Appendix A How to run the low power demo

A.1 Demo to enter power modes

In this Lab we will review the necessary conditions to enter the available power modes based on the demo software.

The objective of this demo is to get familiar with the steps needed to enter the available power modes in the Kinetis family of devices.

It is important to clarify that this demo uses only one mode to exit from any operation mode, but there are many ways to exit from any given operation mode as previously explained in this document.

This demo is prepared to run on TWR-K20D50M with a K20DX128 device.

Low Power exit modes:

External pin SW2 has been enabled to wake up via the LLWU from any LLS and VLLSx mode, all wakeup interrupts from these modes must go through LLWU_ISR.

All other modes (non-leakage) can be taken out of low power mode via an interrupt from any of the available port enabled pins, in the case of this demo that is SW2 or SW3.

The following is required:

1. IAR Embedded Workbench for ARM v6.30 or CodeWarrior MCU V10.1 (with *MCU 10.1 Kinetis 50MHz Service Pack* installed)
2. TWR-K20D50M tower board.
3. P&E OSBDM OSJTAG Virtual Serial Toolkit.
   You can download it from the following site:
   http://www.pemicro.com/osbdm/index.cfm
4. Demo project: “low_power_demo”.

This toolkit contains the P&E terminal utility that you need to visualize the menu options via serial over USB.

Before running the demo you need to configure your IDE to the proper settings depending on the programming/debugging interface that you will use.

NOTE

If your preferred debug interface is already installed you can disregard the following section and go directly to chapter 7.2 “Steps to run the demo”.

A.2 Flash programming and debugging settings

In this section we indicate the settings needed to program and debug you application into the Kinetis board using IAR or CodeWarrior IDEs with any of the following debug interfaces: OSJTAG, P&E Multilink, Segger J-Link.

IAR and OSJTAG/P&E Multilink

Flashloader *FlashK20Xxxx* must be used for these connections.

Unzip **iar_FlashK20Xxxx_8k_ram.zip** located in the demo project zip file and follow the instructions below.

1. Place all of the files in this zip (except “readme.txt”) in your *IAR Systems\Embedded Workbench.6.0_x\arm\config\flashloader\Freescale* folder

NOTE

This applies for the current IAR version IAR 6.30.4, for newer versions these steps will not be necessary.

2. Open your IAR workspace file and select a flash configuration for the project
   a) Open IAR Embedded Workbench IDE.
   b) Open the *low_power_demo* workspace.

To do this you can drag and drop the “*low_power_demo.eww*” located on the following path:

{Demo Installation path}\build\iar\low_power_demo

3. In the project options select Debugger->Download.

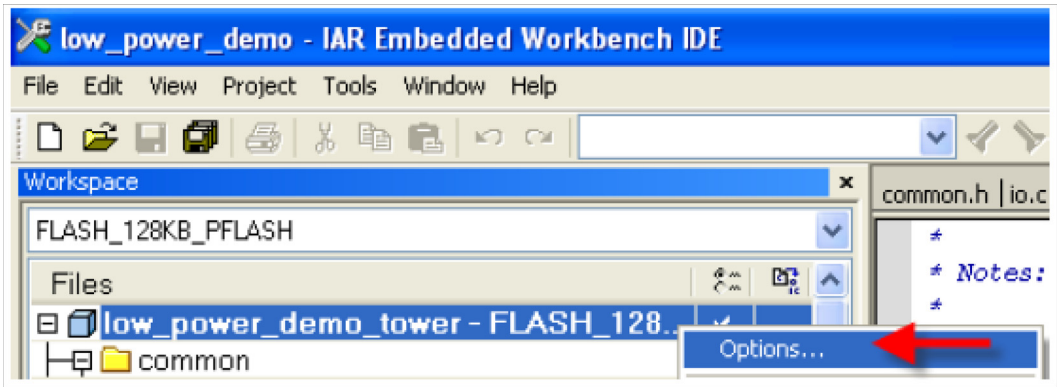

Figure A-1.

4. Check the "Use flash loader(s)" box.
5. Check the "Override default .board file box".
6. Provide the path to the FlashK20Xxxx.board file. This will be given as follows: $TOOLKIT_DIR$\config\flashloader\Freescale\FlashK20Xxxx.board.

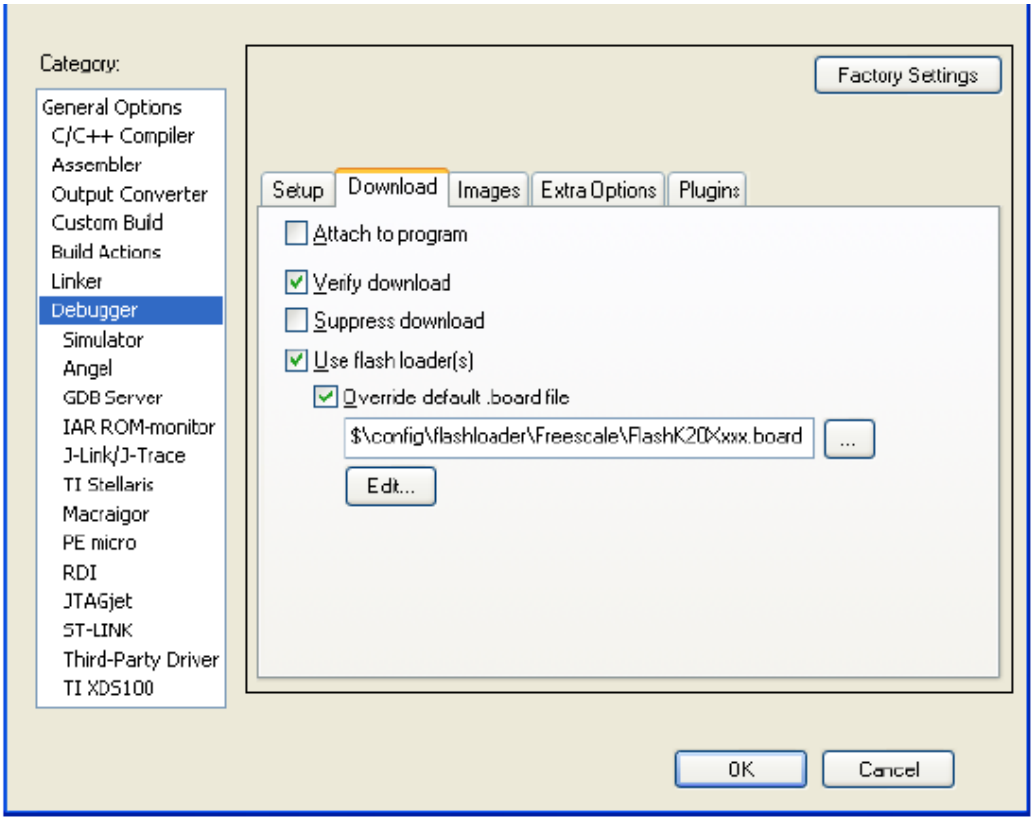

Figure A-2.

7. On debugger select driver *PE_micro.*

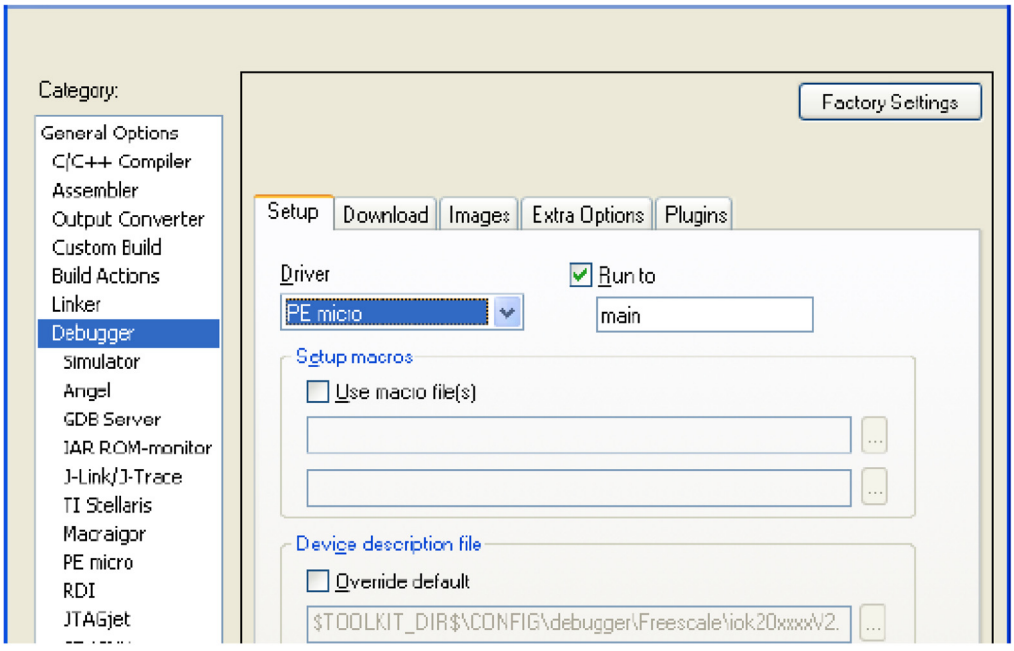

Figure A-3.

8. To program and debug the application click on the debug icon.

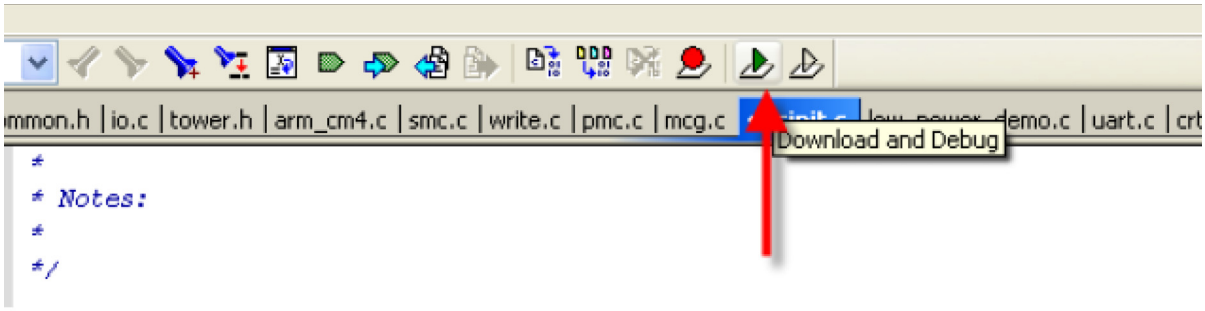

Figure A-4.

