Embedded Masters

Adesto Serial Flash Demo Kit: Quick Start Guide

Introduction:
This document will provide a simple step-by-step description of how to make use of the Adesto Serial Flash Demo Kit which is comprised of an ultra low-power microcontroller(MCU) development kit, a rapid prototype plugin, various Embedded Masters Adesto EMMEM Serial Flash breakout boards and graphical Energy Profiler to accurately measure power consumption and timing details.

Required Contents:
- Silicon Labs EFM32LG-STK3600 Starter Kit
- Embedded Masters EMSENSR-WSP(Wireless Sensor Prototype board)

One or more of the following:
- EMMEM-AT25XE021 (breakout board for the AT25XE021)
- EMMEM-AT25XE041(breakout board for the AT25XE041)
- EMMEM-AT25SF041 (breakout board for the AT25SF041)
- EMMEM-AT45DB081(breakout board for the AT45DB081)
- EMMEM-AT45DB641(breakout board for the AT45DB641)
- EMMEM-RM25C256(breakout board for the RM25C256, resistive memory)

Software Required:
Silicon Labs Simplicity Studio

This document will now walk you through step-by-step how to make use of the Serial Flash Demo Kit and demonstrate the power consumption.

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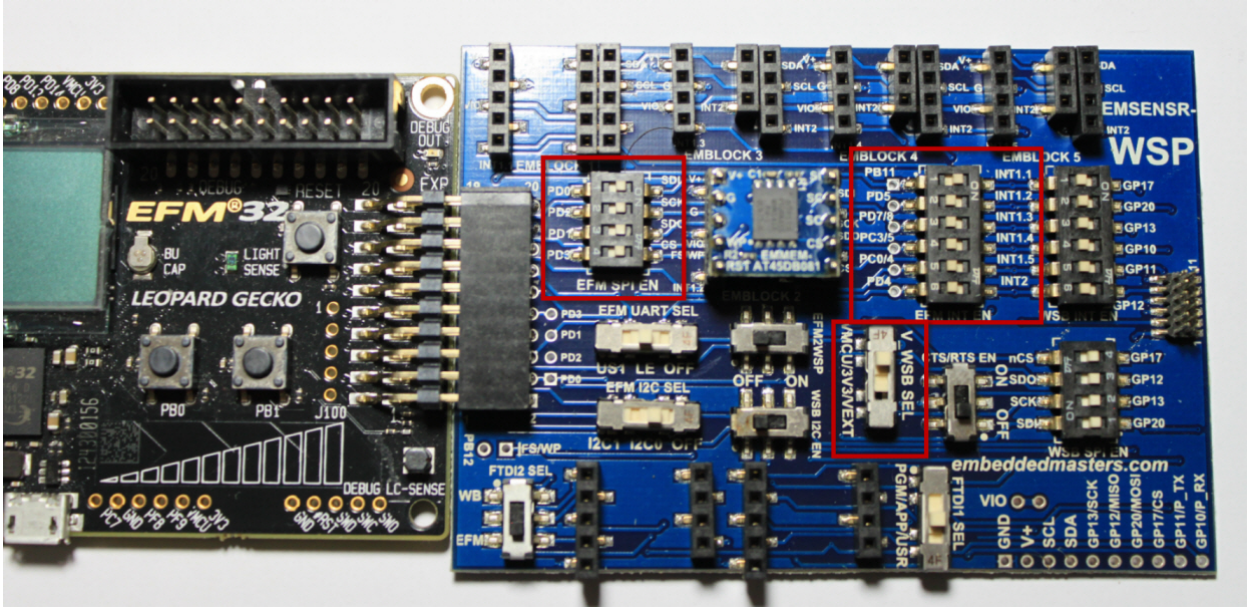
Step 1: Ensure Kit is Configured Properly

DO THIS WITHOUT THE USB CABLE CONNECTED!!

Ensure the EMSENSR-WSP is snugly connected to the STK3600 via the 20pin adapter. Go ahead and plug in the EMMEM-AT25XE021 into the EMBLOCK 2 slot as shown below. The boards should already be configured properly so this configuration detail is provided in case somehow that has changed.



Note: Picture Shown with EMMEM-AT45DB081

A. **EFM SPI EN** -> All selections set to ON. These connect the SPI lines on the EMSENSR-WSP to the EFM32 MCU Pins that are configured in software for SPI.
B. **V_WSP SEL** -> Ensure Slide switch is set to uppermost position/VMCU. The Energy Profiler monitors the VMCU voltage line provided by the STK3600.

Step 2: Download/Install Simplicity Studio

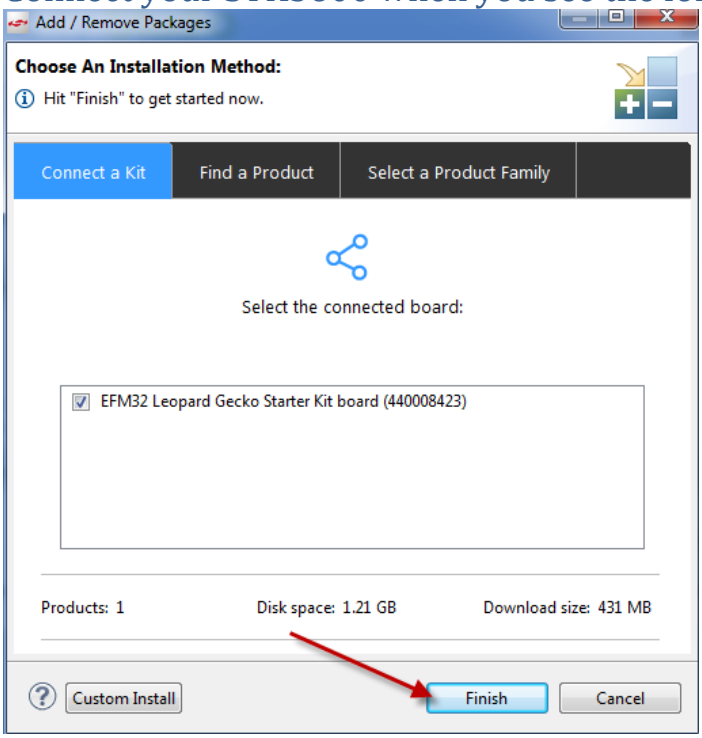
It is necessary to download Simplicity Studio to both update the EFM32LG-STK3600 Starter kit if it should need to be updated with a new demo and most importantly to be able to use the Energy Profiler to show power consumption. Download from this link…

http://www.silabs.com/products/mcu/Pages/simplicity-studio.aspx

Choose from either Windows, Max, Linux.

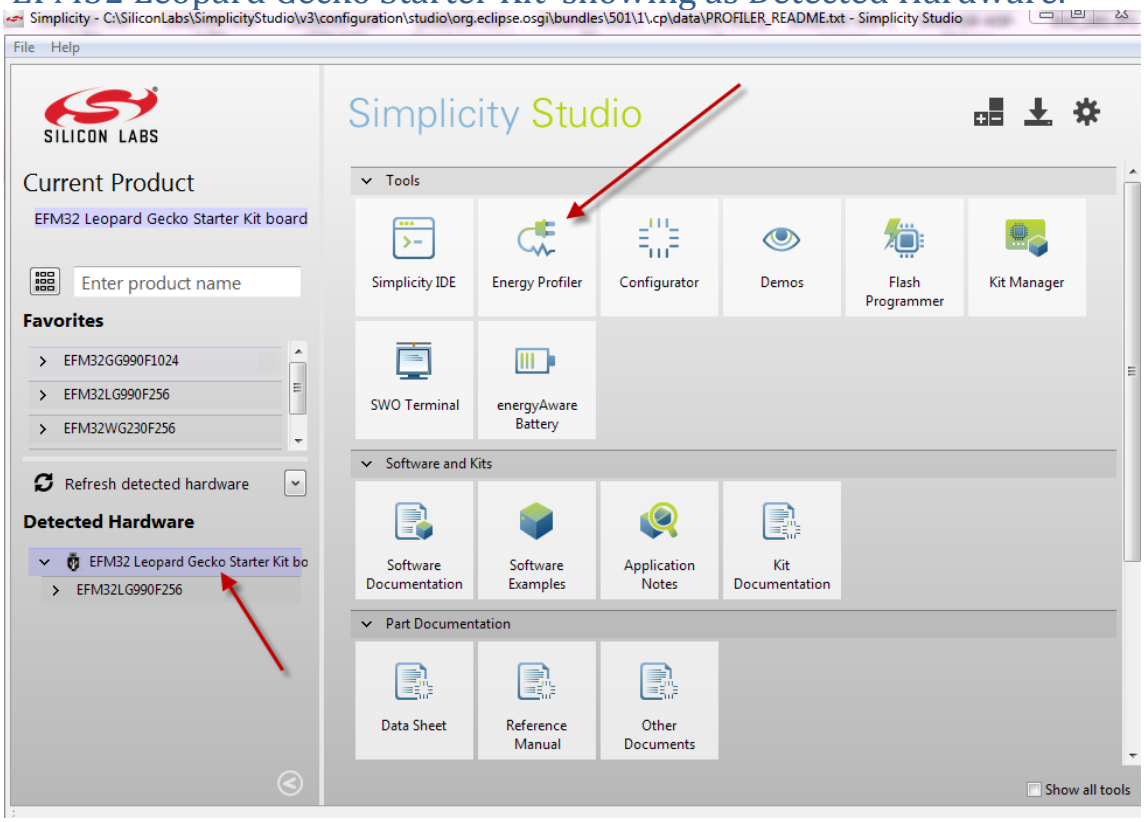
Note: The offline version is the entire download and can install without an internet connection.

