



XBee™ Adapters, Routers, and Sensors User's Guide

XBee ZNet 2.5 (Series 2) Adapters:

XBee RS-232 Adapter

XBee RS-232 PH (Power Harvester) Adapter

XBee RS-485 Adapter

XBee Analog I/O Adapter

XBee Digital I/O Adapter

XBee Sensor Adapter

XBee USB Adapter

XStick ZNet 2.5

XBee Wall Router

XBee Sensors

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This section includes information that applies to all XBee™ Adapter, Router, and Sensor products.

About this guide

This guide describes the features and functions of XBee Adapter, Router, and Sensor products, including connection and setup information, pinouts, configuration, data retrieval, and LEDs and buttons.

This section provides general information that applies to all products.

Scope

This guide covers all XBee ZNet 2.5 (Series 2) adapter, router, and sensor products.

Compatibility Note

Two sets of XBee and XBee-PRO adapters are offered: Series 1 and Series 2. Though overall performance and product specifications are largely similar, the two series are built on distinct and non-compatible technology platforms. Thus, users must standardize on one series or the other for operability. The same is true for compatibility with the ConnectPort X gateways. Series 1 XBee adapters are compatible only with Series 1 gateways, while Series 2 XBee adapters are compatible only with Series 2 gateways.

Mounting orientation

All XBee Adapters can be mounted in any orientation.

Warranty exception for batteries

Some XBee Adapters and Sensor products ship with alkaline batteries that must be replaced by the user when discharged and are not covered under the terms and conditions of the Digi warranty.

Lithium batteries must be replaced by qualified service personnel.

Additional reference material

For additional information about the features and functions of XBee RF modules in XBee Adapters, see these documents.

XBee Adapters data sheet

http://www.digi.com/pdf/ds_xbeeadapters.pdf

XBee Wall Router data sheet

http://www.digi.com/pdf/ds_xbeewallrouter.pdf

These data sheets provide overviews of XBee Adapter and Wall Router products, features and benefits, and specifications.

XBee ZNet 2.5 (Series 2) RF Module Product Manual

http://ftp1.digi.com/support/documentation/90000866_A.pdf

Describes the XBee module embedded in your product, including features, modes of operation, ZigBee and XBee network fundamentals, and commands for configuring, controlling, and retrieving data from the XBee module.

ConnectPort X Family User's Guide (90000832)

http://ftp1.digi.com/support/documentation/90000832_a.pdf

When XBee Adapter, Router, and Sensor products are deployed in Drop-in Networks, a ConnectPort X gateway serves as a coordinator and configuration and monitoring interface for your adapter/router/sensor product. See this guide to learn more about ConnectPort X features and functions.

Related ConnectPort X documentation

<http://www.digi.com/support/supporttype.jsp?tp=3>

An extensive list of related documentation for ConnectPort X gateways is available on digi.com; go to **Support > Documentation** and select the appropriate ConnectPort X model.

Digi Python Programming Guide (90000833)

http://ftp1.digi.com/support/documentation/90000833_b.pdf

Python Support Forum on digi.com

<http://www.digi.com/support/forum/forum.jspa?forumID=104>

Python is a dynamic, object-oriented language for developing software applications, from simple programs to complex embedded applications. Python functions can be used to obtain data from integrated sensors on XBee Adapter, Router, and Sensor products.

The *Digi Python Programming Guide* introduces the Python programming language by showing how to create and run a simple Python program. It reviews Python modules, particularly those modules with Digi-specific behavior. It describes how to load and run Python programs onto Digi devices, either through the command-line or web user interfaces, and how to run several sample Python programs.

Questions and technical support

For technical assistance with your product, contact Digi Technical Support at: **801-765-9885** or **877-912-3444**

or make an online support request at:

<http://www.digi.com/support/index.jsp>

Overview

The XBee RS-232 Adapter provides short range wireless connectivity to any RS-232 serial device, with available solutions for both mesh (including ZigBee) and point-to-multipoint networks. Unlike an embedded wireless module, which requires design integration and development time, these off-the-shelf adapters provides instant wireless connectivity to existing RS-232 serial devices. All XBee adapters can be used with Digi's ConnectPort X gateways for data aggregation and IP connectivity.

Power options

Depending on adapter model, there are several powering options.

Alkaline battery model

This product can be powered by a 9-30VDC external power supply (see "Power requirements" on page 67) or by batteries. Use 3x1.5V "N" alkaline battery cells. To install batteries, insert a screwdriver in the slots in the side of the adapter case and twist to snap off the cover. Insert the batteries following the polarity diagram on the board.

Lithium battery model

This model can be powered by a 3-6VDC external power supply or by 2/3 AA 3.6V lithium batteries and a 1/2 AA boost capacitor. Replacement batteries available for purchase; contact Digi at **952-912-3444** or **877-912-3444**.

Connection and power-on

1. Connect the desired device to the RS-232 port of the adapter.
2. Connect the power supply to the adapter or insert batteries.

Pinouts

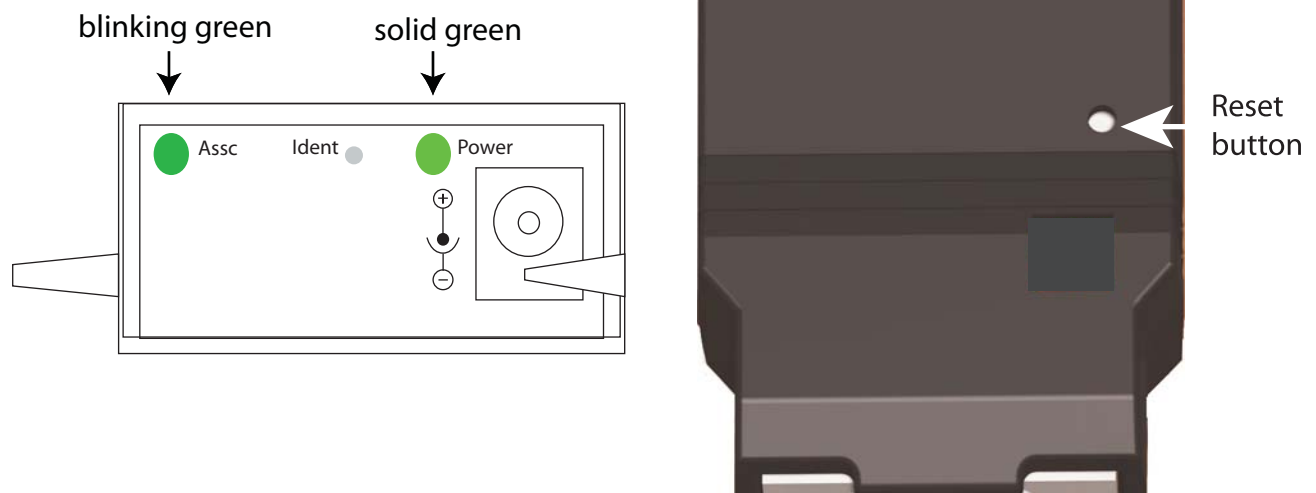
The RS-232 connector is an industry-standard DB9 male connector with a DTE configuration, similar to a PC serial port. Pinouts for the connector are:

| Pin | Function | Data direction |
|-----|---------------------------|----------------|
| 1 | CD | Input |
| 2 | RXD | Input |
| 3 | TXD | Output |
| 4 | DTR | Output |
| 5 | GND | |
| 6 | DSR | Input |
| 7 | RTS | Output |
| 8 | CTS | Input |
| 9 | +12VDC switched power out | Output |

Data retrieval

Retrieving data from XBee adapters is done by issuing a remote AT IS (Force Sample) command through the XBee API. The XBee API and AT IS command are described in detail in the XBee ZNet 2.5 (Series 2) RF Module data sheet. AT IS commands can be issued via a Python program that is executed on the gateway. See also the *Product Manual* for the XBee Module and the *Digi Python Programming Guide*.

LEDs and buttons



Power LED: Indicates that power is on. Illuminated only when adapter is connected to external power only, not when powered by batteries. Not available in lithium-battery models.

Assc LED: Indicates the adapter’s ZigBee network association status:

| LED status | Network association |
|--------------------|---------------------|
| On, solid green | Not associated |
| On, blinking green | Successfully joined |

Reset button: Recessed button on underside of the adapter. Performs equivalent of a power-cycle. Use a small non-conductive tool with a blunt end to press gently and hold down button.

Ident button: Recessed button on power end of the adapter between **Assc** and **Power** LEDs. Performs multiple functions for commissioning the adapter in a ZigBee network. Consecutive button presses must occur within 800ms second of each other to perform the desired action.

| Button press | Network association | Action |
|--------------|-----------------------------|---|
| Single | Associated | <ul style="list-style-type: none"> If adapter is asleep, wakes unit for 30 seconds. Sends a Node Identification broadcast transmission. <p>All devices that receive this transmission will blink their Associate LED rapidly for 1 second.</p> <p>All API devices that receive this transmission will send a Node Identification frame out their UART (universal asynchronous receiver/transmitter) (API ID 0x95).</p> |
| | Unassociated | <ul style="list-style-type: none"> If adapter is asleep, wakes unit for 30 seconds. Blinks a numeric error code on the Assc LED, indicating the cause of join failure. <p>1 blink: Scan found no PANs.</p> <p>2 blinks: Scan found no valid PANs based on current SC (Scan Channel) and ID (PAN ID) settings.</p> <p>3 blinks: Valid Coordinator or Routers found, but they are not allowing joining (NJ expired).</p> <p>7 blinks: Node Joining attempt failed.</p> <p>10 blinks: Coordinator Start attempt failed.</p> |
| Two | Associated | Temporarily enables joining on the adapter 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. |
| Four | Associated/ Unassociated | Adapter leaves PAN, if associated, and issues a factory reset to restore default parameters. Default PAN ID is 0x234. |

XBee RS-232 PH Adapter

Overview

The XBee RS-232 PH Adapter provides short range wireless connectivity to any RS-232 serial device, with available solutions for both mesh (including ZigBee) and point-to-multipoint networks. Unlike an embedded wireless module, which requires design integration and development time, these off-the-shelf adapters provides instant wireless connectivity to existing RS-232 serial devices. All XBee adapters can be used with Digi's ConnectPort X gateways for data aggregation and IP connectivity

Using a powering mode known as power harvesting (PH), this adapter is powered by the connected host device through its RS-232 serial port.

Power requirements

This product requires a fully functional serial port conforming to the RS-232C standard for optimal operation. It requires a sleep/wake duty cycle as part of its normal operation. An internal battery provides power when the adapter is operating, and recharges from the serial port when in sleep mode. The sleep/wake duty cycle requirements vary based on the current output of serial port

Serial ports that provide hard power of 5 to 14VDC on one or more pins allow the device to operate continually without a sleep/wake cycle.



WARNING: Do not use this adapter with serial ports with more than 14VDC output as they may cause the adapter to malfunction.

Connection and power-on

Connect the adapter to the RS-232 port of the host device.

The adapter's power comes from the host's serial port.

Pinouts

The RS232 connector is an industry-standard DB9 male connector with a DTE configuration, similar to a PC serial port. Pinouts for the connector are:

| Pin | Function | Data direction |
|-----|----------|---|
| 1 | CD | Input Also used for parasitic power input from host. |
| 2 | RXD | Input Also used for parasitic power input from host. |
| 3 | TXD | Output |
| 4 | DTR | Output |
| 5 | GND | |
| 6 | DSR | Input Also used for parasitic power input from host. |
| 7 | RTS | Output |
| 8 | CTS | Input Also used for parasitic power input from host. |
| 9 | RI | Input Also used for parasitic power input from host. |

Configuration

There are four key attributes of the Serial PH adapter's firmware that allow it to have a net charge on its batteries:

- Sleep Mode (SM)
- Idle Time (ST)
- Sleep Period (SP)
- Sleep Number (SN)

Sleep mode, determines what sleeping behavior the adapter has. By default the adapter has cyclical sleep enabled. With cyclical sleep enabled, if the adapter is idle (No RS-232 traffic, no transmit/receive) for the given amount of Idle Time, it then performs Sleep Number amount of sleeping cycles, each for the duration of the value of Sleep Period.