9. Verify that the program was successfully downloaded.

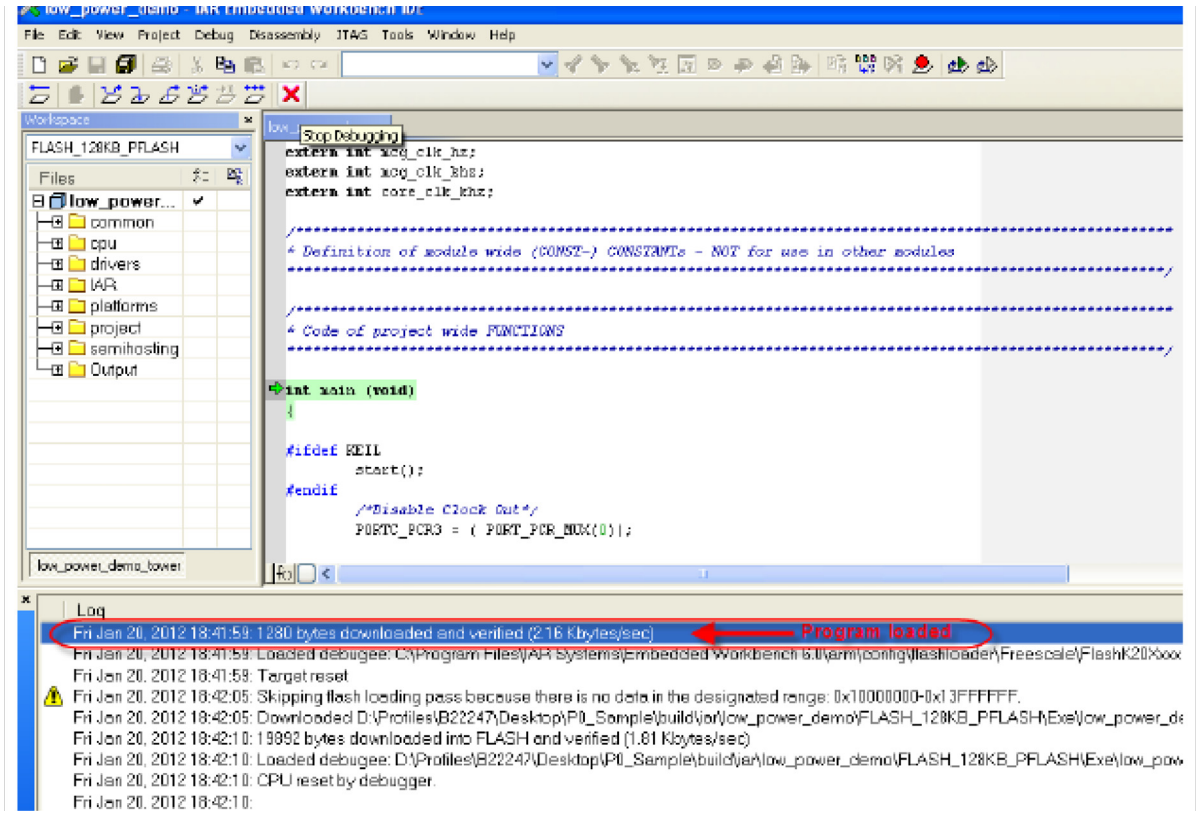

Figure A-5.

10. At this point we have successfully downloaded the application, now we need to exit and close the debugger by clicking on the X mark as shown in the following screen below:

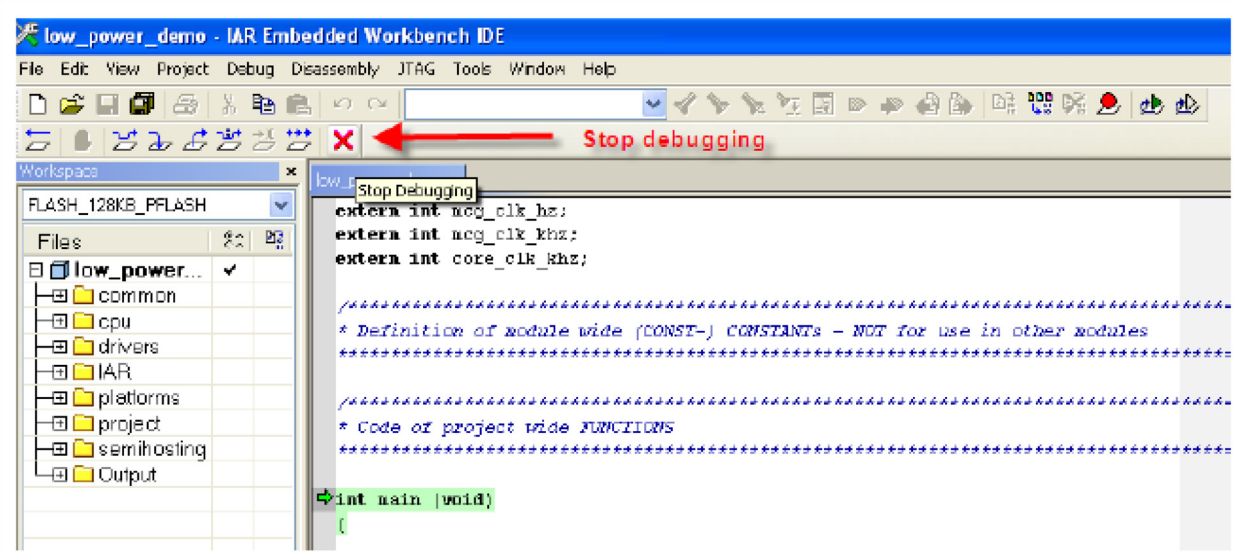

Figure A-6.

NOTE

The purpose of stopping the debug session is due to higher current consumption measurements when the debugger is active.

IAR and J-link

For proper operation you must use: **J-Link DLL V4.36i**

You can download it from the following site:

http://www.segger.com/jlink-software.html?step=1&file=JLink_436kl

IAR must be configured as follows:

1. Open your IAR workspace file and select a flash configuration for the project.
2. Open IAR Embedded Workbench IDE.
3. Open the *low_power_demo* workspace.

To do this you can drag and drop the "*low_power_demo.eww*" located on the following path:

{Demo Installation path}\build\iar\low_power_demo

4. In the project options select General options.

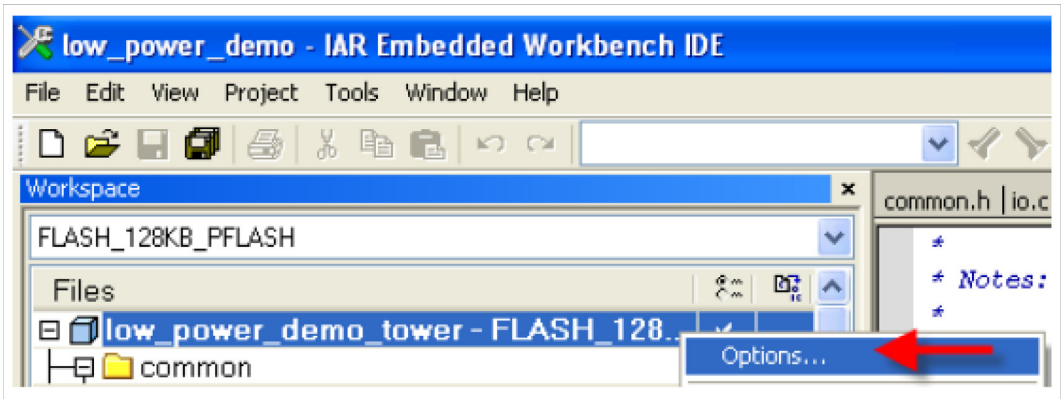

Figure A-7.

5. Select Device *MK20DX128xxx5* on the project options as shown below:

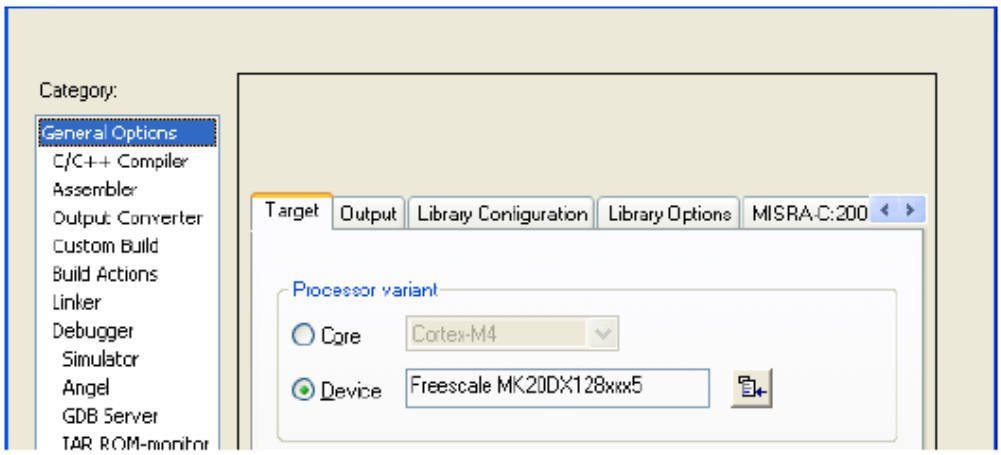

Figure A-8.

