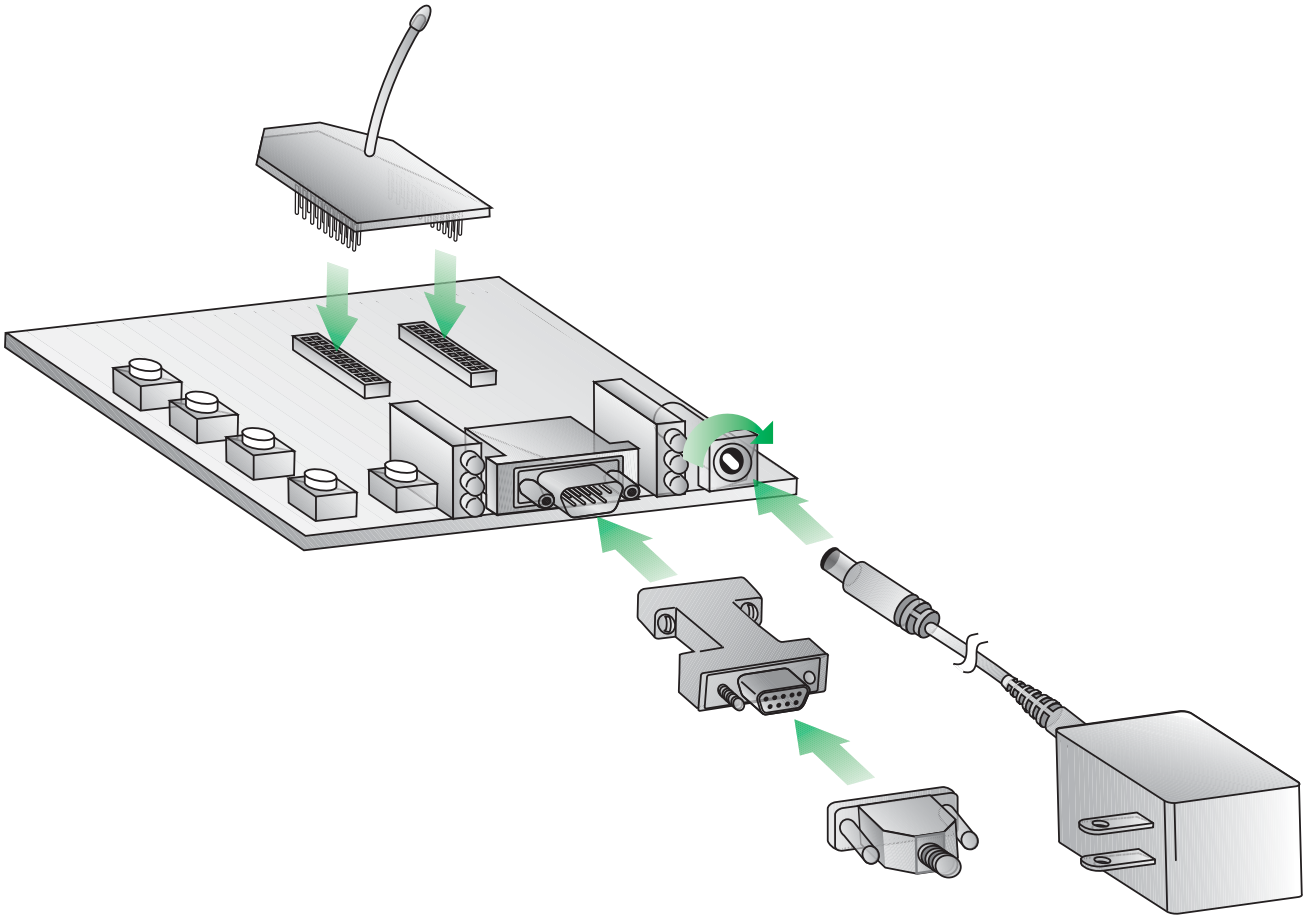
RS-232 interface board (XBee-PRO)

1. Open and unpack the box labeled **RS-232 Interface Board (XBee-PRO)**.
2. Connect the XBee-PRO module to the connectors on the interface board. Orient the board and connector pins as shown in the diagram.
3. Connect the antenna to the RPSMA antenna connector on the XBee-PRO module. Turn the connector clockwise to tighten.
4. Connect the male null modem adapter to the serial port of the interface board and tighten connections.
5. Connect the serial loopback plug to the male null modem adapter.
6. Connect the power supply to the interface board.



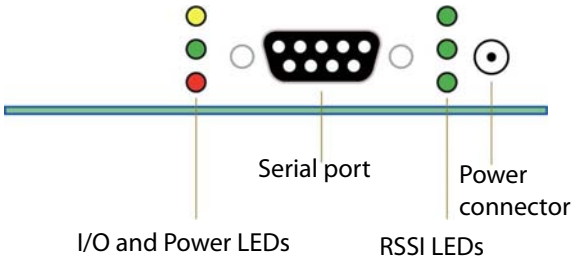
RS-232 interface board (XBee)

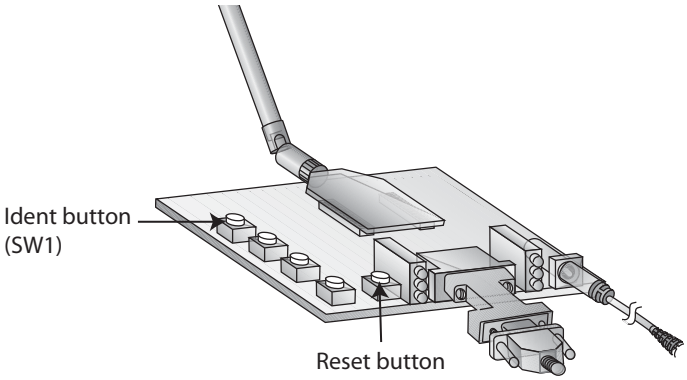
1. Open and unpack the box labeled **RS-232 Interface Board (XBee)**.
2. Connect the XBee module to the connectors on the interface board. Orient the board and connector pins as shown in the diagram.
3. Connect the male null modem adapter to the serial port of the interface board.
4. Connect the serial loopback plug to the male null modem adapter and tighten connections.
5. Connect the power supply to the interface board.



LEDs and buttons

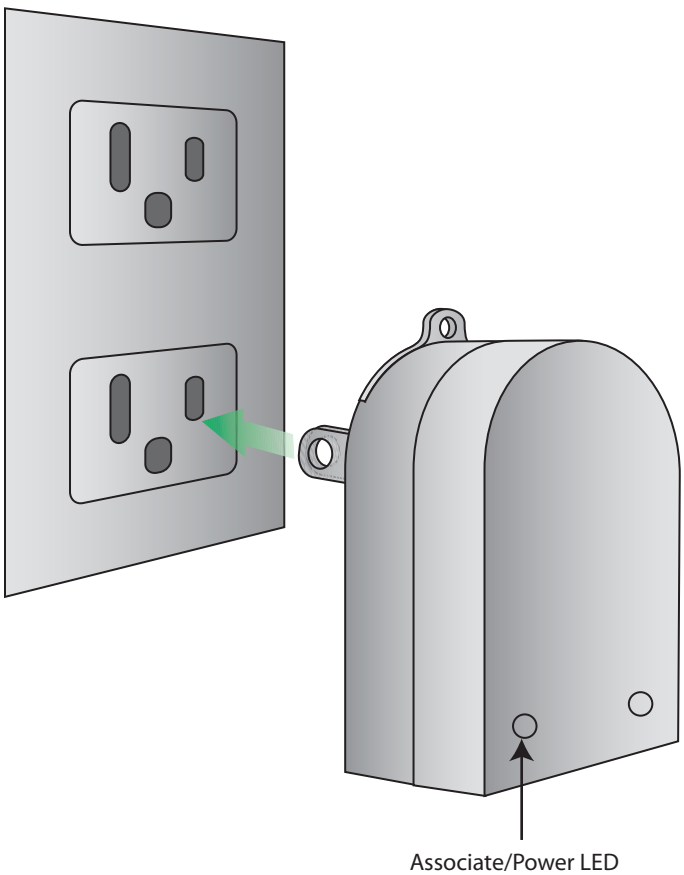
The LEDs and buttons on the RS-232 interface boards are shown below. Their operation and actions are the same as those for the USB interface board; see page 11.