A. Connect your STK3600 when you see the following screen.



B. After the STK3600 has connected you will see it appear as shown above…Click 'Finish'

C. You should now see a screen that looks similar to what is shown below with the 'EFM32 Leopard Gecko Starter Kit' showing as Detected Hardware.

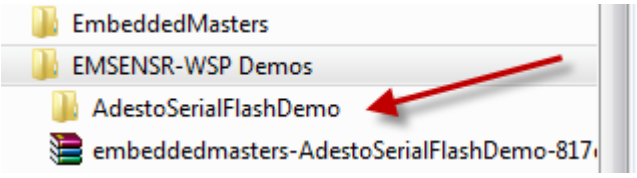


Step 3: Download firmware to EFM32LG-STK3600

To download firmware to the EFM32LG STK please access the Adesto Serial Flash Demo firmware from the Github project homepage at the following link.

http://embeddedmasters.github.io/AdestoSerialFlashDemo/

Download the Zip file to the same Drive that you have installed Simplicity Studio on. Unzip into a folder you have created on this drive similar to shown below...



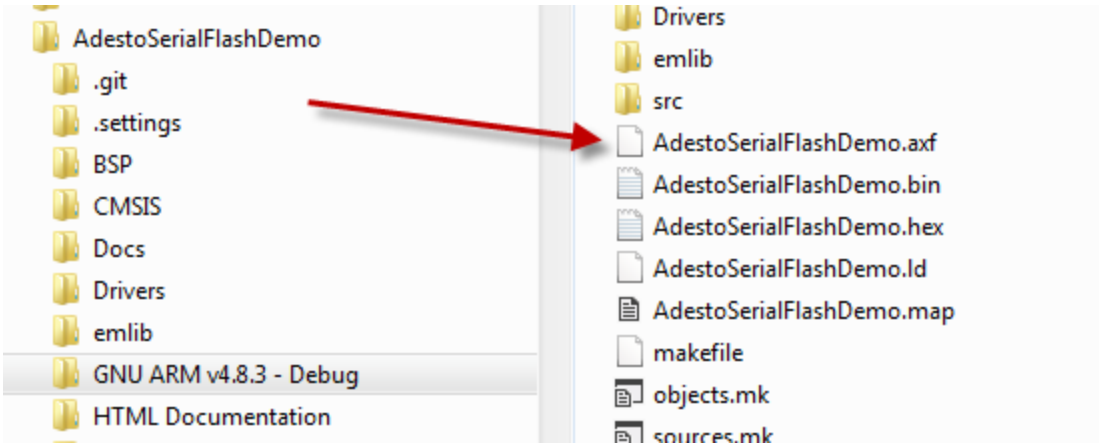
NOTE: It is important to install one level below a top folder if you intend to create a Simplicity Studio Project that you can compile/debug. Also note that I have renamed the project folder itself to remove the excessive naming that github extends on the zip file.

There are 2 methods shown below for loading the Demo firmware onto the STK. The first is the easiest/simplest for those who don't want to look at/compile any firmware and the second is for those who expect to want to inspect the demo firmware and create their own project they can recompile with Simplicity Studio.

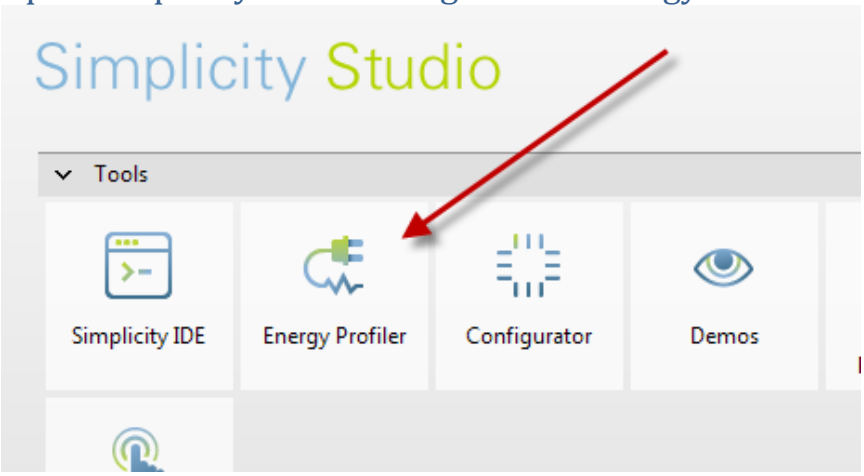
Method 1: Download Binary to STK3600

This section will briefly outline how to update your kit if you don't want to recompile the code or if you have a fresh EFM32LG-STK3600 that has not been programmed yet.

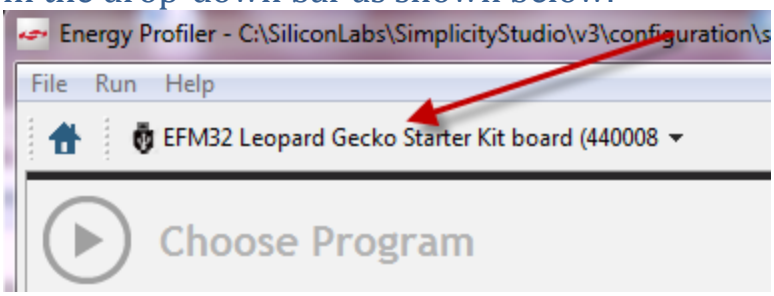
1) Find the binary file you want to use to update your kit. It should have a suffix *.afx. Such as shown below.



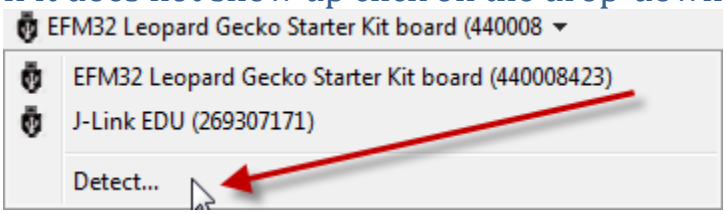
2) Open Simplicity Studio and go to the Energy Profiler



3) Ensure that you are connected to your STK. If you are you will see the STK show up in the drop-down bar as shown below.

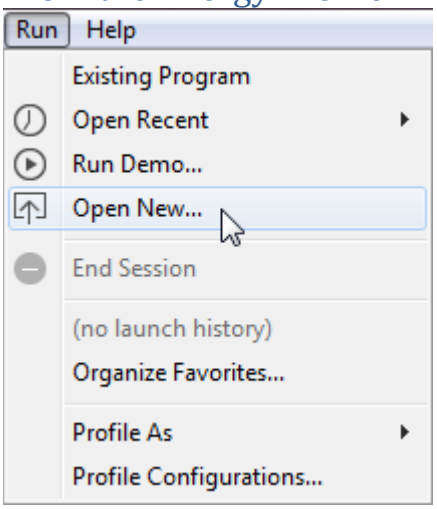


4) If it does not show up click on the drop-down menu and click 'Detect…'

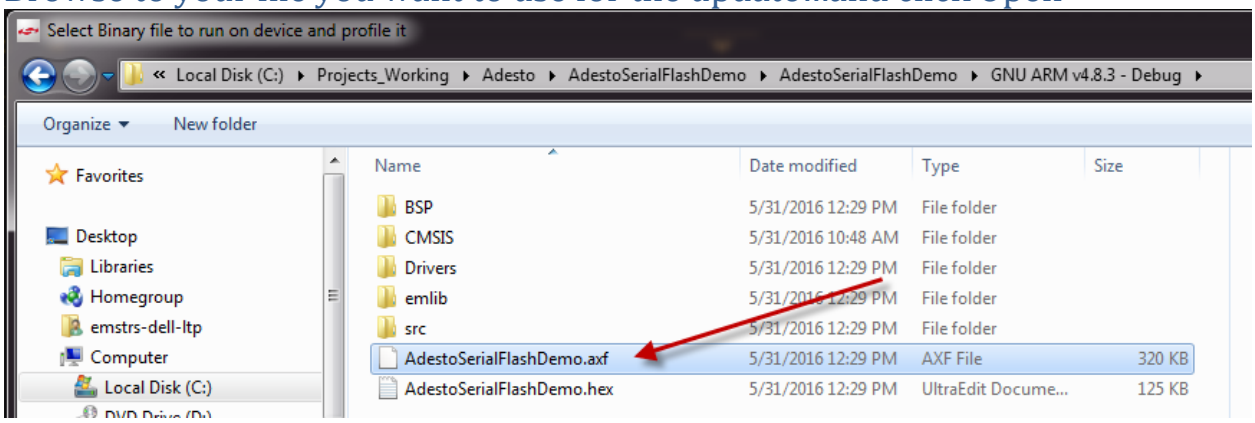


If your board still does not show up it may still be trying to install on your PC if this is the first time you have used your board. Check your taskbar to see if something is still trying to install.

