

# **BOOSTXL-SENSHUB Sensor Hub BoosterPack Getting Started Guide**

The Sensor Hub Booster Pack ([BOOSTXL-SENSHUB](#)) is a low-cost extension board for the Tiva™ C Series TM4C LaunchPad [EK-TM4C123GXL](#) evaluation platform for ARM® Cortex™-M4-based microcontrollers (MCUs). This extension board, or BoosterPack, is specifically designed to expand the functionality of the Tiva TM4C LaunchPad. This Getting Started Guide reviews the initial setup required in order to demonstrate the BOOSTXL-SENSHUB Air Mouse application.

## Contents

1	Introduction .....	1
2	Out of the Box Demonstration .....	2
3	Compile, Download, and Debug .....	8
4	References .....	14

## 1 Introduction

This Getting Started Guide is intended to assist users in the initial setup and demonstration of the BOOSTXL-SENSHUB Air Mouse application. This document contains two primary parts. The first part reviews the download and installation of the minimum required applications in order to load the Air Mouse application and demonstrate its capabilities. The second part explains how to install an Integrated Development Environment (IDE), then compile, download, and debug the example applications.

The Sensor Hub BoosterPack is an extension board for the [TI MCU LaunchPad evaluation module](#) ecosystem. The Sensor Hub BoosterPack plugs in to the BoosterPack XL headers located on the top of the LaunchPad. This board and the available software also highlight the use of the new , an easy-to-use, extendable foundation of sensor communication software.

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**NOTE:** The Sensor Hub BoosterPack is fully compatible with both the Tiva™ C Series LaunchPad ([EK-TM4C123GXL](#)) and its predecessor, the Stellaris® LM4F120 LaunchPad (EK-LM4F120XL).

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## 2 Out of the Box Demonstration

The supporting software platform for the Sensor Hub BoosterPack is TivaWare® for C series. This software suite provides a set of applications in both source and binary form. This section discusses how to install TivaWare for C Series, how to install the BoosterPack, the process of loading a pre-compiled binary file, and explains how to run the Air Mouse example application.

This example also supports the RemoTI™ low-power RF Zigbee® human interface device (HID) profile. The wireless features of this example require the [CC2533EMK](#) expansion module and the [CC2531EMK USB Dongle](#). For details and further instructions regarding wireless operation, see the Tiva C Series LaunchPad wiki at [http://processors.wiki.ti.com/index.php/Tiva\\_C\\_Series\\_LaunchPad](http://processors.wiki.ti.com/index.php/Tiva_C_Series_LaunchPad).

### 2.1 Prerequisites

This demonstration requires that the following items be available to the user:

- One (1) EK-TM4C123GXL (Tiva C Series TM4C123G LaunchPad) or EK-LM4F120XL (Stellaris LM4F120 LaunchPad) kit
- One (1) BOOSTXL-SENSHUB Tiva C Series Sensor Hub BoosterPack
- An active Internet connection
- A computer running Microsoft® Windows® 7 operating system

### 2.2 Download Software

Download the following items:

- TivaWare for C Series. Select either of these two software download options:
  - [Tiva C Series LaunchPad software](http://www.ti.com/tool/sw-ek-tm4c123gxl) (from <http://www.ti.com/tool/sw-ek-tm4c123gxl>). This package is a smaller installer for only the TM4C123G LaunchPad.
  - [TivaWare for C Series](http://www.ti.com/tool/sw-tm4c) (complete) (from <http://www.ti.com/tool/sw-tm4c>). This package is the complete installer and includes the TM4C123G LaunchPad as well as other Tiva C Series related boards.
- [LMFlashProgrammer](http://www.ti.com/tool/lmflashprogrammer), from <http://www.ti.com/tool/lmflashprogrammer>.

If you have not previously installed the drivers for your LaunchPad follow the driver installation guide to complete this process now. The driver installation guide is located at [SPMU287](#). The drivers can be downloaded from [the ICDI Drivers tool folder](#).