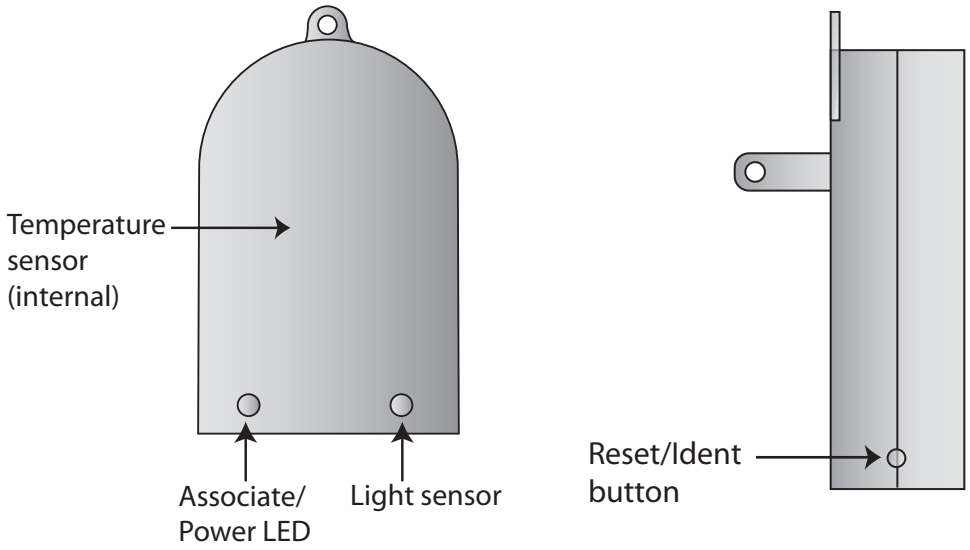
Plug in the XBee Wall Router

1. Plug the XBee Wall Router into a wall socket.



2. Observe the Associate/Power LED. When it changes from solid green to blinking green, the XBee Wall Router has joined the ZigBee network.

LEDs, buttons, and integrated sensors

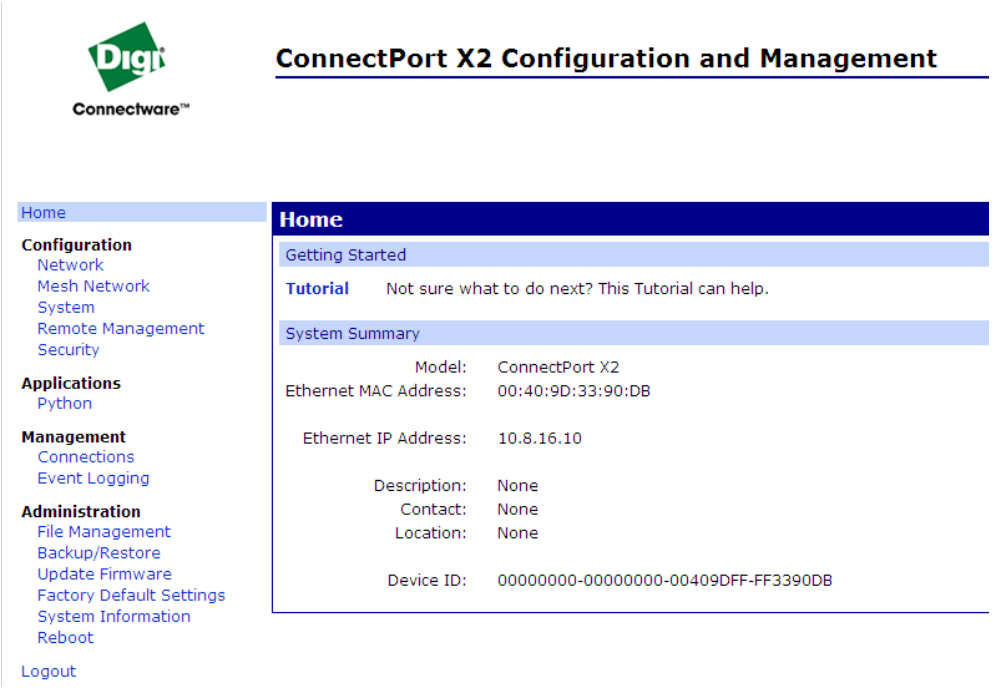


<table>
<tr><th>LED/button</th><th>Description</th></tr>
<tr><td>Associate/
Power LED</td><td>Indicates power and the network association status of the XBee module in the XBee Wall Router:
• Solid green: XBee module is powered and not associated to a ZigBee network.
• Blinking green: XBee module is powered and has associated to a ZigBee network.</td></tr>
<tr><td>Reset/
Ident button</td><td>Performs a reset and multiple functions for commissioning the XBee Wall Router in a ZigBee network. Use a small non-conducive tool with a blunt end to press gently and hold down button. Consecutive button presses must occur within 800 ms of each other to perform the desired action.
<table>
<tr><th>Button press</th><th>Network association</th><th>Action</th></tr>
<tr><td rowspan="2">Single</td><td>Associated</td><td>• If router is asleep, wakes unit for 30 seconds.
• Sends a Node Identification broadcast transmission. All devices that receive this transmission blink their Associate LED rapidly for 1 second. All API devices that receive this transmission will send a Node Identification frame out their UART (universal asynchronous receiver/transmitter) (API ID 0x95).</td></tr>
<tr><td>Unassociated</td><td>• If router is asleep, wakes unit for 30 seconds.
• Blinks a numeric error code on the Assc LED, indicating the cause of join failure.
1 blink: Scan found no PANs.
2 blinks: Scan found no valid PANs based on current SC (Scan Channel) and ID (PAN ID) settings.
3 blinks: Valid Coordinator or Routers found, but they are not allowing joining (NJ expired).
7 blinks: Node Joining attempt failed.
10 blinks: Coordinator Start attempt failed.</td></tr>
<tr><td>Two</td><td>Associated</td><td>Temporarily enables joining on the XBee Wall Router and the entire ZigBee network for 1 minute (if the XBee module’s NJ command setting is less than 255). If joining is permanently enabled on a module (NJ = 255), joining remains permanently enabled, and this button press has no effect.</td></tr>
<tr><td>Four</td><td>Associated/
Unassociated</td><td>XBee Wall Router leaves PAN, if associated, and issues a factory reset to restore default parameters. Default PAN ID is 0x234.</td></tr>
<tr><td>Hold for five seconds</td><td>Associated/
Unassociated</td><td>Performs a hardware reset.</td></tr>
</table>
</td></tr>
</table>

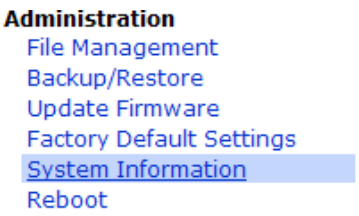
View ZigBee nodes

Next, find the three interface boards and the XBee Wall Router, known in the ZigBee network as ZigBee nodes. In this task, you will see a network view of the adapters and the gateway from the gateway's web interface.