5) From the Energy Profiler Menu select Run->Open New…



6) Browse to your file you want to use for the update…and click Open



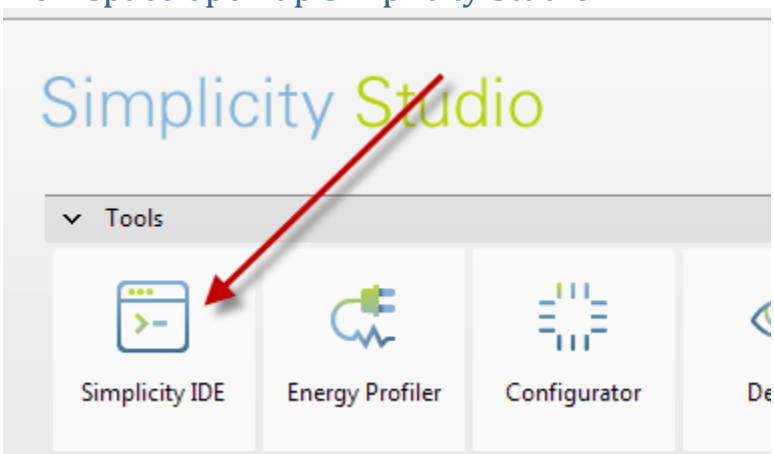
7) You should see a window appear with a progress bar. When this completes the application is running and you will see the RTC Ticks appearing on the screen.

You have successfully updated your Adesto Serial Flash Demo Kit!!

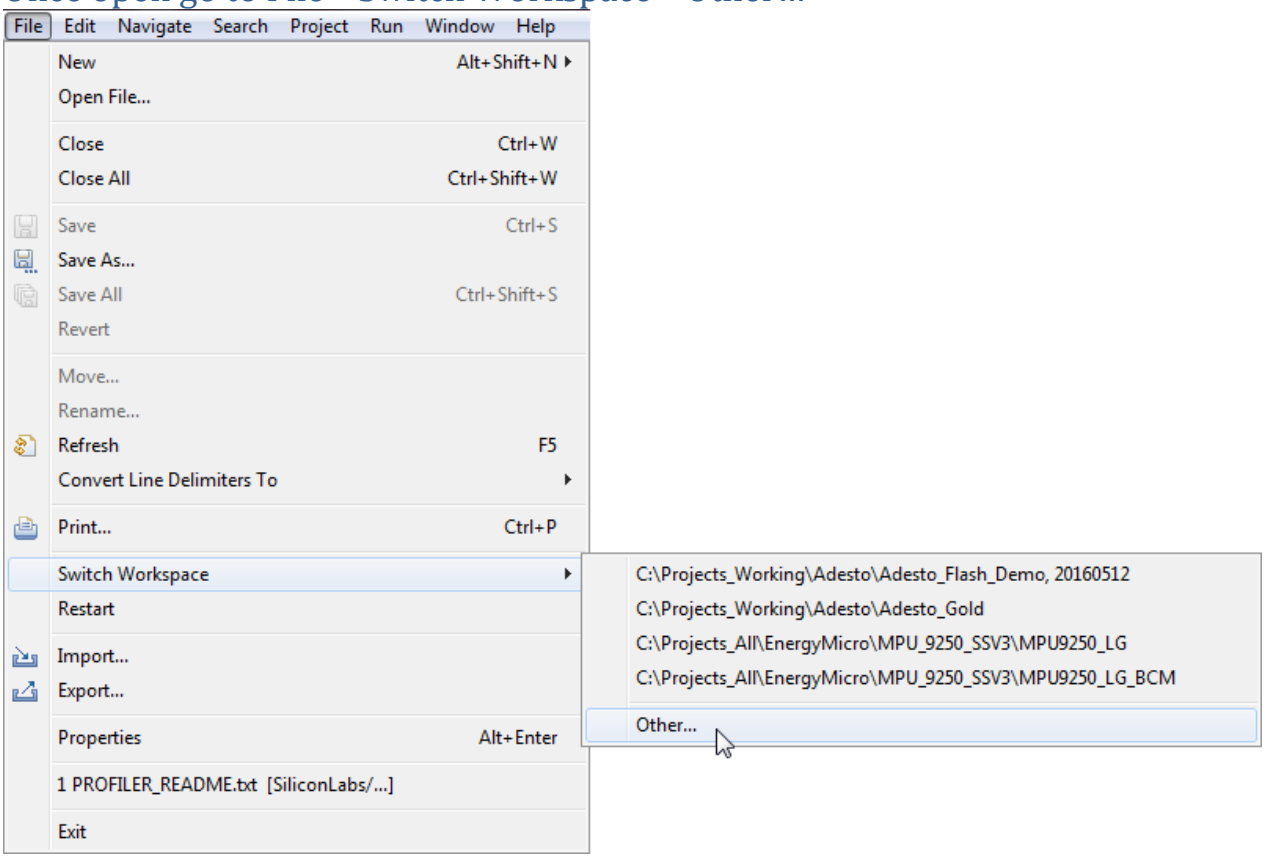
Method 2: Use Simplicity Studio to compile/download

This method is for the users who want to create their own project that they can setup in Simplicity Studio to inspect the firmware and possibly make changes/additions to the project and recompile/download and test.

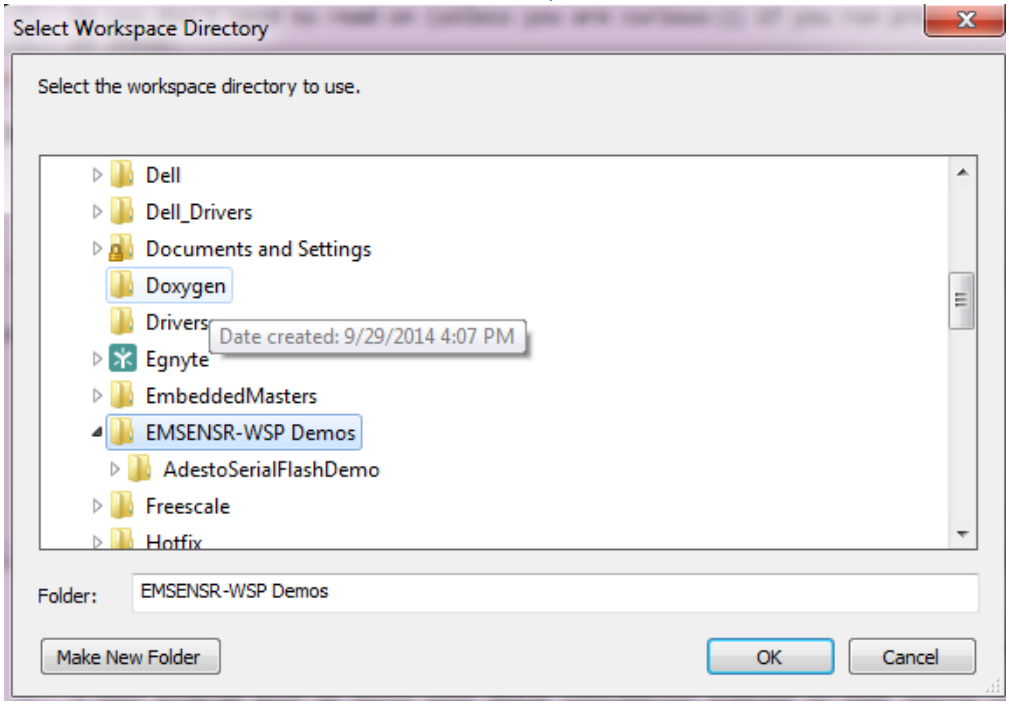
1) Download entire project from the Github repo and unzip into a folder on your root drive that you also have Simplicity Studio install on. The exact folder location should not matter.
2) You will need to create a new workspace using Simplicity Studio otherwise you could import the project into an existing workspace if you like. To create a new workspace open up Simplicity Studio IDE...



