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XBee Wi-Fi Cloud Kit

Radio Frequency (RF) Modules

Getting Started Guide

Revision history—90002195

Revision	Date	Description
A	November 2013	Initial release
B	February 2014	Improved the quality of the images and corrected part number discrepancies.
C	May 2014	Updated the graphics of the loose components to match the loose components and other accessories that are currently available with the kit.
D	July 2014	Completed a major overhaul of the document including reformatting, updating links and graphics, adding information for clarity.
E	August 2016	Converted to the new MadCap Flare format with minor updates.

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Introduction to your XBee Wi-Fi Cloud Kit

The XBee Wi-Fi Cloud Kit shows you how to set up your XBee Wi-Fi hardware and configure its sample web application. You can see sensor data from your development board on the web, as well as send data and commands from the web to your device. The components in this kit allow you to create customized solutions for connected devices.

The XBee Wi-Fi sample web application integrates with Device Cloud to enable two-way communication over the Internet, giving you remote control of your device wherever you are. This application also allows you to customize your dashboard widgets so that you can create your own connected device systems.

The following sections guide you through your kit setup for cloud-based access:

- XBee Wi-Fi development board components and descriptions
- Set up your XBee Wi-Fi Cloud Kit
- XBee Wi-Fi application exercise
- Do more with your XBee Wi-Fi Cloud Kit
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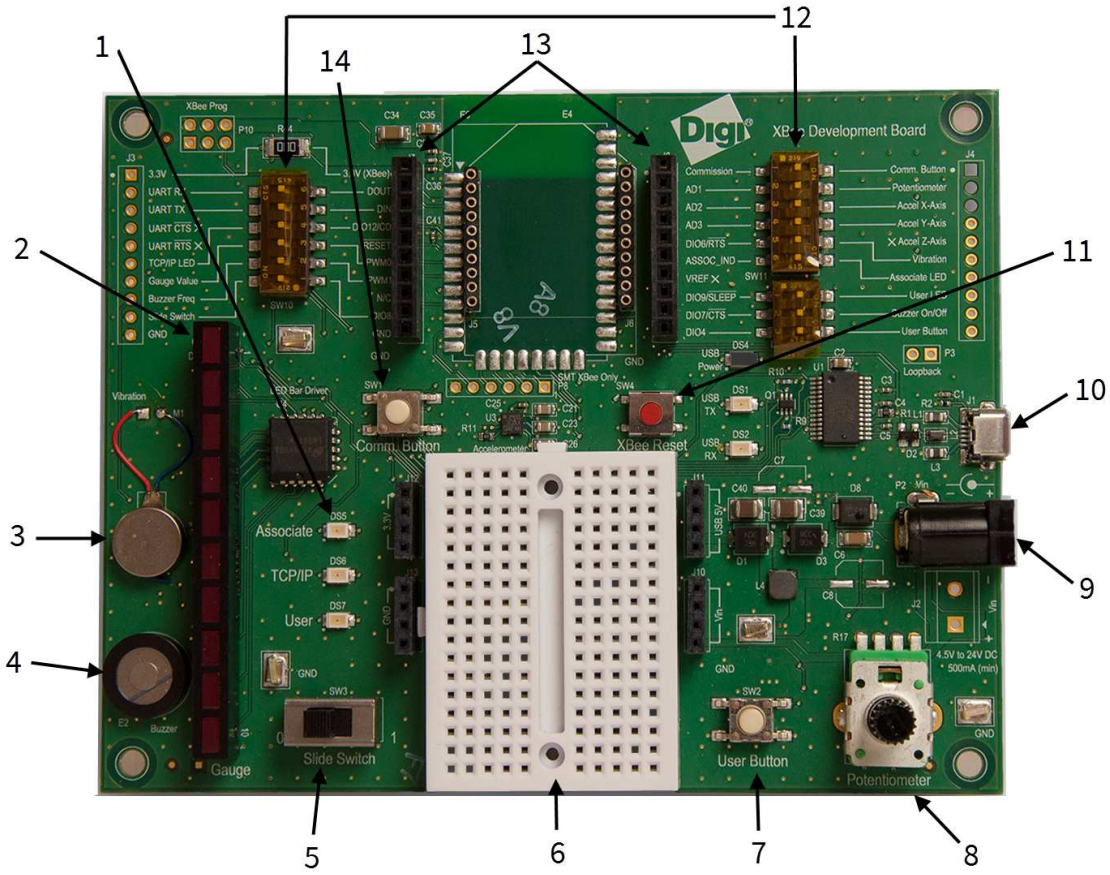
XBee Wi-Fi development board components and descriptions



The following table provides descriptions of the XBee Wi-Fi development board components.