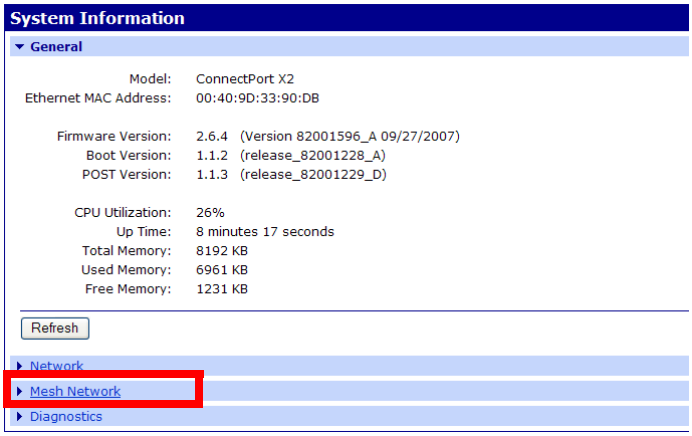
1. Return to the home page of the gateway's web interface:



2. From the menu on the left side, select **Administration > System Information**.

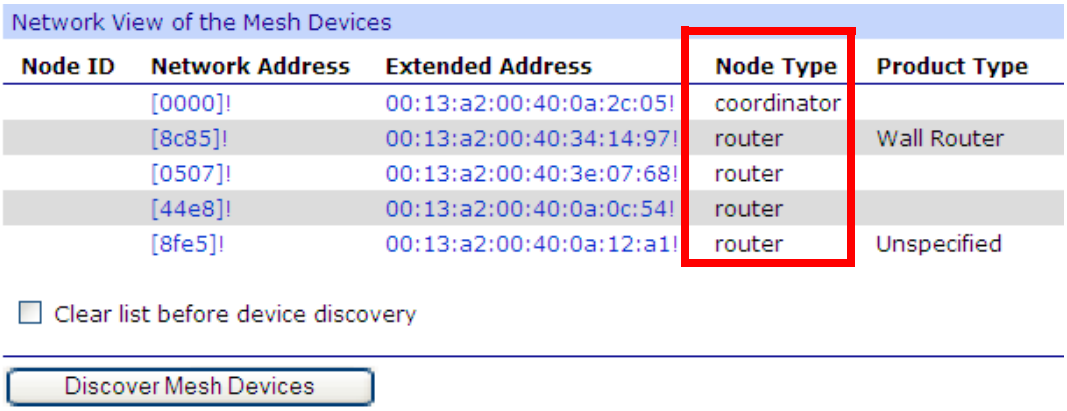


3. In the list of System Information links on the **System Information** page, click **Mesh Network**.

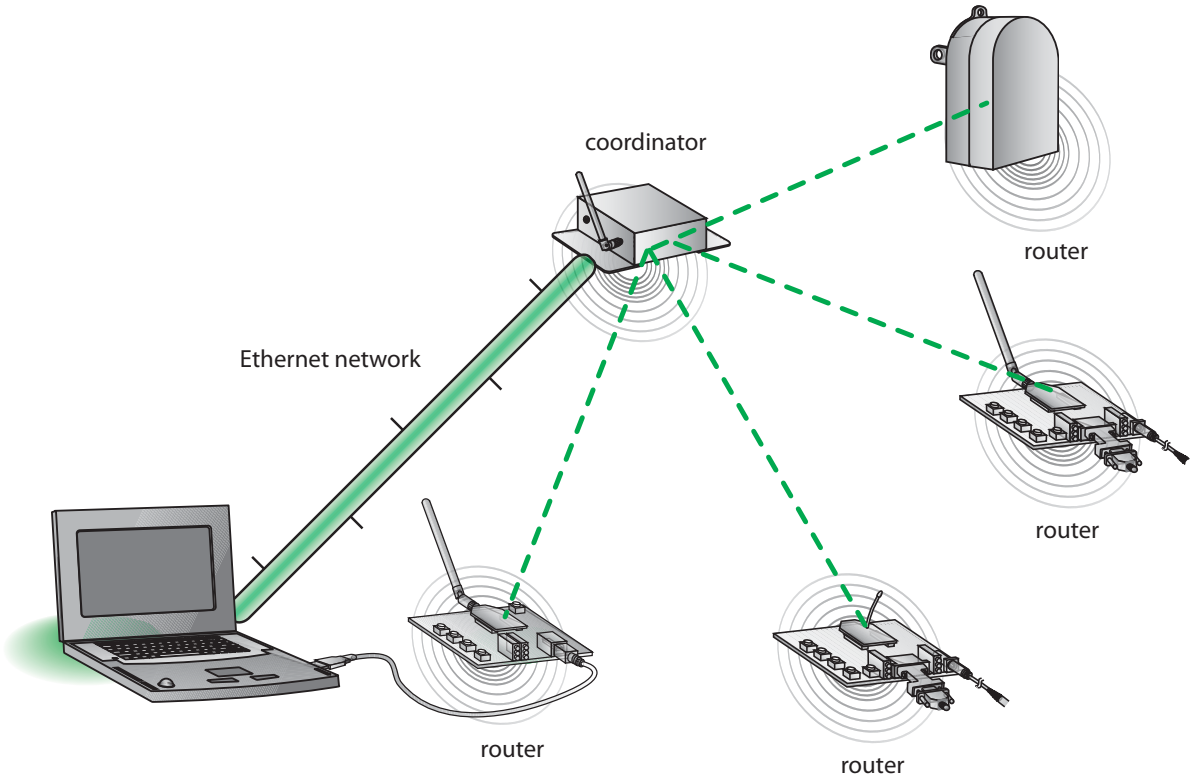


The **Mesh Network** page is displayed. It shows several settings for the the gateway, followed by the **Network View of the Mesh Devices**. In the **Type** column, the XBee module in the gateway is listed as the **coordinator**. The XBee modules in the three interface boards and the XBee Wall Router are listed as **routers**.

The **Clear list before device discovery** check box clears any previously read and displayed network information from the gateway's cache before the device discovery operation occurs.



Here is how the values in the **Type** column are assigned in the network.



4. To refresh the view, click the **Discover Mesh Devices button**.

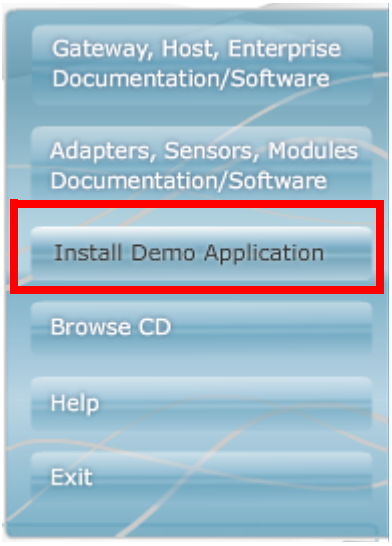
Run gateway and PC demo applications

This kit includes two demo applications: an application that runs on the gateway to discover ZigBee nodes and read temperature and light information from the XBee Wall Router, and an application that runs on your PC and works with the gateway application to display information on your PC. In this step, you will install and run the gateway application.

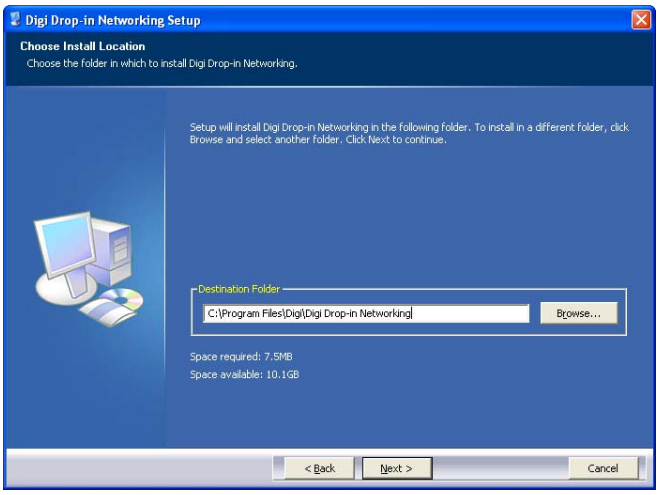
Install Drop-in Networking software/documentation on PC

The gateway demo and PC companion applications are on the Hardware and Software Setup CD. Installing the gateway demo application also creates a Drop-in Networking program group and installs software and documentation.

1. Insert the **Hardware and Software Setup CD** in the CD/DVD drive of the PC. A navigation page for the CD is displayed.
2. In the list of options on the right side of the screen, click **Install Demo Application**.