The default sleep mode settings are:

- SM = 4 (Cyclical sleep enabled)
- ST = 0x3E8 (Idle time of 1 second)
- SP = 0x40 (Each sleep period's duration is 640 ms)
- SN = 1 (Perform 1 sleep period when sleeping)

For this configuration, the adapter would sleep for a total of 640 ms when performing a sleep period, after it was idle for 1 second. During an RF receive/transmit, the device is in an active state for a significant amount of time, regardless of the Idle Time setting. If continuous requests/queries are made to the device, it will stay in an active state, which can lead to a net discharge of the battery, and eventually the adapter will become unresponsive.

Adjusting the default settings is not recommended. Doing so can lead to unit that will not power on. The fix is to remove the module from the adapter and plug it into the serial line. Then, you can adjust these parameters through X-CTU software. This software is available on the Software and Documentation CD that accompanies Drop-in Networking kits and ConnectPort X gateways.

The battery can take up to 24 hours to fully charge, and if the unit is run in the worst-case scenario, no sleep mode enabled and continuously queried, the battery has only a charge for around 40 minutes. After that, the unit will become unresponsive. In addition, if the unit isn't immediately put into a sleep mode after the battery first becomes unable to power the adapter, the battery will further deplete, and you will have to perform the fix mentioned above to recover the device.

Data retrieval

Retrieving data from XBee adapters is done by issuing a remote AT IS (Force Sample) command through the XBee API. The XBee API and AT IS command are described in detail in the XBee ZNet 2.5 (Series 2) RF Module data sheet. AT IS commands can be issued via a Python program that is executed on the gateway. See also the *Product Manual* for the XBee Module and the *Digi Python Programming Guide*.

LEDs and buttons



Assoc LED: Indicates the adapter’s ZigBee network association status:

| LED status | Network association |
|--------------------|---------------------|
| On, solid green | Not associated |
| On, blinking green | Successfully joined |

Reset button: Performs equivalent of a power-cycle. Use a small non-conductive tool with a blunt end to press gently and hold down button.

Ident button: Performs multiple functions for commissioning the adapter in a ZigBee network. Consecutive button presses must occur within 800 ms of each other to perform the desired action.

| Button press | Network association | Action |
|--------------|-----------------------------|---|
| Single | Associated | <ul style="list-style-type: none"> If adapter is asleep, wakes unit for 30 seconds. Sends a Node Identification broadcast transmission. All devices that receive this transmission will 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). |
| | Unassociated | <ul style="list-style-type: none"> If adapter is asleep, wakes unit for 30 seconds. Blinks a numeric error code on the Assc LED, indicating the cause of join failure. <ul style="list-style-type: none"> 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. |
| Two | Associated | Temporarily enables joining on the adapter 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. |
| Four | Associated/ Unassociated | Adapter leaves PAN, if associated, and issues a factory reset to restore default parameters. Default PAN ID is 0x234. |

Overview

The XBee RS-485 PH Adapter provides short range wireless connectivity to any RS-485 serial device, with available solutions for both mesh (including ZigBee) and point-to-multipoint networks. Unlike an embedded wireless module, which requires design integration and development time, these off-the-shelf adapters provides instant wireless connectivity to existing RS-485 serial devices. All XBee adapters can be used with Digi's ConnectPort X gateways for data aggregation and IP connectivity

Power options

Depending on adapter model, there are several powering options.

Alkaline battery model

This product can be powered by a 9-30VDC external power supply (see "Power requirements" on page 67) or by batteries. Use 3x1.5V "N" alkaline battery cells. To install batteries, insert a screwdriver in the slots in the side of the adapter case and twist to snap off the cover. Insert the batteries following the polarity diagram on the board.

Lithium battery model

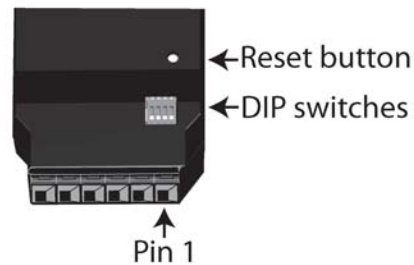
This model can be powered by a 3-6VDC external power supply or by 2/3 AA 3.6V lithium batteries and a 1/2 AA boost capacitor. Replacement batteries available for purchase; contact Digi at **952-912-3444** or **877-912-3444**.

Connection and power-on

1. Connect the desired device to the RS-485 port of the adapter.
2. Connect the power supply to the adapter or insert batteries.

Pinouts

The connector for the adapter is a 6-position wire terminal block. The figure shows Pin 1 of the connector when the adapter is oriented with the mounting tabs, facing upwards (the underside of the adapter).



The adapter is switch-selectable between RS-422 half duplex, RS-422 full duplex, and RS-485 modes (see DIP switches, below). The function for several pins varies between RS-422 and RS-485 modes.

Facing the connector, with the screwdriver release slots up, going from right to left, the pinouts are:

| Pin | Function in RS-422 mode | Function in RS-485 mode |
|-----|------------------------------------|------------------------------------|
| 1 | TxD+ (RS422) | TxD+ and RxD+ (RS485) |
| 2 | TxD- (RS422) | TxD- and RxD- (RS485) |
| 3 | RxD+ (RS422) | Not used. |
| 4 | RxD- (RS422) | Not used. |
| 5 | Ground | Ground |
| 6 | +12VDC 50mA max switched power out | +12VDC 50mA max switched power out |

The connector accommodates wire gauges from 16AWG to 30AWG.

To insert or remove wires, insert a screwdriver blade in the slot directly below the hole where the wire inserts. Press down on the spring to open up the hole and insert or remove the wire.

DIP switches

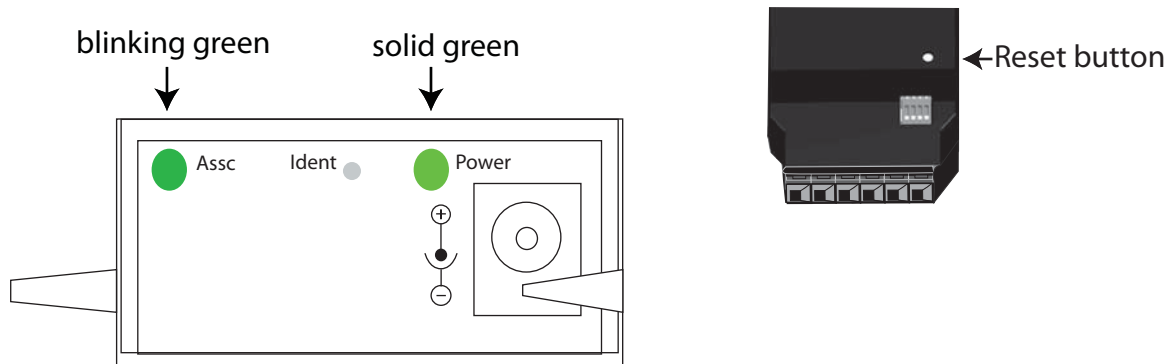
The XBee RS-485 Adapter has several DIP switches on the underside of the unit, with these settings:

| DIP Switch | Switch settings |
|------------|--|
| 1 | Not used. It is covered up by the case and not accessible. |
| 2, 3, 4 | ON = RS485 OFF = RS422 |
| 5, 6 | ON = RS485 Bias and line termination on. OFF = RS485 Bias and line termination off. Note: Bias and line termination feature can be used only when powering from the external power supply. |

Data retrieval

Retrieving data from XBee adapters is done by issuing a remote AT IS (Force Sample) command through the XBee API. The XBee API and AT IS command are described in detail in the XBee ZNet 2.5 (Series 2) RF Module data sheet. AT IS commands can be issued via a Python program that is executed on the gateway. See also the *Product Manual* for the XBee Module and the *Digi Python Programming Guide*.

LEDs and buttons



Power LED: Indicates that power is on. Illuminated only when adapter is connected to external power only, not when powered by batteries. Not available in lithium-battery models.

Assc LED: Indicates the adapter's ZigBee network association status:

| LED status | Network association |
|--------------------|---------------------|
| On, solid green | Not associated |
| On, blinking green | Successfully joined |

Reset button: Recessed button on underside of the adapter. Performs equivalent of a power-cycle. Use a small non-conductive tool with a blunt end to press gently and hold down button.

Ident button: Recessed button on power end of the adapter between **Assc** and **Power** LEDs. Performs multiple functions for commissioning the adapter in a ZigBee network. Consecutive button presses must occur within 800 ms of each other to perform the desired action.

| Button press | Network association | Action |
|--------------|-----------------------------|---|
| Single | Associated | <ul style="list-style-type: none"> If adapter is asleep, wakes unit for 30 seconds. Sends a Node Identification broadcast transmission. <p>All devices that receive this transmission will blink their Associate LED rapidly for 1 second.</p> <p>All API devices that receive this transmission will send a Node Identification frame out their UART (universal asynchronous receiver/transmitter) (API ID 0x95).</p> |
| | Unassociated | <ul style="list-style-type: none"> If adapter is asleep, wakes unit for 30 seconds. Blinks a numeric error code on the Assc LED, indicating the cause of join failure. <p>1 blink: Scan found no PANs.</p> <p>2 blinks: Scan found no valid PANs based on current SC (Scan Channel) and ID (PAN ID) settings.</p> <p>3 blinks: Valid Coordinator or Routers found, but they are not allowing joining (NJ expired).</p> <p>7 blinks: Node Joining attempt failed.</p> <p>10 blinks: Coordinator Start attempt failed.</p> |
| Two | Associated | Used only when network joining is permanently enabled (by the XBee Module's NJ setting being set to anything other than OFF; in the gateway, this setting is known as Allows Join Time=255). Temporarily allows joining on the adapter and the entire ZigBee network for 1 minute. |
| Four | Associated/ Unassociated | Adapter leaves PAN, if associated, and issues a factory reset to restore default parameters. Default PAN ID is 0x234. |

Overview

The XBee Analog I/O Adapter provides short range wireless connectivity to any analog device, with available solutions for both mesh (including ZigBee) and point-to-multipoint networks. Unlike an embedded wireless module, which requires design integration and development time, these off-the-shelf adapters provides instant wireless connectivity to existing analog devices. All XBee adapters can be used with Digi's ConnectPort X gateways for data aggregation and IP connectivity.

The XBee Analog I/O adapter allows for several potential interfaces to analog devices. It provides greater flexibility and uses than the Digi XBee Sensor Adapter and XBee Sensor products, in that:

- It can be used with a variety of off-the-shelf sensor products.
- It can be used in situations when the item being measured or analyzed needs to be separated from the sensor/measuring device itself.

Analog Modes

The XBee Analog I/O Adapter has three modes in which it can measure input on its four terminal lines.

- **0-10 volt mode:** The device measures the voltage on a scale of 1 to 10 volts, and translates it into a 10-bit scale from 0 to 1023 as possible values.
- **Current Loop (4 mA to 20 mA) mode:** The device measures the amperage on a scale of 4 mA to 20 mA, and translates it into a 10-bit scale from 0 to 1023 as possible values.
- **Differential input mode:** The device measures paired terminals (1 and 2 paired, 3 and 4 paired) and translates the difference in voltage between the two lines to into a 10-bit scale from 0 to 1023 as possible values.

A Python module named **xbeeain.py** is available to set the analog mode; see pages 24 and 25.

Power options

Depending on adapter model, there are several powering options.

Alkaline battery model

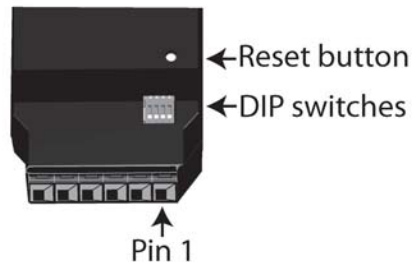
This product can be powered by a 9-30VDC external power supply (see "Power requirements" on page 67) or by batteries. Use 3x1.5V "N" alkaline battery cells. To install batteries, insert a screwdriver in the slots in the side of the adapter case and twist to snap off the cover. Insert the batteries following the polarity diagram on the board.

Lithium battery model

This model can be powered by a 3-6VDC external power supply or by 2/3 AA 3.6V lithium batteries and a 1/2 AA boost capacitor. Replacement batteries available for purchase; contact Digi at **952-912-3444** or **877-912-3444**.

Connection and power-on

1. Connect the wires for the desired analog device to the connector for the adapter. The connector accommodates wire gauges from 16AWG to 30AWG. The connector for the adapter is a 6-position wire terminal block. The figure shows Pin 1 of the connector when the adapter is oriented with the mounting tabs, facing upwards (the underside of the adapter).