	Development board components	Description
1	**Associate LED**	Indicates wireless connection status to local access point. ■ **Solid green**: The XBee module is not connected to a local access point. ■ **Flashing green**: The XBee is connected to a local access point and Device Cloud. ■ **Two short double blinks**: The XBee is connected to a local access point, but not Device Cloud.
	TCP/IP LED	An output light connected to one of the GPIO pins that allows you to turn it on or off using commands sent from Device Cloud.
	User LED	An output light that acts as a second User LED that allows you to turn it on or off using commands sent from Device Cloud.
2	**LED gauge**	The LED gauge indicates analog value ranging from 0-10 LEDs and is controlled through the XBee Wi-Fi dashboard.
3	**Vibration motor**	The vibration motor indicates change in status.
4	**Buzzer**	The buzzer acts as an alarm to indicate trouble. It is loudest at 2 kHz, but works at a range of frequencies. You can also control the frequency of the buzzer through the dashboard using the buzzer frequency slider. Use the buzzer toggle widget to turn the buzzer on or off.
5	**Slide switch**	The XBee Wi-Fi dashboard indicates the state of the slide switch. The switch stays either on or off.
6	**Breadboard**	The rectangular plastic board that lets you easily insert electronic components for testing purposes. This is useful for prototyping electronic circuits.
7	**Push button**	The state of the push button is displayed on the XBee Wi-Fi dashboard. The button appears ON only when actively being pushed.
8	**Potentiometer**	The potentiometer displays on the XBee Wi-Fi dashboard as a speedometer gauge, progress bar, or graph. You can control the potentiometer by turning the adjustable knob left or right.
9	**Barrel jack**	Accepts 4.5V to 24V through the development board. You can also use the barrel jack with the battery pack provided with the kit.
10	**USB jack**	The USB jack has two purposes: 1. To power the development board up to 5V. 2. To provide serial port access to the XBee Wi-Fi for configuration or sending and receiving data to and from Device Cloud.

	Development board components	Description
11	**XBee reset**	The XBee reset is connected to the XBee Wi-Fi reset pin. You can reconfigure it via the USB port.
12	**DIP switches**	These switches allow components on the XBee Wi-Fi development board to disconnect from the XBee. If the switch is away from the XBee, the XBee pin is connected to that built-in widget on the XBee Wi-Fi dashboard. If the switch is towards the XBee, the XBee pin disconnects from that component. **Note** When you are using loose components or doing advanced prototyping, you may need to disconnect the built-in component from the XBee pin.
13	**Prototyping headers**	The prototyping headers allow connection to all pins of the XBee Wi-Fi. Use the prototyping headers to connect to your own circuits including those using the loose components that came with your kit.
14	**Commissioning button**	Press the commissioning button four times to reset the network parameters and reactivate Soft AP mode.

Set up your XBee Wi-Fi Cloud Kit

The XBee Wi-Fi Cloud Kit includes access to a sample web application that makes it quick and easy to work with your XBee device. The XBee Wi-Fi sample web application integrates with Device Cloud to enable two-way communication over the Internet, giving you remote control of your device wherever you are. This application also allows you to customize your dashboard widgets so that you can create your own connected device systems.

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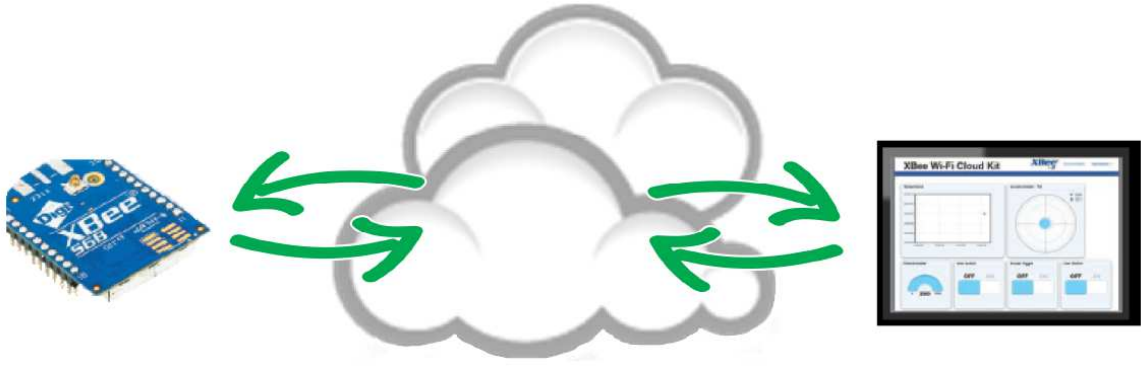
Configure your XBee Wi-Fi module using the Wi-Fi interface

By now you should have already verified the contents of your XBee Wi-Fi Cloud Kit, connected the hardware, and configured your XBee to connect to a local Wi-Fi access point.

1. If you have not yet configured your XBee to connect to a local Wi-Fi access point, follow the instructions in the Quick Start Guide that came in your kit, or find the XBee Wi-Fi Cloud Kit Quick Start Guide online at Digi.com.
2. If your module is not able to connect to your Wi-Fi access point, it returns to Soft AP configuration mode, and you are required to repeat the configuration steps. Keep in mind that your SSID and password are case sensitive.
3. If you are still having trouble connecting your XBee Wi-Fi to a local access point, see Troubleshooting.

Add your XBee Wi-Fi module to your Device Cloud account

The XBee Wi-Fi Cloud Kit includes access to a sample web application that makes it quick and easy to work with your XBee device. The XBee Wi-Fi sample web application integrates with Device Cloud to enable two-way communication over the Internet, giving you remote control of your device wherever you are. This application also allows you to customize your dashboard widgets so that you can create your own connected device systems.



You must have a Device Cloud account to use the features of the XBee Wi-Fi sample web application.

- If you do not yet have a Device Cloud account, go to Create a Device Cloud account.
- If you already have an account, go to Add your XBee Wi-Fi module to Device Cloud.

Create a Device Cloud account

Device Cloud enables you to set up and manage dynamic device networks. Your free developer account lets you explore Device Cloud's application development and device management tools, with a limited number of devices and transactions. With this developer account you discover how Device Cloud's suite of device management and application development tools can help you realize your machine-to-machine (M2M) solution. When you are ready to expand your Device Cloud access, complete the following steps.