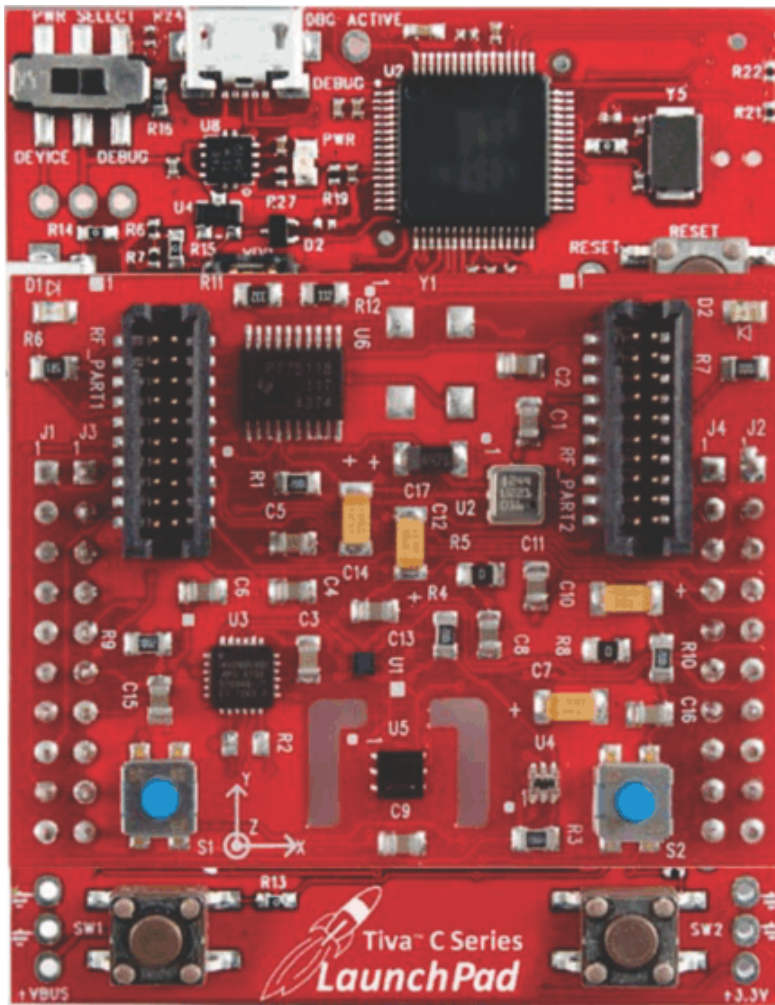
### 2.3 Installation

Install the TivaWare package downloaded in step 1 by running the installation executable file. You may select a different installation folder. This guide assumes the use of the default installation folder, `C:\ti\TivaWare_C_Series-1.0\`. For the balance of this Getting Started Guide, this folder is referred to as the *TivaWare folder*.

Install LMFlashProgrammer by running the installation executable file.

Mount the Sensor Hub BoosterPack onto the LaunchPad. The buttons on the LaunchPad should align with the buttons on the BoosterPack; refer to [Figure 1](#).

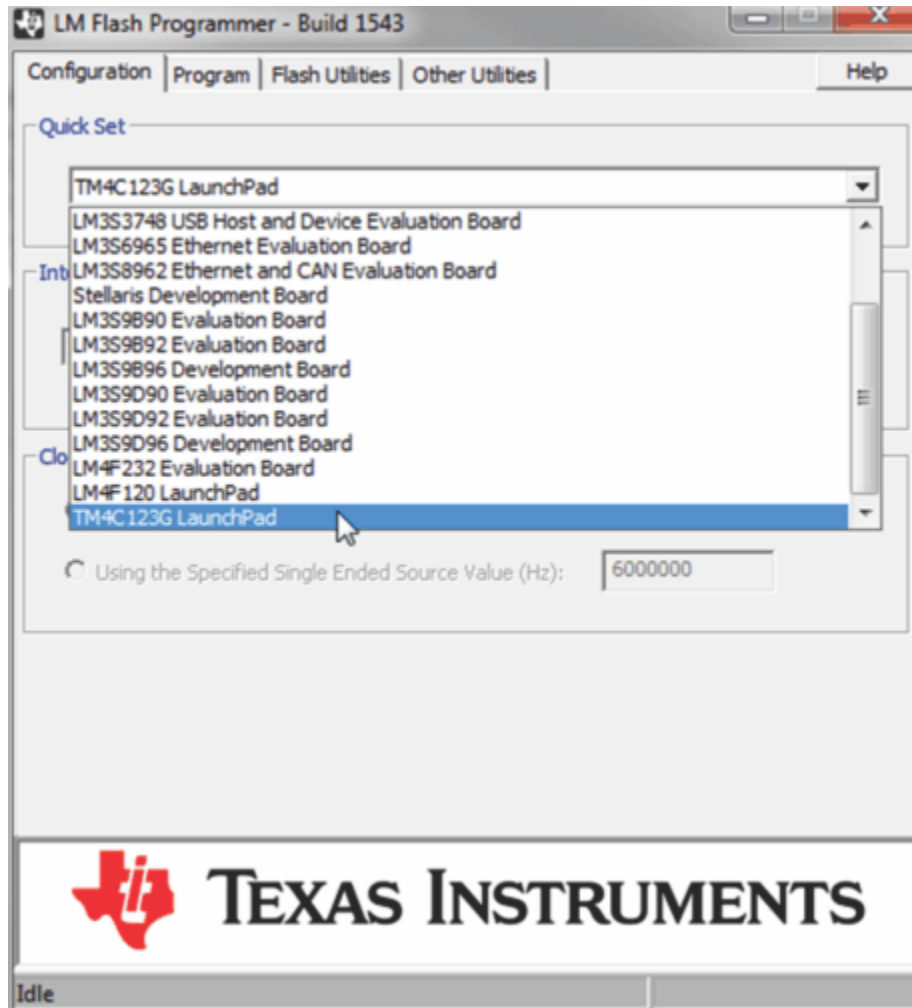
Figure 1. Sensor Hub BoosterPack Mounted on Tiva C Series LaunchPad