6. In the Debugger category: Uncheck “Use flash loaders”.

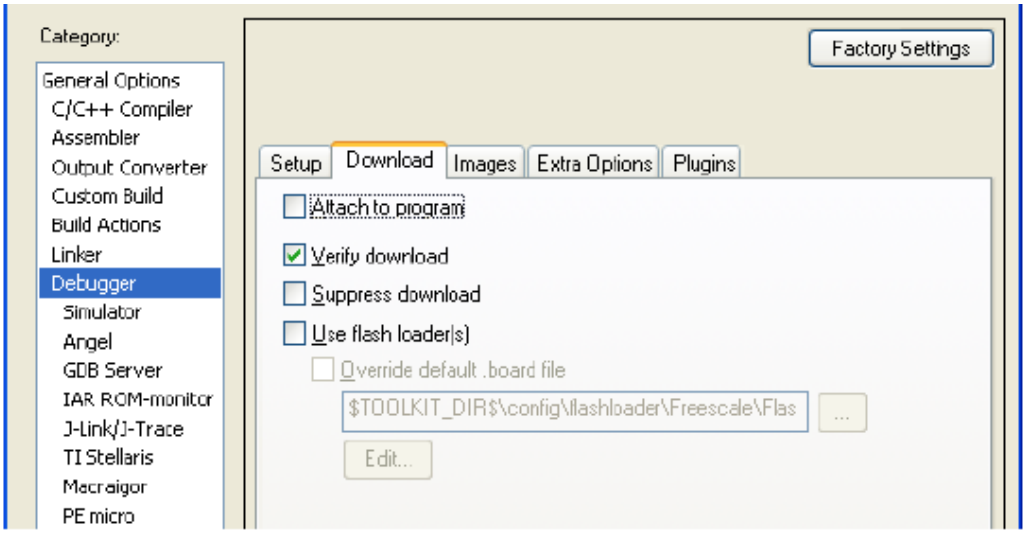

Figure A-9.

7. In J-link/J-trace Connection window: Select JTAG interface.

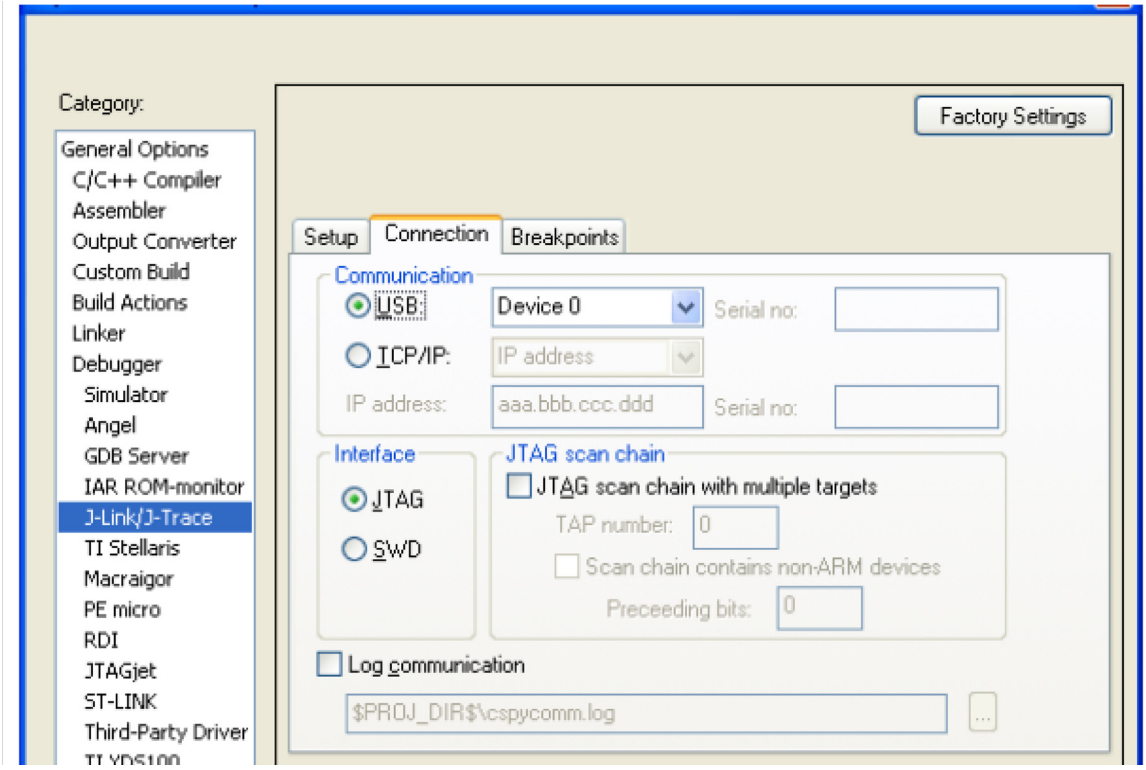

Figure A-10.

8. To program and debug the application click on the debug icon.

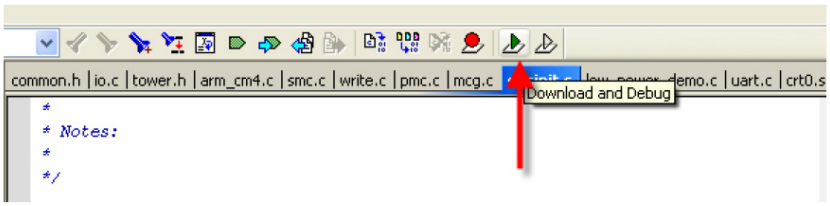

Figure A-11.

9. Verify that the program was successfully downloaded.

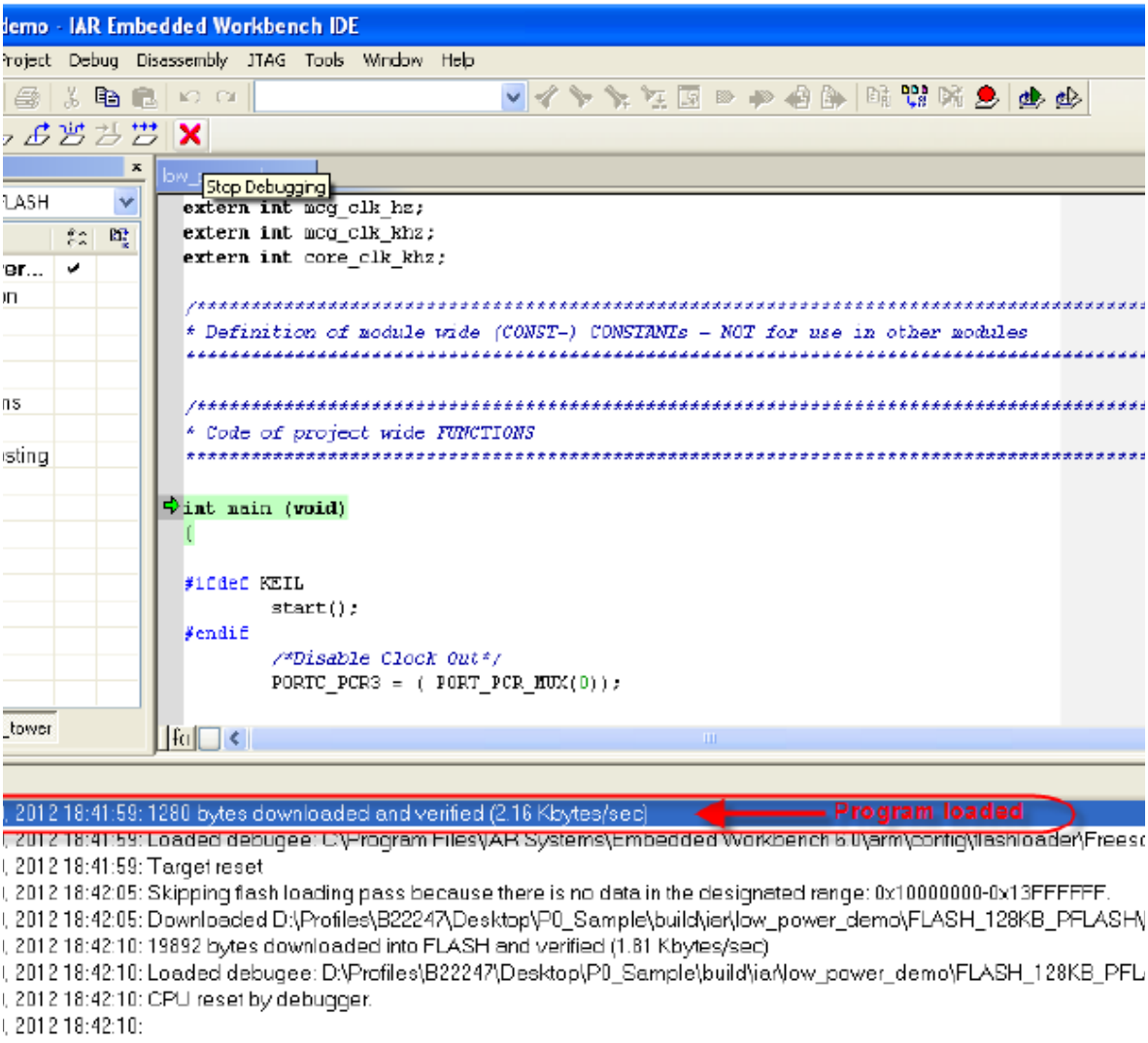

Figure A-12.

10. At this point we have successfully downloaded the application, now we need to exit and close the debugger by clicking on the X mark as shown in the following screen:

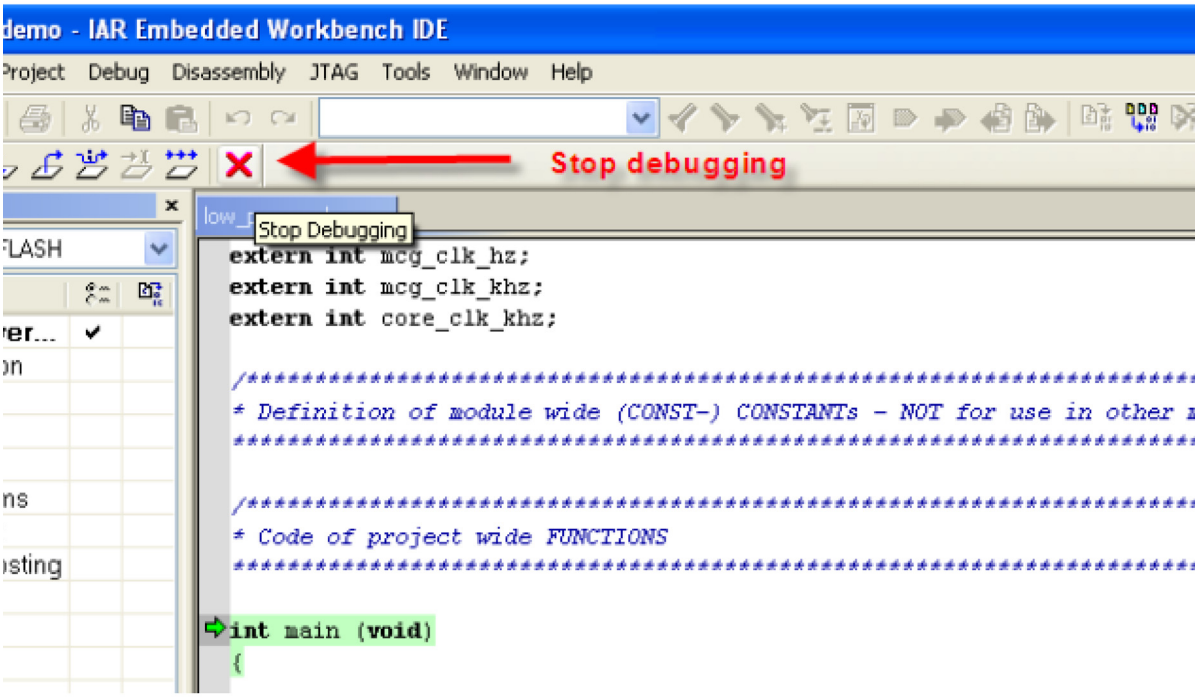

Figure A-13.