To create your free Device Cloud account:

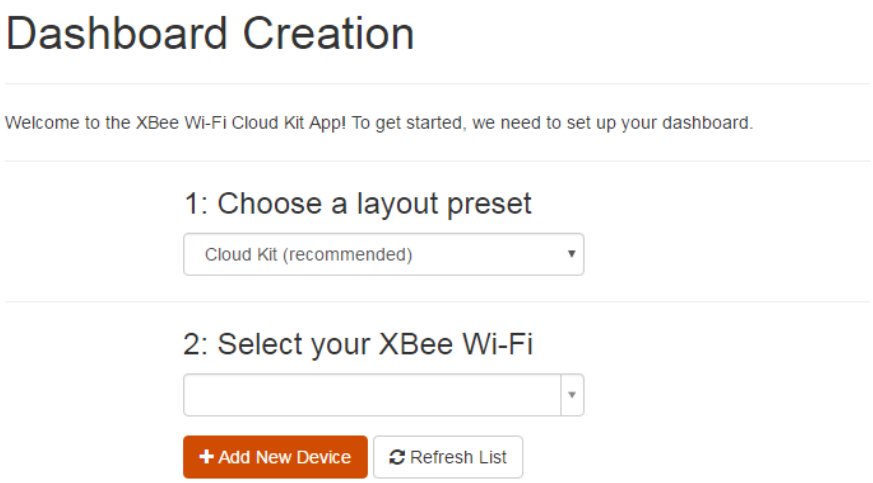
1. Navigate to *www.digi.com/cloud/digi-device-cloud*.
2. Click the **Free Developer Account/Login** button.
3. Follow the steps for creating your account.

If you need help creating an account, see the *Device Cloud User Guide*.

Add your XBee Wi-Fi module to Device Cloud

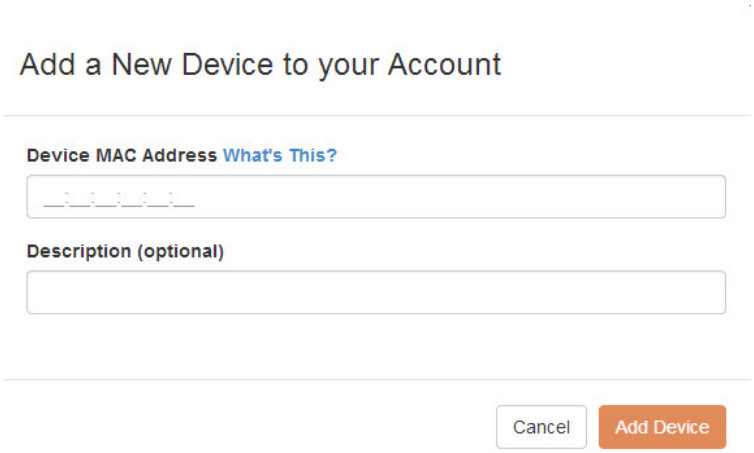
Once you have created your Device Cloud account, follow the steps below to add your XBee Wi-Fi module to Device Cloud.

1. Navigate to the *XBee Wi-Fi Cloud Kit login* page.
2. Enter your Device Cloud username and password. Once you have entered this information, click **Log in.**
3. On the Dashboard Creation page, click the **Add New Device** button.



4. In the pop-up window, enter the MAC address and a name or description for your XBee Wi-Fi module.

   Note Refer to section two of the Quick Start Guide where you wrote down the MAC address.



5. Once you have entered the MAC address and description, click **Add Device** to add the device to your account.
6. Your XBee Wi-Fi device hardware must be configured to properly work with your kit.
7. Click the **Configure For Cloud Kit** button to configure your device. A green check mark displays once your device has been successfully configured.
8. Choose the layout of your dashboard. **Cloud Kit** is the recommended preset.
9. Click **Create Dashboard!**.

   The XBee Wi-Fi sample web application appears.

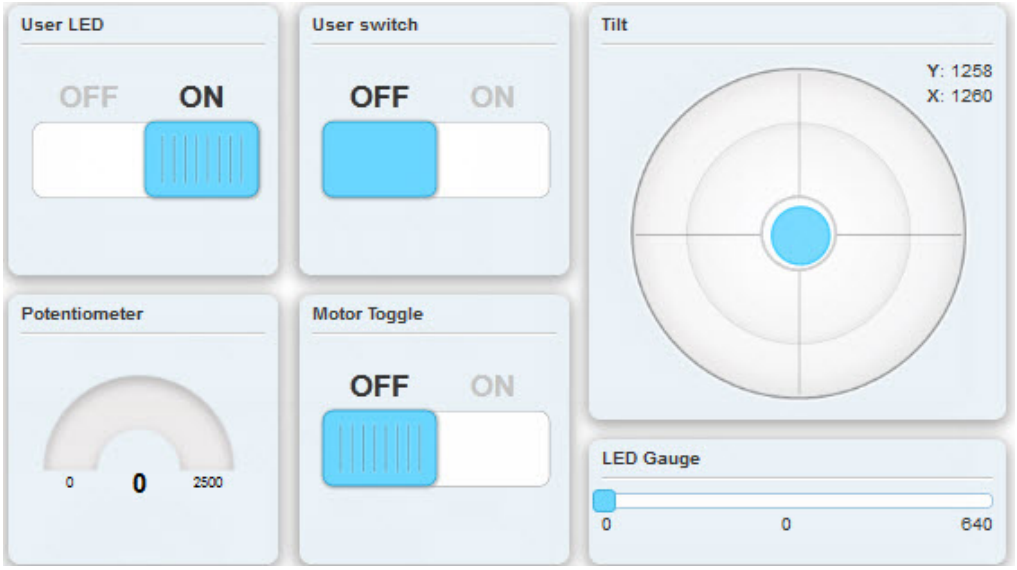
Configure widgets on your XBee Wi-Fi sample web application

This section describes how to add and customize widgets on the dashboard of your XBee Wi-Fi sample web application. If you are an advanced user, you can create your own widgets and write your own applications in source code.