## 2.4 Programming

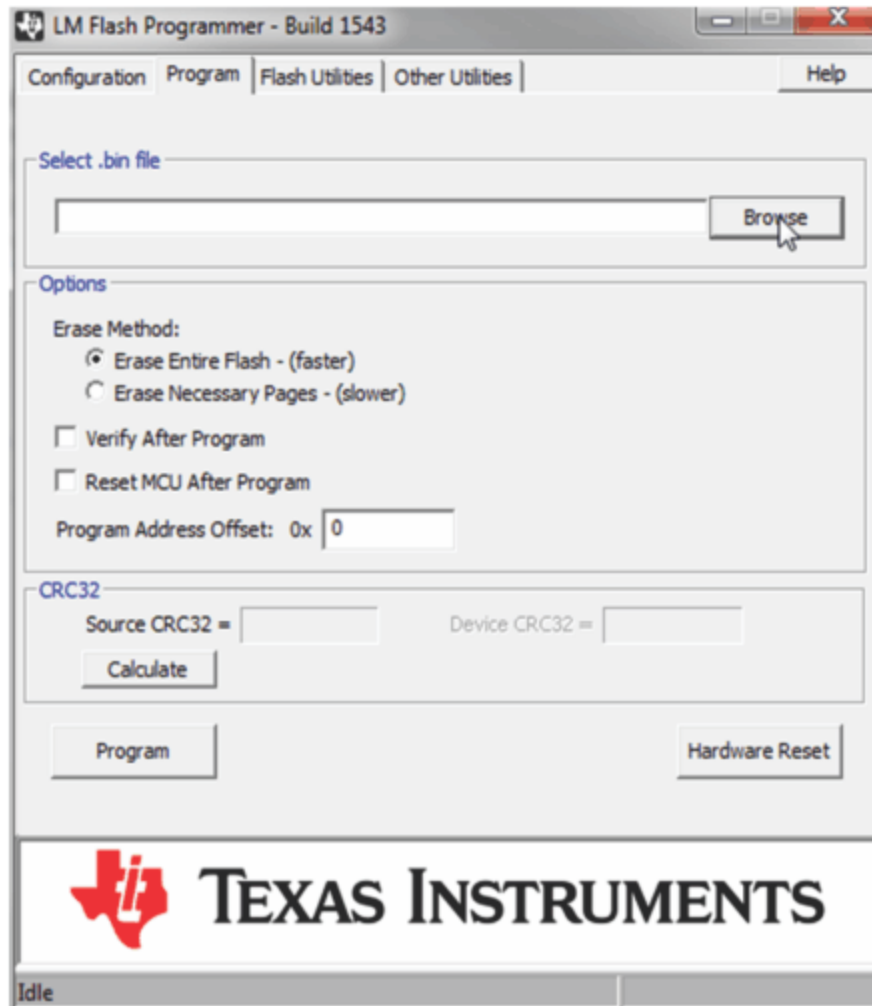
Start the LMFlashProgrammer. Plug the USB micro cable into the ICDI socket on the top of the LaunchPad. Make sure the power select switch is moved to the right and the green power LED is on. Select the TM4C123G LaunchPad from the Quick Set dropdown.

Figure 2.



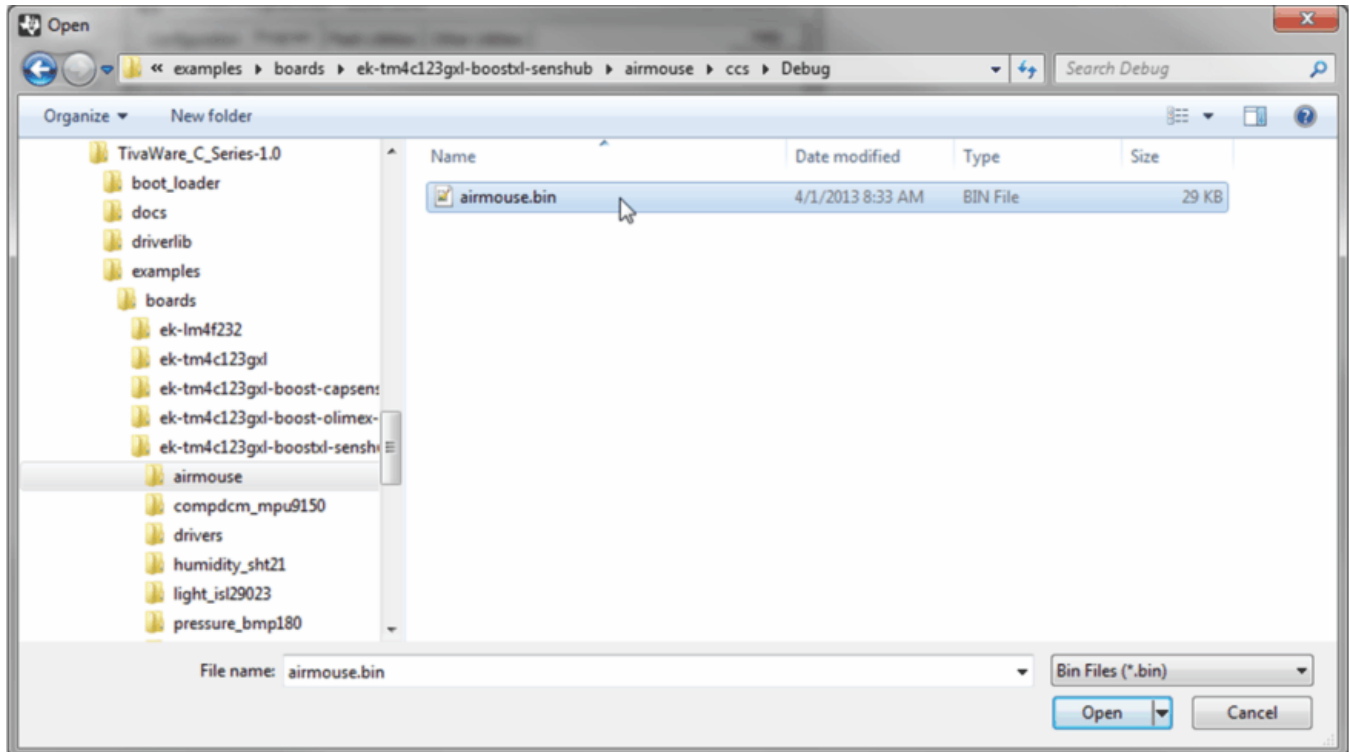
Select the *Program* tab and then use the **Browse** button to begin the binary selection process.