NOTE

The purpose of stopping the debug session is due to higher current consumption measurements when the debugger is active.

CW MCU V10.1 and OSJTAG/ P&E Multilink

For proper operation with CW10.1, it must be configured as follows:

Update the flash programmer:

1. Click on Flash programmer and import “Flash Task”.

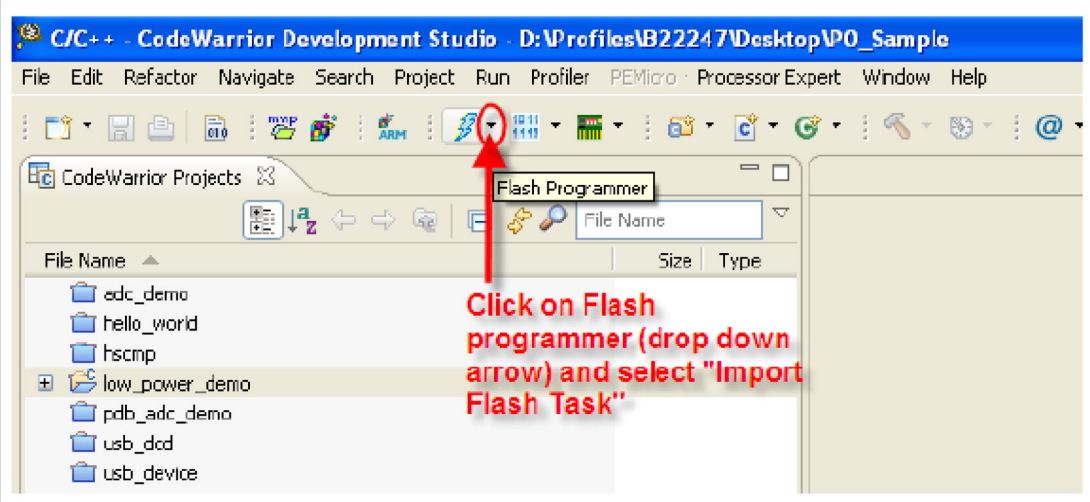

Figure A-14.

2. Open the ARM folder, select *K20DX128.xml* and click Open.

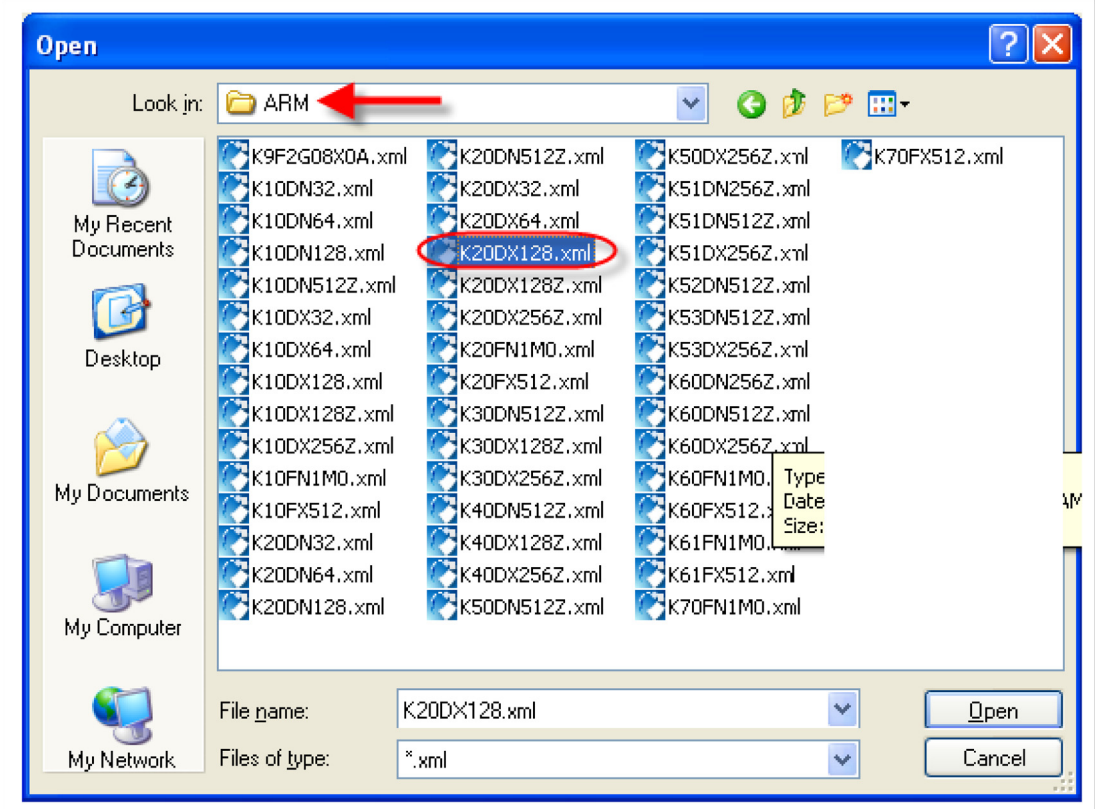

Figure A-15.

3. Select FLASH configuration.

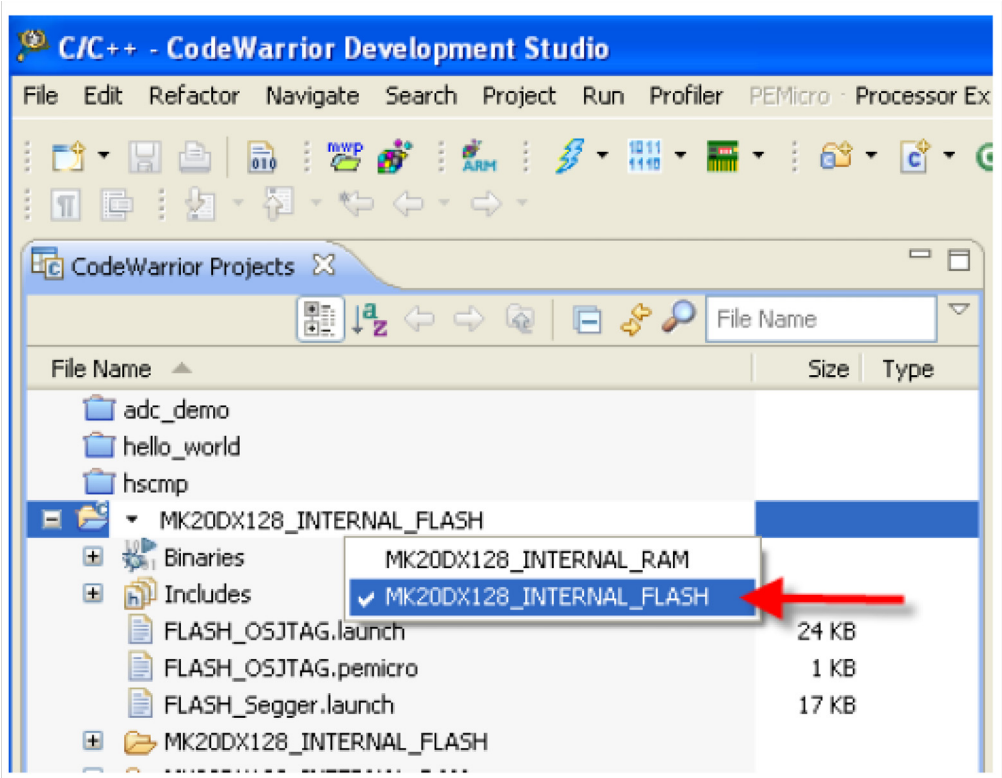

Figure A-16.

4. Build the project by clicking on the hammer icon as shown below:

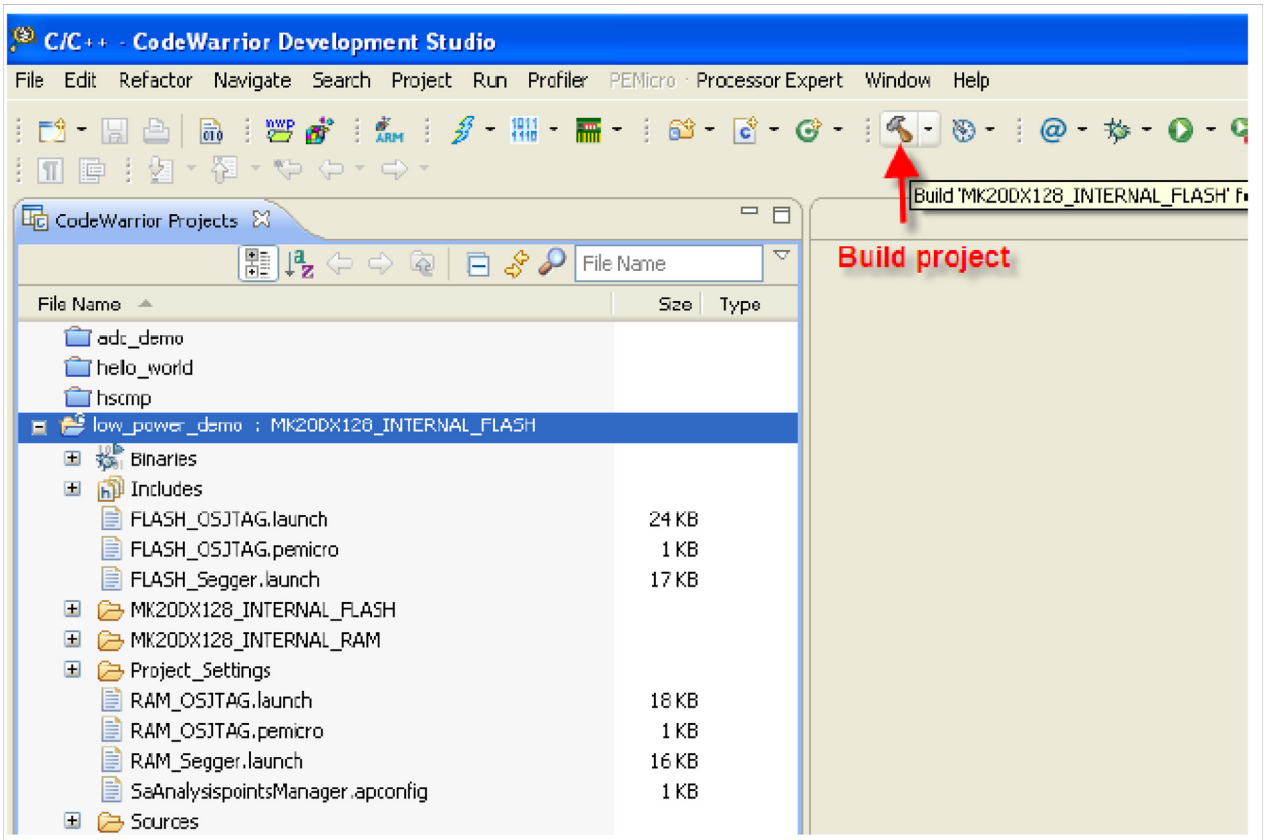

Figure A-17.