How widgets work on the XBee Wi-Fi dashboard

After you have configured the first XBee device, you can access the XBee Wi-Fi dashboard. By default, the dashboard displays the widgets for the built-in components of the development board received within your kit.

Notice how the development board interacts with the XBee Wi-Fi sample web application. Find the Potentiometer located on the bottom-right corner of your development board. If you turn the knob left or right, the Potentiometer gauge on the dashboard displays the change after a short delay. You can also try setting the Buzzer Frequency to around 500, then switching the Buzzer Toggle on your dashboard. After about 10 seconds, the Buzzer sounds and turns itself off automatically.

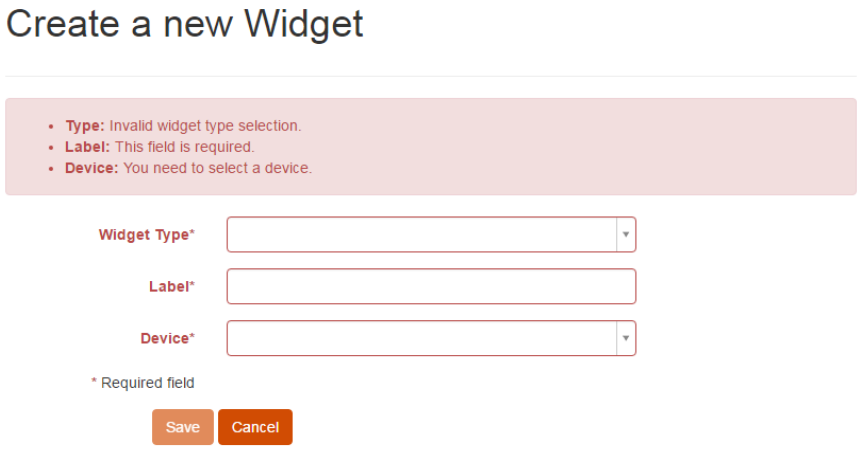


Note If you do not see your changes to the development board, refresh the web page and try again.

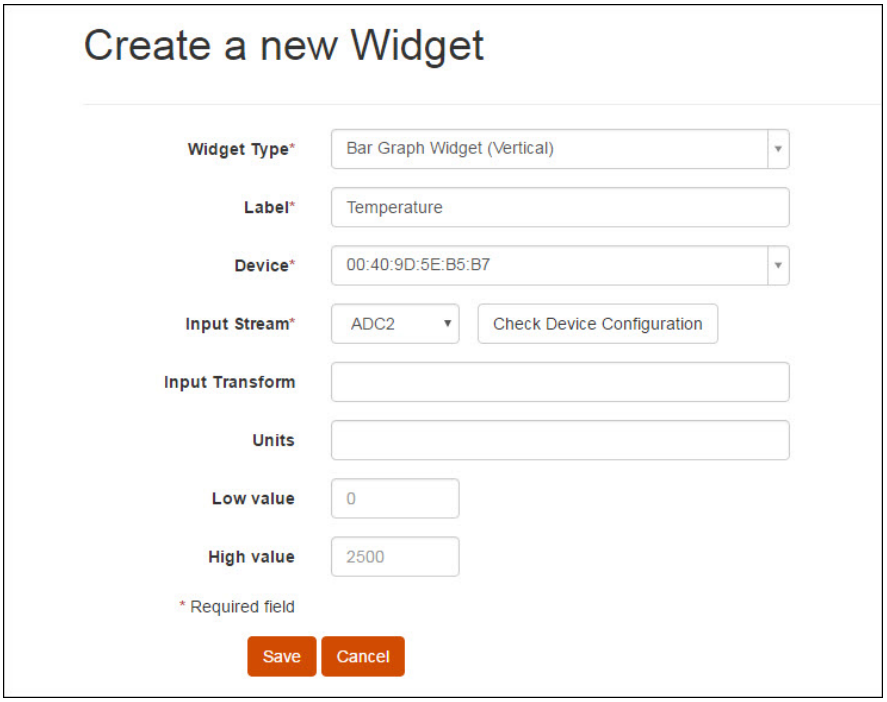
Add widgets to your dashboard

You can add widgets to your XBee Wi-Fi dashboard and customize them for your needs. These instructions show you how to add a progress bar widget:

1. Click the **Add Widget** button located on the bottom right-hand corner of your XBee Wi-Fi dashboard.



2. Click the **Widget Type** drop-down menu and select **Bar Graph Widget (Vertical)**.



2. Type the description of your widget in the Label text box. For example: **Temperature**.
3. Select the XBee device ID you would like to attach to this widget.
4. Click the **Input Stream** drop-down menu and select either **ADC2** or **ADC3**.
5. Click **Save** to save your widget settings.

The widget displays the Bar Graph Widget (Vertical) on the XBee Wi-Fi dashboard.

Note Wait about 20 seconds for the changes to apply.