Figure 3.



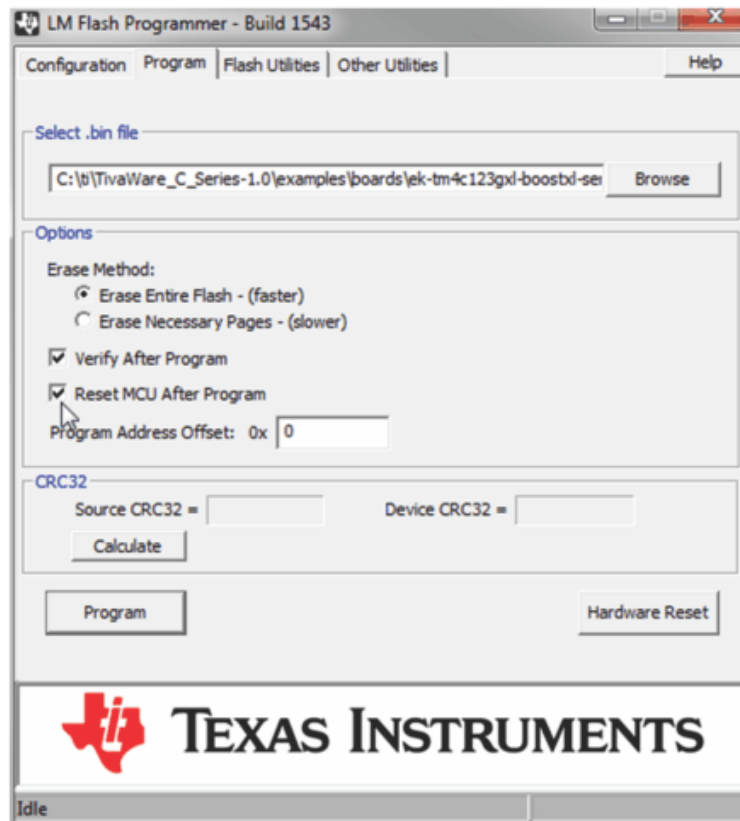
Select the `airmouse.bin` file from `C:\TI\TivaWare_C_Series-1.0\examples\boards\ektm4c123Gxl\ccs\debug` directory. Alternatively, you can find this binary as built by one of the other supported tool chains in the folder that corresponds to your tool chain of choice.

**Figure 4.**



Select the options to erase the entire flash, verify after program, and reset the MCU after program. Then press the **Program** button to execute the flash programming operation.

**Figure 5.**



## 2.5 Demonstration

Connect the device USB port on the side of the LaunchPad to a standard computer USB port. Slide the power select switch to the left to choose power from the USB device port. The LaunchPad with the Sensor Hub BoosterPack attached enumerates on the USB bus as a composite HID keyboard and mouse. A solid blue on the RGB LED indicates that the USB is properly enumerated. A quickly blinking red on the RGB LED indicates that the motion system is operating correctly.

Hold the LaunchPad with the buttons away from the user and toward the computer; the USB device cable should exit the right and bottom corner of the board. Roll or tilt the LaunchPad to move the mouse cursor of the computer up, down and left, right. The buttons on the LaunchPad become the left- and right-mouse click buttons. The buttons on the Sensor Hub BoosterPack are not currently used by this example. A quick spin of the LaunchPad generates a PAGE\_UP or PAGE\_DOWN keyboard press and release, depending on direction of the spin. This action simulates page scrolling. A quick horizontal jerk to the left or right generates a CTRL+ or CTRL- keyboard event. This action creates a zoom effect in many applications, most often in web browsers. A quick vertical lift generates an ALT+TAB keyboard event. This action presents the computer user with an opportunity to select between currently open program windows. A quick twist to the left or right moves the window selector. A quick jerk in a downward direction selects the desired window and closes the window selection dialog.

### 3 Compile, Download, and Debug

#### 3.1 Download and Install

If you have not already done so, refer to [Section 2.2](#) of this guide for information about how to download and install TivaWare for C Series. Then download Code Composer Studio (CCS) from [the TI website](#) or from the [CCS wiki page](#). Install CCS using the installation wizard.