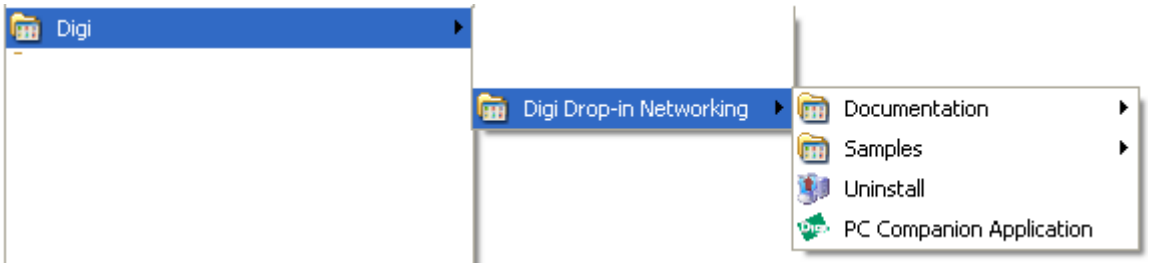


3. The **Digi Drop-in Networking Setup** wizard is launched. Follow the wizard prompts, choosing to install the demo application in the default location.



4. Click **Finish** to complete the wizard.

   The gateway demo application and PC companion application that will be run later are now installed on your PC. In addition, the Drop-in Networking program group was created, which includes documentation, sample programs, and other development resources. To view it, select **Start > Programs > Digi > Digi Drop-in Networking**.



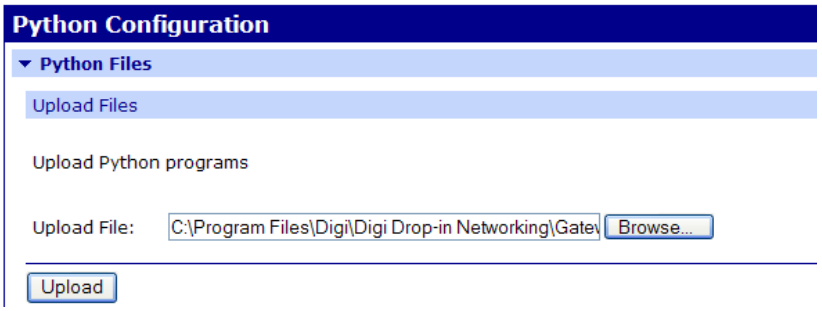
Upload the gateway demo application to gateway

Next, upload the gateway demo application from your PC to the gateway.

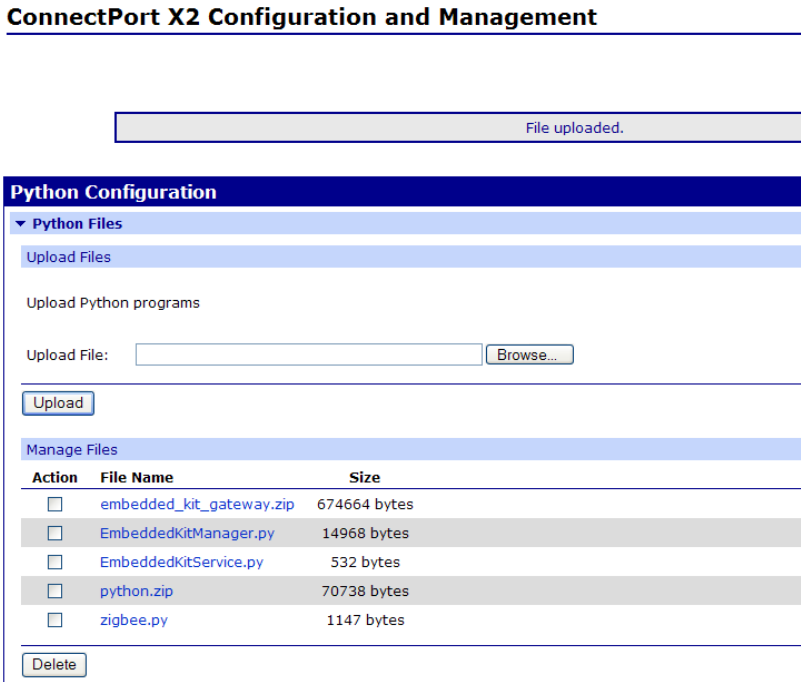
1. Open the web interface for the gateway.
2. From the menu on the left side, go to **Applications > Python**. The Python Configuration page is displayed.
3. In the **Upload File** edit box, use the **Browse** button to navigate to this location: **C:\Program Files\Digi\Digi Drop-in Networking\ Gateway Samples** (substitute your actual root directory as needed). Locate each file and click **Upload**.

   The files to be uploaded are:

   - **embedded_kit_gateway.zip**
   - **EmbeddedKitManager.py**
   - **EmbeddedKitService.py**.

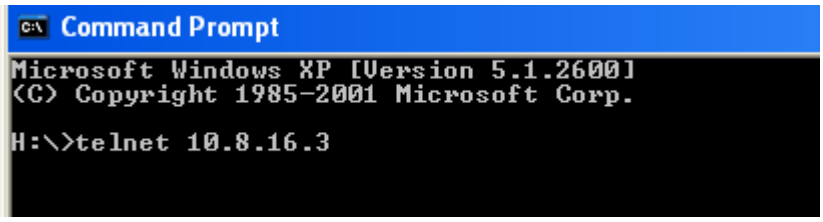


When the files are uploaded, a confirmation message is displayed and the files are displayed in the **Manage Files** list.



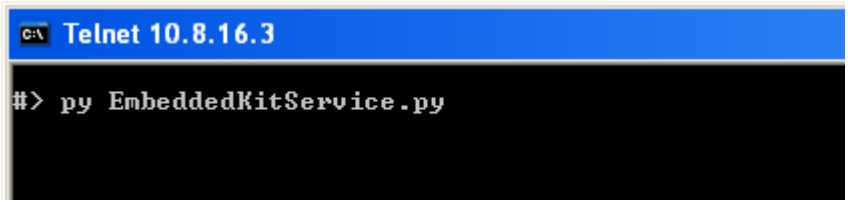
Run the gateway demo application

1. Open a Telnet connection to the gateway, specifying the IP address of the gateway. For example:



2. Run the application by typing the **py** (**python**) command, specifying the name of the gateway demo application. The command is case-sensitive; enter exactly as shown:

   py EmbeddedKitService.py



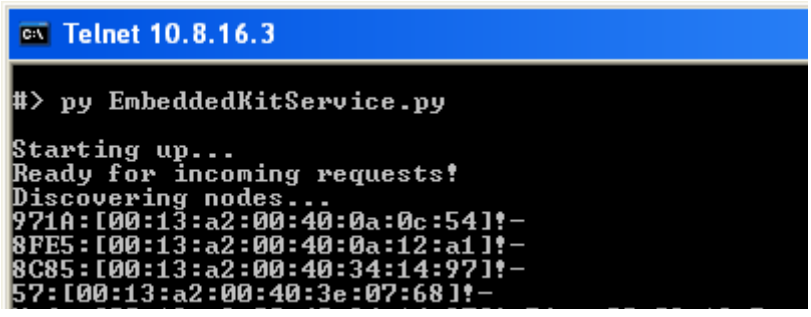
The application will take some time to begin.

To stop the application once it begins, reboot the gateway from the gateway's web interface (**Administration > Reboot**). Later, when the PC companion application is started, you can also shut down the gateway demo application from it.

Display ZigBee nodes

The gateway demo application uses Python programming language functions to do several things.

First, the gateway demo application searches for any ZigBee nodes in the range of the gateway. Four nodes are discovered; they are listed by their MAC addresses:



Assign TCP socket numbers to the nodes

Next, the gateway demo application assigns a TCP port number to each ZigBee node. This assignment is the key link between the ZigBee and Ethernet networks, and allows the demo application to communicate with each ZigBee node over the Ethernet network. This operation occurs without displaying any output in the gateway demo application. Later, when you run the PC companion application, you will see these TCP port numbers displayed (in "Display ZigBee nodes" on page 34; see the values displayed in the **TCP Port** column).

Assigning TCP port numbers to the ZigBee nodes enables any TCPI/IP-based applications to communicate with the ZigBee nodes. To demonstrate this, you can open a serial connection (Telnet) to one of the RS-232 interface boards in the ZigBee network and send data back and forth.