For more information about customizing widget settings, see Edit (and customize) widget settings.

Edit (and customize) widget settings

1. Click the **widget settings** icon in the upper right corner of a widget.
2. On the Widget Settings page, customize the display of your widget by changing the settings available to your widget.

The following table provides descriptions of all of the widget settings.

Widget Setting	Description
Input Stream	Specifies the data stream on the XBee module that the widget subscribes to for data updates. Can be Digital (DIO/#), Analog (ADC/#) or Serial.
Output Stream	Specifies the output stream or pin on the XBee module that the widget will send its output values to. Can be Digital (DIO/#) or Serial.

Widget Setting	Description
Device Configuration Button	Checks that the module's firmware configuration is appropriate for the selected input or output stream. For example, if the Input Stream is set to DIO/0, the Check Device Configuration dialog verifies that D0 on the XBee acts as an input stream. Click this button to configure your XBee module to work with your XBee Wi-Fi Cloud Kit.
Units	Indicates the string label used within the widget that displays the unit values. Defines the units for the widget values, such as milivolts or decibels.
Timespan	Defines the total timespan, in seconds, that appears in the graph. For example, if you set the timespan to 90, the graph shows 90 seconds of data at a time.
X-axis Tick Size	Defines the spacing, in seconds, between tick marks/lines drawn along the X-axis of the graph.
Y-axis Auto Scale	Defines the automatic scaling of the Y-axis. If selected, the Y-axis of the graph automatically scales to fit the data being displayed. If not selected, the Y-axis min/max values are hard minimum and maximum values for the Y-axis.
Y-axis Min/Max	Sets the minimum and maximum values for the range of the graph's Y-axis. You can only use this setting if the "Y-axis Auto Scale" box is not selected.
Low/High Values (For progress bar and slider widgets)	Sets the low and high values for a progress bar or gauge widget. For example, you can set this value to display a data stream's values ranging from 100 to 1000. Slider widget: Sets the minimum and maximum allowed values in a slider's range.
Input Transform	Allows processing of incoming data with an expression for display. The AngularJS's $eval function implements the transform field and only evaluates Angular expressions.
PMW Output	Specifies the PWM output where the widget send its output values. This is similar to the "Output Stream" setting but is limited to PWM outputs.
Invert Values	Sends the value 0 when the switch is On, and 1 when the switch is Off, if selected.
Read Only Switch	Represents the data stream value last received from the server, if selected.
Setting	Specifies the timeout configuration setting on the XBee module where a widget writes new values.
Step Size	Sets the "step" size between slider values. The spacing snaps to those increments when you drag the slider handle. Default value is 1.

Remove widgets from your dashboard

These instructions show you how to remove widgets from your XBee Wi-Fi dashboard:

1. Hover over the upper right corner of your widget and select the **Widget Settings** icon ( ). The Widget Settings window appears.

2. Click the **Remove Widget** button located on the upper right corner of your XBee Wi-Fi dashboard.

Viewing widget source code

If you are an advanced user, you can create your own widgets and write your own applications in source code. For more information, see GitHub, a host site for various software development products. GitHub has many features including discussion tools, access to millions of repositories, and the ability to collaborate with other users.

Within the XBee Wi-Fi sample web application, you can view your widget's Javascript, CSS and HTML source code. Click the **View Widget Code** icon </> located in the upper right corner of your widget.

View Widget Code

JavaScript (src/app/widgets/barGraphVerticalWidget/barGraphVerticalWidget.js)

```
/*
 * This Source Code Form is subject to the terms of the Mozilla Public License,
 * v. 2.0. If a copy of the MPL was not distributed with this file, You can
 * obtain one at http://mozilla.org/MPL/2.0/.
 *
 * Copyright (c) 2014 Digi International Inc., All Rights Reserved.
 */

'use strict';

angular.module('XBeeWiFiApp')
    .directive('barGraphVerticalWidget', function (widgetRegistry, utils) {
        // called after DOM element is compiled
        var linker = function postLink(scope, element) {
```

LESS (src/app/widgets/barGraphVerticalWidget/barGraphVerticalWidget.less)

```
@import '../../../less/variables.less';
@import '../../../vendor/bootstrap/less/mixins.less';

.ui-progressbar-vertical {
    width: 3em;
    height: 250px;
    text-align: left;
    position: relative;
    /* Align the vertical bar to the center of the widget */
    margin: 0 auto;
}

.ui-progressbar-vertical .ui-progressbar-value {
    margin: -1px;
```

HTML Template (src/app/widgets/barGraphVerticalWidget/barGraphVerticalWidget.tpl.html)

```
<div class="widget-bar-graph-vertical" timestamp-tooltip="_lastTimestamp">
    <div progress-bar low="{{widget.low}}" high="{{widget.high}}"
        ng-model="value" vertical="true"></div>
    <p class="bar-graph-units">
        {{widget.units}}
    </p>
</div>
```

Close

XBee Wi-Fi application exercise

The exercise in this section shows you how to use your XBee Wi-Fi Cloud Kit to create custom connected device applications. The exercise uses some of the loose components that came with your kit to create a simple application that interacts with your online dashboard. This example is also available on XBee Wi-Fi Examples and Guides.

Note To complete the exercises described in this section, you must have completed the previous steps for setting up your kit.