To insert or remove wires, insert a screwdriver blade in the slot directly below the hole where the wire inserts. Press down on the spring to open up the hole and insert or remove the wire.

2. Connect the power supply to the adapter or insert batteries.

Pinouts

Facing the connector, with the screwdriver release slots down, going from right to left, the pinouts are:

| Pin | Analog Mode | | |
|-----|------------------------------------|------------------------------------|------------------------------------|
| | Ten Volt | Current Loop | Differential |
| 1 | 0-10 Volt | 4-20 mA | Terminal Pair 1 positive |
| 2 | 0-10 Volt | 4-20 mA | Terminal Pair 1 negative |
| 3 | 0-10 Volt | 4-20 mA | Terminal Pair 2 positive |
| 4 | 0-10 Volt | 4-20 mA | Terminal Pair 2 negative |
| 5 | Ground | Ground | Ground |
| | +12VDC 50mA max switched power out | +12VDC 50mA max switched power out | +12VDC 50mA max switched power out |

DIP switches

The XBee Analog I/O Adapter has several DIP switches on the underside of the unit, with these settings:

| DIP Switch | Switch settings |
|------------|--|
| 1 | Enables and disables direct battery pack voltage output. On=battery power out Off=no battery power out |
| 2 | Enables and disables +12V power out. On=+12V power out Off=no +12V power out |
| 3 | Not used |
| 4 | Not used |

Note: Switches 1 and 2 should not be on at the same time as increased parasitic battery drain will result.

Configuring inputs and outputs

Input selection

Six control lines from the XBee module are used to place the four external terminals into the desired input mode.

The power-on default is 0-10VDC on all four terminals.

Set the analog mode

The AT commands D8, D4, and D6 set the analog mode for terminals 1 and 2. P0, D7, and P2 set the mode for terminals 3 and 4. All other configurations are invalid. A Python module named `xbeeain.py` is available to set the analog mode; see pages 24 and 25.

| Terminal | Analog Mode | Terminal | Analog Mode | AT Commands | | |
|------------|--------------|------------|--------------|-------------|----|----|
| | | | | D8 | D4 | D6 |
| Terminal 1 | Current Loop | Terminal 2 | Current Loop | 0 | 0 | 0 |
| | Current Loop | | Ten Volt | 0 | 0 | 1 |
| | Ten Volt | | Current Loop | 0 | 1 | 0 |
| | Ten Volt | | Ten Volt | 0 | 1 | 1 |
| | Differential | | Differential | 1 | 0 | 0 |
| | | | | P0 | D7 | P2 |
| Terminal 3 | Current Loop | Terminal 4 | Current Loop | 0 | 0 | 0 |
| | Current Loop | | Ten Volt | 0 | 0 | 1 |
| | Ten Volt | | Current Loop | 0 | 1 | 0 |
| | Ten Volt | | Ten Volt | 0 | 1 | 1 |
| | Differential | | Differential | 1 | 0 | 0 |

Enable a terminal line for measurement

To enable a terminal line for measurement, the following analog I/O lines have to be set to value **2**:

- D0
- D1
- D2
- D3

D0, D1, D2, and D3 represent terminal lines 1, 2, 3, and 4 respectively. In the case of a terminal pair in differential mode, only the first terminal of the terminal pair should be enabled. To disable a terminal line, set the respective analog I/O line to value 0.

Input specifications and characteristics

| Analog mode | Specification | Value |
|-----------------------------------|-------------------------------|-----------------------|
| 0-10 volt mode | Full-scale input | 10.25 VDC |
| | Minimum input | 0 VDC |
| | Maximum safe input | 11VDC |
| | Minimum safe input | -.5VDC |
| | Input impedance | 28200 ohms |
| Current Loop (4 mA to 20 mA) mode | Full-scale input | 23.5mA |
| | Minimum input | 0mA |
| | Maximum safe input | 40mA |
| | Minimum safe input | -.5VDC |
| | Input impedance | 51.1 ohms |
| +/- 2 VDC differential mode | Full-scale input | +2.4 VDC differential |
| | 0V differential | Half-scale reading |
| | -2V differential | Minimum-scale reading |
| | Maximum safe input (each pin) | 11VDC |
| | Minimum safe input (each pin) | -.5VDC |
| | Input impedance | ~1 Megaohm |



Exceeding the maximum or minimum safe input values will result in damage to the unit.

Power output specifications

External terminal 6 is a power-out pin. It can be set to either battery pack voltage out or +12VDC at 50mA out via DIP switches 1 and 2.

External terminal 5 is a system ground pin. This ground pin should be used for all external ground connections for both power and input connections.

DIP switch 1 enables battery pack voltage minus .5VDC to terminal 6, resulting in 4VDC out with new alkaline batteries, or 3.1VDC with new lithium battery. DIP switch 2 enables +12VDC to terminal 6. Only one switch should be on at a time. No damage will happen if both are set to on, but the output will default to the +12VDC output and increased parasitic battery drain will result.

The battery pack voltage is on terminal 6 all the time, and is not gated with the sleep of the module when DIP switch 2 is on. Any current draw from terminal 6 will result in reduced battery life.

When DIP switch 2 is on, the +12VDC at 50mA max is provided at terminal 6. This power is gated by both the sleep of the module and AT command P3. For this power setting to be on, the XBee module needs to be awake and AT command P3 set to a high level.

Python modules for configuring inputs and outputs

Digi provides a library of Python modules for configuring inputs and outputs on the adapter and retrieving data from the adapter. These modules are available for downloading from www.digi.com/din/docs, in a file named **XBee Adapter Libraries**. By uploading these Python modules to the gateway that serves as a coordinator for the adapter, you can use them in your own programs.

Python module descriptions

The Python modules in the XBee Adapter Libraries that are relevant to programming the XBee Analog I/O Adapter are:

| Module | Description |
|---------------|--|
| xbeeprodid.py | Contains calls to determine the type of adapter; (Analog, Digital, Sensor, RS-232, etc.) |
| xbeedevic.py | Implements a base class of any XBee device on the ZigBee network. |
| xbeeain.py | Configures analog mode, issues AT commands to retrieve data from the adapter, including raw analog sample data and sensor data scaled appropriately for operating mode, and toggles power on/off on terminal 6. Functions and arguments are shown on page 25. This module derives an AIO (analog input/output) class from the base class of any XBee device on the ZigBee network. That is, module xbeeain.py uses xbeedevic.py internally. |
| sensor_io.py | Decodes the output of the AT IS command. |

Upload Python modules to gateway

1. Go to **www.digi.com/din/docs**.
2. In the list of downloadable files, select and download file **XBee Adapter Libraries**.
3. Unzip the downloaded file.
4. Read the readme file.
5. Open the web interface for the gateway, go to **Applications > Python**.
6. In the **Upload File** edit box, enter the file name for the XBee Adapter Libraries, **DigiXBeeDrivers.zip**, using the **Browse** button as needed, and click **Upload**.

Use Python modules in programs

To use the Python modules in the XBee Adapter Libraries in programs that you develop, append this statement:

```
sys.path.append("WEB/python/DigiXBeeDrivers.zip")
```


Use xbeeain.py functions in Python programs

To use the functions in the module **xbeeain.py**, any Python programs must contain the next statement:

```
from xbeeain import *
```

The functions and arguments in module **xbeeain.py** are as follows.

```
#####
#                                                                 #
#                               Class XBeeAIN                       #
#                                                                 #
#####
#                                                                 #
# This class derives from the base XBeeDevice class, and implements #
# the Analog IO layer of the Digi XBee Analog IO Adapter.         #
#                                                                 #
#####
#                                                                 #
# Functions:                                                       #
#                                                                 #
#   configure(channel, mode) - Define channel usage                #
#       channel - Channel number to be configured.                 #
#       mode    - One of (CurrentLoop, TenV, Differential)          #
#                                                                 #
#   raw_sample(channel)                                           #
#       channel - Channel number to be read.                       #
#       Returns raw analog sample data for specified channel      #
#                                                                 #
#   sample(channel)                                               #
#       channel - Channel number to be read.                       #
#       Returns sensor data scaled appropriately for operating mode #
#                                                                 #
#   power(onoff) - Toggles Power Output on Terminal 6.           #
#       onoff    - Specifies Power Output either on (1) or off (0). #
#                                                                 #
#####
```

Additional programming resources

For further information on writing Python programs and using Python functions, see:

- Digi Python Programming Guide
http://ftp1.digi.com/support/documentation/90000833_b.pdf
- The Python Support Forum on digi.com
<http://www.digi.com/support/forum/forum.jspa?forumID=104>

For more information about AT commands, see:

- XBee ZNet 2.5 (Series 2) RF Module data sheet
http://www.digi.com/pdf/ds_xbeemodules.pdf
- XBee ZNet 2.5 (Series 2) RF Module Product Manual
http://ftp1.digi.com/support/documentation/90000866_A.pdf

Data retrieval

To retrieve measurement data from the XBee Analog I/O Adapter, use these Python modules, provided in the XBee Adapter Libraries:

- **xbeeain.py**: Issues the AT IS command to retrieve the data.
- **sensor_io.py**: Decodes the output of the AT IS command.

Byte structure returned by IS command

The AT IS (Force Sample) command is used to force a read of all enabled analog I/O lines. The command returns a byte structure that identifies which lines are enabled for digital or analog sampling, and the current measurement.

| Byte size | Purpose |
|-----------|--|
| 1 | The number of samples in this message. |
| 2 | Bitmask of which digital I/O lines are enabled for this sample. |
| 1 | Bitmask of which analog I/O lines are enabled for this sample. |
| 2 | Digital sample, only present if any digital I/O lines are enabled. |
| 2 * N | Analog sample, N is the number of analog I/O lines enabled. |

Number of samples

The number of samples in this reading. Should always be 0x01.

Bitmask for digital sampling

In this bitmask, bit 0 is the least significant bit.

The measurement associated with AD0 is from terminal line 1, AD1 is from terminal line 2, etc.

| Bit | Matching I/O line |
|-----|-------------------|
| 0 | AD0/DIO0 |
| 1 | AD1/DIO1 |
| 2 | AD2/DIO2 |
| 3 | AD3/DIO3 |
| 4 | DIO4 |
| 5 | Assoc/DIO5 |
| 6 | DIO6 |
| 7 | DIO7 |
| 8 | DIO8 |
| 9 | Not Used |
| 10 | DIO10 |
| 11 | DIO11 |
| 12 | DIO12 |
| 13 | DIO13 |
| 14 | Not Used |
| 15 | Not Used |

Note: If any of these AT commands is set to values 3, 4, or 5, the bitmask will show them as enabled. If they are set to values 0, 1, or 2, the bitmask will show them as disabled.

Bit mask for analog sampling

In this bitmask, bit 0 is the least significant bit. The measurement associated with AD0 is from terminal line 1, AD1 is from terminal line 2, etc. Typically all the lines except Supply Voltage would be enabled.

| Bit | Matching I/O line |
|-----|-------------------|
| 0 | AD0/DIO0 (pin 20) |
| 1 | AD1/DIO1 (pin 19) |
| 2 | AD2/DIO2 (pin 18) |
| 3 | D3/DIO3 (pin 17) |
| 7 | Supply Voltage |

Digital sample

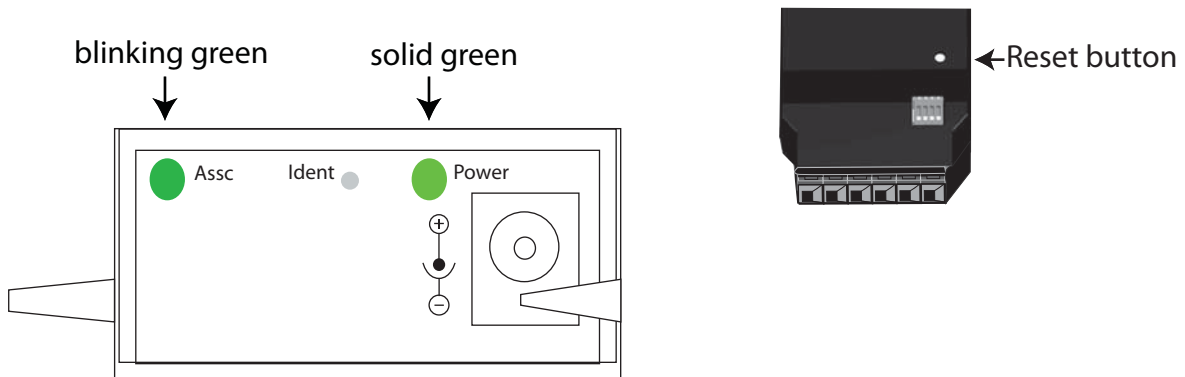
This field should be ignored.