Read temperature and light data from the XBee Wall Router

The gateway demo application reads the temperature and light information from the integrated sensors in the XBee Wall Router.

```
Node:[00:13:a2:00:40:34:14:97]! Time:00:02:19 Temp:22.542522 Light
Node:[00:13:a2:00:40:34:14:97]! Time:00:02:51 Temp:22.542522 Light
```

If there were more XBee products with attached or integrated sensors in the ZigBee network, the gateway demo application would display the data read by these sensors as well.

Additional XBee Sensors, Sensor Adapters and Watchport Sensors can be purchased at the digi online store at **www.digi.com**.

Run the PC companion application

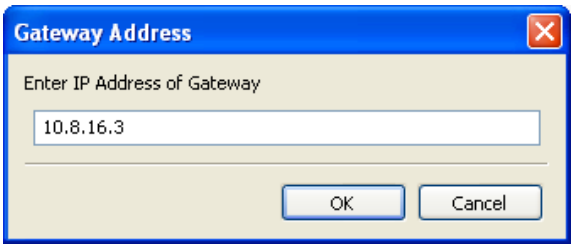
The PC companion application is a Windows application that is used with the gateway demo application, **EmbeddedKitService.py**. It was installed on your PC as part of the Drop-in Networking program group in the previous step. It demonstrates interaction between a Python-based application that runs on a gateway and a Windows application that runs on a PC. It provides an easy way to get and display information from the ZigBee nodes in a Drop-in Network, such as the temperature and light data from the integrated sensors in the XBee Wall Router. When the two applications work together, the gateway demo application handles most of the data reading, and the PC companion application handles displaying the data on the PC.

Start the application

To start the PC companion application:

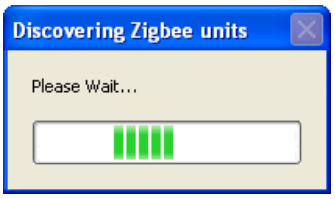
Start > Programs > Digi > Drop-in Networking > Digi PC Companion Application

Enter the IP address of the gateway:



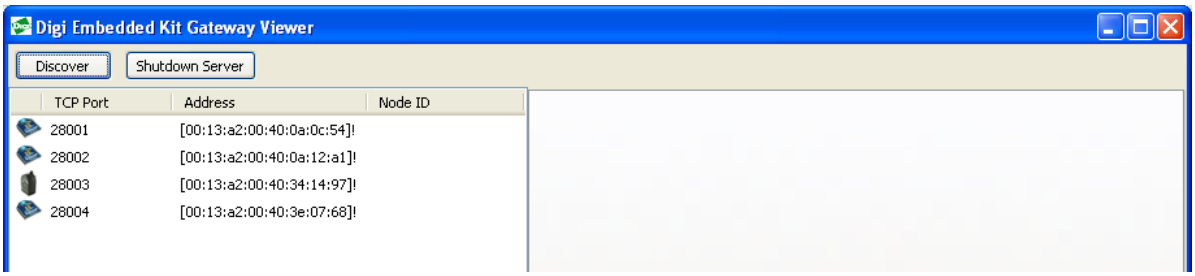
Discover ZigBee nodes

The PC companion application searches for any ZigBee nodes in the range of the gateway. A progress dialog is displayed during this function:



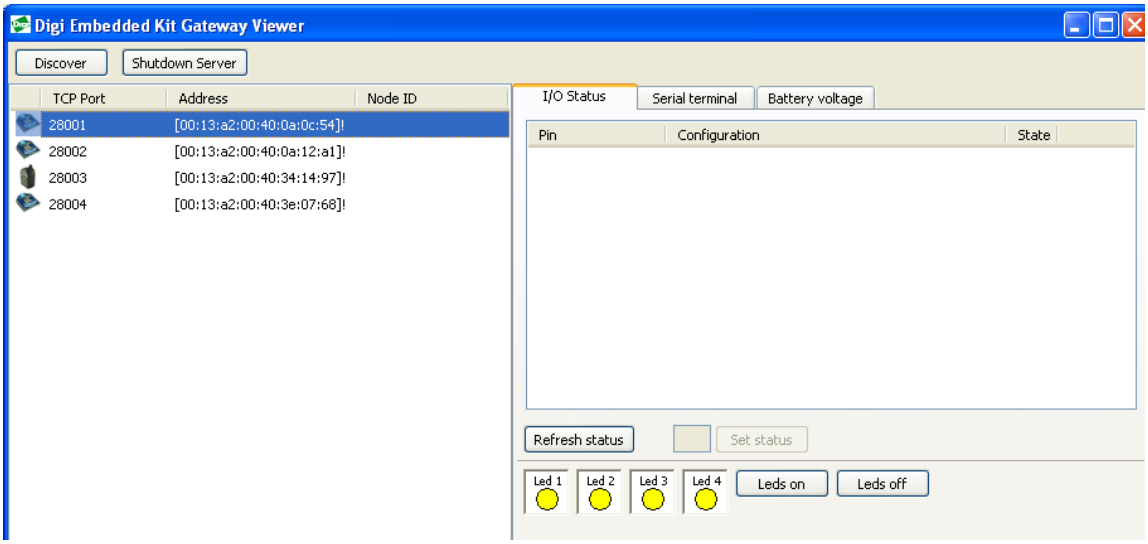
Display ZigBee nodes

The discovered ZigBee nodes are displayed in the **Digi Embedded Kit Gateway Viewer**, in the left window pane. Note the TCP number assigned to each ZigBee node:



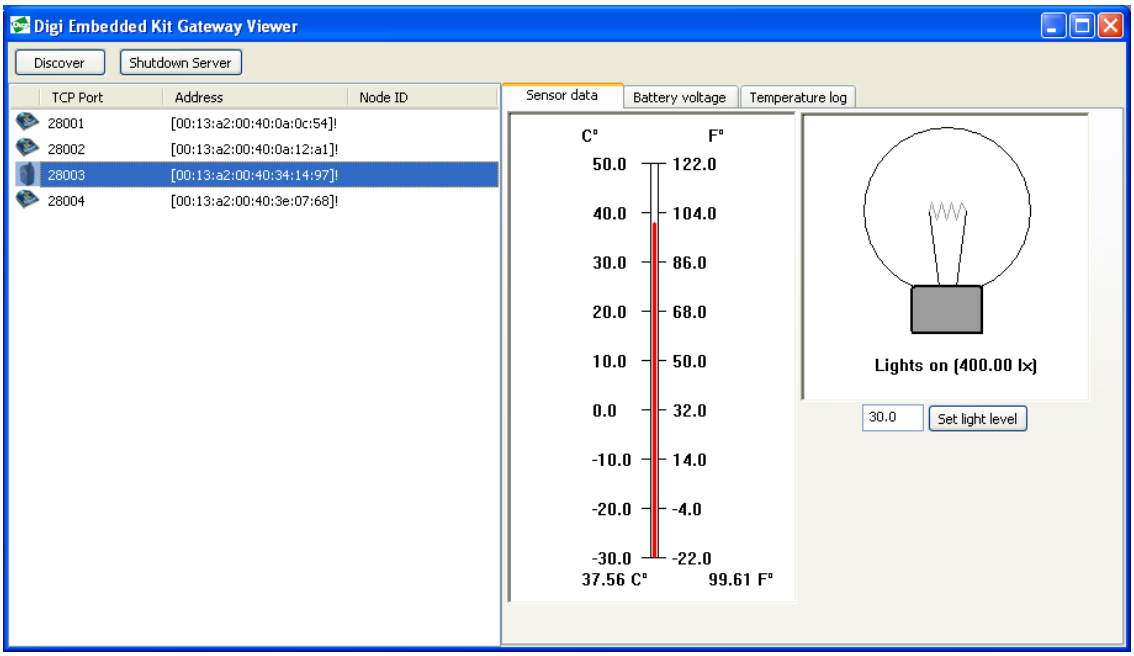
View status and read data from ZigBee nodes

Click on a ZigBee node. In the right pane, several tabs of status information and other data read from the unit are displayed. For example, here is the **I/O Status** tab for one of the interface boards.