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Create a temperature sensor

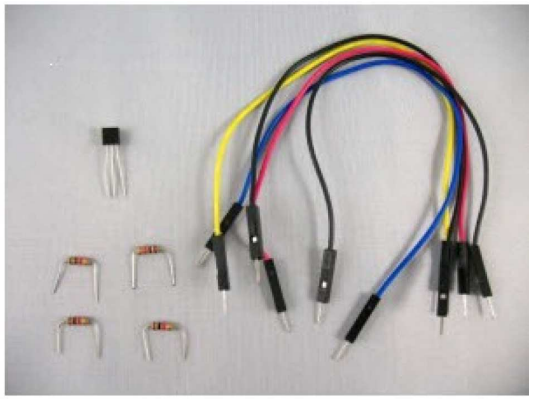
Measuring temperature is a popular method for getting started with analog sensing. This example uses the TMP36 low-voltage linear sensor that is included in the XBee Wi-Fi Cloud Kit. The TMP36 is simple to set up and does not require any complicated circuits or calculations.

The sensor generates a voltage output that is directly proportional to the Celsius temperature. The warmer the temperature, the higher the voltage that passes to the XBee devices analog-to-digital converter (ADC). The device sends this reading through Device Cloud to the XBee Wi-Fi Cloud Kit's online dashboard application where you can monitor the temperature from your web browser.

Assemble the parts

For this exercise, you need the following components:

- XBee Wi-Fi Cloud Kit or a powered XBee Wi-Fi with a breadboard and jumper wires.
- TMP36-for sensing temperature
- 4-1K ohm resistors
- Jumper wires

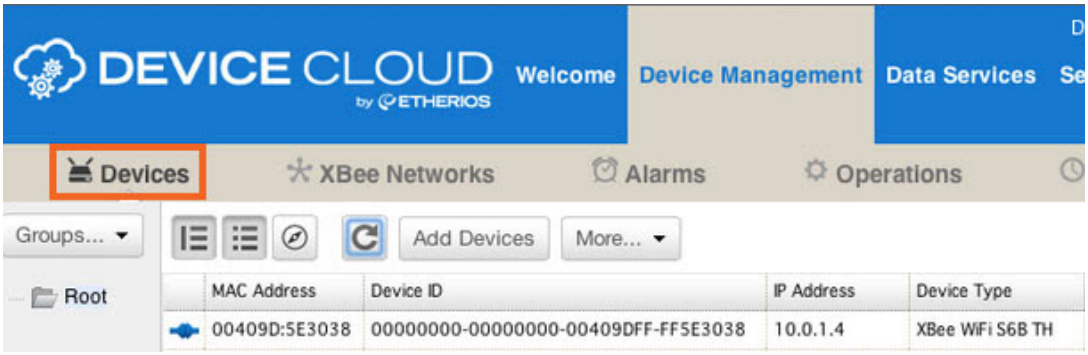


Configure the radio

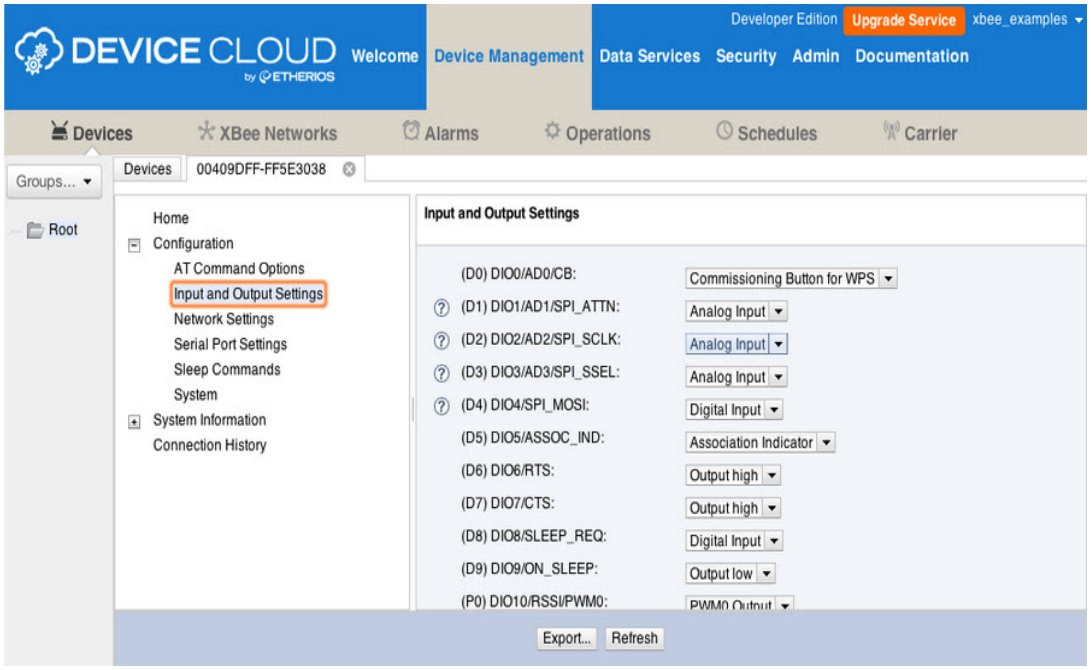
Configure the radio using your free Device Cloud account. You can also configure radios using XCTU.

Note If your radio was recently configured by the XBee Wi-Fi Cloud Kit, the sampling rate and pin settings are already set, and you can skip this procedure and continue to Wire up the circuit.

1. Log in to Device Cloud.
2. Select the **Device Management** tab, and then select **Devices**.



3. Select the XBee device you want to configure, and select **Properties** or double-click the device to open the Properties window for the device.
4. Select **Configurations > Input and Output settings**, and confirm that DIO2/AD2/SPI_SCLK is set to **Analog Input**.