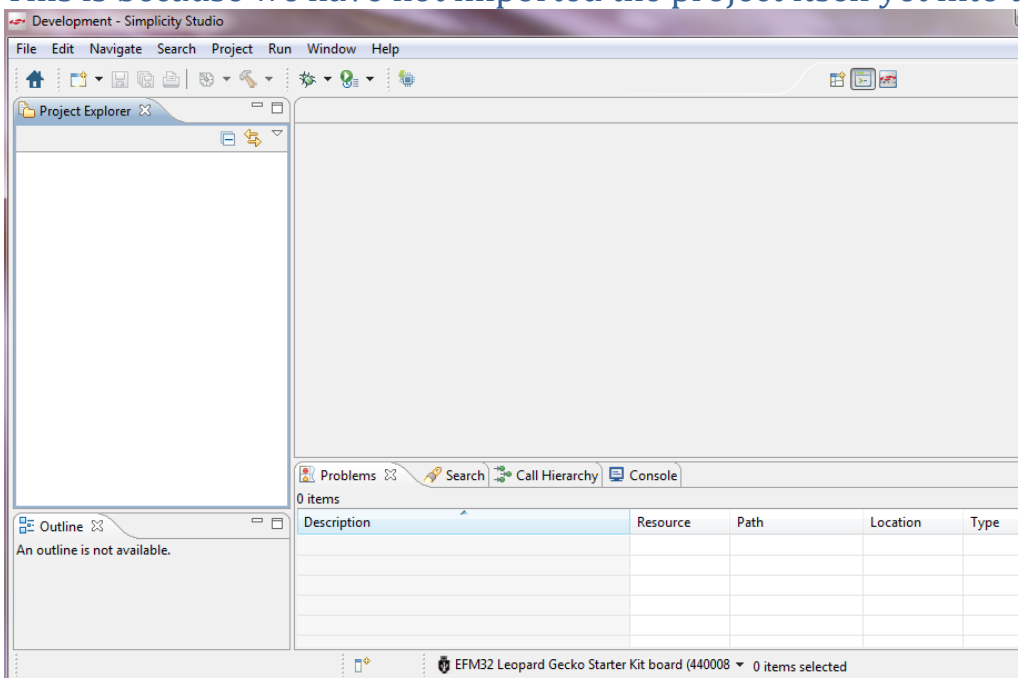
3) Once open go to File->Switch Workspace->Other…



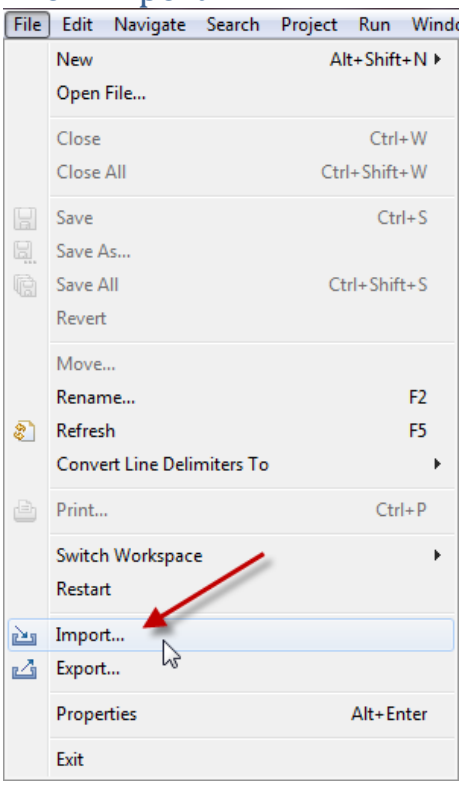
4) Browse to the directory where you unzipped the project…
For those of you new to Eclipse based projects you should ensure to have at least one directory level above the project to place the 'workspace' in. For example I am choosing to put the workspace in the folder EMSENSR-WSP Demos which is one level above the actual demo folder, AdestoSerialFlashDemo. Click OK…



5) Simplicity Studio will close down and re-open to the new workspace location… You will most likely need to click on the Simplicity Studio IDE icon again.
6) After re-opening Simplicity Studio IDE you will see a blank project space… This is because we have not imported the project itself yet into the workspace.

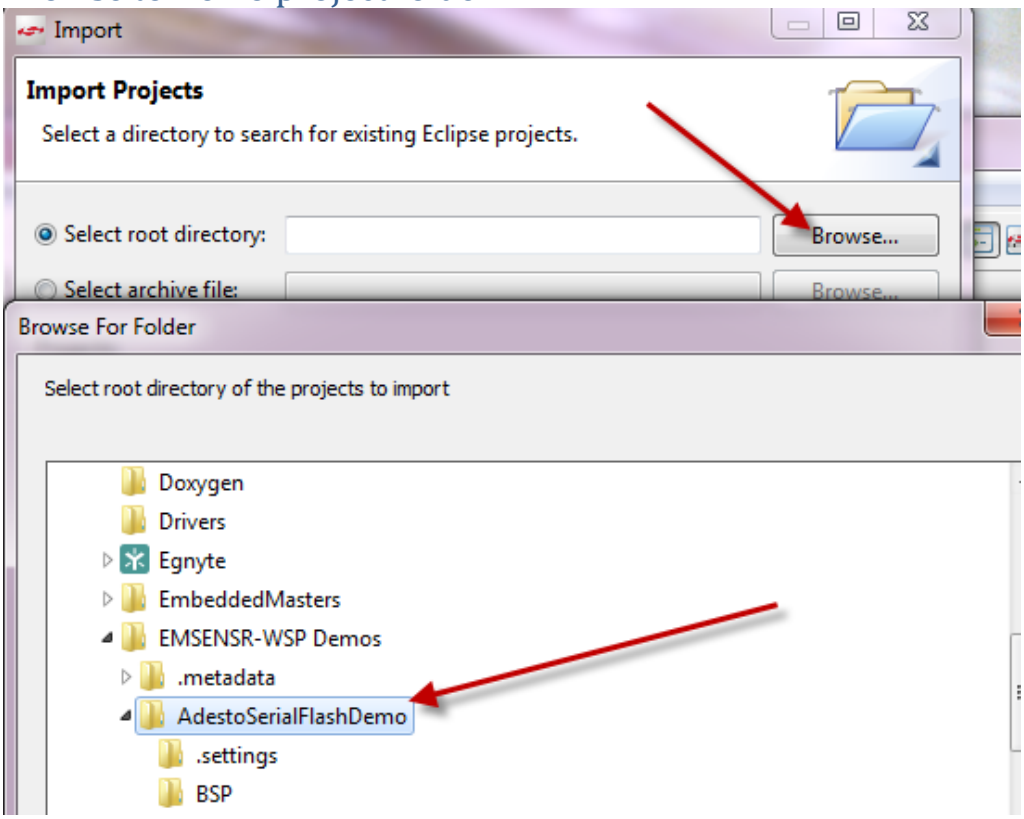


7) Now we import the AdestoSerialFlashDemo project into the workspace by doing the following…
   a) File->Import…

