

Sensor Monitor Network Sample Application CC2530ZNP Mini Kit – Quick Start Guide

STEP 1 – Introduction

The CC2530ZNP (ZigBee Network Processor) can be used for designs where the CC2530ZNP, containing the ZigBee Pro stack, communicates to the system's main processor through the SPI/UART/USB interface. This partitioning option allows the designer to keep the ZigBee application profile and any other applications on the main processor. Thereby, allowing developers to add ZigBee to existing designs or for a design of small footprint easy to develop ZigBee Solutions

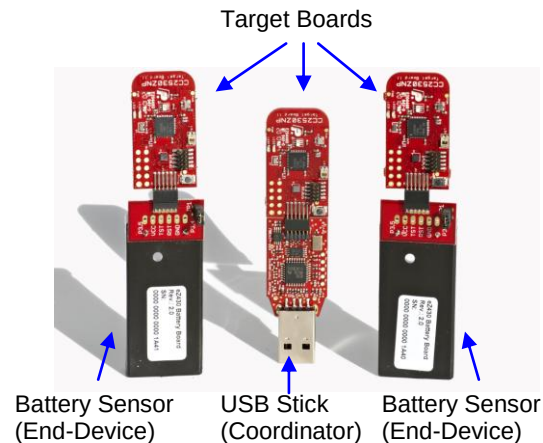
The ZigBee Network Processor development kit is designed to give a simple introduction to ZigBee wireless networks. The hardware consists of a CC2530 ZigBee device talking to an MSP430F2274 micro-controller over the SPI interface that controls the ZigBee device. The development kit demonstrates examples of typical sensor networks with temperature, light, voltage, and motion sensors.

This guide describes how to set up a CC2530 ZigBee® Network Processor (ZNP) development kit for Sensor Monitor Network Sample Application functionality.

The sensor monitor network application is comprised of two types of devices: Sources and a single Sink, operating in potentially all three ZigBee roles: Coordinator, Router, and End Device. Sources provide temperature and battery voltage readings collected by the MSP430F2274 using its on-chip temperature sensor and A2D converter periodically to the Sink. The sink in the network is the Coordinator and routers and end-devices operate as source of data in the network. ZigBee nodes and data collected by the sink device are displayed on a GUI for network visualization.

For the Sensor Monitor Network Sample Application, the CC2530 on all the target boards will be programmed with the ZNP images based on the latest release Z-Stack-2.5.0 included with the Sample Application and MSP430F2274 programmed with the sample application. Follow the steps below for setting up a ZigBee based Sensor Monitor Network.

To run this sample application you also need to order a CC-debugger for upgrading the image on the CC2530 to the latest Z-Stack-2.5.0 release. The CC-Debugger can be ordered from <http://www.ti.com/tool/cc-debugger#buy>



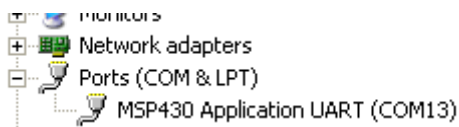
STEP 2 – Install the sample software and connect the USB stick

Download the CC2530ZNP example software (Sensor Monitor Network Sample Application) from <http://www.ti.com/cc2530znp>

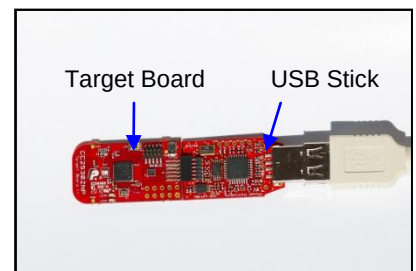
Double-click the installer file to install the example software package and drivers. After installation the default location for the sample software is

C:\Texas Instruments\CC2530ZNP-MK Sensor Network Monitor Application

Connect the USB stick to a USB port on the PC. The Windows new device found pop-up will request a new device driver to be installed. Normally the driver should be detected automatically. If the driver is not detected it can be found at the default location **C:\Texas Instruments\CC2530ZNP-MK Sensor Network Application\IAR\Drivers**



After installation a new COM port will be installed on the PC. To see the COM port number, open the **Windows Control panel – System – Hardware – Device Manager** and check the COM port number under Ports (COM and LPT).