5. Click on the drop down arrow to select the corresponding debug configuration.

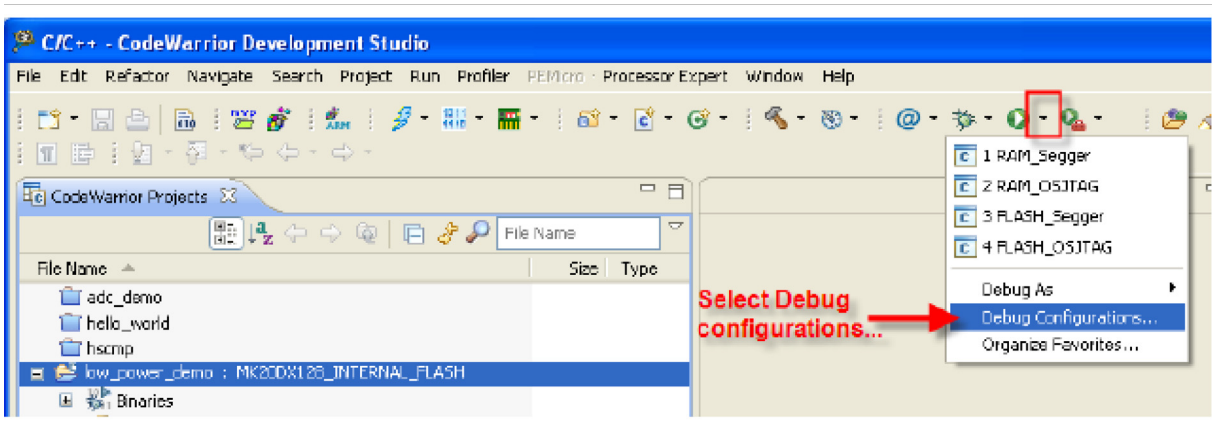

Figure A-18.

6. Select FLASH_OSJTAG, go to Debugger tab, open Download section, uncheck “Perform Standard Download”.

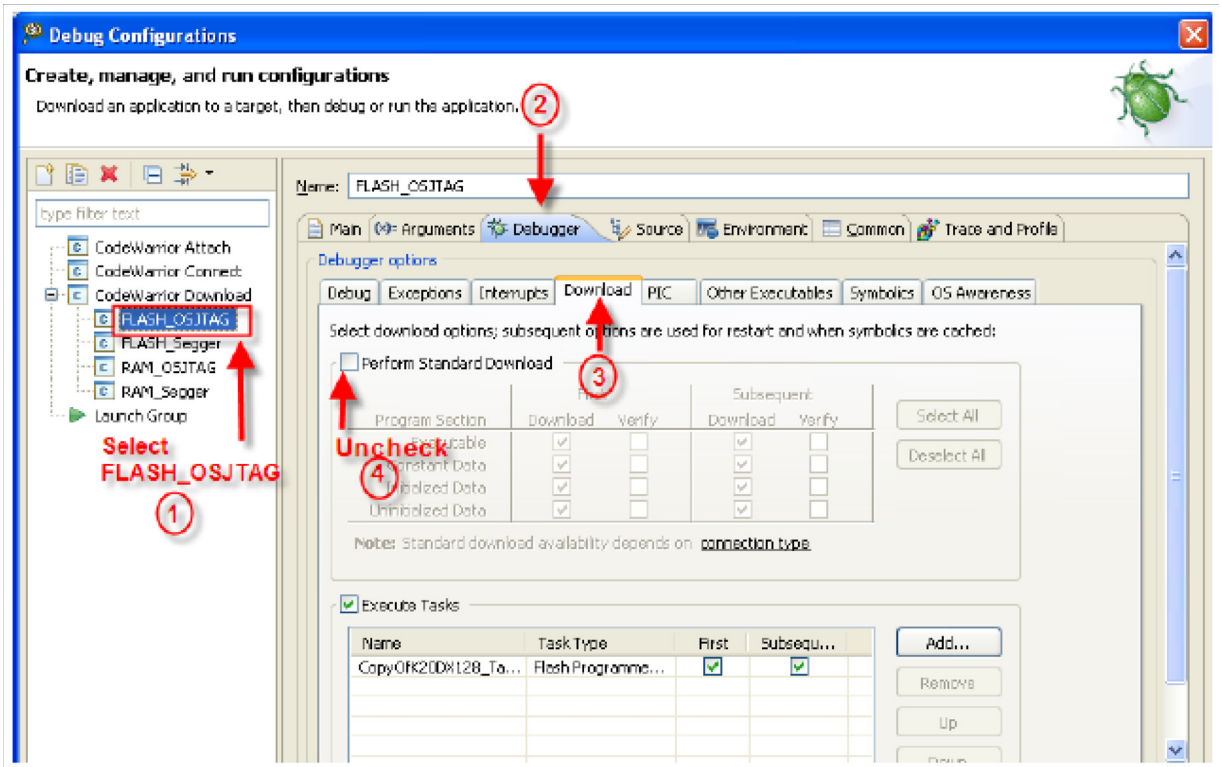

Figure A-19.

7. Check the box for Execute Tasks, select the current task and click on Remove.

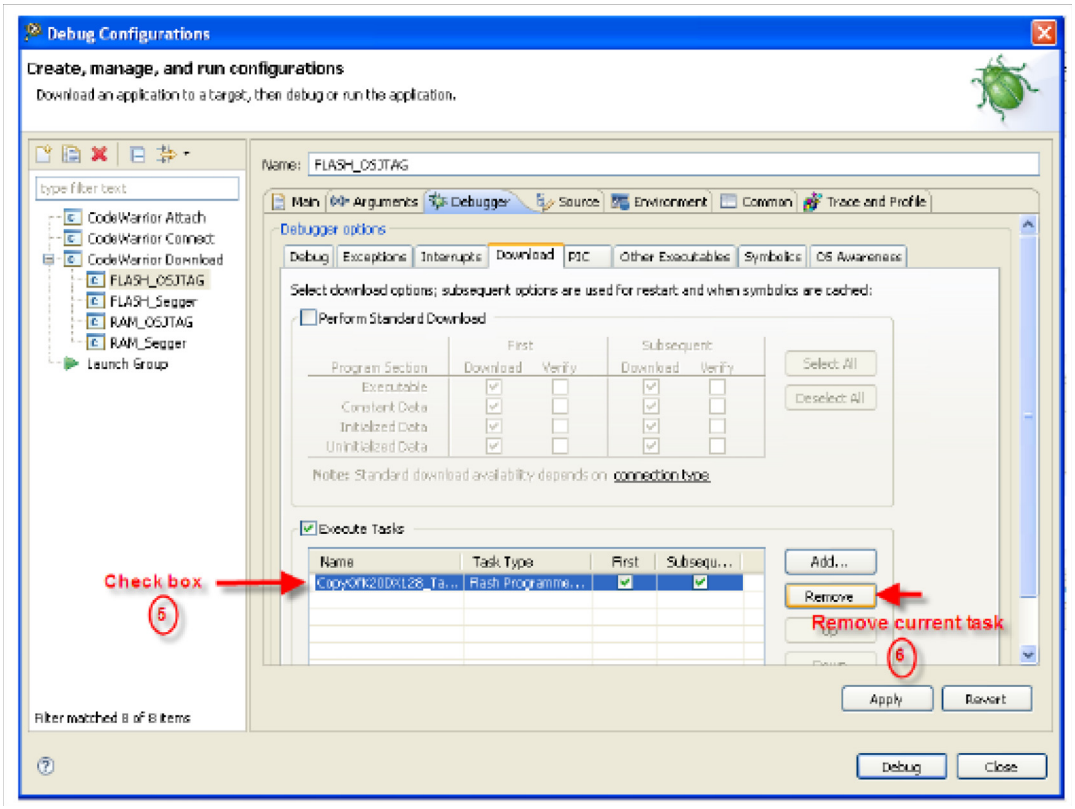

Figure A-20.