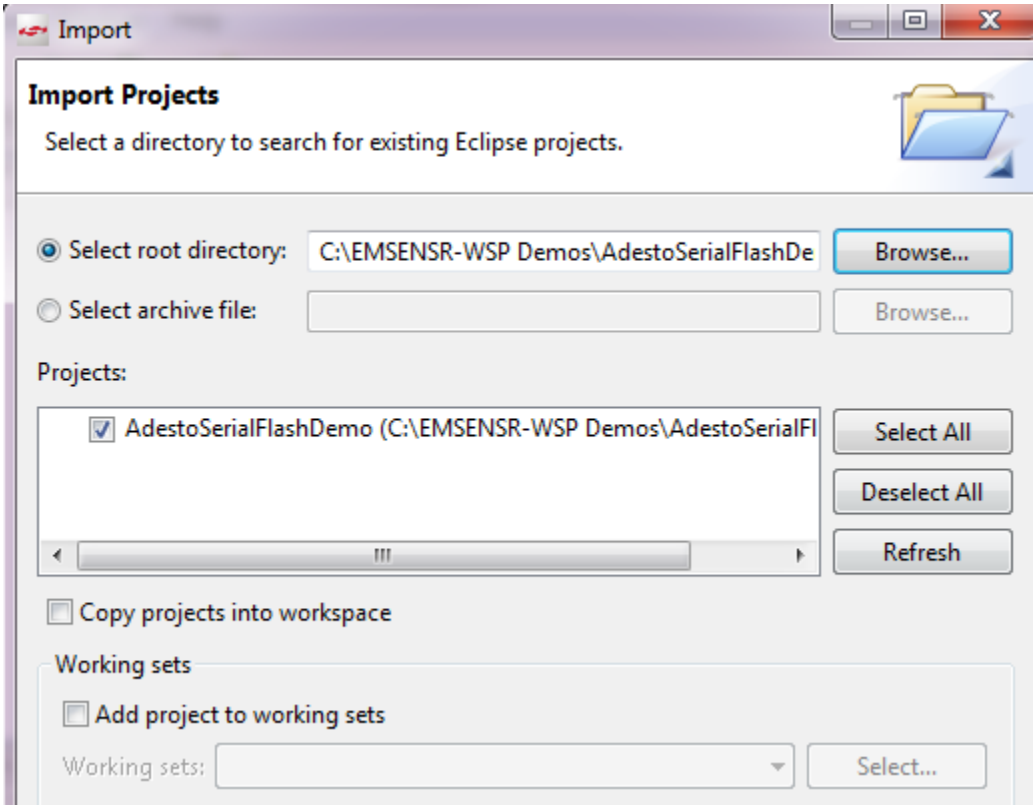


b) Select 'Existing Projects into Workspace' Click Next…

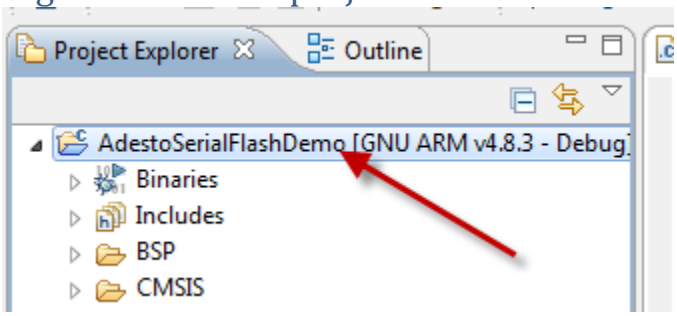
c) Browse to Demo project folder…



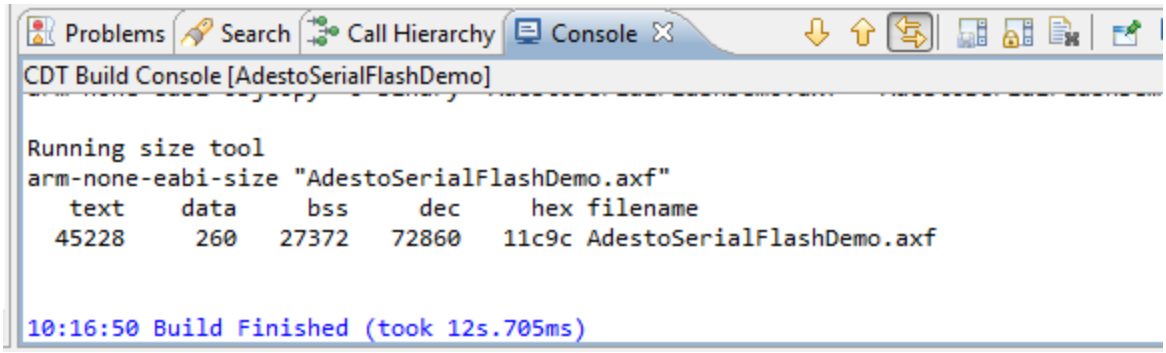
d) You should now see the project appear in the window with a checkbox next to it… Click Finish



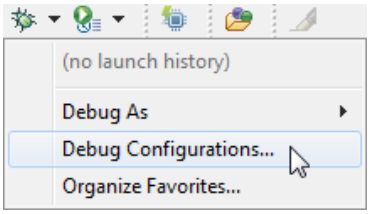
e) Right-click on the project and select 'Build Project'



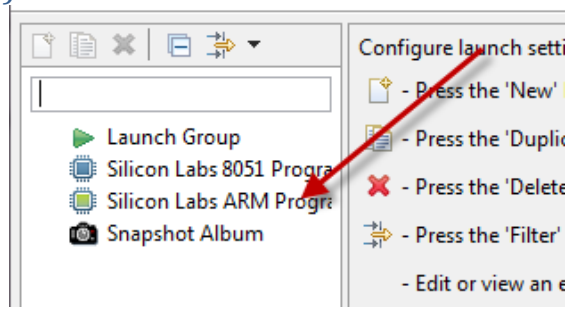
f) Everything should compile successfully and you will see this in the Console Window.



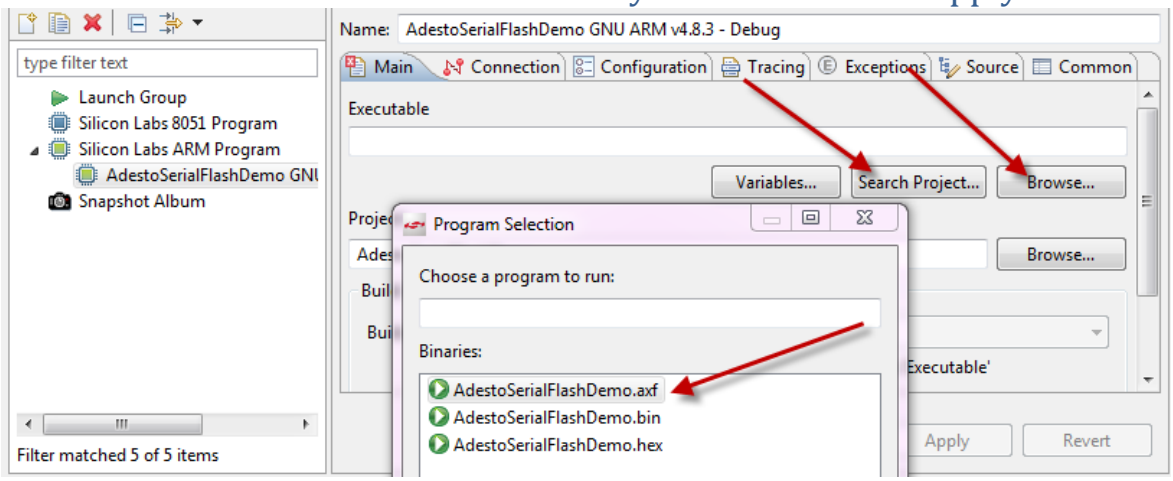
8) We can now download/debug or view the demo on the Energy Profiler.
9) To download/debug click on the drop-down menu for the 'Beetle' on the main toolbar and select 'Debug Configurations…'



10) Double-Click on 'Silicon Labs ARM Program'

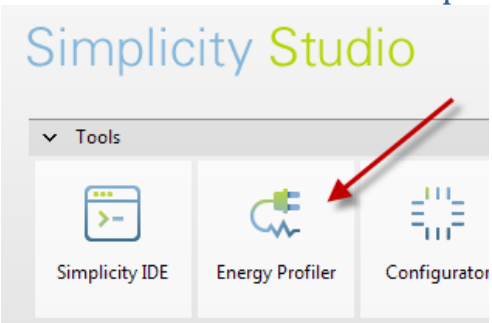


11) Now select the executable for the Debugger to load. You can do this by either clicking the 'Browse…' button or click 'Search Project…' you should select the *.axf file as shown below whichever method you choose. Click 'Apply' and then 'Debug'

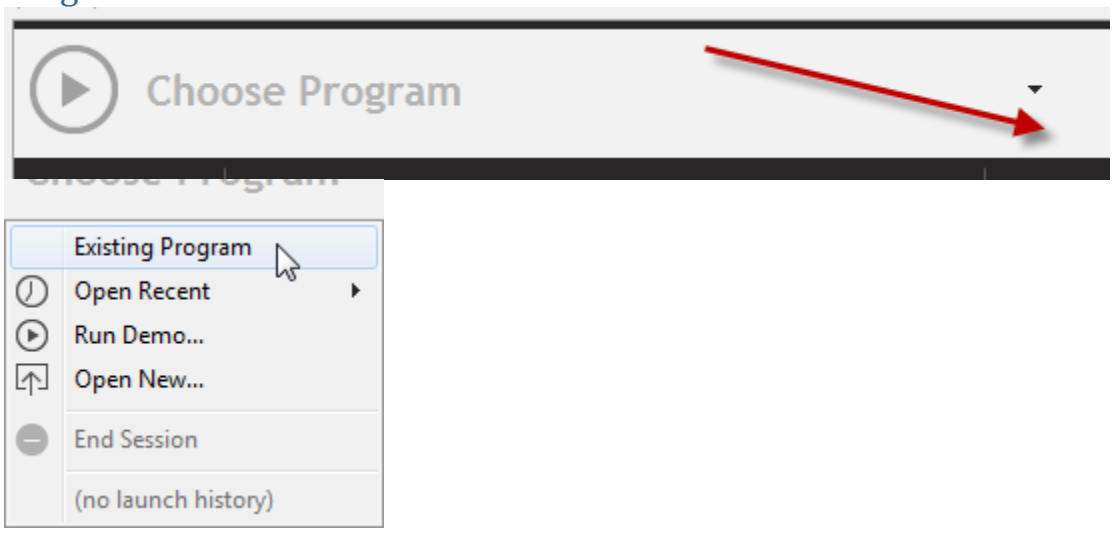


12) If everything is successful the IDE will change to a 'Debug' perspective and provide you a toolbar that you can single step, set breakpoints, view registers, etc.

13) You can also use the Energy Profiler once you have compiled/downloaded the code to view the Power Consumption of individual Erase/Write/Read cycles or view the power consumption of say writing 64KB chunk of data. Select 'Energy Profiler' from the main 'Simplicity Studio' menu.



14) Click on the drop-down menu to the right of the 'Play' button and choose 'Existing Program'

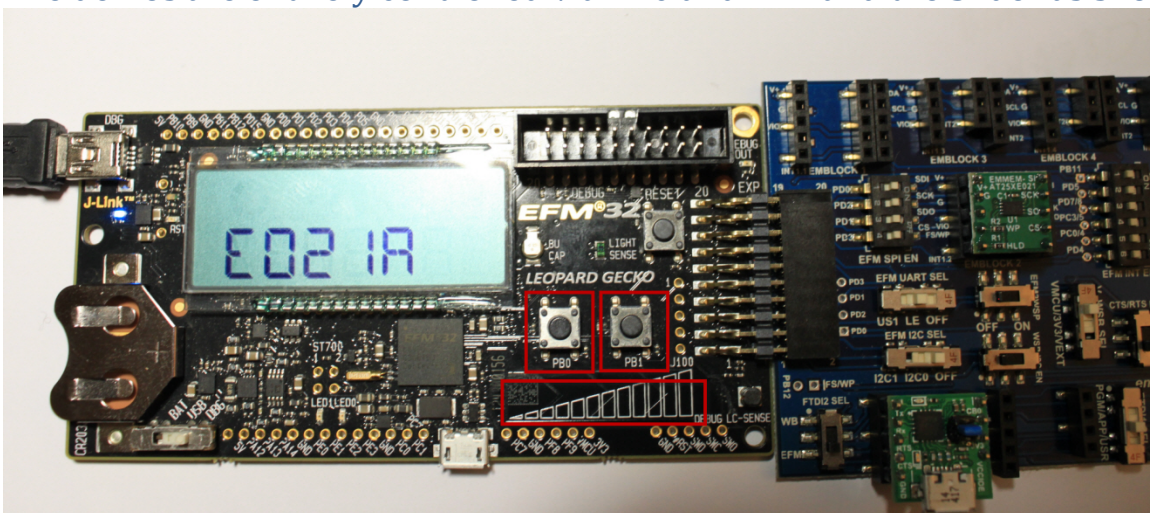


Step 4: Configure Menu/Initialize Demo

We will now walk-through the Serial Flash Demo Menu that provides the capability to configure the system and run different demos . This is done using the EMMEM-AT25XE021 but is similar for any of the EMMEM-ATxxxx devices.