Read temperature and light information from the Wall Router

Click on the XBee Wall Router. Temperature and light data from the integrated sensors are displayed in the right pane.



Rediscover ZigBee nodes

Click the **Discover** button to perform another ZigBee node discovery.

Stop the gateway demo application

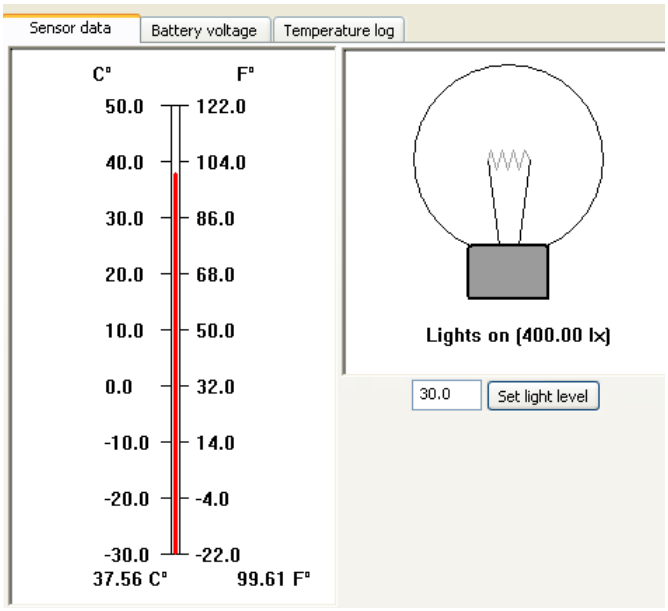
Click **Shutdown Server** to stop the gateway demo application.

Further explore applications and embedded development

The PC companion application demonstrates how you can interact with the gateway application from an external application and with the ZigBee nodes. For example:

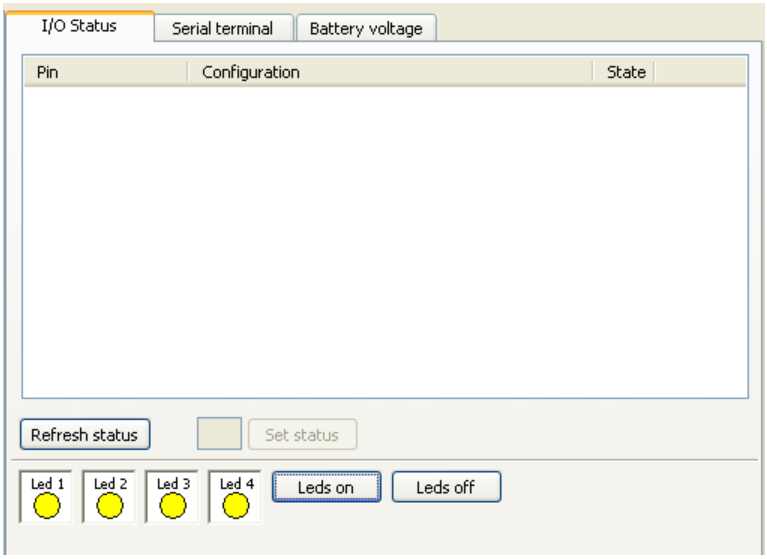
Change light on/off set point on the XBee Wall Router

On the XBee Wall Router, you can change the light level at which point the unit's sensor program considers the lights to be on or off. Select the XBee Wall Router. Enter a different value for the light on/off set point for the light sensor and click **Set Light Level.**



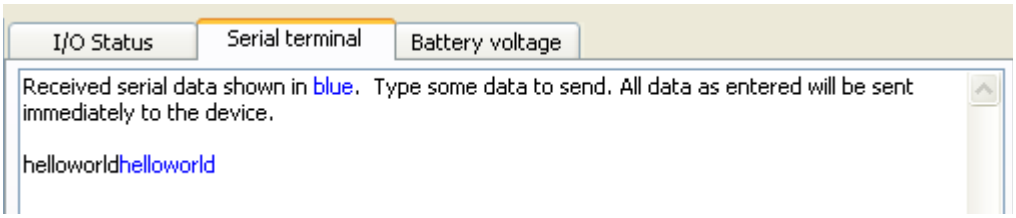
Experiment with I/O using buttons on the interface boards

Select one of the interface boards. On the **I/O Status** tab, click the **Leds on** button. Observe how the LEDs on the interface board, labeled LED 1 through LED 4, are turned on. Click the **Leds off** button and observe how the LEDs are turned off.



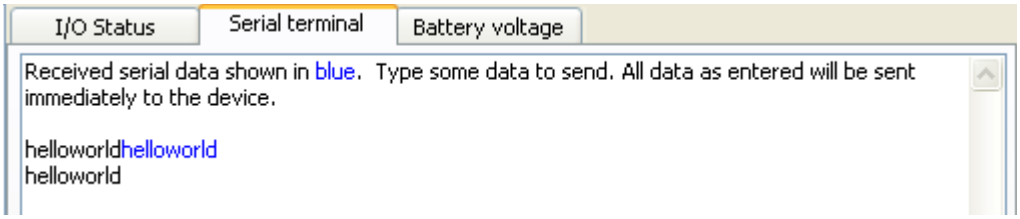
Send/receive serial data using the XBee modules and interface boards

Select one of the RS-232 interface boards and click the **Serial terminal** tab. Type some text. The text transmitted to the interface board is displayed in black. The text returned from the interface board is displayed in blue.



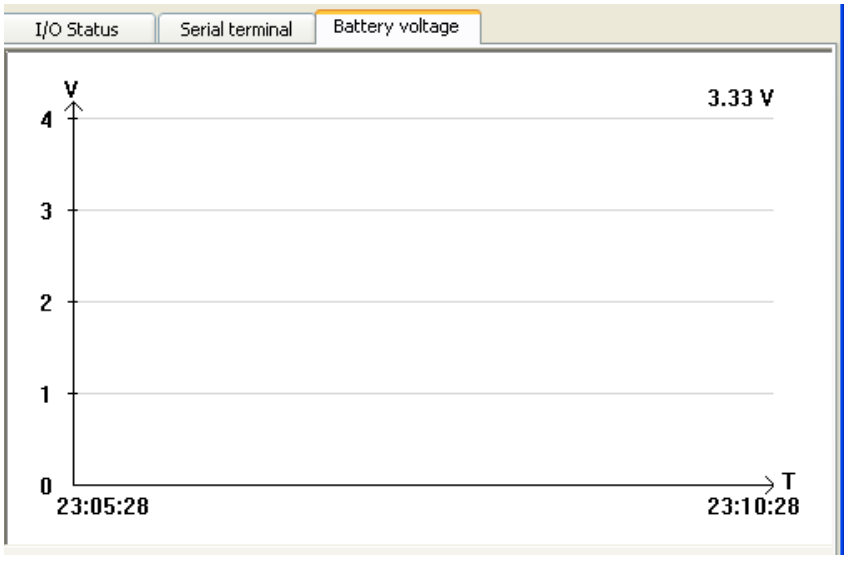
Remove the loopback plug from the interface board.

In the terminal emulator window, type some text again. Note how only black text is displayed, because no text is being returned from the XBee RS-232 Adapter.



Monitor battery/voltage supply on any node

Click the **Battery voltage** tab to display the battery/voltage supply for any ZigBee node. When an XBee module is powered through the interface board, the voltage will always display 3.3VDC.



Change the PC companion application using Python software tools

The PC companion application is written in Python, and serves as an example for Drop-in Networking application development. A great way to get started developing in Python is to change this application.

Python is a dynamic, object-oriented language for developing software applications, from simple programs to complex embedded applications. It includes extensive libraries and works well with other languages. A true open-source language, Python runs on a wide range of operating systems. The *Digi Python Programming Guide* shows how to create and run a simple Python program, reviews Python modules, particularly modules with Digi-specific behavior, and functions used in several Digi sample applications, and shows how to load and run Python programs onto Digi devices, either through the command-line or web user interfaces. This guide is available in the Drop-in Networking program group.

Use Drop-in Networking development resources

Drop-in Networking development resources are available in the Drop-in Networking program group, the Hardware and Software Setup CD, and on the web.