Analog sample

Contains the measured results from the analog-enabled digital I/O lines. This example is for a 10-bit sample.

Each measurement is 2 bytes long, and ranges between 0-1023 for value (10 bit resolution). The lowest lines are always first, so if digital I/O 0 and 2 were enabled, the first 2 bytes would represent digital I/O 0's measurement and the second two bytes would represent digital I/O 2's measurement.

LEDs and buttons



Power LED: Indicates that power is on. Illuminated only when adapter is connected to external power only, not when powered by batteries. Not available in lithium-battery models.

Assc LED: Indicates the adapter’s ZigBee network association status:

| LED status | Network association |
|--------------------|---------------------|
| On, solid green | Not associated |
| On, blinking green | Successfully joined |

Reset button: Recessed button on underside of the adapter. Performs equivalent of a power-cycle. Use a small non-conductive tool with a blunt end to press gently and hold down button.

Ident button: Recessed button on power end of the adapter between **Assc** and **Power** LEDs. Performs multiple functions for commissioning the adapter in a ZigBee network. Consecutive button presses must occur within 800 ms of each other to perform the desired action.

| Button press | Network association | Action |
|--------------|-----------------------------|---|
| Single | Associated | <ul style="list-style-type: none"> If adapter is asleep, wakes unit for 30 seconds. Sends a Node Identification broadcast transmission. <p>All devices that receive this transmission will blink their Associate LED rapidly for 1 second.</p> <p>All API devices that receive this transmission will send a Node Identification frame out their UART (universal asynchronous receiver/transmitter) (API ID 0x95).</p> |
| | Unassociated | <ul style="list-style-type: none"> If adapter is asleep, wakes unit for 30 seconds. Blinks a numeric error code on the Assc LED, indicating the cause of join failure. <p>1 blink: Scan found no PANs.</p> <p>2 blinks: Scan found no valid PANs based on current SC (Scan Channel) and ID (PAN ID) settings.</p> <p>3 blinks: Valid Coordinator or Routers found, but they are not allowing joining (NJ expired).</p> <p>7 blinks: Node Joining attempt failed.</p> <p>10 blinks: Coordinator Start attempt failed.</p> |
| Two | Associated | Temporarily enables joining on the adapter 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. |
| Four | Associated/ Unassociated | Adapter leaves PAN, if associated, and issues a factory reset to restore default parameters. Default PAN ID is 0x234. |

Overview

The XBee Digital I/O Adapter provides short range wireless connectivity to any digital device, as well as an interface to logic-level inputs and sinking driver output. Solutions are available for both mesh (including ZigBee) and point-to-multipoint networks. Unlike an embedded wireless module, which requires design integration and development time, these off-the-shelf adapters provides instant wireless connectivity to existing digital devices. All XBee adapters can be used with Digi's ConnectPort X gateways for data aggregation and IP connectivity.

Power options

Depending on adapter model, there are several powering options.

Alkaline battery model

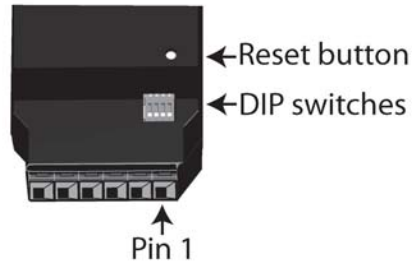
This product can be powered by a 9-30VDC external power supply (see "Power requirements" on page 67) or by batteries. Use 3x1.5V "N" alkaline battery cells. To install batteries, insert a screwdriver in the slots in the side of the adapter case and twist to snap off the cover. Insert the batteries following the polarity diagram on the board.

Lithium battery model

This model can be powered by a 3-6VDC external power supply or by 2/3 AA 3.6V lithium batteries and a 1/2 AA boost capacitor. Replacement batteries available for purchase; contact Digi at **952-912-3444** or **877-912-3444**.

Connection and power-on

1. Connect the wires for the desired digital device to the connector for the adapter. The connector for the adapter is a 6-position wire terminal block. The connector accommodates wire gauges from 16AWG to 30AWG. The figure shows Pin 1 of the connector when the adapter is oriented with the mounting tabs, facing upwards (the underside of the adapter).



To insert or remove wires, insert a screwdriver blade in the slot directly below the hole where the wire inserts. Press down on the spring to open up the hole and insert or remove the wire.

2. Connect the power supply to the adapter or insert batteries.

Pinouts

Facing the connector, with the screwdriver release slots down, going from right to left, the pinouts are:

| Pin | Function |
|-----|--|
| 1 | These pins are configurable as digital input or sinking driver output. |
| 2 | |
| 3 | |
| 4 | |
| 5 | GND |
| 6 | +12VDC 50mA max switched power out |

DIP switches

The XBee Digital I/O Adapter has several DIP switches on the underside of the unit, with these settings:

| DIP Switch | Switch settings |
|------------|--|
| 1 | Enables and disables direct battery pack voltage output. On=battery power out Off=no battery power out |
| 2 | Enables and disables +12V power out. On=+12V power out Off=no +12V power out |
| 3 | Turns on 10K pullup on terminal 1 to 3VDC. |
| 4 | Turns on 10K pullup on terminal 2 to 3VDC. |

Note:

- Switches 1 and 2 should not be on at the same time as increased parasitic battery drain will result.
- Pullup use is not recommended when running from battery power, owing to the constant drain on the batteries.

Configuring inputs and outputs

As shown in the pinouts table, the XBee Digital I/O Adapter product has four external terminals that can be set as either a digital input or a sinking driver output.

The XBee module controls the sinking drivers on pins 11, 16, 12, 4 for terminals 1, 2, 3, 4 respectively.

The AT commands to the XBee module for the output function are D4, D6, D7, P2 for terminals 1, 2, 3, 4 respectively.

Outputs are activated (that is, the sinking function is turned on) by setting high the corresponding XBee pin for the output that is desired. To set a terminal high, set the corresponding AT command to value 5. To set a terminal low, set the corresponding AT command to value 4. For example, setting terminal 1 to high would call the AT command D4 and set it to value 5.

Since the input and output functions overlap, the input function is always active and when the input function is desired, the output control pin for the matching output must be set low (turns off the sinking function). This feature can allow the inputs to monitor the output sinking operation if desired.

Input/output specifications and characteristics

| Digital mode | Specification | Value |
|----------------|-------------------------------------|---|
| Digital Input | Input type | Non-inverting Schmidt trigger gate |
| | Positive-going switching threshold | ~1.6 VDC |
| | Negative-going switching threshold | ~1.0 VDC |
| | Maximum safe input | +30VDC |
| | Minimum safe input | -.5VDC |
| | Input impedance | ~1.5 Megaohms |
| | Default level when no input applied | Low |
| Digital Output | Output type | Open collector sinking driver |
| | Maximum sink current | 1.8ADC |
| | Maximum off voltage | +30VDC |
| | Minimum safe input | -.5VDC |
| | Resistor pullups | 10K ohms pulled up to 3VDC; switch-selectable |



Exceeding the maximum or minimum safe input values will result in damage to the unit.

Power output specifications

External terminal 6 is a power-out pin. It can be set to either battery pack voltage out or +12VDC at 50mA out via DIP switches 1 and 2.

External terminal 5 is a system ground pin. This ground pin should be used for all external ground connections for both power and input connections.

DIP switch 1 enables battery pack voltage minus .5VDC to terminal 6, resulting in 4VDC out with new alkaline batteries, or 3.1VDC with new lithium battery. DIP switch 2 enables +12VDC to terminal 6. Only one switch should be on at a time. No damage will happen if both are set to on, but the output will default to the +12VDC output and increased parasitic battery drain will result.

The battery pack voltage is on terminal 6 all the time and not gated with the sleep of the module when DIP switch 2 is on. Any current draw from terminal 6 will result in reduced battery life. This mode is primarily intended with switch closure applications with the XBee Digital I/O Adapter with the external switch in the customer equipment in the normally open position, so no battery current results until the activating event happens.

When DIP switch 2 is on, the +12VDC at 50mA max is provided at terminal 6. This power is gated by both the sleep of the module and AT command P3. For this power setting to be on, the XBee module needs to be awake and AT command P3 set to a high level.

Python modules for configuring inputs and outputs

Digi provides a library of Python modules for configuring inputs and outputs on the adapter and retrieving data from the adapter. These modules are available for downloading from www.digi.com/din/docs, in a file named **XBee Adapter Libraries**. By uploading these Python modules to the gateway that serves as a coordinator for the adapter, you can use them in your own programs.

The Python modules in the zip file that are relevant to programming the XBee Digital I/O Adapter are:

| Module | Description |
|---------------|--|
| xbeeprodid.py | Contains calls to determine the type of adapter; (Analog, Digital, Sensor, RS-232, etc.) |
| xbeedevic.py | Implements a base class of any XBee device on the ZigBee network. |
| xbeedin.py | Configures inputs and outputs, issues AT commands to retrieve data from the adapter, and toggles power on/off on terminal 6. Functions and arguments are shown page 36. Derives an DIO (digital input/output) class from the base class of any Digi Xbee device on the mesh network. That is, module xbeedin.py uses xbeedevic.py internally. |
| sensor_io.py | Decodes the output of the AT IS command. |

Upload Python modules to gateway

1. Go to www.digi.com/din/docs.
2. In the list of downloadable files, select and download file **XBee Adapter Libraries**.
3. Unzip the downloaded file.
4. Read the readme file.
5. Open the web interface for the gateway, go to **Applications > Python**.
6. In the **Upload File** edit box, enter the file name for the XBee Adapter Libraries, **DigiXBeeDrivers.zip**, using the **Browse** button as needed, and click **Upload**.

Use Python modules in programs

To use the Python modules in the XBee Adapter Libraries in programs that you develop, append this statement:

```
sys.path.append("WEB/python/DigiXBeeDrivers.zip")
```

Use xbeedin.py functions in Python programs

To use the functions in the module **xbeedin.py** for programming inputs and outputs, any Python programs you create must contain this statement:

```
from xbeedin import *
```

The functions and arguments in module **xbeedin.py** are as follows.

```
#####
#                                                                 #
#                               Class XBeeDIN                       #
#                                                                 #
#####
#                                                                 #
# This class derives from the base XBeeDevice class, and implements #
# the Digital IO layer of the Digi XBee Digital IO Adapter.       #
#                                                                 #
#####
#                                                                 #
# Functions:                                                       #
#                                                                 #
#   configure(channel, mode, highlow) - Define channel usage      #
#       channel - Channel number to be configured.               #
#       mode    - One of (Input, Output)                          #
#       highlow - If in Output mode, this specifies whether the signal #
#                 should be driven high (1) or low (0).          #
#                                                                 #
#   sample(channel)                                               #
#       channel - Channel number to be read.                      #
#       Returns digital sample data for specified channel        #
#                                                                 #
#   power(onoff) - Toggles Power Output on Terminal 6.          #
#       onoff   - Specifies Power Output either on (1) or off (0). #
#                                                                 #
#####
```

Additional programming resources

For further information on writing Python programs and using Python functions, see:

- Digi Python Programming Guide
http://ftp1.digi.com/support/documentation/90000833_b.pdf
- The Python Support Forum on digi.com
<http://www.digi.com/support/forum/forum.jspa?forumID=104>

For more information about AT commands, see:

- XBee ZNet 2.5 (Series 2) RF Module data sheet
http://www.digi.com/pdf/ds_xbeemodules.pdf
- XBee ZNet 2.5 (Series 2) RF Module Product Manual
http://ftp1.digi.com/support/documentation/90000866_A.pdf

Data retrieval

To retrieve measurement data from the XBee Digital I/O Adapter, use these Python modules, provided in the XBee Adapter Libraries:

- **xbeedin.py**: Issues the AT IS command to retrieve the data.
- **sensor_io.py**: Decodes the output of the AT IS command.