8. Click on Add button and select K20DX128.

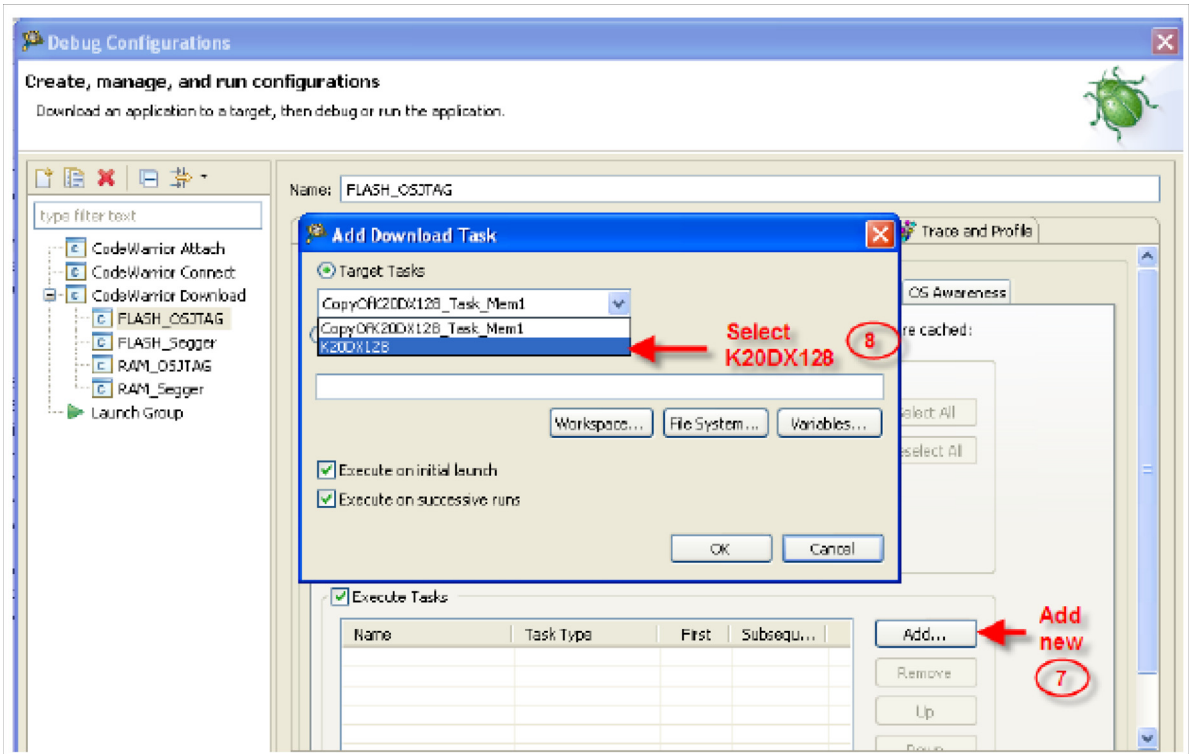

Figure A-21.

9. Click Apply and Debug.

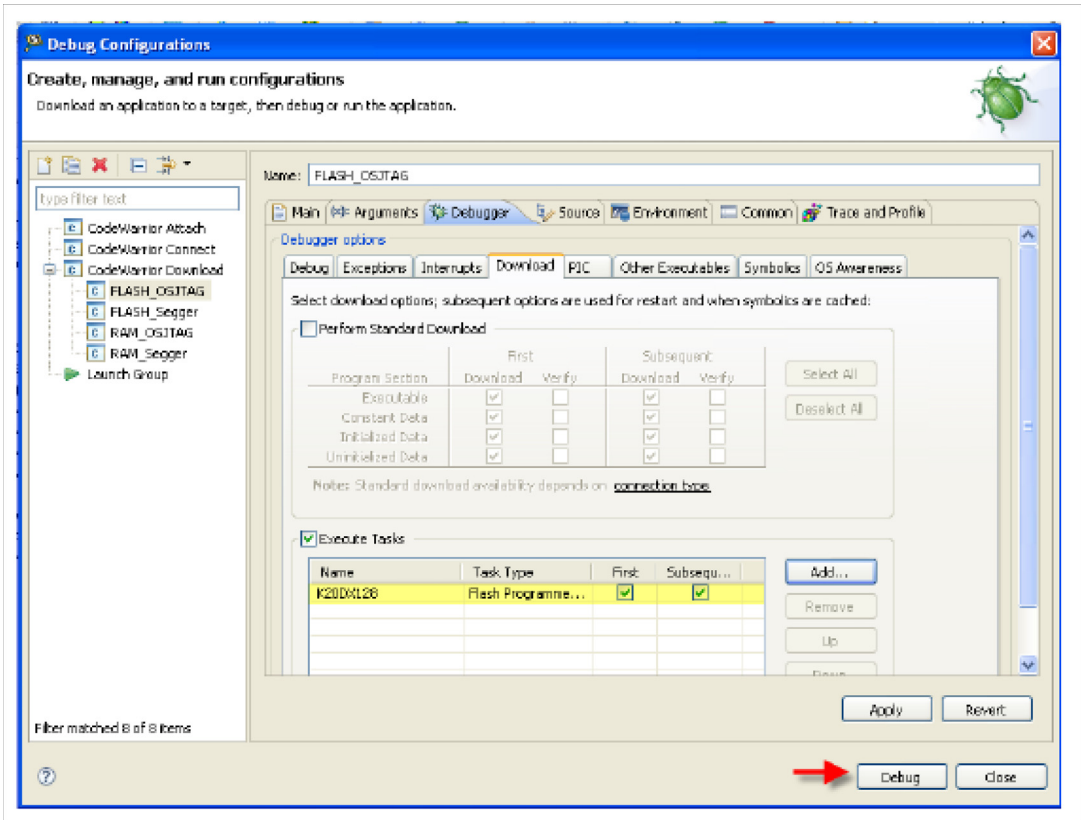

Figure A-22.

10. Verify download.

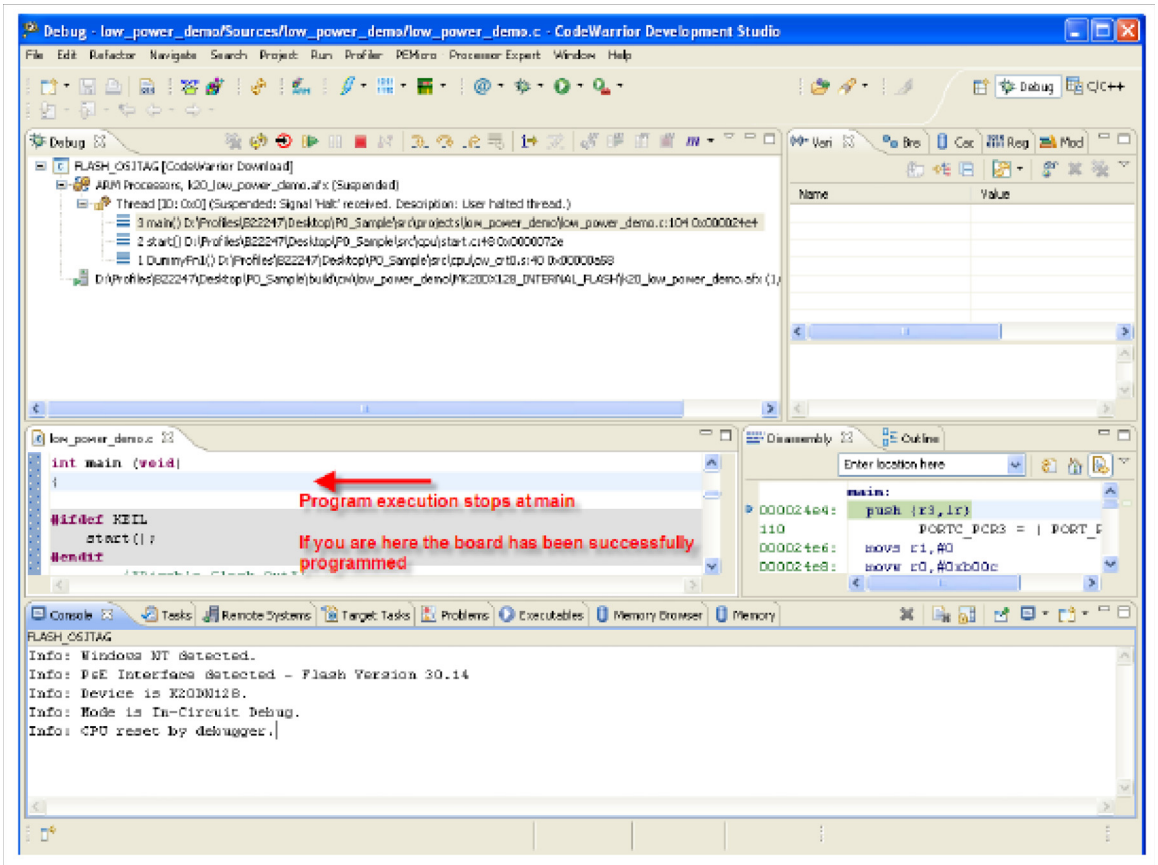

Figure A-23.

11. In order to measure current consumption properly, terminate debug session by clicking on the red square button.

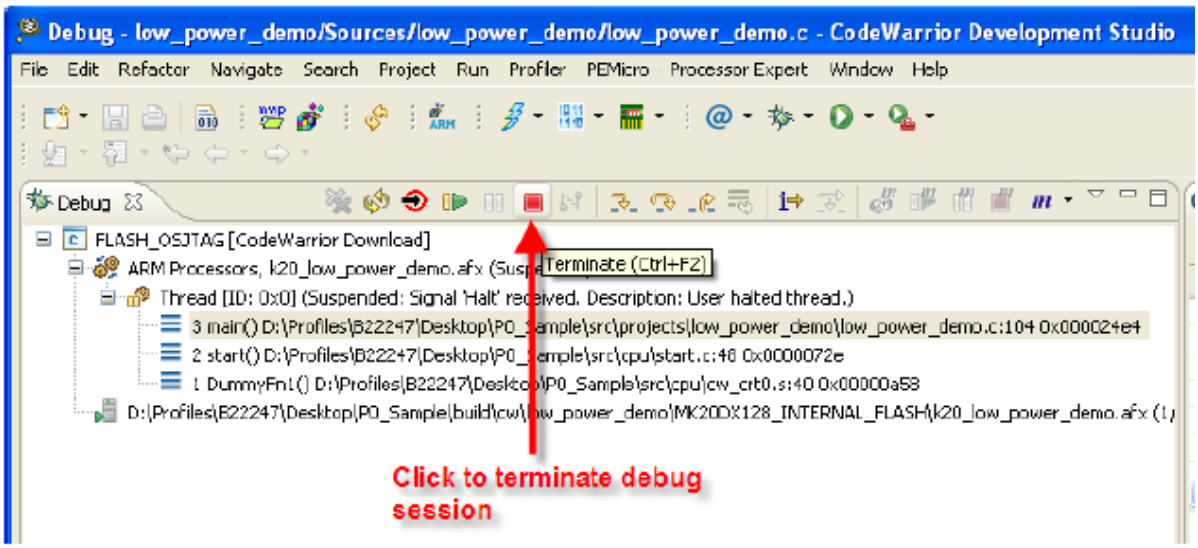

Figure A-24.