The USB stick serves both as a virtual serial port interface and as debugger/programmer. This means that during normal operation the USB stick should be connected to the **coordinator** target board. The USB stick can also be used to program and debug the end-device target boards using the Code Composer Studio or the IAR Embedded Workbench.

If you need more information how to use the IAR Embedded Workbench for compiling and debugging please see the user's guide: <http://www.ti.com/iarkickstart>.

STEP 3 – Download the ZNP Image on CC2530

Download and Install the TI SmartRF Flash Programmer from <http://www.ti.com/lit/zip/swrc045>

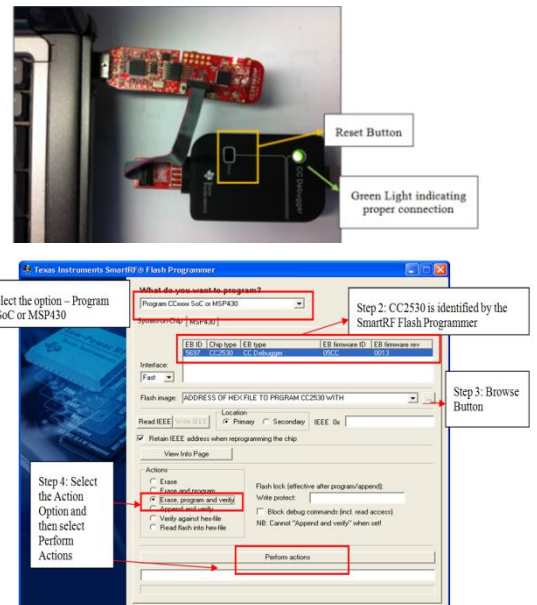
Download and install SmartRF Studio to get the driver for CC-Debugger from <http://www.ti.com/lit/zip/swrc176>

Connect the CC-Debugger to a USB port on the PC. The Windows new device driver will request a new device driver to be installed. Normally the driver should be detected automatically. If the driver is not detected it can be found at the default location: **C:\Program Files\Texas Instruments\SmartRF Studio 7\drivers**

Connect the CC-Debugger to USB port on the PC and connect the 10 pin ribbon cable to ZNP-Mini-Kit 10-Pin Header connector as shown in the figure. Ensure that pin 1 on the header (marked by red wire) is connected to the Pin-1 on the CC2530ZNP Mini kit 10 pin DEBUG connector. Press the Reset button on the CC-debugger, if properly connected Green Light will glow. If not Check the connections and ensure that the CC-Debugger is also connected to the PC's USB port.

Start SmartRF Flash Programmer from Start -> All Programs -> Texas Instruments -> SmartRF Flash Programmer -> Flash Programmer

Follow the steps as shown in figure. **CC2530ZNP image for Step 3** will be located at from **C:\Texas Instruments\CC2530ZNP-MK Sensor Network Application\IAR\Bin\TestHex Images** file name **CC2530ZNP-MK-Pro.hex**. Download the CC2530ZNP image on all three target boards in the CC2530ZNP Mini Kit.



STEP 4 – Download the Application Code on MSP430F2274

Either Code Composer Studio v 4.2.3 (or above) or IAR Embedded workbench v 5.20 (or above) can be used to download and debug the Sensor Monitor Network Application code.