To	Go to
View the source for the gateway demo application	**Start > Digi > Drop-in Networking > Samples > View Gateway Sample source**
View the source for the PC companion application	**Start > Digi > Drop-in Networking > Samples > PC Samples View PC Companion Application source**
View gateway documentation	**Start > Digi > Drop-in Networking > Documentation > Digi ConnectPort X User's Guide**
Learn about the Python functions in the gateway and PC companion applications, and share Python programs with others	**Start > Digi > Drop-in Networking > Documentation > Digi Python Programmers Guide** Visit Digi International's Python Support Forum at: http://www.digi.com/support/forum/forum.jspa?forumID=104 Use this forum to view sample programs, ask questions, and share Python programming information and solutions with other Python developers.
View XBee module documentation	The XBee module product manual on the Hardware and Software Setup CD. On the CD's front page, click **Adapters, Sensors, Modules Documentation/Software**. Click the XBee module image to browse documentation. The product manual describes module features, modes of operation, and commands for controlling the module and retrieving data.
View XBee Wall Router documentation	The XBee Adapters, Routers, and Sensors User's Guide. Download this document from www.digi.com/din/docs/
View more Drop-in Networking documentation	www.digi.com/din/docs/ Browse the Hardware and Software Setup CD. On the CD's front page, click **Browse CD**.
Order additional Drop-in Networking products	Browse the Software and Documentation CD, and go to Digi's Drop-in Networking page at www.digi.com/din/

Plan, deploy, and manage Drop-in Networks

Congratulations!

You have successfully installed the Drop-in Networking Professional Development Kit and exercised the gateway and PC companion demo applications.

As you move from running demo applications to deploying an actual Drop-in Network of XBee wireless network devices, Digi has several products to assist you.

Use Digi XBee planning, commissioning, and deployment tools

The **Network Planner** is a planning tool that allows a network designer to define the topology and characteristics of the network. The network plan created in the planning tool can then be used in the commissioning tool to easily commission an XBee wireless network. Creation of network plans is useful when your networks are fairly large or you need to commission and manage many networks. In a planned network, the terms *plan* and *manifest* may be used interchangeably.

The **Commissioner** is a tool that allows an installer to commission (or install) physical devices on the wireless network. Once the plan has been generated using the network planning tool, the installer may import that file into their commissioning tool and begin commissioning. Alternatively the installer can use the commissioning tool without a plan to perform ad-hoc commissioning of devices if necessary. The commissioning tool is intended to be very easy to use. The tool is available in Windows (Java) and PDA (Windows Mobile) versions.

When commissioning devices, the commissioning tool updates the plan with the physical address of the device associated with the logical device from the network plan. The manifest can then be used later in the network planning tool, the gateway, and Connectware Manager.

For more information and to order these tools, go to **www.digi.com/din**.

Use Connectware Manager

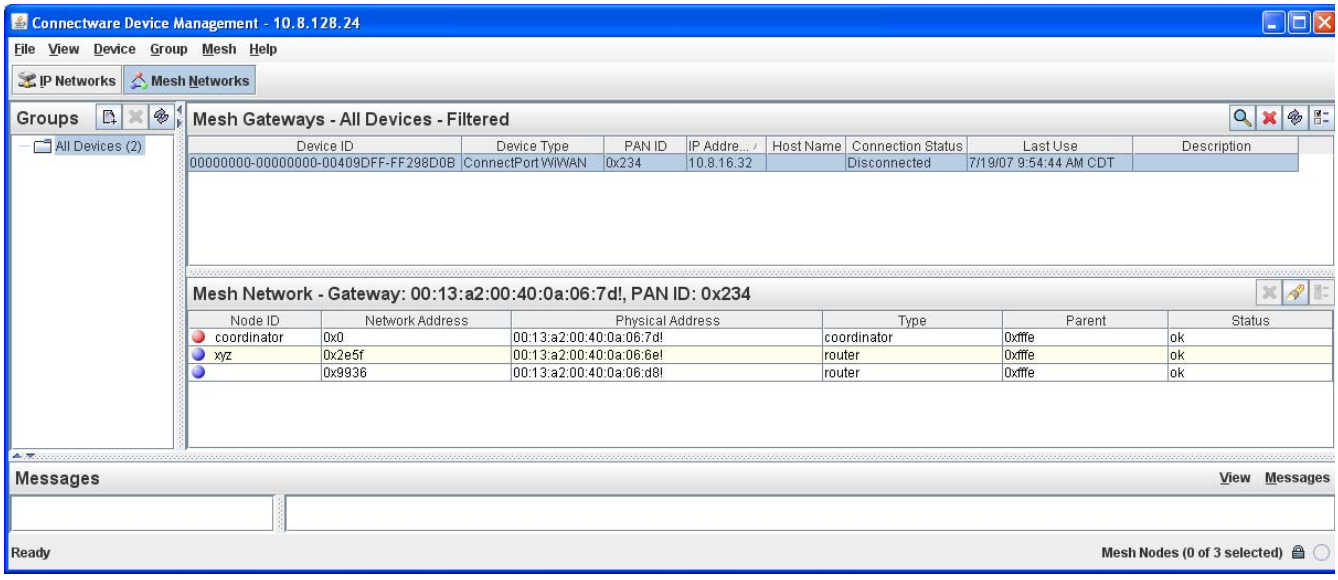
Digi Connectware Manager is a device management platform that provides remote network management of all connected hardware, including devices on the ZigBee network. In contrast to the one-user-to-one-device model of other Digi device interfaces, Digi Connectware Manager deploys a one-user-to-many-devices interface model. From Digi Connectware Manager, you can provision and configure network hardware, track device performance, remotely set filters and alarms, monitor connections, reboot devices and reset defaults, and remotely upgrade firmware. ZigBee extensions to Digi Connectware Manager make it a particularly attractive platform for managing ZigBee devices behind the gateway. It displays all nodes on the ZigBee network with the ability to query for node profiles, node descriptors, connected endpoints, radio configuration settings, radio statistics, bindings, and more.

This kit includes a 30-day trial offer for a live demonstration version of Digi Connectware Manager. In addition, the Hardware and Software Setup CD includes a copy of Digi Connectware Manager that can be installed on your PC.

Digi Connectware Manager displays that are particularly useful for viewing and configuring ZigBee networks are the ZigBee Networks View and detailed views of ZigBee network nodes.