CW MCU V10.1 and JLink

Follow the same steps as indicated above (for CW MCU V10.1 and OSJTAG/ P&E Multilink), except that in step 6, you must select **FLASH_Segger**.

Select FLASH_Segger, go to Debugger tab, open Download section, uncheck “Perform Standard Download”.

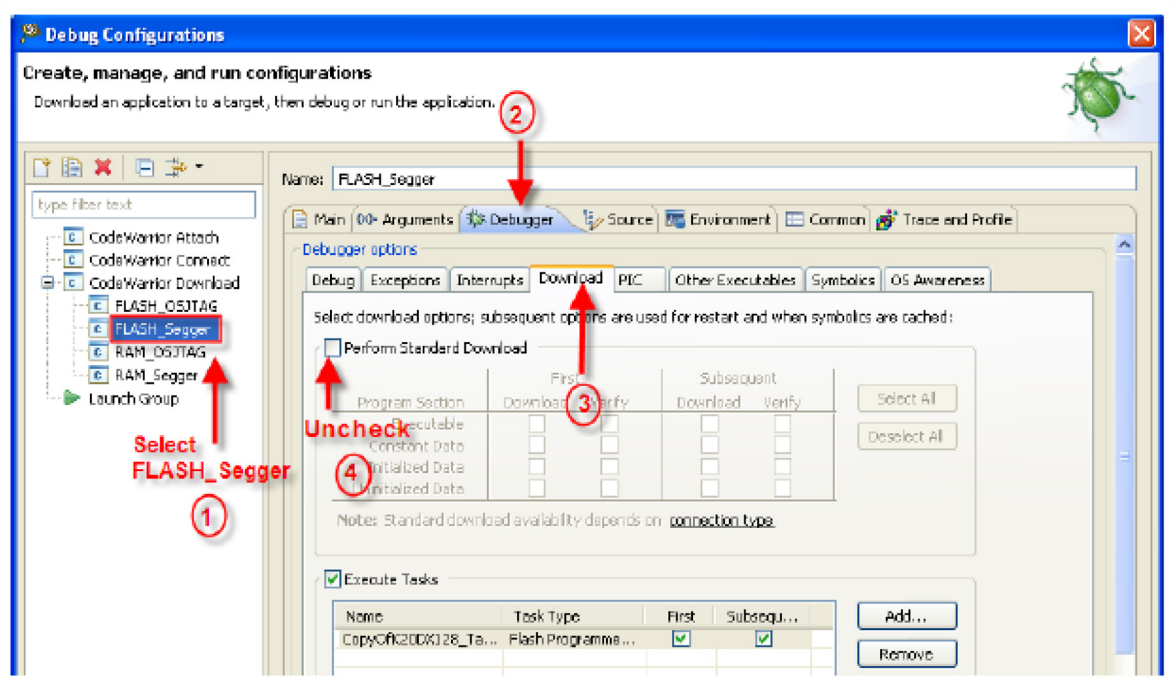

Figure A-25.

A.3 Steps to run the demo

Once you have successfully loaded the application to the device and stopped the debugger, you can proceed with the following steps:

1. Open the Terminal application from P&E.
2. Set the port to Port: USB COM, Baud: 115200,Parity: None, Bits: 8 Click on “Open Serial Port”.

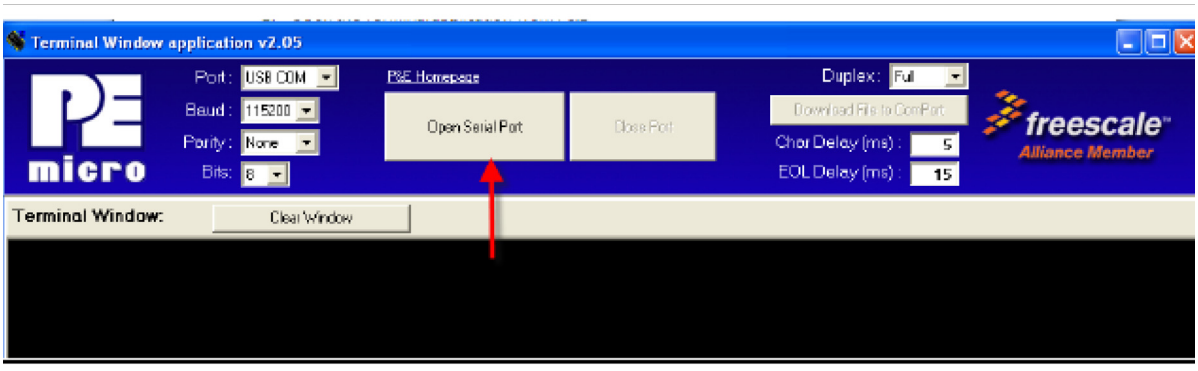

Figure A-26.

3. Make sure the port is successfully opened.

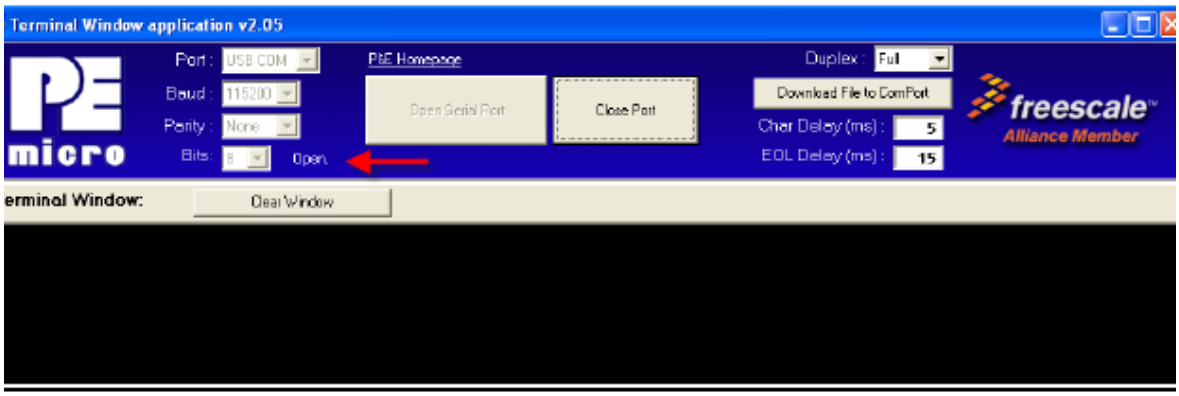

Figure A-27.

4. Now click on the reset button of your board.
5. If you look to the Terminal Window you should have all available options displayed.

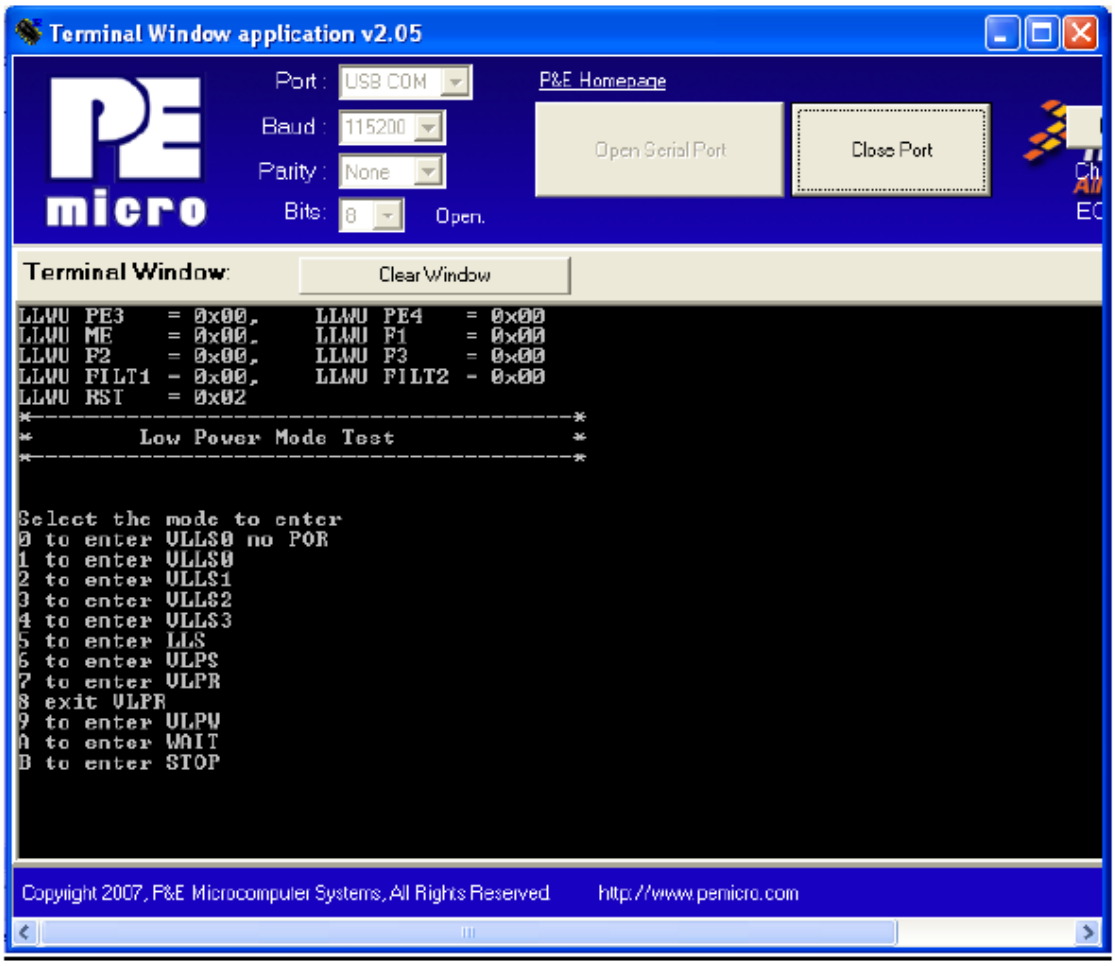

Figure A-28.

6. Follow the instructions on the menu.

Example:

To enter Stop Mode:

- Type letter B in the terminal window.