To enable a terminal line for measurement, the following digital I/O lines have to be set to value **3**:

- D8
- D1
- D2
- D3

D8, D1, D2, and D3 represent terminal lines 1, 2, 3, and 4 respectively. To disable a terminal line, set the respective digital I/O line to value 0.

Following is a description of the data returned by the IS command.

Byte structure returned by IS command

The AT IS (Force Sample) command is used to force a read of all enabled digital I/O lines. The command returns a byte structure that identifies which lines are enabled for digital or analog sampling, and the current measurement.

| Byte size | Purpose |
|-----------|--|
| 1 | The number of samples in this message. |
| 2 | Bit mask of which digital I/O lines are enabled for this sample. |
| 1 | Bit mask of which analog I/O lines are enabled for this sample. |
| 2 | Digital sample, present only if any digital I/O lines are enabled. |
| 2 * N | Analog sample; N is the number of analog I/O lines enabled. |

Number of samples

This represents the number of samples that make up the measurement. This number is most commonly set to 1.

Bit mask for digital sampling

In this bitmask, bit 0 is the least significant bit.

The measurement associated with AD0 is from terminal line 1, AD1 is from terminal line 2, etc.

| Bit | Matching I/O line |
|-----|-------------------|
| 0 | AD0/DIO0 |
| 1 | AD1/DIO1 |
| 2 | AD2/DIO2 |
| 3 | AD3/DIO3 |
| 4 | DIO4 |
| 5 | Assoc/DIO5 |
| 6 | DIO6 |
| 7 | DIO7 |
| 8 | DIO8 |
| 9 | Not Used |
| 10 | DIO10 |
| 11 | DIO11 |
| 12 | DIO12 |
| 13 | DIO13 |
| 14 | Not Used |
| 15 | Not Used |

Note: If any of these AT commands is set to values 3, 4, or 5, the bitmask will show them as enabled. If they are set to values 0, 1, or 2, the bitmask will show them as disabled.

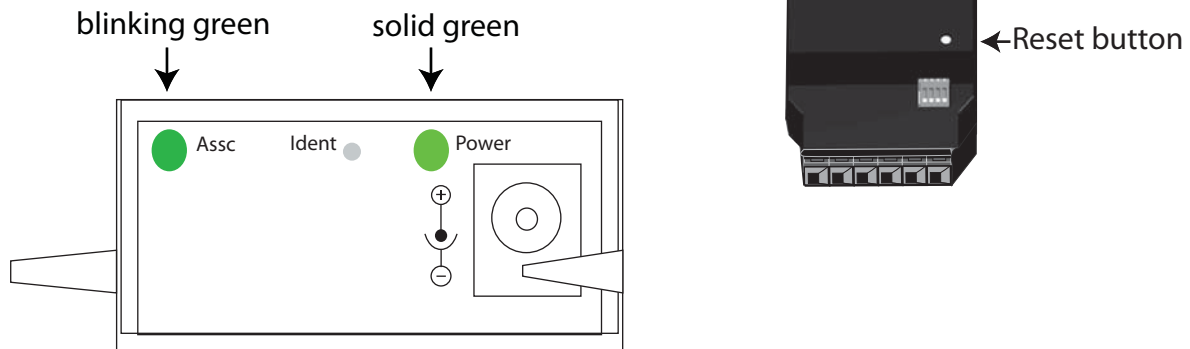
Bit mask for analog sampling

Should always be 0x00 on the digital adapter.

Digital sample

The ninth LSB (least significant bit) represents terminal line 1. Terminal line 2 is represented by the second LSB. Terminal line 3 is represented by the third LSB, and terminal Line 4 is represented by the fourth LSB.

LEDs and buttons



Power LED: Indicates that power is on. Illuminated only when adapter is connected to external power only, not when powered by batteries. Not available in lithium-battery models.

Assc LED: Indicates the adapter's ZigBee network association status:

| LED status | Network association |
|--------------------|---------------------|
| On, solid green | Not associated |
| On, blinking green | Successfully joined |

Reset button: Recessed button on underside of the adapter. Performs equivalent of a power-cycle. Use a small non-conductive tool with a blunt end to press gently and hold down button.

Ident button: Recessed button on power end of the adapter between **Assc** and **Power** LEDs. Performs multiple functions for commissioning the adapter in a ZigBee network. Consecutive button presses must occur within 800 ms of each other to perform the desired action.

| Button press | Network association | Action |
|--------------|-----------------------------|---|
| Single | Associated | <ul style="list-style-type: none"> If adapter is asleep, wakes unit for 30 seconds. Sends a Node Identification broadcast transmission. All devices that receive this transmission will 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). |
| | Unassociated | <ul style="list-style-type: none"> If adapter is asleep, wakes unit for 30 seconds. Blinks a numeric error code on the Assc LED, indicating the cause of join failure. <ul style="list-style-type: none"> 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. |
| Two | Associated | Temporarily enables joining on the adapter 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. |
| Four | Associated/ Unassociated | Adapter leaves PAN, if associated, and issues a factory reset to restore default parameters. Default PAN ID is 0x234. |

Overview

The XBee Sensor Adapter provides short range wireless connectivity to Digi Watchport[®] Sensors, with available solutions for both mesh (including ZigBee) and point-to-multipoint networks. Unlike an embedded wireless module, which requires design integration and development time, these off-the-shelf adapters provides instant wireless connectivity to existing Watchport Sensors. All XBee adapters can be used with Digi's ConnectPort X gateways for data aggregation and IP connectivity

Available sensor products

The XBee Sensor Adapter can be used with a variety of Watchport sensors. For a description and list of supported sensors, go to Digi's Drop-in Networking page at www.digi.com/din, navigate to **Products**, and click on **Sensors**.

Power options

Depending on adapter model, there are several powering options.

Alkaline battery model

This product can be powered by a 9-30VDC external power supply (see "Power requirements" on page 67) or by batteries. Use 3x1.5V "N" alkaline battery cells. To install batteries, insert a screwdriver in the slots in the side of the adapter case and twist to snap off the cover. Insert the batteries following the polarity diagram on the board.

Lithium battery model

This model can be powered by a 3-6VDC external power supply or by 2/3 AA 3.6V lithium batteries and a 1/2 AA boost capacitor. Replacement batteries available for purchase; contact Digi at **952-912-3444** or **877-912-3444**.

Connection and power-on

1. Connect the sensor to the **SENSOR** port of the adapter.
2. Connect the power supply to the adapter or insert batteries.

Pinouts

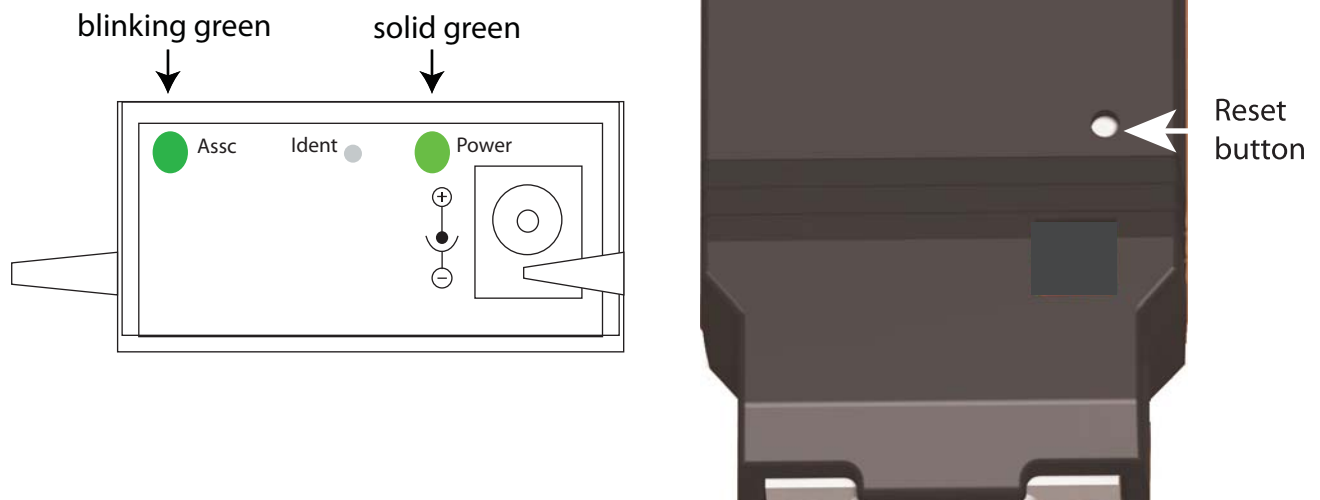
The XBee Sensor Adapter uses an industry-standard RJ45 10 pin modular jack with these pinouts:

| Pin | Function |
|-----|--|
| 1 | Not used. |
| 2 | Not used. |
| 3 | Not used. |
| 4 | GND |
| 5 | 1-wire (sensor) data |
| 6 | +5VDC switched power out. |
| 7 | GND |
| 8 | +5VDC switched power out. |
| 9 | General-purpose logic input for moisture sensor. |
| 10 | Not used. |

Data retrieval

Retrieving data from XBee adapters is done by issuing a remote AT IS (Force Sample) command through the XBee API. The XBee API and AT IS command are described in detail in the XBee ZNet 2.5 (Series 2) RF Module data sheet. AT IS commands can be issued via a Python program that is executed on the gateway. See also the *Product Manual* for the XBee Module and the *Digi Python Programming Guide*.

LEDs and buttons



Power LED: Indicates that power is on. Illuminated only when adapter is connected to external power only, not when powered by batteries. Not available in lithium-battery models.

Assc LED: Indicates the adapter's ZigBee network association status:

| LED status | Network association |
|--------------------|---------------------|
| On, solid green | Not associated |
| On, blinking green | Successfully joined |

Reset button: Recessed button on underside of the adapter. Performs equivalent of a power-cycle. Use a small non-conductive tool with a blunt end to press gently and hold down button.

Ident button: Recessed button on power end of the adapter between **Assc** and **Power** LEDs. Performs multiple functions for commissioning the adapter in a ZigBee network. Consecutive button presses must occur within 800 ms of each other to perform the desired action.

| Button press | Network association | Action |
|--------------|-----------------------------|---|
| Single | Associated | <ul style="list-style-type: none"> If adapter is asleep, wakes unit for 30 seconds. Sends a Node Identification broadcast transmission. All devices that receive this transmission will 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). |
| | Unassociated | <ul style="list-style-type: none"> If adapter is asleep, wakes unit for 30 seconds. Blinks a numeric error code on the Assc LED, indicating the cause of join failure. <ul style="list-style-type: none"> 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. |
| Two | Associated | Temporarily enables joining on the adapter 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. |
| Four | Associated/ Unassociated | Adapter leaves PAN, if associated, and issues a factory reset to restore default parameters. Default PAN ID is 0x234. |

Overview

The XBee USB Adapter provides short range wireless connectivity to any USB device, with available solutions for both mesh (including ZigBee) and point-to-multipoint networks. Unlike an embedded wireless module, which requires design integration and development time, these off-the-shelf adapters provides instant wireless connectivity to existing USB devices. All XBee adapters can be used with Digi's ConnectPort X gateways for data aggregation and IP connectivity

Power requirements

The XBee USB Adapter is a bus-powered device.

Download and install device driver

The XBee USB Adapter requires a device driver, FT232R. This device driver causes adapter device to appear as an additional COM port available to the PC. Application software can access the adapter in the same way as it would access a standard COM port.

To download this device driver, go to this web page and select the download appropriate for your operating system:

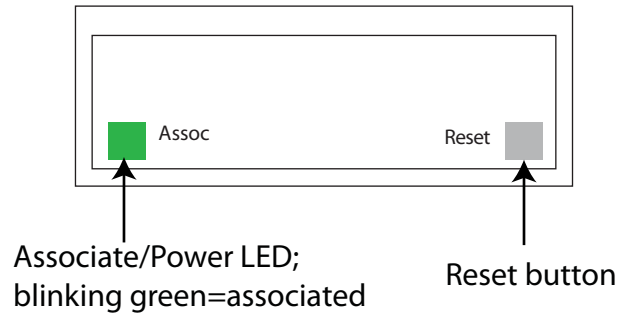
<http://www.ftdichip.com/Drivers/VCP.htm>

Data retrieval

Retrieving data from XBee adapters is done by issuing a remote AT IS (Force Sample) command through the XBee API. The API and AT IS command are described in detail in the XBee ZNet 2.5 (Series 2) RF Module data sheet. These AT IS commands can be issued via a Python program that is executed on the gateway. See also the *Product Manual* for the XBee Module and the *Digi Python Programming Guide*.