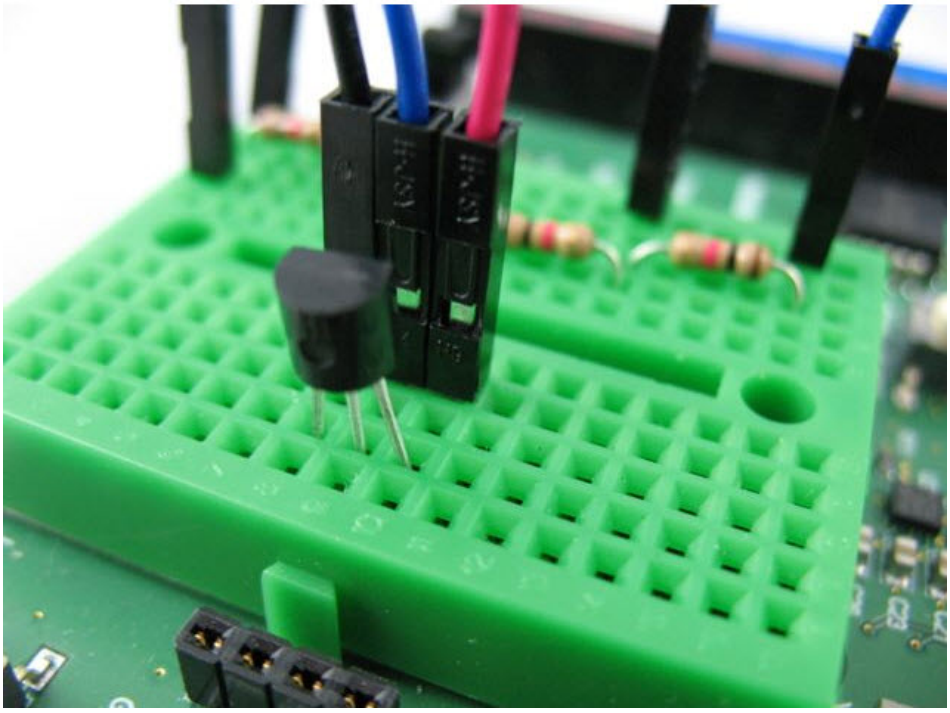


5. Confirm that the Sample Rate is set to **5000ms** which will take a sample every five seconds.
6. Click **Save**.

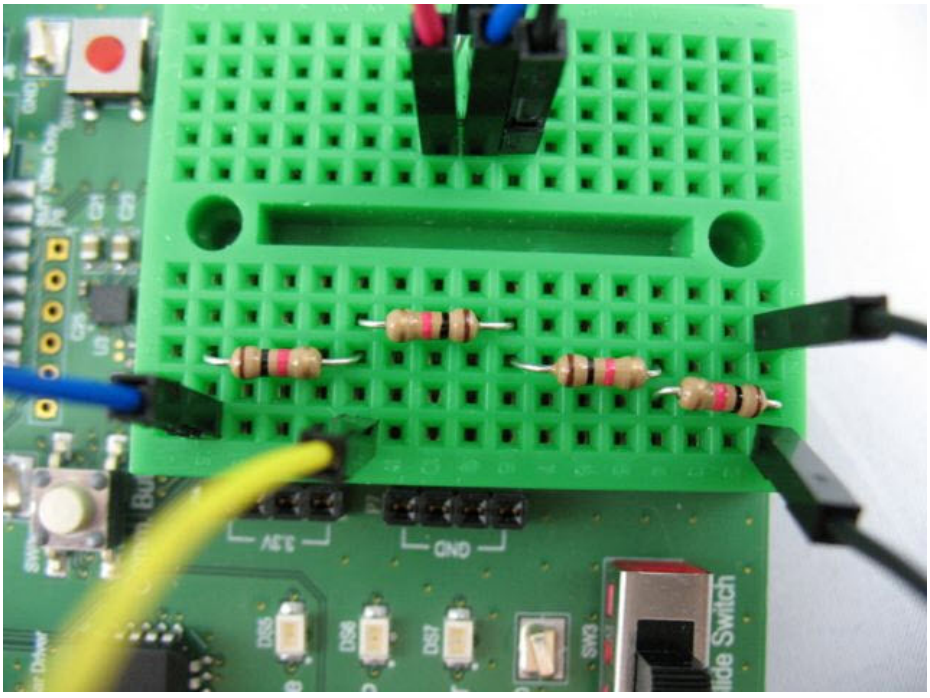
Wire up the circuit

Build the sensor circuit using the XBee Development Board.

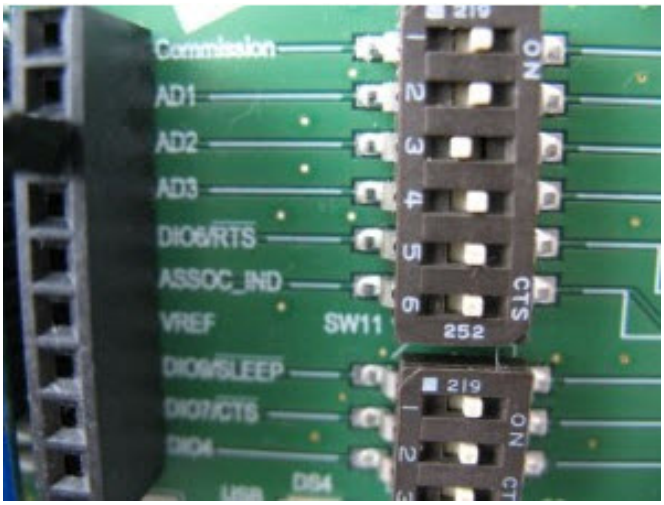
1. Plug the temp sensor into three separate rows on the breadboard as shown. With the flat side facing you, the pins are numbered 1 to 3 from right to left.
2. Connect a red jumper wire from a socket in the same row as pin 1 of the TMP36 to 3.3 volts power.
3. Connect a black jumper wire so that pin 3 of the TMP36 is connected to **GND** (ground).