The following message will be displayed:

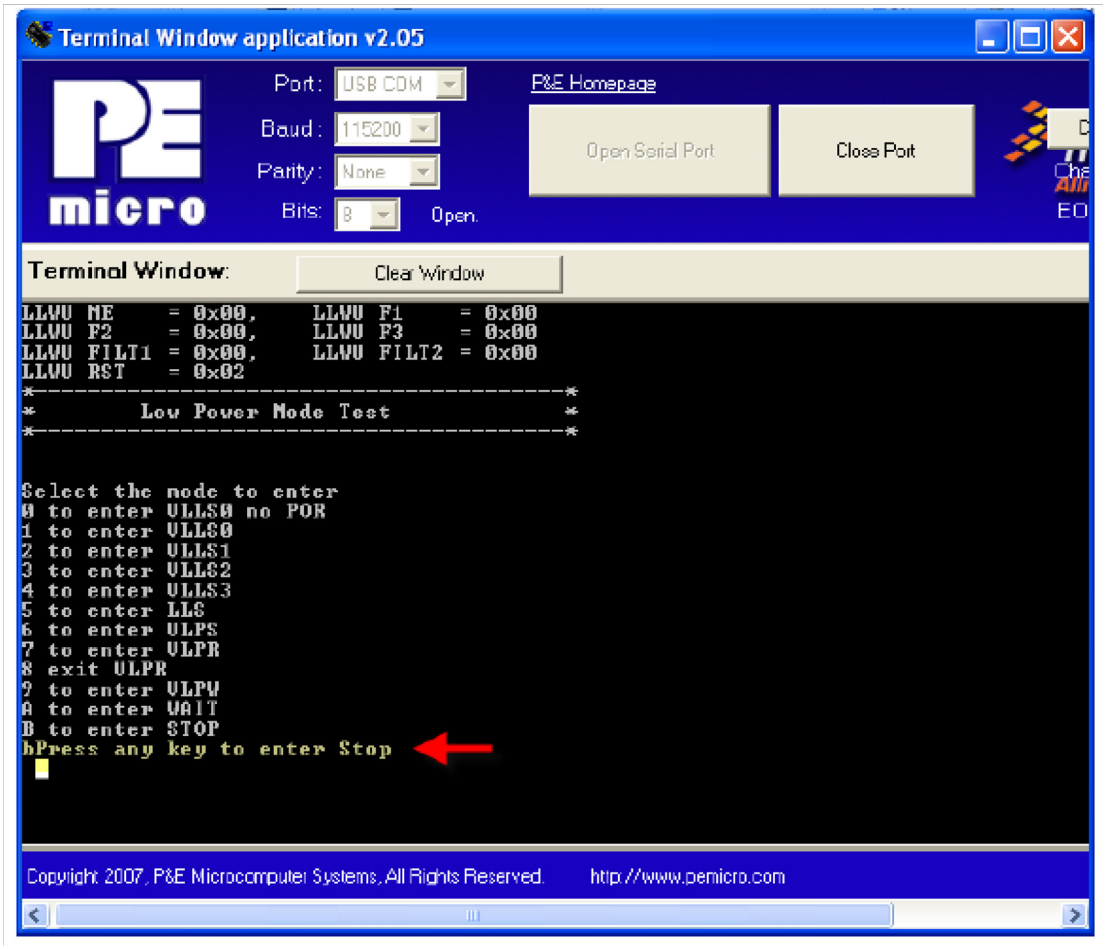

Figure A-29.

- Press any key.

The following message is displayed:

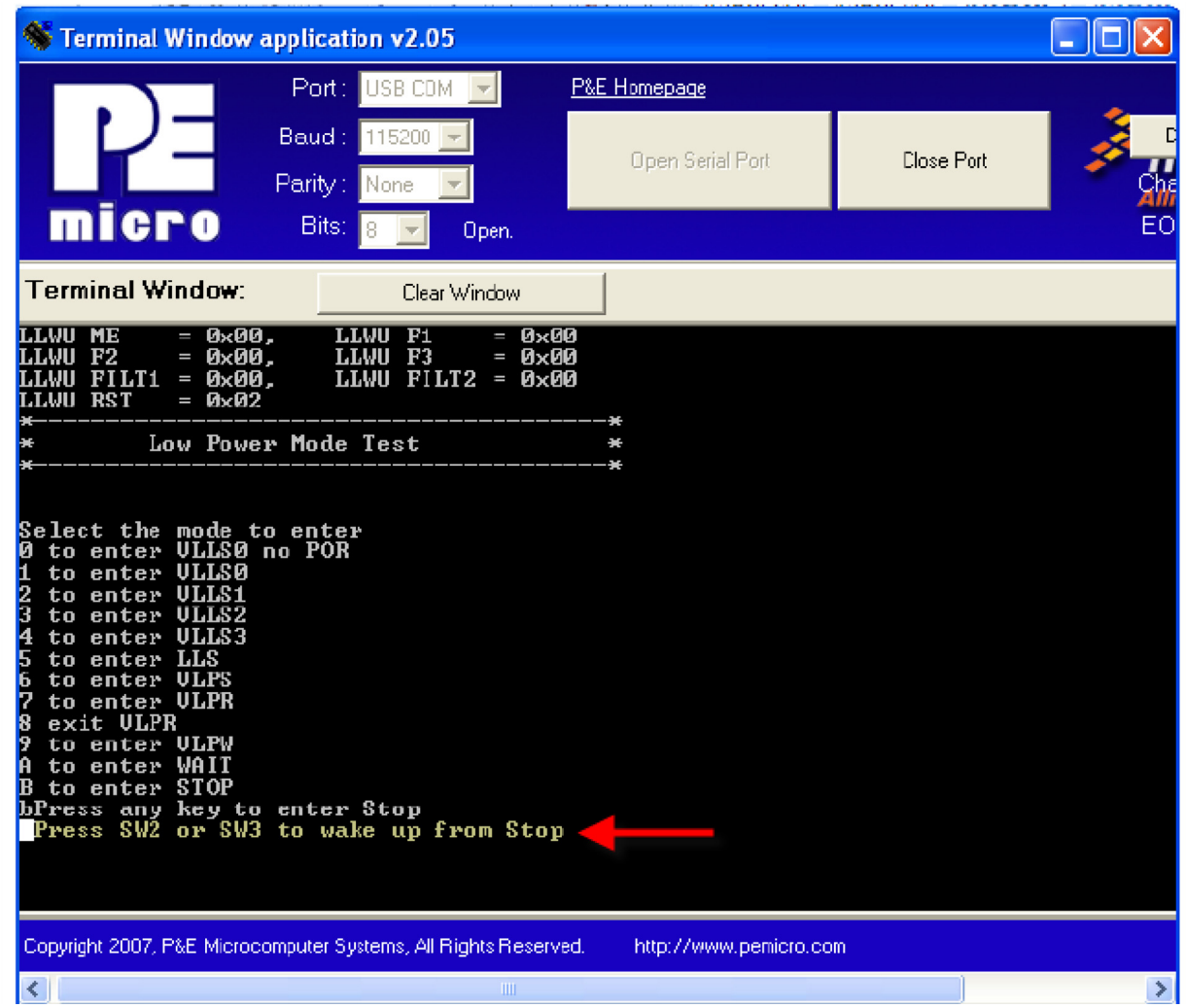

Figure A-30.

This means we are currently in stop mode.

- To measure power consumption (depending on your board) you should take off the Jumper that corresponds to MCU power connections.

This is J25 on the TWR-K20D50M Rev. C

NOTE

If you are unsure of the corresponding jumper please refer to your tower board user manual.

- Now measure the device consumption between these terminals:

You must be measuring approximately 320µA.

- If you want to exit this low power mode and enter another one press SW2 or SW3:

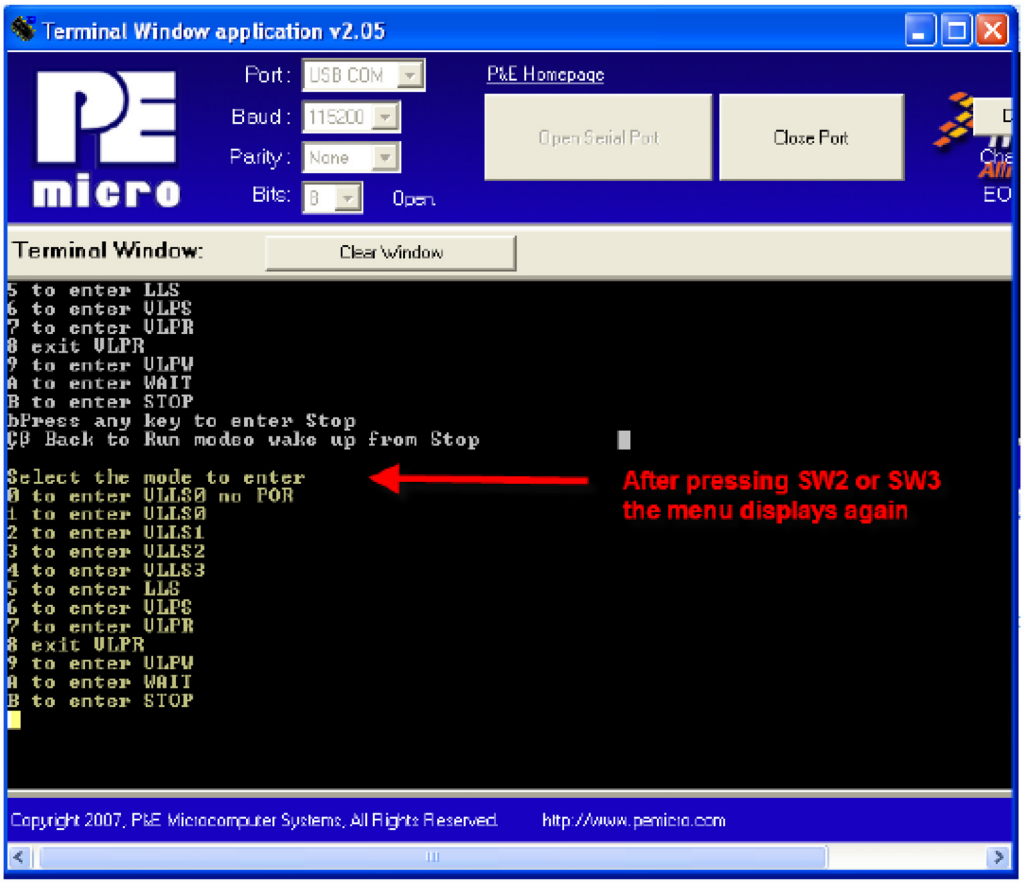

Figure A-31.

Now you can follow the steps again to enter a new power mode.

NOTE

You can exit any power mode via reset.