LEDs and buttons

There is one LED and one button on the end of the adapter opposite the USB connector:



Associate/ Power LED:

Indicates power and the adapter's ZigBee network association status:

| LED status | Network association |
|--------------------|-----------------------------|
| On, solid green | Powered and not associated. |
| On, blinking green | Powered and associated. |

Reset button:

Performs a reset.

Use a small non-conductive 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.

Overview

The XStick ZNet 2.5 is a USB peripheral module adapter that provides short-range wireless connectivity to a ZigBee Mesh network.

Power requirements

The XStick ZNet 2.5 is a USB bus-powered device.

Connection and startup

Plug the XStick ZNet 2.5 into the USB connector of a PC, or use a USB extension cable. The extension cable must be no more than 3 meters long.

Download and install device driver

The XStick ZNet 2.5 requires a device driver, FT232R. To download this device driver, go to this web page and select the download appropriate for your operating system:

<http://www.ftdichip.com/Drivers/VCP.htm>

Unsupported XBee AT commands

The XStick ZNet 2.5 does not support these XBee AT commands:

- D0 • D1 • D2 • D3 • D4 • D6 • IS
- IC • P0 • P1 • P2 • RP • %V • V

LEDs and buttons

Associate/ Power LED:

This LED is located inside the case of the device. It indicates whether the device is powered and its ZigBee network association status:

| LED status | Network association |
|--------------------|-------------------------|
| Off | Not associated. |
| On, blinking green | Powered and associated. |

Overview



ZigBee technology enables low-cost, low-power networking of sensors, controllers and other such devices in self-configuring, self-healing wireless mesh networks. Digi's XBee Wall Router is a small extender used to create the backbone of a ZigBee network or to expand the range of a ZigBee network so that other ZigBee devices can seamlessly communicate with one another. The XBee Wall Router can be used with Digi's ConnectPort X gateways for data aggregation and IP connectivity.

Part of Digi's Drop-in Networking solutions, the XBee Wall Router helps to create and/or fortify the infrastructure of a ZigBee network by simply plugging into standard wall power sockets around a customer facility, creating a multi-path self-healing network. Installation is easy and completely unobtrusive.

The U.S. version of the XBee Wall Router includes a built-in mounting tab, which allows it to be securely screwed into standard wall sockets using the existing mounting screw hole. This prevents accidental unplugging of the repeater and reduces risk of theft or vandalism. 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 air interference. It also serves to create multiple pathways, increasing the redundancy of the mesh communications to ensure maximum network reliability.

In addition to ZigBee network extension, the XBee Wall Router also includes two integrated environmental sensors. Customers using ConnectPort X gateways have the ability to retrieve data from ZigBee enabled temperature and light sensors built inside of the product. XBee wall routers can be used with ConnectPort X gateways, XBee embedded modules, XBee adapters or XBee sensors to "drop-in" end-to-end device networks – without the need for a wired network infrastructure.

Connection and startup

1. Plug the XBee Wall Router into an outlet.
2. To make sure your XBee Wall Router is properly connected to the ZigBee network, check the **Associate/Power** LED, as described above.
3. Discover the XBee Wall Router in the ZigBee network and change configuration settings as needed, as described in "Configuration with a ConnectPort X gateway" on page 60.

Configuration

Digi provides a library of Python modules for configuring light and temperature functions on the XBee Wall Router and retrieving light and temperature data from it. These modules are available for downloading from www.digi.com/din/docs, in a file named **XBee Adapter Libraries**. By uploading these Python modules to the gateway that serves as a coordinator for the XBee Wall Router, you can use them in your own programs.

Python module descriptions

The Python modules in the XBee Adapter Libraries that are relevant to programming the XBee Wall Router are:

| Module | Description |
|---------------|---|
| xbeeprodid.py | Contains calls to determine the type of adapter; (Analog, Digital, Sensor, RS-232, etc.) |
| xbeedevic.py | Implements a base class of any XBee device on the ZigBee network. |
| xbeewr.py | Configures Light and Temperature functions for the XBee Wall Router and issues AT commands to retrieve data from the integrated sensors. Functions and arguments are shown on page 55. This module derives an LT (Light/Temperature) class from the base class of any XBee device on the ZigBee network. That is, module xbeelt.py uses xbeedevic.py internally. |
| sensor_io.py | Decodes the output of the AT IS command. |

Upload Python modules to gateway

1. Go to **www.digi.com/din/docs**.
2. In the list of downloadable files, select and download file **XBee Adapter Libraries**.
3. Unzip the downloaded file.
4. Read the readme file.
5. Open the web interface for the gateway, go to **Applications > Python**.
6. In the **Upload File** edit box, enter the file name for the XBee Adapter Libraries, **DigiXBeeDrivers.zip**, using the **Browse** button as needed, and click **Upload**.

Use Python modules in programs

To use the Python modules in the XBee Adapter Libraries in programs that you develop, append this statement:

```
sys.path.append("WEB/python/DigiXBeeDrivers.zip")
```

Use xbeewr.py functions in Python programs

To use the functions in the module **xbeewr.py**, any Python programs must contain the next statement:

```
from xbeewrn import *
```

The functions and arguments in module **xbeeain.py** are as follows.

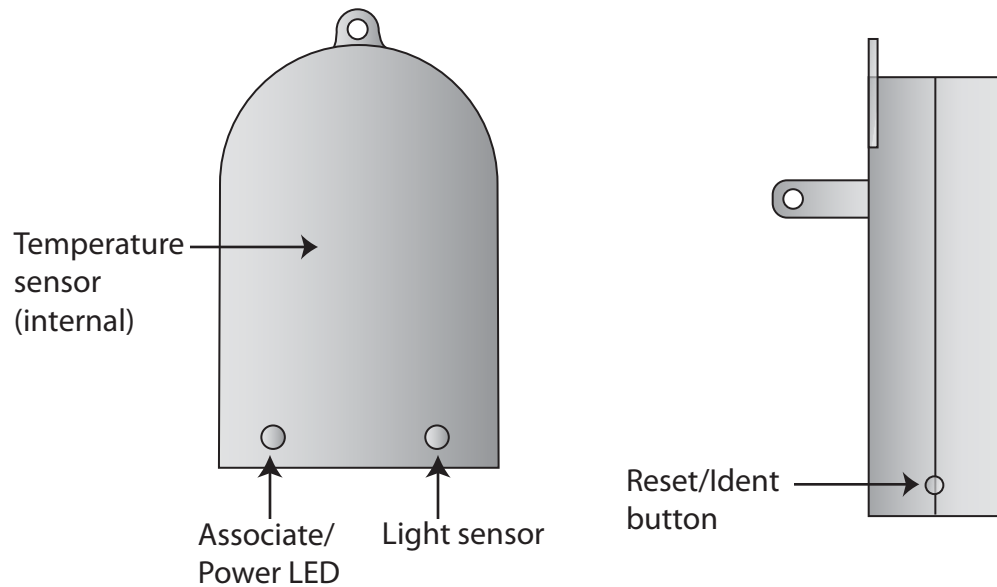
```
#####
#
#                               Class XBeeWRN                               #
#                               #####                               #
#
# This class derives from the base XBeeDevice class, and implements      #
# the LT (Light/Temperature) layer of the Digi XBee Wall Router Adapter.  #
#                               #####                               #
#
# Functions:                                                                #
#
#   raw_sample()                                                            #
#
#       Returns a dictionary of raw analog sample data                    #
#
#       The dictionary will contain the following keys:                   #
#           1) 'temperature'                                               #
#           2) 'light'                                                     #
#
#
#   sample()                                                                #
#
#       Returns a dictionary of data scaled into actual usable values.   #
#
#       The dictionary will contain the following keys:                   #
#           1) 'temperature' - Degrees in Celsius.                       #
#           2) 'light' - value in lux.                                     #
#
#####
```

Data retrieval

To retrieve measurement data from the XBee Wall Router, use these Python modules, provided in the XBee Adapter Libraries:

- **xbewr.py**: Issues the AT IS command to retrieve the data from the integrated sensors.
- **sensor_io.py**: Decodes the output of the AT IS command.

LEDs, buttons, and integrated sensors



**Associate/
Power LED:**

Indicates power and the Wall Router's ZigBee network association status:

| LED status | Network association |
|--------------------|---------------------|
| On, solid green | Not associated |
| On, blinking green | Successfully joined |

**Reset/
Ident button:**

Performs a reset and multiple functions for commissioning the Wall Router in a ZigBee network.

Use a small non-conductive 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.

| Button press | Network association | Action |
|-----------------------|-----------------------------|--|
| Single | Associated | <ul style="list-style-type: none"> If router is asleep, wakes unit for 30 seconds. Sends a Node Identification broadcast transmission. All devices that receive this transmission will 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). |
| | Unassociated | <ul style="list-style-type: none"> If router is asleep, wakes unit for 30 seconds. Blinks a numeric error code on the Assc LED, indicating the cause of join failure. <ul style="list-style-type: none"> 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. |
| Two | Associated | Temporarily enables joining on the 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. |
| Four | Associated/ Unassociated | Router leaves PAN, if associated, and issues a factory reset to restore default parameters. Default PAN ID is 0x234. |
| Hold for five seconds | Associated/ Unassociated | Performs a hardware reset. |

Overview



The XBee Sensor family is a group of Zigbee-enabled, battery-powered sensors incorporating an XBee module. Part of Digi's Drop-in Networking solutions, XBee Sensors read real-time data from sensors such as temperature, humidity, and light. This data can be retrieved and transmitted through wireless communications in a ZigBee infrastructure. Compact size and battery power enable XBee Sensors to be dropped into facilities easily and unobtrusively while providing reliable communications. Applications include building automation, environmental monitoring, security, asset monitoring, and more.

Installation is easy: simply insert batteries, add the XBee Sensor to the ZigBee network, and configure inputs and outputs, using Digi-provided modules written in the Python programming language. Next, mount the device in a desired out-of-the-way location and begin collecting data. XBee Sensors can be used with ConnectPort X gateways, XBee embedded modules, XBee adapters or XBee Wall Routers to "drop-in" end-to-end device networks, without the need for a wired network infrastructure.

Sensor options

There are currently two XBee Sensor product options available:

- **XBee Sensor /L/T:** Integrated ambient light and temperature sensors
- **XBee Sensor /L/T/H:** Integrated ambient light, temperature, and humidity sensors

Power options

Alkaline Battery Model: This product is powered by three AA batteries (1.5V). To install/replace batteries, remove the two outer case screws and insert batteries according to the polarity diagram printed on the board.

Connection and power-on

Insert batteries. Device power is indicated by the green **ASSC** LED on the front panel of the XBee Sensor.

Discover the XBee Sensor in the ZigBee network and change configuration settings as needed, as described in "Configuration with a ConnectPort X gateway" on page 60.

Configuration

Python modules for configuring inputs and outputs

Digi provides several Python modules for configuring the light, temperature, and humidity functions for XBee Sensors and retrieving data from them. These modules are available for downloading from www.digi.com/din/docs, in a file named **XBee Adapter Libraries**. By uploading these Python modules to the gateway that serves as a coordinator for the adapter, you can use them in your own programs.

Python module descriptions

The Python modules in the zip file that are relevant to programming XBee Sensors are:

| Module | Description |
|---------------|---|
| xbeeprodid.py | Contains calls to determine the type of adapter; (Analog, Digital, Sensor, RS-232, etc.) |
| xbeedevic.py | Implements a base class of any XBee device on the ZigBee network. |
| xbeelt.py | Configures Light and Temperature functions for the XBee Sensor /L/T and issues AT commands to retrieve data from the integrated sensors. Functions and arguments are shown on page 55. This module derives an LT (Light/Temperature) class from the base class of any XBee device on the ZigBee network. That is, module xbeelt.py uses xbeedevic.py internally. |
| xbeeelh.py | Configures Light, Temperature, and Humidity functions for the XBee Sensor /L/T/H and issues AT commands to retrieve data from the integrated sensors. Functions and arguments are shown on page 56. This module derives an LTH (Light/Temperature/Humidity) class from the base class of any XBee device on the ZigBee network. That is, module xbeeelh.py uses xbeedevic.py internally. |
| sensor_io.py | Decodes the output of the AT IS command. |

Upload Python modules to gateway

1. Go to www.digi.com/din/docs.
2. In the list of downloadable files, select and download file **XBee Adapter Libraries**.
3. Unzip the downloaded file.
4. Read the readme file.
5. Open the web interface for the gateway, go to **Applications > Python**.
6. In the **Upload File** edit box, enter the file name for the XBee Adapter Libraries, **DigiXBeeDrivers.zip**, using the **Browse** button as needed, and click **Upload**.