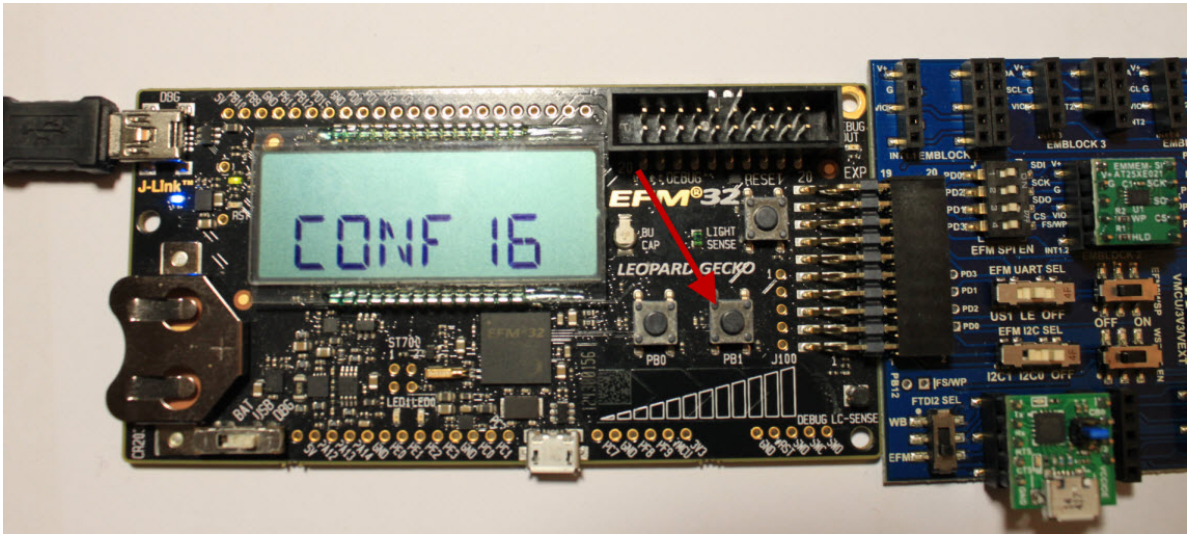
After powering the board via the USB Connector and with the EMMEM-AT25XE021 plugged into the EMBLOCK 2 slot you will now see that the AT25XE021 Serial Flash has been detected and is being displayed on the LCD. We will now walk through the Demo Modes and Configuration Menu.

The demos are entirely controlled via PB0 and PB1 and the Slider as shown below.



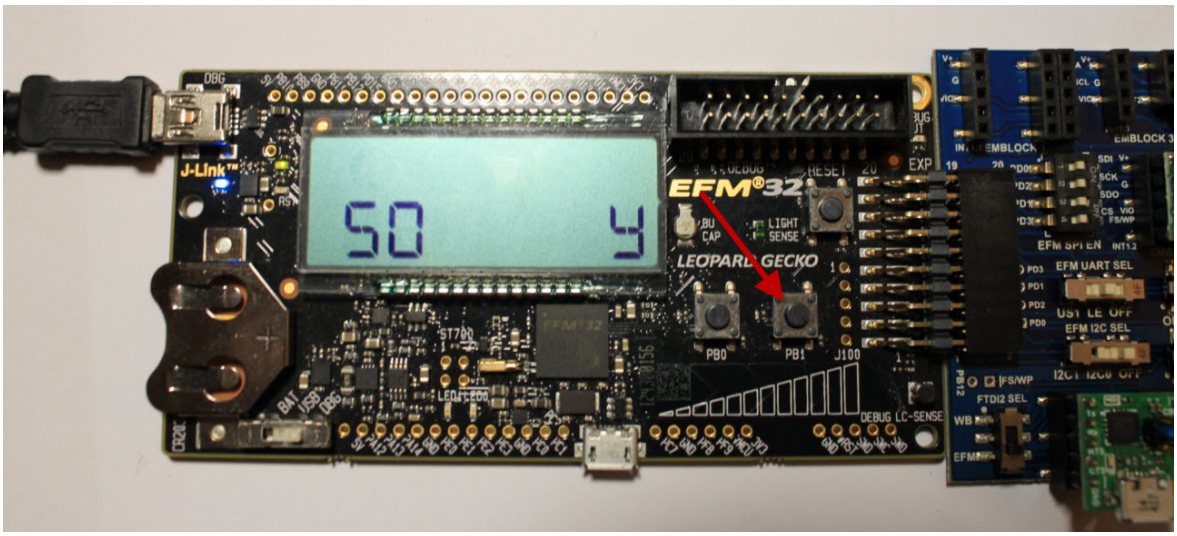
1. Start by Pressing PB0 Push-button You will now see the CONFIG menu appear

CONFIG Menu:



2. Press PB1 to enter Configuration, PB0 will go directly to Demo Menu and use default configuration values. After Pressing PB1 you will see the Active SO Menu.

Active SO Menu:



3. Press PB1 to Enable/Disable(Y/N) Active SO Interrupt for Demos.
   Note: This will not appear for devices that do not support Active SO Interrupt capability.

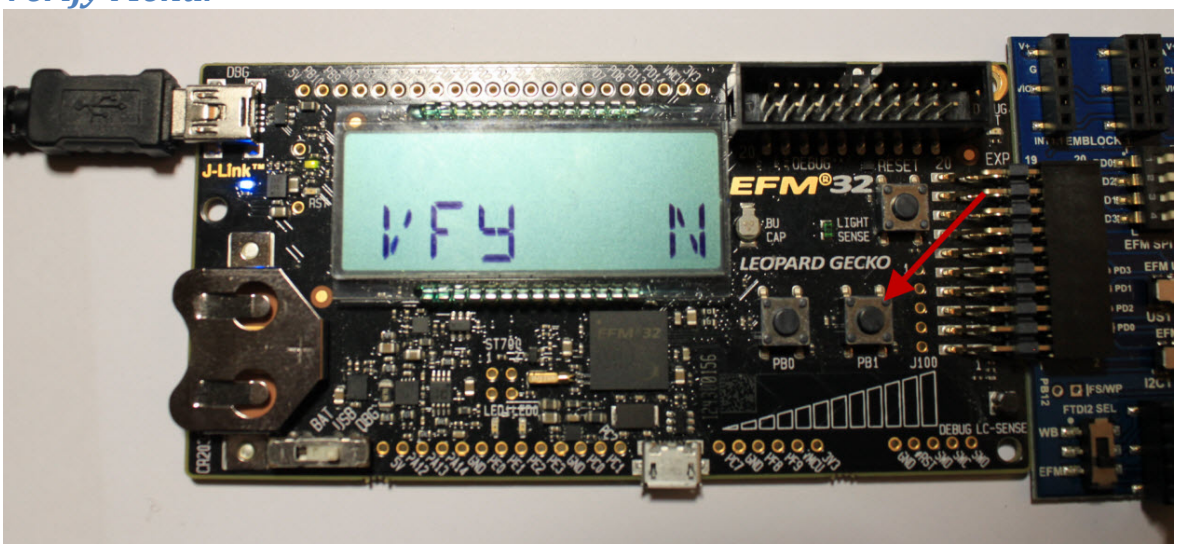
4. To continue press PB0 again…You will now see the Erase Size Menu

Erase Block Size Menu:

5. To change the default Erase Block Size use the slider shown above.
   a. Range: 0-256 : 0 = 256byte, 256=Chip Erase

6. To continue press PB0 again…You will now see the Verify Menu

Verify Menu:



The Verify menu provides a means to Error Check data that was wrote by reading it back immediately afterwards. This **SHOULD NOT** be used in any demos but can be useful for a customer to validate data. If it is used it will take a substantial amount of time to perform the various task.

