

LAB #1: The CSM12C32 Module and PBMCUSLK Project Board

Lab writeup is due to your TA at the beginning of your next scheduled lab. Don't put this off to the last minute! In future labs, there will also be pre-lab work to complete before the start of the next lab. **NO LATE LAB REPORTS WILL BE ACCEPTED.**

1 Objectives

- Gain familiarity with lab tools and development board prototyping.
- Learn procedures for assembling and downloading programs to the CSM12C32 module using CodeWarrior.
- Learn how to interface with the CSM12C32 module standalone and with the PBMCUSLK project board.

2 Tasks

1. Download sample C-code to the CSM12C32 module using the project board.
2. Create and download a 4-bit counter to the CSM12C32.
3. Download C-code to the CSM12C32 in the stand-alone configuration.

3 Microcontroller Kit

Each partnership can check out one microcontroller kit which includes:

- PBMCUSLK project board
- CSM12C32 module
- 9 VDC universal AC/DC adapter
- USB cable
- RS-232 serial cable
- Jumper wires kit
- MCU project development board CD
- 68HC12 development board CD
- Technical training 8-bit, 16-bit, and 32-bit processors CD
- Various documentation

Both parties must be present to checkout the kit and sign the loan agreement. The entire contents of the kit must be **CLEAN, COMPLETE, AND IN WORKING CONDITION** before the last day of class. You are responsible for up to \$250 for loss or damage.

4 Other Useful Information

The following is available from the course website:

- Lab1 example code (Lab1Example.c)
- Serial monitor code (hcs12serialmon2r1.zip)
- Reference materials for the MC9S12C microcontroller.
- Reference materials for the CSM12C32 module.
- Reference materials for the MCU project board.
- Reference materials for CodeWarrior.

If you would like to work at home, you can download the CodeWarrior Development Studio for HCS12X Microcontrollers V4.6 (Special Edition) from the Freescale website after registering. There is a link on the course website. Note that this version is limited to 32K, but it should be sufficient for this course.

5 Saving Your Work

Students should also bring a diskette or USB memory drive for saving work completed during the lab. Internet is available on lab machines for e-mail. **IMPORTANT: NO WORK SHOULD BE LEFT ON THE LAB MACHINES.**

6 Procedures

1. Download over USB:
 - (a) Create a new CodeWarrior project and replace the contents of main.c with the contents of Lab1Example.c (see tutorial at the end of this handout on how to create a project in CodeWarrior). The main.c file can be found under Sources.
 - (b) Review the code and make sure you understand each of the instructions. Refer to the Motorola Data Sheet document for more detailed information.
 - (c) Mount your CSM12C32 module to the J5 MCU Port on the Project Board, making sure that pin1 on the module matches up with pin1 on J5.
 - (d) Connect your Project Board to your computer using the USB cable provided.
 - (e) Make sure USER jumpers on your module have not been removed.
 - (f) Compile and download your newly compiled program (see tutorial at the end of this handout on how to download over USB).
 - (g) In the debugger, press the green run button, or click Run→Start.
 - (h) Press SW1 and SW2 (on the module, not the dip switches on the Project Board) and note how LED1 and LED2 of the module board turn on and off. Also note how the LEDs (1-4) on the Project Board light up as well.
 - (i) Now press buttons PB1 and PB2 on the Project Board and note how they perform the same action as SW1 and SW2 on the module. The code in Lab1Example.c ties SW1 and PB1, and SW2 and PB2, and electronically enables the four LEDs. Refer to pages 18 and 19 of the “Prototyping Board with Microcontroller Interface” document (mcu_project_board.pdf) for more information.

2. Construct, download, and run a simple four-bit counter program:
 - (a) Create a lab directory on your lab PC. Use your own name for this directory. To minimize the risk of someone stealing your code, be sure to clean this directory of all your personal lab assignments and code at the end of the session. Remember to save your work on your own USB drive or floppy disk.
 - (b) Modify the Lab1Example.c code to create a 4-bit counter that increments when SW1, SW2, PB1 or PB2 is pressed. For this program, the module will be plugged into the Project Board and use the available four LEDs.
 - (c) Remember to review “Prototyping Board with Microcontroller Interface” (pg16-17) and “Application Module Student Learning Kit” documents (pg9-10) for more detailed information about the interconnectivity of the module and Project Board.
3. Download using serial monitor:
 - (a) Download over USB the serial monitor to your module (see the tutorial at the end of this handout).
 - (b) Disconnect the CSM12C32 module from the Project Board.
 - (c) Plug the barrel connector, from the power supply, into the module.
 - (d) Plug the serial cable from the computer into your module.
 - (e) Create a new CodeWarrior project and replace the contents of main.c with the contents of Lab1Example.c.
 - (f) Compile and download your newly compiled program (see tutorial at the end of this handout on how to download a program using the Serial Monitor).
 - (g) If the program is not running, make sure to press the green run button, or click Run→Start.
 - (h) Press SW1 and SW2 and make sure that the LEDs of the module turn on and off.