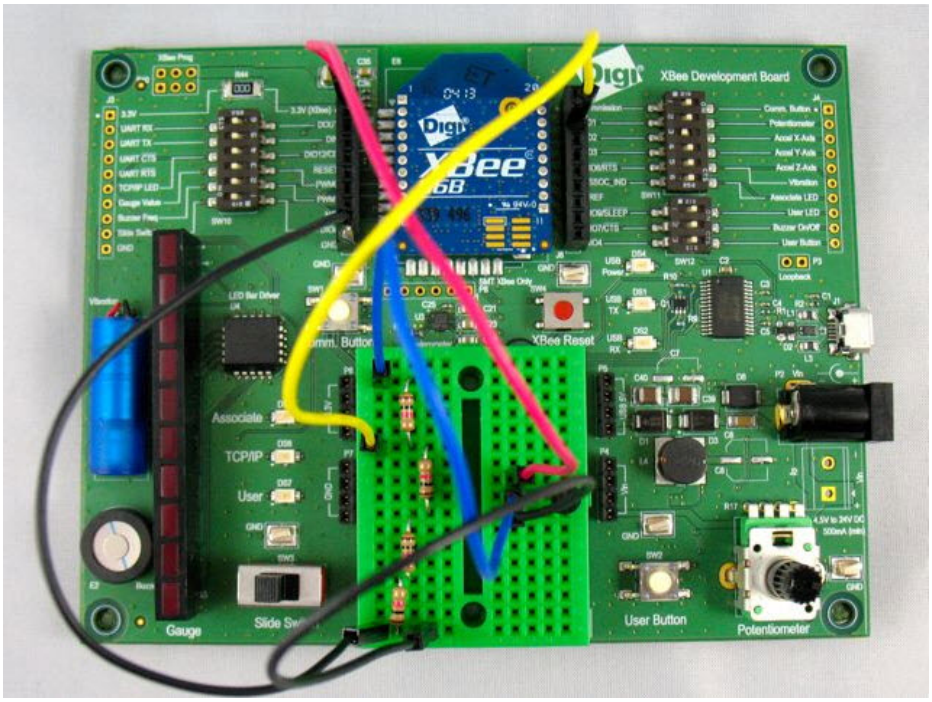
4. Plug the four resistors into separate rows of the breadboard as shown in the following graphic. This forms a chain, with each resistor connecting the end of each other resistor on either side and scales the input down from 3.3 volt input to the 2.5 volt maximum of the XBee Wi-Fi's ADC.
5. Connect a blue (or any other color) jumper wire so that the middle pin (2) of the TMP36 connects to the open end of the first resistor.
6. Connect one end of a yellow (or any other color) jumper wire to the row where the first and second resistors meet. Connect the other end of this wire to the XBee's **AD2** pin.
7. Use a black wire to connect the open end of the fourth resistor to **GND**.



8. Set the DIP switch for AD2 on the PCB to **OFF** to disconnect the soldered-on component.



The following image provides an example of how the board appears when you have finished connecting all the circuits:



View it

Use the XBee Wi-Fi Cloud Kit's web application to configure a widget for viewing the temperature readings from your sensor.

1. Log in to the *XBee Wi-Fi sample web application*.
2. Click **Add Widget** located on the bottom corner of your screen to create a new display widget.
3. Choose **Gauge Widget** for the widget type, and give the widget a name (for example, **°C**).
4. Select the XBee device you are using for this widget.
5. Select **ADC2** as the input stream and check the device configuration to make sure it is configured properly.
6. Enter "**value/0.75/10-50**" to transform the input from millivolts to degrees Celsius.

   Note If you want to use Fahrenheit, the calculation is **"(value/ 0.75/ 10-50)* 1.8+32"**. Make sure you change the label and value range to reflect the new unit of measure.

   The calculation takes the input value, scales back by 1/4 from 3.3 volts to the 2.5 volt maximum that the ADC input on the XBee Wi-Fi can manage. It then divides that value by ten and subtracts half a volt to get the Celsius value. For more information see the TMP36 *data sheet*.
7. Set a low value of **0** and a high of **50** to see a reasonable Celsius temperature range.
8. Click **Save**.

Use it

Now you can see the temperature using the analog input of your XBee Wi-Fi. You can test getting data from various locations, such as outside or inside your freezer. You can also add a graph widget to examine data over time, and log the changes in your office to see temperature change from day to night.

Note This temperature sensor is designed to produce stable readings, so it may take a few minutes for the sensor to fully reflect changes from its environment. If you want to experiment with rapidly changing sensor data, try building a light sensor. You can follow the instructions located on the *XBee Wi-Fi Examples and Guides page*.

Do more with your XBee Wi-Fi Cloud Kit

This section provides some additional guidance about how to work with your XBee Wi-Fi Cloud Kit.

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