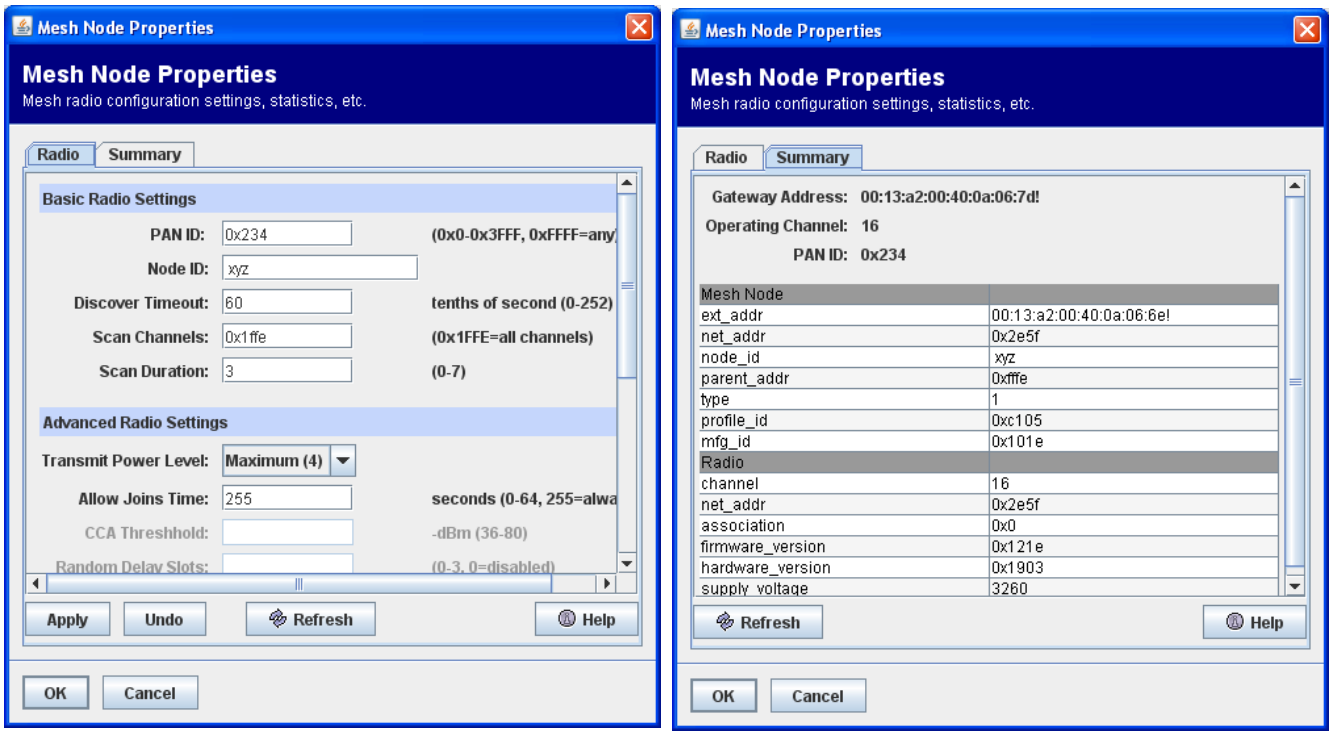
ZigBee Networks View

The **Mesh Networks** device management view of Digi Connectware Manager allows for displaying devices in their ZigBee network, including their node ID, the network to which they belong, physical addresses, their role in the ZigBee network (coordinator, router, or end node), and their defined parent in the ZigBee network.



ZigBee Node Views

From the ZigBee Networks view, more detailed views of devices can be accessed. For example, here are the **Radio** and **Summary** tabs of the **Device Properties** view for a particular ZigBee network node:



Digi Connectware Manager product information

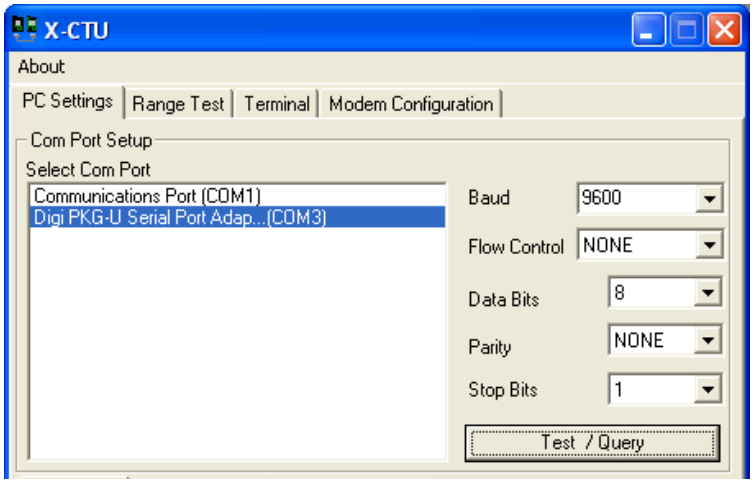
For more information about Digi Connectware Manager, see the *Connectware Manager Getting Started Guide* on the Hardware and Software Setup CD.

Configure low-power mode for battery-powered interface board

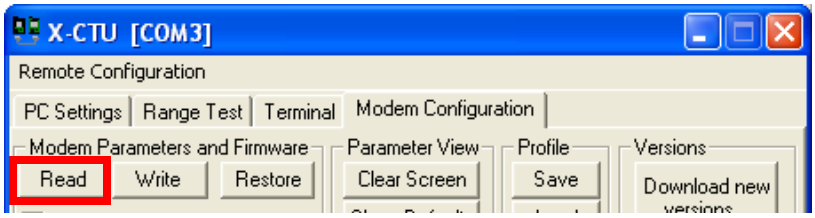
When powering an interface board with batteries, the XBee module on the interface board must be configured to low-power mode before using it. This configuration step is necessary because all XBee modules have a default setting of Sleep Mode = 0 (No Sleep). With this setting, a typical Alkaline 9-volt battery will power the module for less then a day. The sleep mode setting is changed through X-CTU.

To reconfigure the XBee module to Low Power mode:

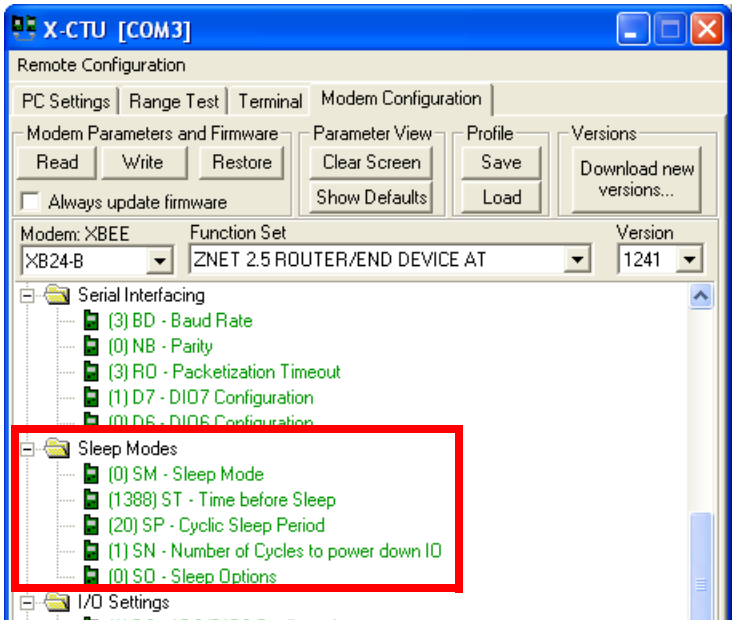
1. Disconnect the power supply from the RS-232 interface board and the USB cable from the USB interface board.
2. Remove the XBee modules from both boards, and Install the RS-232 interface board's XBee module on the USB board.
3. Reconnect the USB cable to the USB interface board.
4. If X-CTU needs to be restarted on the PC, select **Start > Programs > Digi-MaxStream > X-CTU**.
5. On the **PC Settings** tab, establish communications between the PC and USB interface board:
   - Select select the COM port to which the coordinator is attached: **DIGI-PKG-U (Serial Port Adap...)**.
   - Click the **Test/Query** button.



6. Click the **Modem Configuration** tab.
7. Click the **Read** button.



The parameters and settings for the XBee module on the interface board are read and displayed. Scroll down to the **Sleep Modes** settings.



8. Set the Sleep Mode settings as follows:
   - **SM - Sleep Mode**: Set to **4 – Cyclic Sleep**. This setting causes the XBee module to sleep in a period of time (ST) following the last data transmission, and wake up following the Cyclic Sleep Period (SP).
   - **ST - Time before Sleep**: Set to **1388**.

     1388 (hex) = 5000 (dec) X 1ms = 5000 ms = 5 seconds
   - **SP - Cyclic Sleep Period**: Set to **7d0**

     7d0 (hex) = 2000 (dec) x 10ms = 20000 ms = 20 seconds

     Note: For this end node to communicate with the other nodes in direct range, they must also have their **SP** parameter set to **7do**.
9. To write these settings to the XBee module, click the **Write** button.
10. Disconnect the USB cable from the USB interface board.
11. Remove the XBee module from the USB interface board, and install it on the RS-232 interface board.
12. Connect the 9V battery to the battery clip, and connect the battery clip to the power connector on the RS-232 interface board.
13. For all the other ZigBee nodes, including the coordinator/gateway, set the **SP** parameter to **7do**. This setting on the non-sleeping nodes tells them to use appropriate timeouts and delays when communicating with the sleeping node.
14. Verify that the XBee module enters and exits sleep mode. As it enters sleep mode, the red Associate/Power Indicator LED turns off. When it exits sleep mode, the Associate/Power LED turns on again.

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