7. Press PB0 to skip this section as we do not want to enable this for demos. You will now see the SPI Clock Menu

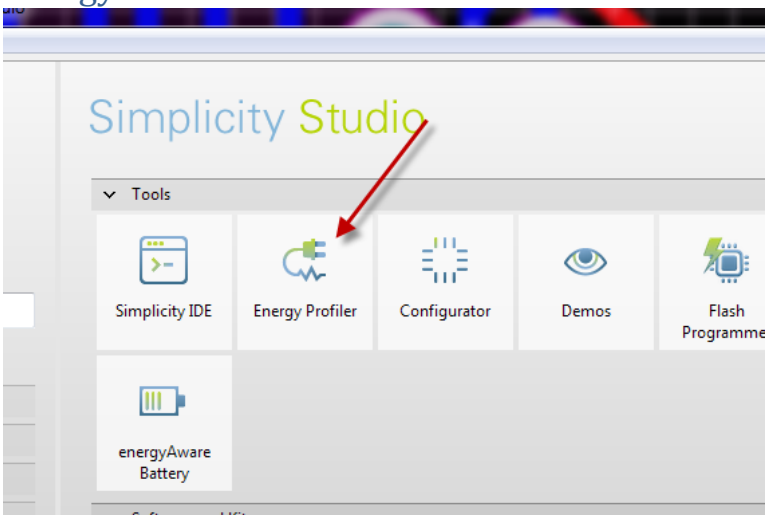
SPI CLOCK Menu:

This menu allows the user to select between a 2MHz or 12MHz SPI clock using the slider. The primary difference being that using the 2MHz Clock the EFM32/MCU operates off of its internal 14MHz clock whereas the 12MHz SPI clock requires the EFM32/MCU to use an external 48MHz XTAL. For lowest power consumption it is recommended to keep the SPI clock set to 2MHz as this provides a lower system current and also can wake from sleep modes faster.

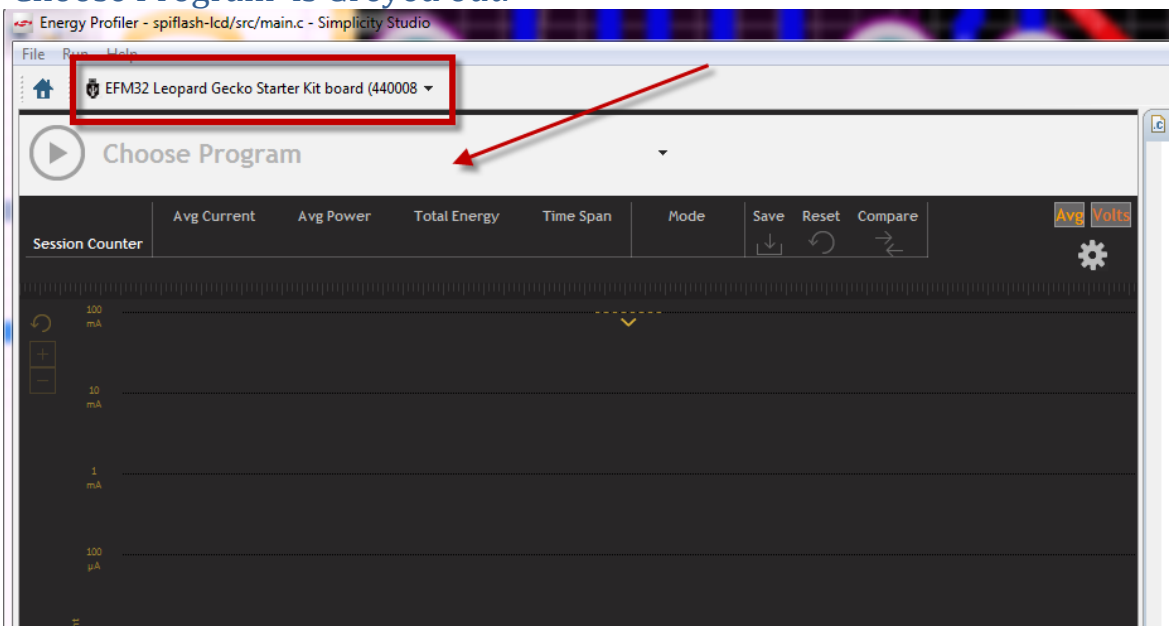
8. Press PB0 to continue. We are now back at the main Config menu. Press PB0 again to continue into the Demo Menu. Before we get any further let's make sure we view our results using the Energy Profiler from Simplicity Studio.

Step 5: Open Energy Profiler

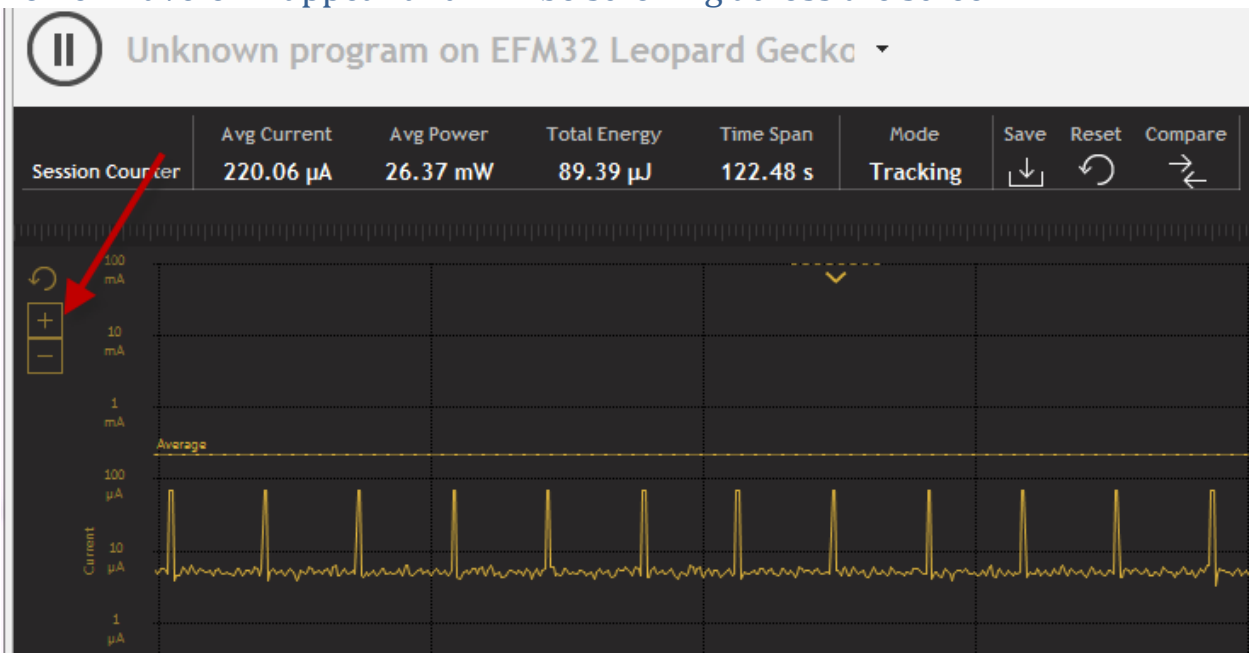
Open the 'Energy Profiler' utility from the Simplicity Studio Menu by double-clicking the Energy Profiler ICON.



You should now see the screenshot shown below with the 'EFM32 Leopard Gecko Starter Kit Board' showing in the top drop-down. You will current not see any activity and the 'Choose Program' is Greyed out.



To start seeing Power Profiler data simply click 'Choose Program'…You should now see a Power waveform appear and will be scrolling across the screen.



You can change the Timescale and Current by clicking on the +/- areas on the Current and Timescale axes. This will allow you to zoom in and out on the waveform. More details on using the profiler to come…

Step 6: Erase Demo

From where we left off at the Config Menu press PB0 and we should be at the Erase Menu.

The Erase menu allows the user to erase the Serial Flash device based on the Erase Block size selected earlier in the Config menu. Use the Slider to adjust the total amount of memory to be erased.

Once you have chosen the amount of memory to erase using the slider press PB1 to perform Erase. You should also be watching the Energy Profiler as you will see this action show up in the Profiler.

You should see a similar profile. It may look different depending on your zoom level.

To utilize the Profiler to measure the Timespan/Energy/Avg Power/Avg Current of a waveform do the following steps…

1. Click in the Window with your Left Mouse Button => You will see a vertical line appear.
2. Now go to the little flag that shows the instantaneous current and click on the flag/box with your Left Mouse-Button, Hold and Drag to the left or right. You will see a 'shaded' area and a box appear in the window titled 'Selected Range' as can be seen above.

3. You can now measure the entire Erase Action, zoom into see a single Erase waveform, etc.

4. You can also place a 3rd cursor after you have the shaded area to show a specific current at a location by simply clicking again in the waveform with your Left Mouse button. See below…

You can repeat the Erase operation by pressing PB1 twice or to continue onto other demos press PB0…pressing PB0 we will now come to the Write Demo menu.

NOTE: For the AT25XE021 you can perform the demos with and without Active SO and note the differences in your measurements with the Profiler. It is very noticeable.

The same methodologies used for this Erase demo will apply for all the other demos. These details will not be repeated for each Demo option.