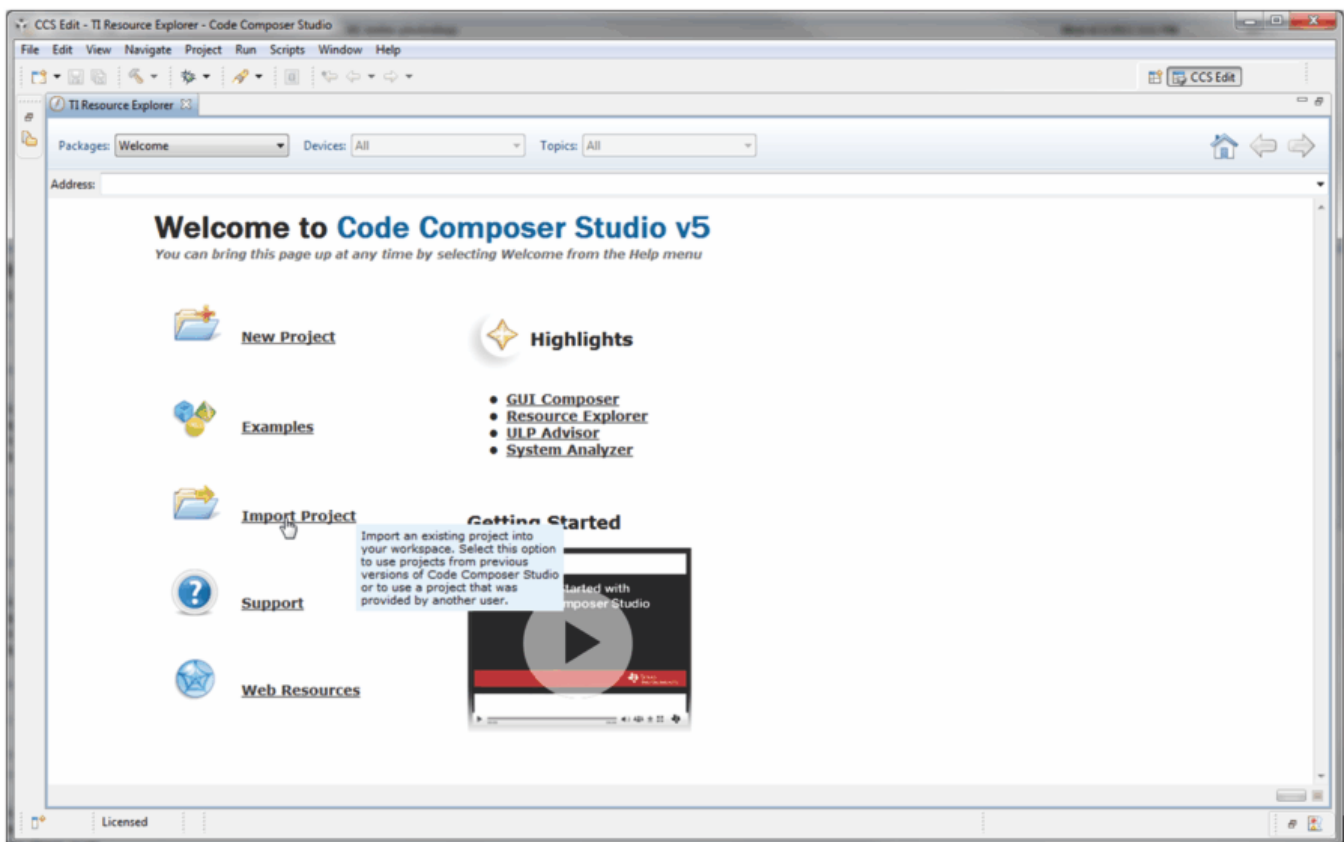
Alternatively, you may choose to install or use another IDE. TivaWare is built, tested, and shipped with project files and binaries for Code Composer Studio, Keil, IAR, Sourcery CodeBench, and GCC Makefile. This guide demonstrates the use of Code Composer Studio.

#### 3.2 Import

Open CCS and choose a workspace where your projects will reside. During the import process, the example application code files are copied to this workspace. This approach allows local modifications of the example while preserving the original files for reference. The library source files are not copied to the workspace, but are linked into the workspace and modified in place within the TivaWare installation folder. This type of modification occurs so that any updates to TivaWare may be installed to the same directory and reflected in the resulting library for all applications. It also allows the user to modify library source if needed and have the changes reflected in all projects, even across workspaces. Follow these procedures to import your project to a selected workspace.

- Choose the *Import Project* link on the TI Resource Explorer page.

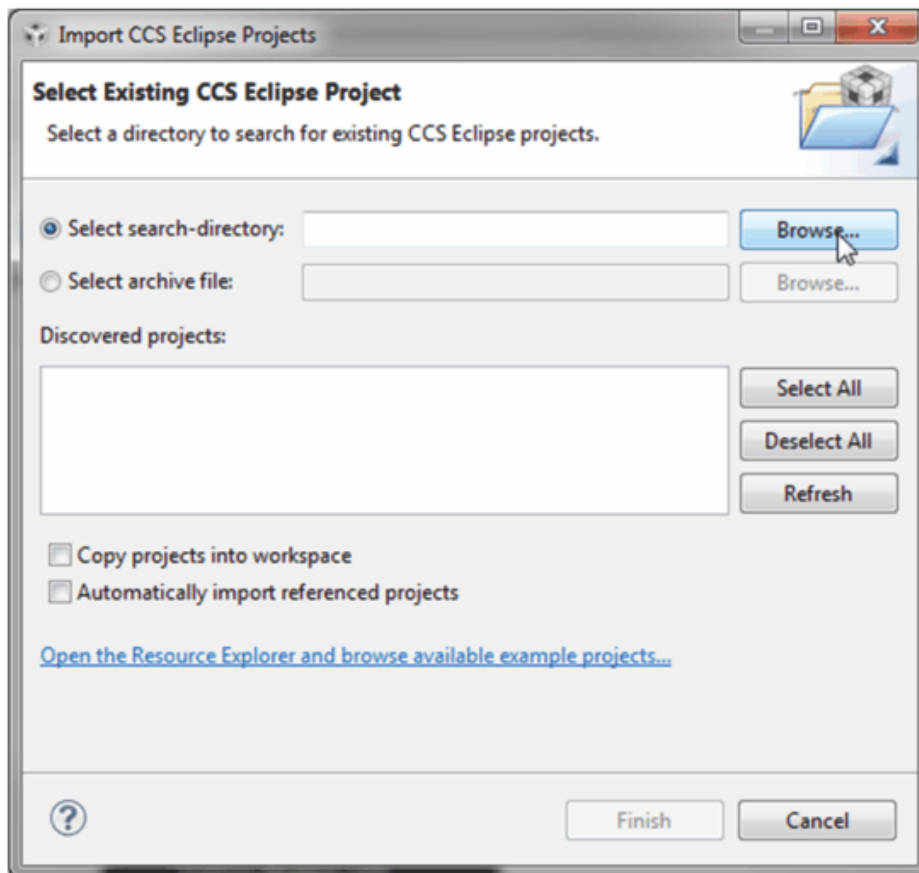
Figure 6.