7 Writeup

1. Include printouts of your (commented!) counter program.
2. Describe any problems you encountered.

8 Tutorials

Interfacing using the PB MCU Student Learning Kit (PBMCUSLK)

- Creating a C-code project in CodeWarrior:
 1. Start up the CodeWarrior IDE on one of the lab machines by clicking the ICON or by finding the shortcut under Start→Program Files→Freescale Codewarrior.
 2. A new window will pop up, choose the HC(S)12 New Project Window option. Give the project a name and click OK. (If this window does not popup automatically, you can open it with File→New...
 3. On page 2, select the model number of your module, MC9S12C32.
 4. On the next page, select C and make sure the other options are deselected.
 5. Click no on page 4 and 5.
 6. Choose ANSI startup code on page 6.
 7. On page 7 and 8, choose none and small, respectively.

8. On page 9, select Full Chip Simulation, P&E Multilink/Cyclone Pro, and HSC12 Serial Monitor. These options allow you to create different builds of your program to be used for different interfacing options.
 9. Finally, click finish and your project will be created.
- Downloading over USB:
 1. In your project window, make sure that “P&E Multilink CyclonePro” is selected. This option tells the compiler to build the program to debug on the Project Board.
 2. To compile, click Project→Make, or press F7. Make sure you have no compiler errors.
 3. To download, make sure the CSM12C32 module is plugged into the Project Board, and is receiving power from the USB port.
 4. Click Project→Debug (F5)
 5. A new program will open called True-Time Simulator & Real-time debugger. It will immediately try to download your compiled program to the board. If it warns you about erasing the flash, click OK.
 6. After downloading, the program will display a number of windows showing the current status of your module. To run your program, simply click the green arrow, or click Run→Start. If you wish to step through the program, click the Step Over button.
 - Downloading the serial monitor to your module:
 1. Visit the class website and download the serial monitor zip file (hcs12serialmon2r1.zip).
 2. Extract the file on the hard drive and open the .mcp CodeWarrior project file.
 3. Make sure the module is connected to the Project Board, and that the Project Board is plugged into the USB port.
 4. Build the project by clicking Project→Make (F7).
 5. Download the project over to your module by clicking Project→Debug (F5).
 6. After it has downloaded over the program, you can disconnect the USB cable and detach the module. It is now ready as a stand-alone module using the serial port.
 - Downloading your program using the Serial Monitor:
 1. Open your CodeWarrior project that you made before.
 2. In the project window, select HCS12 Serial Monitor. This option tells the compiler to build the program to debug using the serial monitor.
 3. To compile, click Project→Make (F7). Make sure you have no compiler errors.
 4. To download, make sure the CSM12C32 module is plugged into the power adapter and that it is connected to the PC using the serial cable.
 5. Click Project→Debug (F5)
 6. A new program will open called True-Time Simulator & Real-time debugger. It will immediately try to download your compiled program to the board. It may come up with a window called Monitor Setup. If it does, select the correct Com port that you wish to communicate over. Also, if it warns you about erasing the flash, click OK.
 7. After downloading, the program will display a number of windows showing the current status of your module. To run your program, simply click the green arrow, or click Run→Start. If you wish to step through the program, click the Step Over button.
 8. Note if you are debugging using the serial monitor, you can step through your code, but once you click Run, you cannot stop the program. You must reset it to regain control.

9. **IMPORTANT:** After you've downloaded your program onto your module, your module will continue to run your program each time it is reset. This will prevent you from downloading a new program onto it. To have your module boot back into the serial monitor, press and hold SW1 while pressing reset. If that fails, try pressing SW2 while pressing reset. Use this method if you ever receive a connection lost error while using CodeWarrior.