Use Python modules in programs

To use the Python modules in the XBee Adapter Libraries in programs that you develop, append this statement:

```
sys.path.append("WEB/python/DigiXBeeDrivers.zip")
```

Use xbeelt.py functions in Python programs

To use the functions in the module **xbeelt.py** for programming light and temperature functions in a XBee Sensor /L/T product, any Python programs you create must contain this statement:

```
from xbeelt import *
```

The functions and arguments in module **xbeelt.py** are as follows:

```
#####
#                                                                 #
#                               Class XBeeLTN                     #
#                                                                 #
#####
#                                                                 #
# This class derives from the base XBeeDevice class, and implements #
# the LT (Light/Temperature) layer of the Digi XBee LT Adapter.    #
#                                                                 #
#####
#                                                                 #
# Functions:                                                       #
#                                                                 #
#   raw_sample()                                                  #
#                                                                 #
#       Returns a dictionary of raw analog sample data            #
#                                                                 #
#       The dictionary will contain the following keys:          #
#           1) 'temperature'                                     #
#           2) 'light'                                           #
#                                                                 #
#   sample()                                                      #
#                                                                 #
#       Returns a dictionary of data scaled into actual usable values. #
#                                                                 #
#       The dictionary will contain the following keys:          #
#           1) 'temperature' - Degrees in Celsius.              #
#           2) 'light' - value in lux.                           #
#                                                                 #
#####
```

Use xbeelth.py functions in Python programs

To use the functions in the module **xbeelth.py** for programming light, temperature, and humidity functions in a XBee Sensor /L/T/H product, any Python programs you create must contain this statement:

```
from xbeelth import *
```

The functions and arguments in module **xbeelth.py** are as follows:

```
#####
#                                                                 #
#                               Class XBeeLTHN                    #
#                                                                 #
#####
#                                                                 #
# This class derives from the base XBeeDevice class, and implements #
# the LTH (Light/Temperature/Humidity) layer of the Digi XBee LTH Adapter. #
#                                                                 #
#####
#                                                                 #
# Functions:                                                       #
#                                                                 #
#   raw_sample()                                                  #
#                                                                 #
#       Returns a dictionary of raw analog sample data           #
#                                                                 #
#       The dictionary will contain the following keys:          #
#           1) 'temperature'                                     #
#           2) 'light'                                          #
#           3) 'humidity'                                       #
#                                                                 #
#                                                                 #
#   sample()                                                     #
#                                                                 #
#       Returns a dictionary of data scaled into actual usable values. #
#                                                                 #
#       The dictionary will contain the following keys:          #
#           1) 'temperature' - Degrees in Celsius.              #
#           2) 'light' - value in lux.                          #
#           3) 'humidity' - value in %rh                        #
#                                                                 #
#                                                                 #
#####
```

Sample program

```
import sys
import time

# When running on the gateway, all of the modules our # application
# will use shall exist within this ZIP file:
sys.path.append("WEB/python/DigiXBeeDrivers.zip")

from xbeelth import *

lth = XBeeLTHN("00:13:a2:00:40:3e:16:d2!")
print lth.getname()

reading = lth.sample()
print "-----"
print "Temperature (C):\t" + str("%.2f" % reading['temperature'])
print "Temperature (F):\t" + str("%.2f" % (reading['temperature'] *
(9.0 / 5.0) + 32.0))
print "Light (lx):\t\t" + str("%.2f" %
reading['light'])
print "Humidity (%RH):\t\t" + str("%.0f" %
reading['humidity']) + '%'
print "-----"
```


Additional programming resources

For further information on writing Python programs and using Python functions, see:

- Digi Python Programming Guide
http://ftp1.digi.com/support/documentation/90000833_b.pdf
- The Python Support Forum on digi.com
<http://www.digi.com/support/forum/forum.jspa?forumID=104>

For more information about AT commands, see:

- XBee ZNet 2.5 (Series 2) RF Module data sheet
http://www.digi.com/pdf/ds_xbeemodules.pdf
- XBee ZNet 2.5 (Series 2) RF Module Product Manual
http://ftp1.digi.com/support/documentation/90000866_A.pdf

Data retrieval

To retrieve measurement data from XBee Sensors, use these Python modules, provided in the XBee Adapter Libraries:

- **xbeelt.py**: Issues the AT IS command to retrieve data from the integrated sensors in the XBee Sensor /L/T.
- **xbeelth.py**: Issues the AT IS command to retrieve data from the integrated sensors in the XBee Sensor /L/T/H.
- **sensor_io.py**: Decodes the output of the AT IS command.

LEDs, buttons, and integrated sensors

XBee Sensors have one button and one LED.

XBee Sensor /L/T models have integrated light and temperature sensors.

XBee Sensor /L/T/H models have integrated light, temperature, and humidity sensors.



**Associate/
Power LED:**

Indicates power and the XBee Sensor's ZigBee network association status:

| LED status | Network association |
|--------------------|---------------------|
| On, solid green | Not associated |
| On, blinking green | Successfully joined |

**Reset/
Ident button:**

Performs a reset and multiple functions for commissioning the XBee Sensor in a ZigBee network.

Use a small non-conductive tool with a blunt end to press gently and hold down button. Consecutive button presses must occur within one second of each other to perform the desired action.

| Button press | Network association | Action |
|-----------------------|-----------------------------|---|
| Single | Associated | <ul style="list-style-type: none"> If XBee Sensor is asleep, wakes unit for 30 seconds. Sends a Node Identification broadcast transmission. All devices that receive this transmission will blink their Associate LED rapidly for 1 second. All API devices that receive this transmission will send a Node Identification frame out their UART (API ID 0x95). |
| | Unassociated | <ul style="list-style-type: none"> If XBee Sensor is asleep, wakes unit for 30 seconds. Blinks a numeric error code on the Assc LED, indicating the cause of join failure. <ul style="list-style-type: none"> 1 blink: Scan found no PANs. 2 blinks: Scan found no valid PANs based on current SC and 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. |
| Two | Associated | Used only when network joining is permanently enabled (by the XBee Module's NJ setting being set to anything other than OFF; in the gateway, this setting is known as Allows Join Time=255). Temporarily allows joining on the XBee Sensor and the entire ZigBee network for 1 minute. |
| Four | Associated/ Unassociated | XBee Sensor leaves PAN, if associated, and issues a factory reset to restore default parameters. Default PAN ID is 0x234. |
| Hold for five seconds | Associated/ Unassociated | Performs a hardware reset. |

There are several configurable radio settings in XBee Adapter, Router, and Sensor products, including the PAN ID, the node identifier or name for the unit, and timeout and scanning settings. This chapter shows how to configure your XBee product through the gateway's web interface.

Configuration with a ConnectPort X gateway

Access the gateway's web interface

Once the core Drop-in Network components are connected and powered on, open the web interface of the ConnectPort X gateway.

1. On the PC, open a web browser such as Internet Explorer.
2. In the browser's address bar, enter **192.168.1.1** which is the default IP address for the gateway.
3. The home page of the gateway's web interface is displayed.

ConnectPort X8 Configuration and Management

Connectware™

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- Backup/Restore
- Update Firmware
- Factory Default Settings
- System Information
- Reboot

Logout

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Getting Started

Tutorial Not sure what to do next? This Tutorial can help.

System Summary

| | |
|-----------------------|-------------------------------------|
| Model: | ConnectPort X8 |
| Ethernet MAC Address: | 00:40:9D:32:7E:0C |
| Ethernet IP Address: | 192.168.1.1 |
| Mobile IP Address: | Not Connected |
| Description: | None |
| Contact: | None |
| Location: | None |
| Device ID: | 00000000-00000000-00409DFF-FF327E0C |

Discover the device and view the network

1. In the gateway's web interface, select **Administration > System Information** from the menu.

Administration

- [File Management](#)
- [X.509 Certificate/Key Management](#)
- [Backup/Restore](#)
- [Update Firmware](#)
- [Factory Default Settings](#)
- [System Information](#)
- [Reboot](#)

The **System Information** page is displayed.

System Information

▼ General

| | |
|-----------------------|---|
| Model: | ConnectPort X8 |
| Ethernet MAC Address: | 00:40:9D:32:7A:08 |
| WiFi MAC Address: | 00:40:9D:2E:91:74 |
| Firmware Version: | 2.7.0.9 (Version 82001115_C_SA9 12/14/2007) |
| Boot Version: | 1.1.3 (release_82001113_C) |
| POST Version: | 1.1.3 (release_82001114_C1P) |
| CPU Utilization: | 6% |
| Up Time: | 15 minutes 22 seconds |
| Total Memory: | 16384 KB |
| Used Memory: | 13705 KB |
| Free Memory: | 2679 KB |

- ▶ Serial
- ▶ Network
- ▶ WiFi LAN
- ▶ Mobile
- ▶ **Mesh Network**
- ▶ Diagnostics

- From the list of System Information links, click **Mesh Network**. The **Mesh Network** page is displayed. It shows several settings for the gateway, followed by the **Network View of the Mesh Devices**. In the **Type** column, the ZigBee module in the gateway is listed as the **coordinator**, and any XBee adapter/router/sensor products discovered are listed as **routers**.

Network View of the Mesh Devices

| Node ID | Network Address | Extended Address | Node Type | Product Type |
|---------|-----------------|--------------------------|-------------|--------------|
| [0000]! | | 00:13:a2:00:40:0a:2c:05! | coordinator | |
| [971a]! | | 00:13:a2:00:40:0a:0c:54! | router | |
| [8c85]! | | 00:13:a2:00:40:34:14:97! | router | Wall Router |
| [8fe5]! | | 00:13:a2:00:40:0a:12:a1! | router | Unspecified |
| [0507]! | | 00:13:a2:00:40:3e:07:68! | router | |

Clear list before device discovery

Discover Mesh Devices

View and change XBee radio settings as needed

- Select **Configuration > Mesh Network** from the menu.

The **Mesh Network Configuration** page is displayed. It shows several settings for the gateway, followed by the **Network View of the Mesh Devices**. In the **Type** column, the ZigBee module in the gateway is listed as the **coordinator**. Your adapter/router/sensor product is listed as a **router**. To refresh the view, click the **Refresh** button.



ConnectPort X2 Configuration and Management

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Administration

- File Management

Mesh Network Configuration

Network View of the Mesh Devices

| Node ID | Network Address | Extended Address | Node Type | Product Type |
|---------|-----------------|--------------------------|-------------|--------------|
| [0000]! | | 00:13:a2:00:40:0a:2c:05! | coordinator | |
| [971a]! | | 00:13:a2:00:40:0a:0c:54! | router | |
| [8c85]! | | 00:13:a2:00:40:34:14:97! | router | Wall Router |
| [8fe5]! | | 00:13:a2:00:40:0a:12:a1! | router | Unspecified |
| [0507]! | | 00:13:a2:00:40:3e:07:68! | router | |

Clear list before performing refresh

Refresh

- In the list under **Network View of the Mesh Devices**, locate your product by its physical address. This address is printed on a label on the bottom of the unit. Click on the **Network Address** or **Physical Address** to open the product's settings page.
- The Mesh Network Configuration page is displayed.

Mesh Network Configuration

Basic Radio Settings

PAN ID: hex (0-3FFF,FFFF=any PAN ID)
Note: Changing the PAN ID may make this node i

Node Identifier:

Scan Channels: hex (1FFE=all channels)

Scan Duration: (0-7)

Advanced Radio Settings

Transmit Power Level: ▾

Allows Join Time: seconds (0-64. 255=always)

Broadcast Hops: (0-7, 0=disabled)

RSSI PWM (PWM0): Enable RSSI PWM

RSSI Timer: msec (0-255, 255=always on)

Associate LED (DIO5): ▾

Serial Interface Settings

Baud Rate: ▾

Parity: ▾

Flow Control: Enable CTS Flow Control (DIO7)

Packetization Timeout: msec (0-255, 255=immediate)

View and change configuration settings as needed. To apply configuration changes, click **Apply**.