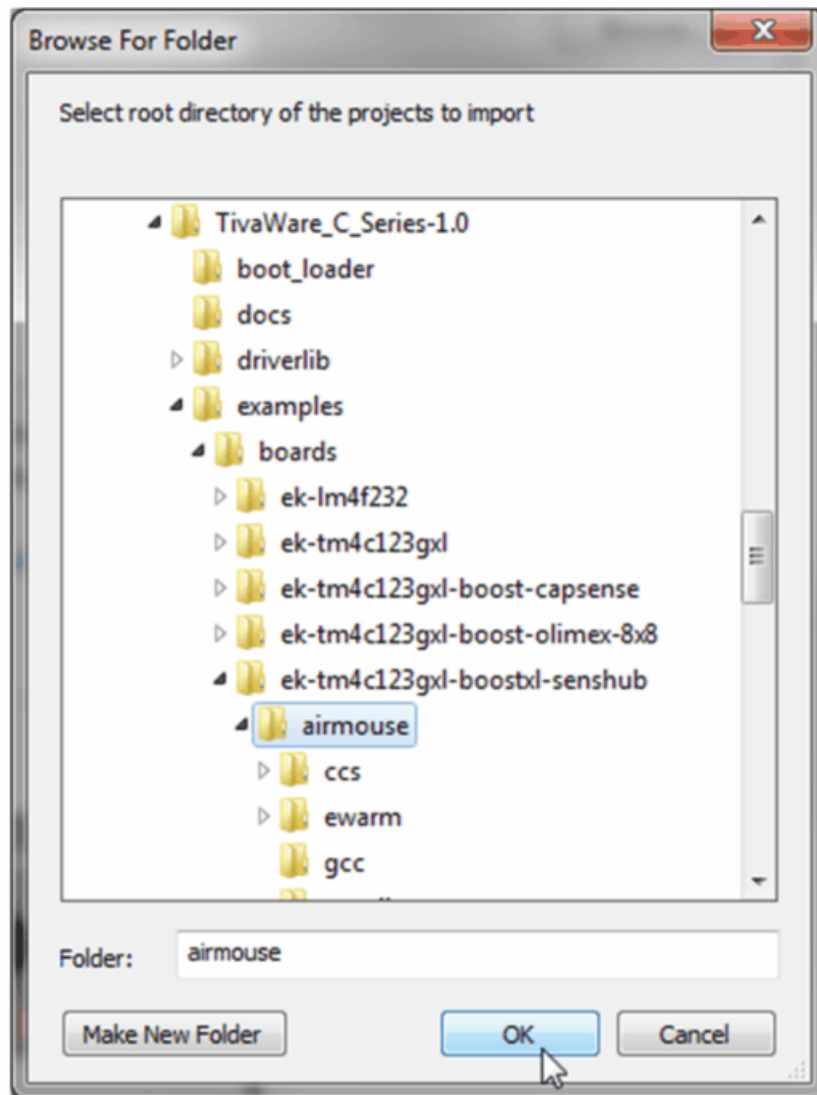


- Select the **Browse** button in the Import CCS Eclipse Projects dialog.