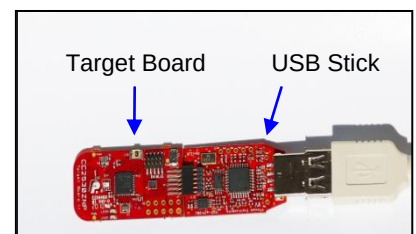
If you don't have the Code Composer Studio for MSP430 v4.2.3 or above, download and install the Code Composer Studio 120 day evaluation version from www.ti.com/ccs

If you don't have full version of IAR Embedded workbench for MSP430 v5.20 or above, download and install the IAR Embedded workbench 30 day evaluation version from www.iar.com/downloads

When using the code composer studio open the Sensor Monitor Network Sample Application project located at **C:\Texas Instruments\CC2530ZNP-MK Sensor Network Application\CCS\Sensor Demo CC2530ZNP**

When using IAR, open the project Sensor Monitor Network Sample Application.eww from **C:\Texas Instruments\CC2530ZNP-MK Sensor Network Application\IAR\ZNP Sensor Monitor Demo Application\IAR**

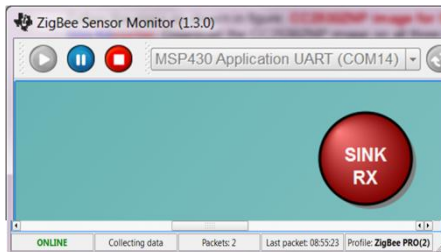
Connect the USB stick to a USB port on the PC. Download the code on the target board by selecting the option Download and Debug under the Project tab in IAR. Stop Debugging by selecting the option Stop debugging under Debug tab. After this you should see both LED's Blinking on the target board. If not, remove and re-plug power on the board. Else download the code again. Download the code on the all three Target boards by connecting them to the USB stick.



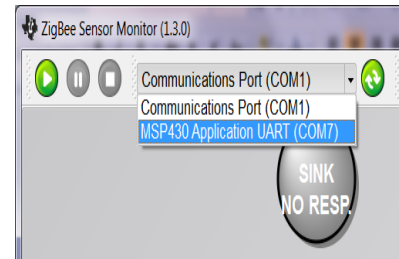
STEP 5 – Download and Start the Sensor Monitor GUI

Download and install the Sensor Monitor GUI from <http://www.ti.com/cc2530znp>

Connect a target board on the USB stick and connect it to the PC's USB port.



Start the Sensor Monitor GUI
Application Start-> All Programs ->
Texas Instruments -> ZigBee Sensor
Monitor -> ZigBee Sensor Monitor



Select the MSP430 Device and select the start button; the identified device will then be displayed as a RED circle, a sink device and status in the GUI window will change to **ONLINE** Collecting data.

STEP 6 – Start the network – Coordinator (Sink Device)

Any device on the kit programmed with Sensor monitor network sample application can assume the role of coordinator – Sink. For the data to be reported to the GUI we will make the device connected to the PC **Coordinator Sink** by **pressing the button ONCE on the target board connected to the PC**. After button press, LED's on the board will stop blinking. Device will first start up as a router and will try to join a network, if it does not find a network in ~10 seconds, it will reconfigure itself as coordinator and start up as coordinator. RED LED will turn on indicating device has started up as a coordinator and a **ZigBee network is initialized**.

STEP 7 – Add end-devices and Routers (Source Devices)

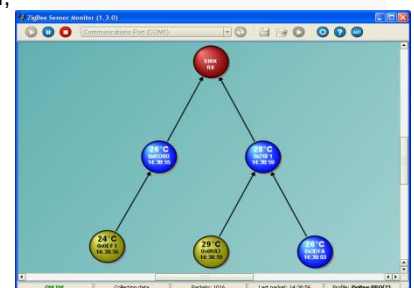
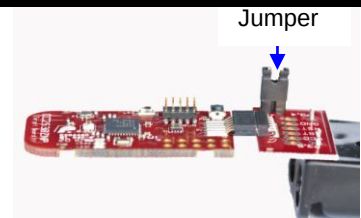
Insert batteries in one or more of the battery boards and make sure the jumper is connected to power the end-device.

On Start-up both LED's on the board should blink at interval of ~1sec, indicating the device is now waiting for input from the user for its configuration.

Configure device as **Router** – Pressing button once on the target board will configure the device as router, it will then join the network initialized in step 3. On the GUI, router will be recognized as a Blue circle.