Basic radio settings control basic operation of the XBee Module in a ZigBee network.

- **PAN ID:** Sets the PAN (Personal Area Network) ID, in hexadecimal. This is the preferred PAN ID for the ZigBee network. All Digi Drop-in Networking products have a default PAN ID of **0x234**. A PAN ID of **FFFF** causes the XBee Module to select a random PAN ID. Otherwise, the specified ID will be used.

When a Router or End device searches for a Coordinator on the ZigBee network, it joins to a parent that has a matching PAN ID. If that device's configured ID setting is FFFF, the device will join a parent operating on any PAN ID.



Note: Changing the PAN ID may make your XBee product inaccessible.

- **Node Identifier:** A descriptive, user-friendly name for the device. This identifier is returned as part of any Node Discover operations done on the ZigBee network. Using Node Identifiers for Drop-in Networking devices makes it possible to reference them by names rather than their physical addresses. Enter a name of up to 20 characters.
- **Discover Timeout:** Sets the amount of time a node will spend discovering other nodes when a Node Join or Node Discover is issued.
- **Scan Channels:** A bit field list of the channels to scan. The Digi device chooses of the channels when starting the network. In a Router or End device, the bit field is a list of channels that will be scanned to find a Coordinator/Router to join.
- **Scan Duration:** Sets the scan duration exponent of the Active and Energy Scans (on each channel) that are used to determine an acceptable channel and Pan ID for startup of the Coordinator.

Advanced radio settings control behavior of the XBee Module at a more detailed level. Generally, these settings can be left at their defaults.

- **Transmit Power Level:** Sets the power level at which the XBee Module transmits conducted power.

| Power Level | Conducted Power in dBm |
|-------------|------------------------|
| Lowest (0) | -10 to 10 dBm |
| Low (1) | -6 to 12 dBm |
| Medium (2) | -4 to 14 dBm |
| High (3) | -2 to 16 dBm |
| Maximum (4) | 1 - 18 dBm |

- **Allows Join Time:** Determines how long a Coordinator or Router will allow other devices to join it. If set to 255, devices can join at anytime. (This setting is supported on Coordinators and Routers only.)
- **CCA Threshold:** Sets the CCA (Clear Channel Assessment) threshold. Prior to transmitting a packet, a CCA is performed to detect energy on the channel. The packet will not be transmitted if the detected energy is above the CCA threshold.
- **Random Delay Slots:** Sets the minimum value of the back-off exponent in the CSMA-CA algorithm for collision avoidance. If set to zero, collision avoidance is disabled during the first iteration of the algorithm.
- **Broadcast Hops:** Sets the maximum number of hops for each broadcast data transmission. 0 sets the radio to use the maximum number of hops.

Serial interface settings

- **Baud Rate:** The baud rate for the modem serial port.
 - **Parity:** The parity for the modem serial port.
 - **Flow Control:** Enable or disable CTS flow control for the serial port.
 - **Packetization Timeout:** The number of character times of inter-character delay required before transmission. If set to zero, characters are transmitted as soon as they arrive instead of buffering them into one RF packet.
4. If you assigned a Node Identifier, to view it, go to **Configuration > Mesh Network** and click **Refresh**. The new name is displayed in the **Node Identifier** field.

XBee Adapters

Hardware specifications for XBee Adapters (Sheet 1 of 3)

| Specification | | Value |
|---------------|-----------------------|---|
| Environmental | Operating temperature | <p>XBee RS-232 Adapter, XBee RS-485 Adapter, XBee Analog I/O Adapter, XBee Digital I/O Adapter, XBee Sensor Adapter, XBee USB Adapter: -40° C to 70° C (-40° to 158° F)</p> <p>Operating temperature for powering options: The temperature range of the UL/C-UL Listed power supply must be -40C to +70C minimum to meet the allowed ambient temp range for XBee Adapters. If a power supply with an ambient rating of less than 70 C is used, then the allowed ambient temperature range of the XBee Adapter is reduced to the rating of the power supply chosen.</p> <ul style="list-style-type: none"> • Battery: -18° C to 55° C (0.4° to 131° F) • External power: 0° C to 40° C (32° to 104° F) • External power (hardened): -35° C to 74° C (-31° to 165.2° F) <p>XBee RS-232 PH Adapter: 0° C to 65° C (32° to 149° F)</p> |

Hardware specifications for XBee Adapters (Sheet 2 of 3) (Continued)

| Specification | | Value |
|--------------------|-----------------------|--|
| Power requirements | DC power input | <p>XBee RS-232 Adapter, XBee RS-485 Adapter, XBee Analog I/O Adapter, XBee Digital I/O Adapter, XBee Sensor Adapter:</p> <p>External power supply varies by model:</p> <ul style="list-style-type: none"> • Alkaline battery model: UL /c-UL Listed ITE or Class II external power supply, with output rated between 9 to 30VDC, with a current rating of 300mA or greater; locking-barrel connector of 2.1mm x 5.5mm, center is positive. • Lithium battery model: 3-6VDC external power supply with locking-barrel connector. |
| | N-cell batteries | <p>XBee RS-232 Adapter, XBee RS-485 Adapter, XBee Analog I/O Adapter, XBee Digital I/O Adapter, XBee Sensor Adapter:</p> <p>3x1.5V "N" alkaline battery cells</p> |
| | Lithium batteries | <p>XBee RS-232 Adapter, XBee RS-485 Adapter, XBee Analog I/O Adapter, XBee Digital I/O Adapter, XBee Sensor Adapter:</p> <p>2/3 AA 3.6V lithium batteries and a 1/2 AA boost capacitor.</p> |
| | Power harvesting (PH) | <p>XBee RS-232 PH Adapter:</p> <p>Internal battery provides power when unit is operating and recharges from the serial port when in sleep mode.</p> <ul style="list-style-type: none"> • Requires a sleep/wake duty cycle as part of its normal operation. • Requires a fully functional serial port conforming to the RS-232C standard for optimal operation. • Sleep/wake duty cycle requirements vary based on the current output of serial port. • Serial ports with more than 14VDC output (rare) are not supported and may cause malfunction. • Serial ports that provide hard power of 5 to 14VDC on one or more pins allow the device to operate continually without a sleep/wake cycle. |
| | Bus-powered | <p>XBee USB Adapter:</p> <ul style="list-style-type: none"> • Bus powered: +5V from USB bus • Power consumption during normal operation: <ul style="list-style-type: none"> - XBee: 70 mA - XBee-PRO: 70 mA (Rx) and 250 mA (Tx) • Power consumption during suspend mode: <ul style="list-style-type: none"> XBee and XBee-PRO: 200 uA |

Hardware specifications for XBee Adapters (Sheet 3 of 3) (Continued)

| Specification | Value | |
|---------------|--|-------------------|
| Dimensions | XBee RS-232 Adapter, XBee RS-485 Adapter, XBee Analog I/O Adapter, XBee Digital I/O Adapter, XBee Sensor Adapter: | |
| | Width | 4.26 cm (1.68 in) |
| | Height | 2.53 cm (0.99 in) |
| | Length | 9.84 cm (3.87 in) |
| | Weight | 65.0 g (2.29 oz) |
| | XBee RS-232 PH Adapter, XBee USB Adapter: | |
| | Width | 4.57 cm 1.80 in) |
| | Height | 2.10 cm (0.83 in) |
| | Length | 7.29 cm (2.87 in) |
| | Weight | 45.36 g (1.60 oz) |

XStick ZNet 2.5

| Specification | | Value |
|-------------------------|--|--|
| Environmental | Operating Temperature | -40°C to 85°C (-40° to 185° F) |
| Power Requirements | Supply Voltage | 5V from USB port of PC |
| | Operating Current (Transmit) | 51mA |
| | Operating Current (Receive) | 47mA |
| | Power-down Current | Do not put the XStick in sleep mode. |
| Dimensions | Width | 1.78 cm (0.7 in) |
| | Height | 1.02 cm (0.4 in) |
| | Length | 4.57 cm (1.8 in) |
| | Weight | 7.5 g (0.265 oz) |
| RF Operation | Operating Frequency Band | 2.4GHz ISM |
| | Antenna Options | internal only |
| RF Performance | Indoor/Urban Range | 20m |
| | Outdoor RF line-of-sight Range | 50m |
| | Transmit Power Output (nominal 25°C) | 2.8 mW (4.5 dBm) Peak Conducted (FCC & Industry Canada) |
| | RF Data Rate | 250kbps |
| | Serial Interface Data Rate (software selectable) | 1200 bps-1M bps |
| | Receiver Sensitivity | -90dBm |
| Networking and Security | Supported Network Topologies | <ul style="list-style-type: none"> • Point-to-point • Point-to-multipoint • Peer-to-peer • ZigBee/Mesh |
| | Number of Channels (software selectable) | 16 |
| | Addressing Options | PAN, Channel and address |
| Certifications | The XStick ZNet 2.5 is a radio transceiver, and has received these agency approvals: | |
| | United States (FCC Part 15.247) | FCC ID: MCQ-XSTICK2 |
| | Industry Canada (IC) | IC: 1846A-XSTICK2 |
| | Europe (CE) | ETSI |

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

XBee Wall Router

| Specification | | Value |
|--------------------|-----------------------|--------------------------------------|
| Environmental | Operating temperature | -20° C to 75° C (-4° F to 167° F) |
| | Relative humidity | 5% to 95% (non-condensing) |
| Power requirements | AC power input | Universal AC input (85VAC to 265VAC) |
| Dimensions | Width | 5.0 cm (2.87 in) |
| | Height | 3.50 cm (1.37 in) |
| | Length | 7.30 cm (2.87 in) |
| | Weight | 70.87 g (2.50 oz) |

Integrated sensors

| Sensor | Specification | Value |
|----------------------|--------------------------------|--------------------------------------|
| Temperature sensor | Range | -20° C to 70° C (-4° F to 158° F) |
| | Accuracy | +/- 2° C |
| Ambient light sensor | Range of spectral bandwidth | 360 to 970 nm (similar to human eye) |
| | Wavelength of peak sensitivity | 570 nm |

XBee Sensors

| Specification | | Value |
|--------------------|-----------------------|--|
| Environmental | Operating temperature | -18° C to +55° C (-64.4° F to 131° F) |
| | Relative humidity | 5% to 95% (non-condensing) |
| Power requirements | AC power input | Alkaline Batteries 3 x 1.5V Alkaline battery cells |
| Dimensions | Width | 6.35 cm (2.50 in) |
| | Height | Height: 3.30 cm (1.30 in) |
| | Length | 6.85 cm (2.70 in) |
| | Weight | 0.35 lb (0.158 kg) with batteries installed, 0.20 lb (0.091 kg) without batteries installed |

Integrated sensors

| Sensor | Specification | Value |
|----------------------|--------------------------------|--|
| Temperature sensor | Range | -18° C to +55° C (-64.4° F to 131° F) |
| | Accuracy | +/- 2° C |
| Ambient light sensor | Range of spectral bandwidth | 360 to 970 nm (similar to human eye) |
| | Wavelength of peak sensitivity | 570 nm |
| | Luminance range | 10 to 1000 lux |
| Humidity sensor | Range | 5 to 95% RH |
| | Interchangeability | +/- 5% RH (0% RH to 59% RH), +/- 8%RH (60% RH to 95% RH) |
| | Accuracy | +/- 3.5% RH |

Class I Division 2, Groups A, B, C, D Hazardous location

XBee Adapter, Sensor, and Router products are intended for use **in ordinary locations only.**

The device and any leads for the device may **not** be extended into a Hazardous Location.

This device has not been evaluated for use in wet locations or near combustible liquids, fumes, or vapors.

Lithium battery safety precaution

XBee adapter and sensor products have no user-serviceable parts and are intended to be opened by qualified service personnel only.

Danger of explosion exists if lithium batteries are replaced incorrectly. Replacement must be done by qualified service personnel, and only with the same or equivalent battery type recommended by the manufacturer. Dispose of unused batteries according to the manufacturer's instructions.