Step 7: Write Demo

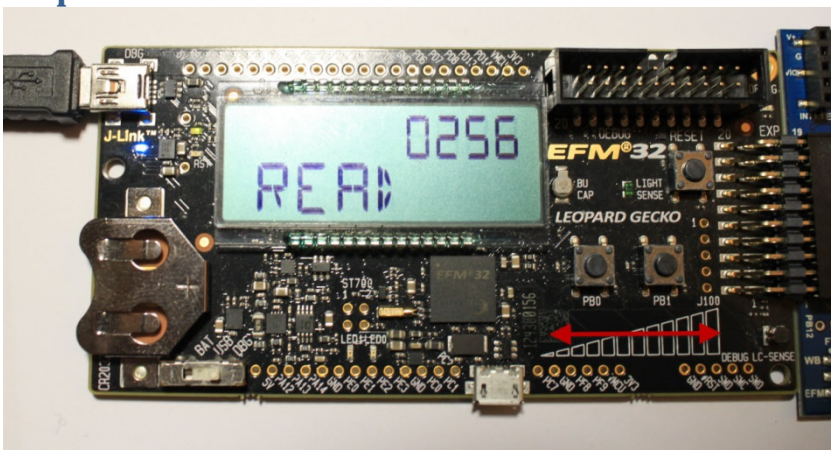
The Write Demo provides the user the capability to write to the Serial flash using a 256byte page write.

Using the slider select how much memory you want to write to, 16-256KB. As before with the Erase Demo Press PB1 to perform action. Upon completing the action you will see 'Wr done' printed to the LCD.

View on Energy Profiler. Zoom in to look at individual Write waveform.
Compare Write waveform with Active SO and without…

Press PB0 to continue to other demos or press PB1 to perform Write again. Pressing PB0 takes us to the read-modify-write demo.

Step 8: Read Demo



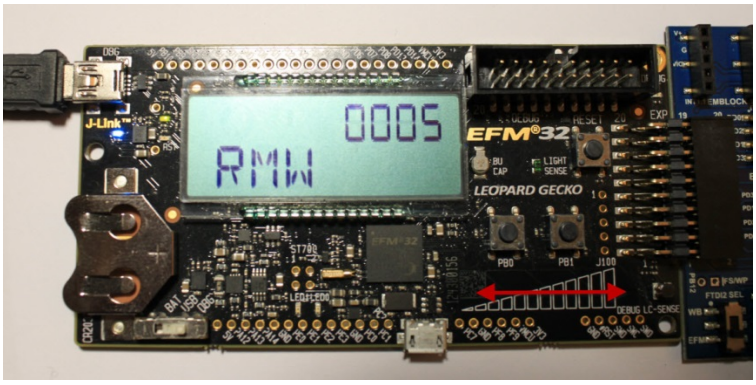
As before use the slider to adjust the amount of memory to be read. Press PB1 to perform action. View on Energy Profiler.

Press PB0 to continue to next demo or press PB1 to run the Read demo again. Pressing PB0 takes us to the Read Modify Write demo.

NOTE: Active SO has NO effect on Reads.

Step 9: Read-Modify-Write Demo

This demo performs a read-modify-write operation. It is performed on the AT25XE021 and the AT45DB081/641 series. Since the AT25XE021 does not actually have a true read-modify-write command we read a 256byte page, modify 20bytes and then erase that same page and write back the updated results. This can be compared to the AT25SF in which it is required to perform a 4KB read, update 20bytes, erase the 4KB block and write back the entire 4KB block.



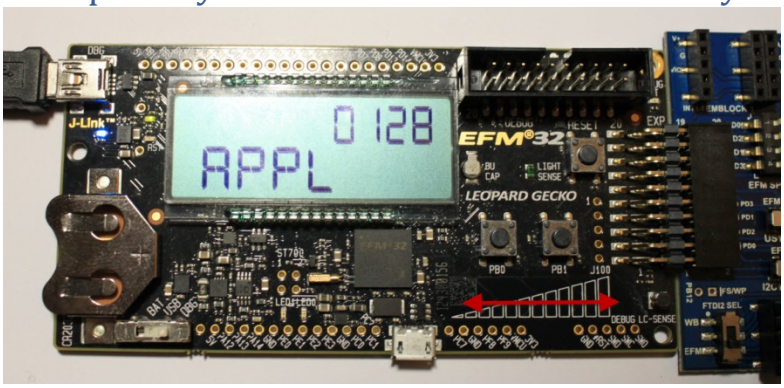
As before use the slider to determine how many times the RMW action will occur(1-100). It is useful to perform the action more than once so you can see a repeating waveform.

Compare results RMW using AT25SF041. **DO NOT HOT-SWAP EMMEM** devices.

NOTE: You can save the Energy Profiler waveforms as *.csv files and load them back into the profiler at a later date.

Step 10: Application Demo

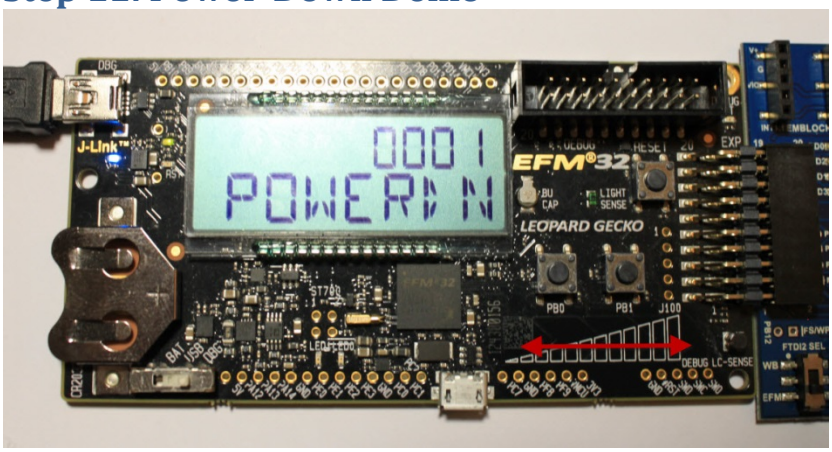
The Application Demo is intended as a highly abbreviated application example in which an erase is followed by a write which is followed by a read. The erase, write and reads occur repeatedly for the size chosen by the user. The value shown on the slider is multiplied by 1024 to scale to a 1KB boundary.



Use the slider to go from 16-256KB. Press PB1 to perform action.

Press PB0 to continue to next demo or press PB1 to run Application Demo again. Pressing PB0 takes us to the PowerDown demo…

Step 11: Power-Down Demo

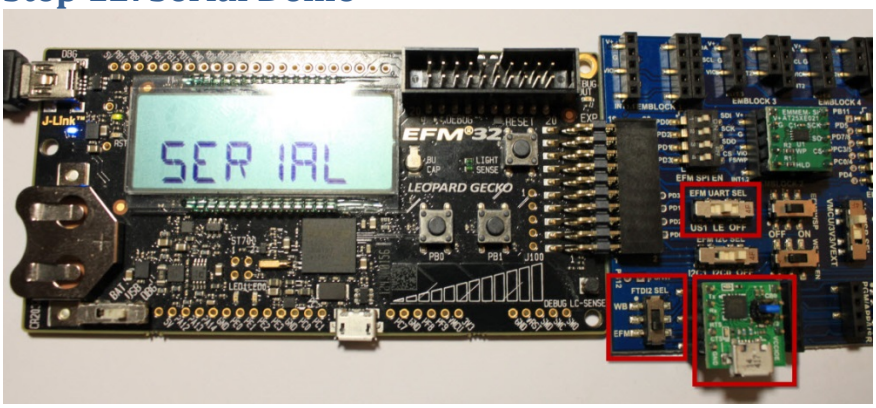


The Power Down demo demonstrates making use of the various DEEP Power-down and ULTRA DEEP Power-down modes. Use the Slider to select between the two.

0 = DEEP Power-down 1 = ULTRA DEEP Power-down

Press PB0 to continue to next demo or press PB1 to run Power-Down Demo again. Pressing PB0 takes us to the Serial demo…

Step 12: Serial Demo



The Serial Demo outputs the data onto the EFM32 LEUART(Low Energy Uart). To make use of this demo the user would need a EMCOM-FT230 (micro-sized USB-UART module) or provide their own USB-UART and wire into the EMCOM-FT230 plugin slot. The slide switches need to be configured as shown for this to work.

The EMCOM-FT230 is not provided with the Serial Flash kit but can be purchased from Embedded Masters from the link below.
https://www.embeddedmasters.com/ProductDetail/EMCOMFT230X-Embedded-Masters/552435

Appendix

Links:

Links to specific EMMEM Product homepages which includes datasheets, schematics, other information. Serial Flash Demo firmware will be available as a download from the Embedded Masters website.

Public Github Page:
https://github.com/embeddedmasters/AdestoSerialFlashDemo

Adesto Technologies:
http://www.adestotech.com/

EMSENSR-WSP:
https://www.embeddedmasters.com/WSEP/

EMMEM-AT25XE021 Home Page:
https://www.embeddedmasters.com/ProductDetail/EMMEMAT25XE021A-Embedded-Masters/571354

EMMEM-AT25SF041 Home Page:
https://www.embeddedmasters.com/ProductDetail/EMMEMAT25SF041-Embedded-Masters/592484

EMMEM-AT45DB081 Home Page:
https://www.embeddedmasters.com/ProductDetail/EMMEMAT45DB081-Embedded-Masters/583411

EMMEM-AT45DB641 Home Page:
https://www.embeddedmasters.com/ProductDetail/EMMEMAT45DB641-Embedded-Masters/583410

Revisions:

20150531/ V1.0: Public release of Quick Start guide.

20160601/V1.0.1: Updated to expand how to update STK3600 including setting up a workspace/project in Simplicity Studio.