Configure device as **End Device** – Pressing button twice on the target board will configure the device as end device, it will then join the network initialized in step 3. On the GUI, end device will be recognized as a yellow circle.

Both Router and End device are the source of data on the network and send message to the sink (temperature, bus voltage and parents address to the coordinator).



STEP 8 – Allow or Disallow Network Joins

On coordinator and routers pressing the button after the devices have joined the network enables or disables the “allow join” option on these devices. Pressing the button one time on the coordinator will cause the RED LED to Blink, indicating coordinator will not allow any new device to join to it. Similarly on Routers, pressing button once will cause the GREEN LED to blink, indicating the router will not allow any new device to join to it. Pressing the button again will cause the RED LED on the coordinator and GREEN LED on the router board to turn ON, indicating they allow new devices to join to the network via them.

STEP 9 – Next steps and more Information

For more details and better understanding of the application code please refer to the document Sensor Monitor Network - Sample Application.pdf included with the install of this sample application at <C:\Texas Instruments\CC2530ZNP-MK> [Sensor Network Application](#). For detailed tutorial on the Sample Application please see the online workshop at http://processors.wiki.ti.com/index.php/Getting_Started_with_ZigBee_using_the_CC2530ZNP_Mini_Kit. Lab 2 of this workshop covers the Sensor Monitor Demo Application.

To modify the sample application for developing custom applications use the Code Composer Studio v4.2.3 or a newer version. You can download the Code Composer Studio from www.ti.com/ccs. Alternatively, you can also use IAR Embedded Workbench v5.20 or a newer version for developing custom applications. You can download IAR Embedded Workbench from www.iar.com/downloads

In addition to the sensor monitor network sample application, extensive examples are provided to help you get started. Download these sample applications by clicking on the following link <http://www.ti.com/lit/zip/swrc211a>. Building and running each example is recommended to become acquainted with the device. Start with the Hardware Interface Examples, then the ZNP Interface Examples, and finally the Communications Examples. Refer to the examples' wiki page for more information.

Use ZNP target board connected to the USB stick to test these examples and keep a UART terminal window open to see the data sent to the PC. The board connected to the USB cable should normally be selected as **Coordinator** while the battery boards are **End-Devices**. The development kits are shipped with the “**Simple Applications**” coordinator and end-devices programmed. Hex files for the MSP430 sample applications and for CC2530ZNP can be found at: <C:\Texas Instruments\CC2530ZNP Mini kit\Bin>. These files can be programmed with the [SmartRF Flash Programmer](#).

For detailed information about the sample applications please see the following resources:

- CC2530ZNP wiki page: <http://processors.wiki.ti.com/index.php/CC2530ZDK-ZNP-MINI>
- CC2530ZNP product web page: <http://focus.ti.com/docs/toolsw/folders/print/cc2530zdk-znp-mini.html>
- CC2530 product web page www.ti.com/cc2530
- ZigBee training material: http://processors.wiki.ti.com/index.php/Low_Power_RF_Solutions_Workshop
- The Low Power RF Online Community has forums, blogs and videos. Use the forums to find information, discuss and get help with your design. Join us at www.ti.com/lprf-forum
- If you want to modify the CC2530ZNP image to fit your application the source code can be found on the Z-stack product page: www.ti.com/z-stack

Important note: The CC2530ZNP Mini kit is an educational tool that allows developers to get familiar with basic ZigBee networks. It is based on a 32Kbyte flash MSP430, because of this it does not support ZigBee Public Profiles. You can use this kit to build only the private profile based applications.

Do you need more than 32Kbyte of flash? The full ZigBee development kit allows development of public ZigBee profiles. Try the ZigBee Application Processor with support for ZigBee profiles: <http://focus.ti.com/lit/wp/slyy022/slyy022.pdf>. Texas Instruments has ZigBee solution for any application; see the complete offering on www.ti.com/zigbee