**Figure 7.**

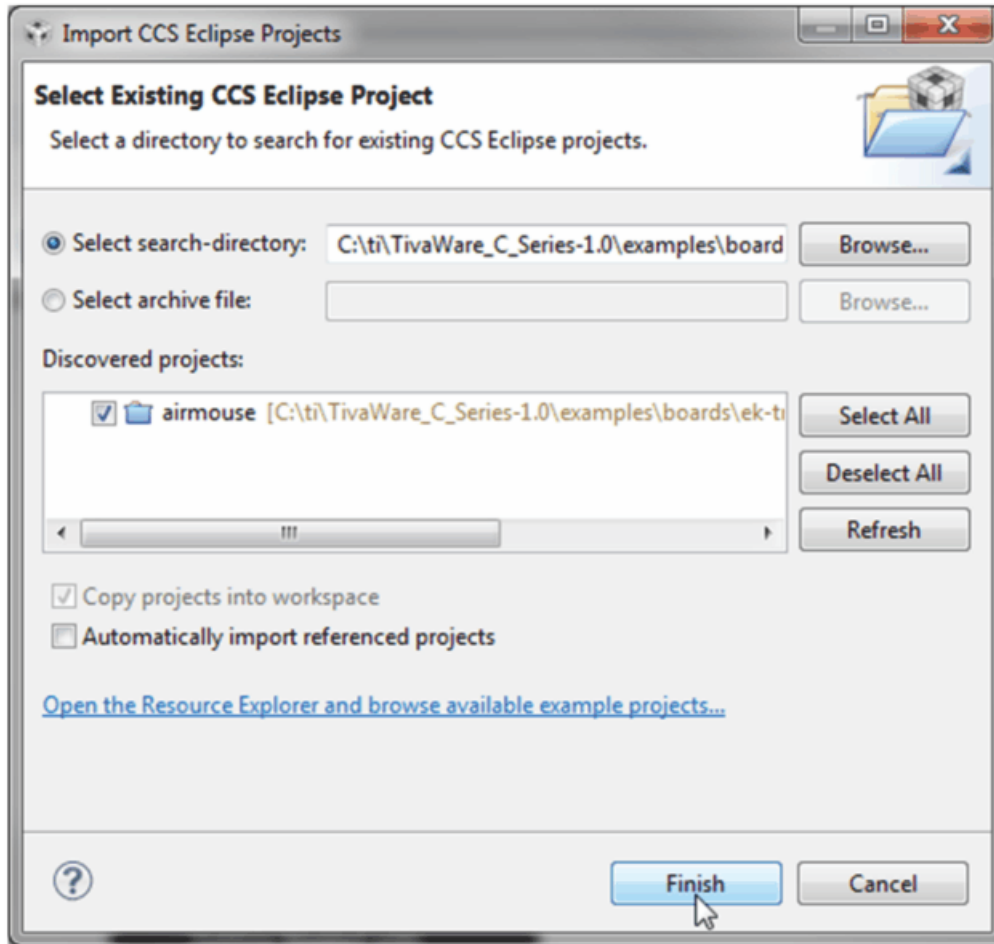


- Select the *airmouse* directory within *TivaWare\_C\_Series\examples\boards\ek-tm4c123gxl-boostxlsenshub\*.

**Figure 8.**


The import wizard then finds the air mouse project. Click **Finish**.

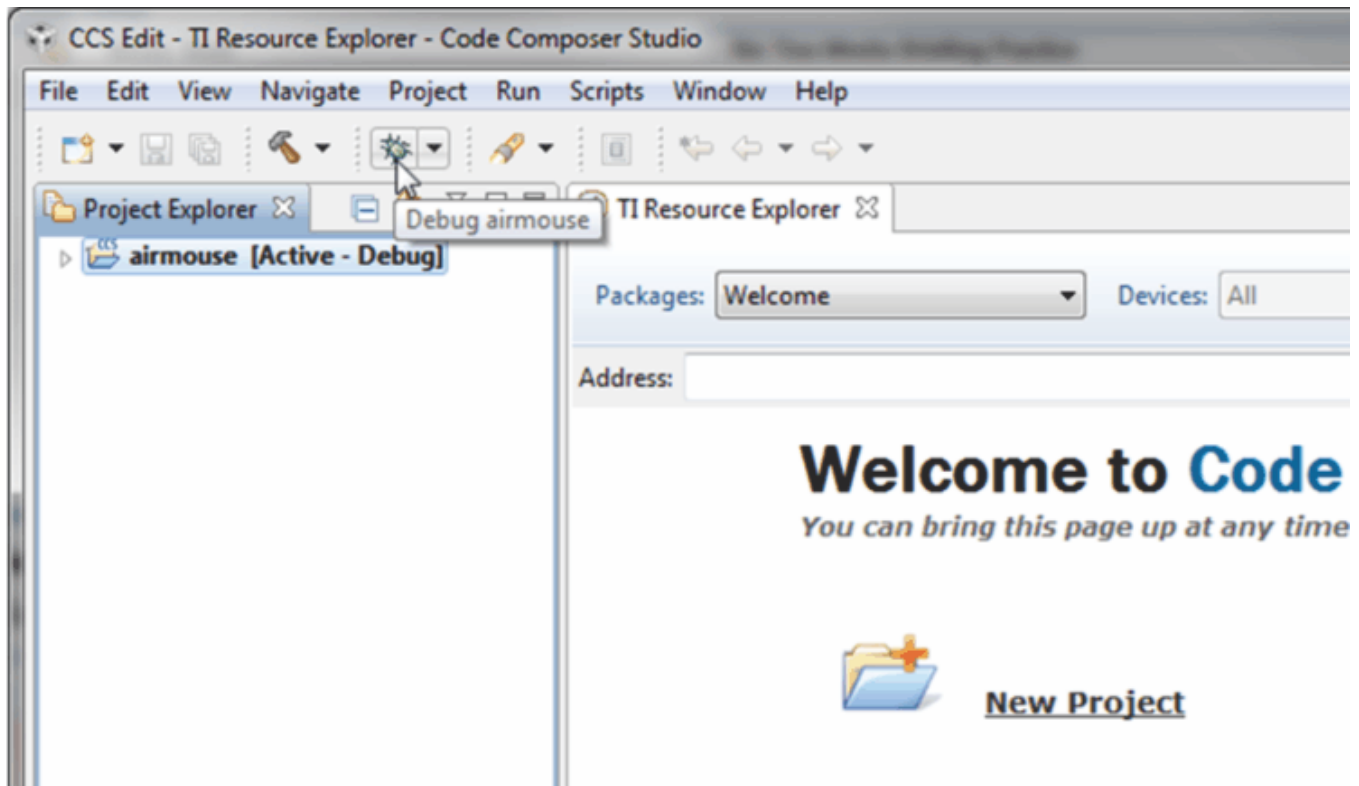
Figure 9.



### 3.3 Compile, Download, and Debug

The project is now in the workspace and ready to be compiled, downloaded, and debugged. To do these steps, click on the *debug* icon at the top left of the CCS window. Make sure a USB cable is connected to the top of the board for debugging. **Note:** A second USB cable (not provided) is required in order to perform the air mouse functions. Plug the second cable into the side USB device port. Either USB connection may be used to power the board.

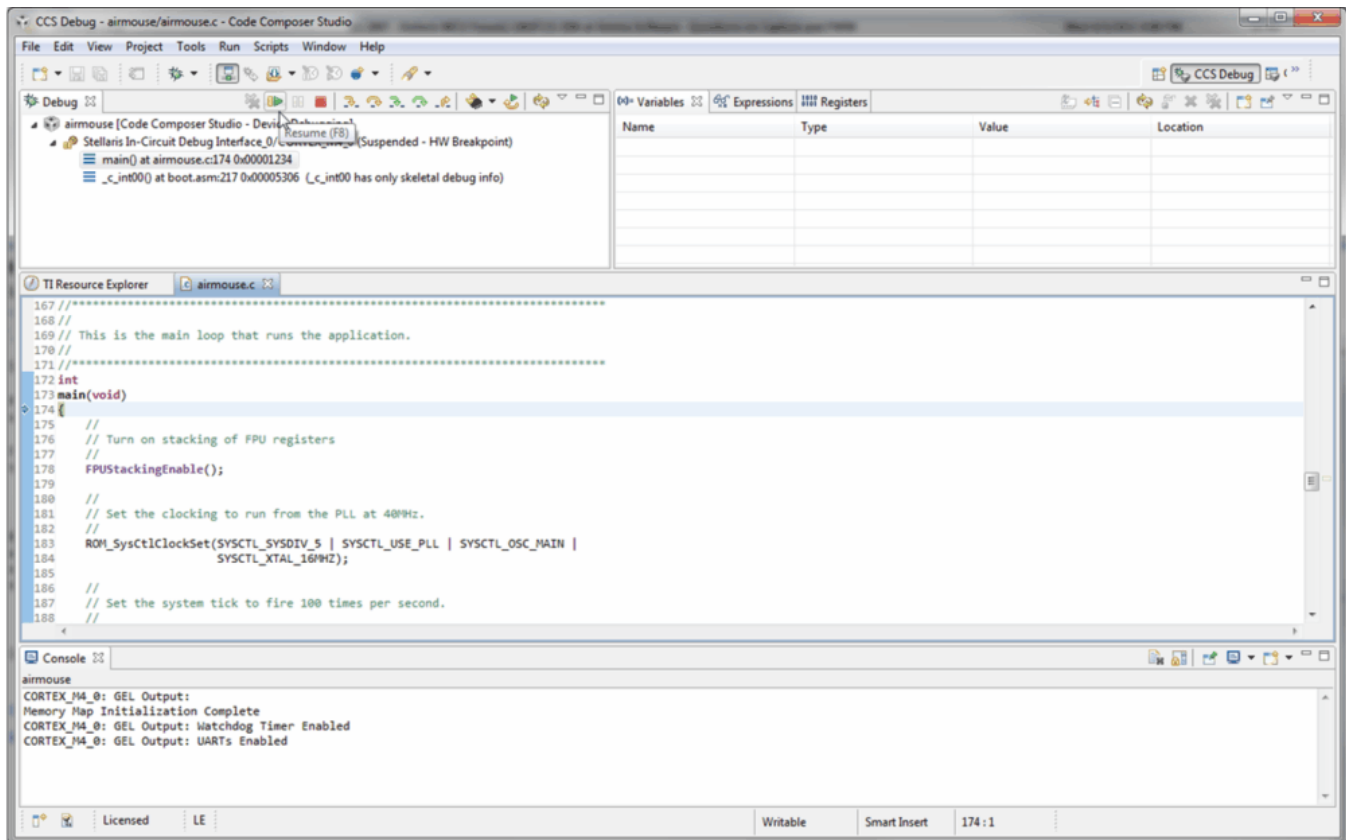
Figure 10.



CCS then downloads the program to the LaunchPad and opens the Debug Perspective.

The program is stopped on the first line of the main function. Click the **Resume** button to begin execution of the program with JTAG debug connectivity.

Figure 11.



### 3.4 Explore

You have now verified that your development system is operational. It is time to see what else you can do with your new Sensor Hub BoosterPack.

Use the Import wizard (found in the file menu) to load other example projects provided for the Sensor Hub BoosterPack. The TivaWare package contains examples to perform simple measurements with each of the sensors on the board. These examples can be used as the starting point for your application development.

Import and explore the examples provided for other boards if you downloaded the full TivaWare package. There are three types of TivaWare examples, and all are located in the TivaWare\examples directory. The first type of example are board-specific examples. These examples can usually be ported between boards with a small effort, typically involving pin configuration. The second type of example are peripheral examples. These examples can be used on any Tiva C Series device. The third type of example are base project examples. These examples are provided as the basis for your application if TI software licensing of the other examples is not acceptable. The air mouse base project example is licensed under a BSD style license.

## 4 References

In addition to this document, the following references are available for download at [www.ti.com](http://www.ti.com):

- BOOSTXL-SENSHUB BoosterPack User Manual (literature number [SPMU290](#))
- Tiva C Series TM4C123GH6PM Microcontroller Data Sheet (literature number [SPMS376](#)).
- Tiva C Series TM4C123G LaunchPad (EK-TM4C123GXL) User Guide (literature number [SPMU296](#))
- TivaWare for C Series Driver Library. Available for download at [www.ti.com/tool/sw-tm4c-drl](http://www.ti.com/tool/sw-tm4c-drl).
- TivaWare for C Series Driver Library User's Manual (literature number [SPMU298](#)).
- TPS75118 Fast Transient Response, 1.5-A, Low-Dropout Regulator Data Sheet (literature number [SLVS241](#))
- TMP006 Infrared Thermopile Sensor Data Sheet (literature number [SBOS518](#))
- Texas Instruments' Code Composer Studio IDE website: [www.ti.com/ccs](http://www.ti.com/ccs)

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Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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