

# DEMOQE128 Labs 4

## LAB 4: USING THE LOW POWER MODES

This lab will demonstrate usage of three of the MC9S08QE128's low power modes: LPRun, stop2 and stop3. ***This lab requires that the external crystal circuit is populated and connect through jumper J17.*** The lab uses the Terminal Window application from the DEMOQE Toolkit Utilities to display the elapsed time since the program started in hours:minutes:seconds. The software has four modes of operation:

1. normal run mode
2. low power run mode (LPRun)
3. stop3 with the external oscillator running and
4. stop2 with the external oscillator running

The different modes are selected with the switches on the DEMOQE board. The display will update every 5 seconds with the elapsed time since the last reset. In the LPRun mode, the display is not updated, but the total count is continuously updated. In addition, pressing the RESET button will toggle the clock gating open and shut.

1. Open CodeWarrior for Microcontrollers. From Windows start menu you can locate it using the "Programs>Freescale CodeWarrior>CW for Microcontroller V6.0>CodeWarrior IDE.exe" path.
2. Click on "Load Example Project" from CodeWarrior startup dialog. If the startup dialog is not shown, it may be opened from the CodeWarrior menu by clicking "File" and then "Startup Dialog...".
3. From example projects menu, open tree to select "HCS08>Evaluation Board Examples>DEMOQE128>DEMOQE128\_Low\_Power\_S08."
4. Create a new project name (ex. Lab2), set desired location and click "Create Project". This will open the project for the Low Power application for the DEMOQE128.
5. Launch "Terminal Utility" from the start menu (Programs>P&E DemoQE Toolkit>Utilities>Terminal Utility). \*See DEMOQE128 User Manual for details on the Terminal Utility.
6. Set port to USB COM.
7. Set Baud rate to 9600.
8. Turn board power switch to OFF position.
9. Make sure the green 8-bit S08 daughter card is plugged in to board. Board jumpers should all be set to the default settings shown in Quick Start Guide.
10. Turn board power switch to ON position and close debugger window.

**Run demo on 8-bit S08:**

1. Compile and program the 8-bit QE128 microcontroller with Low Power Application by clicking on “Debug” button. This will launch Debugger.
2. From Connection Manager menu, select “DEMOQE on USB1” port and click on “Connect (Reset).”
3. From Erase and Program Flash menu, click on “Yes” to allow the debugger to mass erase the microcontroller’s on-chip flash memory and program it with the new application.
4. Bring Terminal Utility to front and click the “Open Serial Port” button.
5. For the application to run correctly, the MCU cannot be in debug mode. Therefore, close the Debugger window. Turn the board power switch OFF, then ON to power cycle the MCU. The MCU will now be running the Low Power application.
6. Observe output in Terminal Utility. Time should increase by 5 every 5 seconds.
7. Click button labeled “PTA3” on board to enter LPRun mode. The terminal updates will cease but the PTC0 LDE will continue to blink. Wait 5 or more seconds.
8. Click button labeled “PTA2” on board to enter normal run mode. The terminal updates will resume with accurate total count.
9. Click button labeled “PTD2” on board to enter stop3 mode. The MCU will wake from stop3 mode every 5 seconds and update the total count.
10. Click button labeled “PTD3” on board to enter stop2 mode. The MCU will wake from stop2 mode every 5 seconds and update the total count.
11. To exit from the stop2 mode, hold one of the other buttons down until the terminal window shows a change of mode. This may take up to 5 secs.
12. The MCU current can be measured in the different modes by replacing the shunt on jumper J24 (labeled on the bottom of the DEMOQE board) with a current meter.
13. Click the button labeled “RESET” to toggle the clock gates open and shut. When the gates are shut, the normal run mode current will be noticeably lower. You should not see a significant difference in the other modes. ***The RESET button should not be used when the DEMO is in stop2 mode.***

#### **Change device to 32-bit ColdFire V1:**

1. Click on “Close Port” button in Terminal Utility.
2. Close S08 debugger window.
3. Bring CodeWarrior IDE window to front with Accelerometer Application project for 8-bit microcontroller.
4. Open the MCU Change Wizard to switch project to 32-bit microcontroller by clicking on NAME button in the project panel.
5. From wizard, change microcontroller selection from 8-bit “MC9S08QE128” to 32-bit “MCF51QE128” in Flexis>QE Family tree.
6. Click “Finish.” In the background, CodeWarrior will transform your project to the 32-bit microcontroller with no software changes needed.
7. Turn board power switch to OFF.

8. Switch green 8-bit S08 daughter card with red 32-bit ColdFire V1 daughter card. Make sure to align pin 1 marked by arrows on daughter card and board.
9. Turn board power switch to ON.

#### **Run demo on 32-bit ColdFire V1:**

1. Compile and program the 32-bit QE128 microcontroller with Low Power Application by clicking on “Debug” button. This will launch Debugger.
2. From Connection Manager menu, select “DEMOQE on USB1” port and click on “Connect (Reset).”
3. From Erase and Program Flash menu, click on “Yes” to allow the debugger to mass erase the microcontroller’s on-chip flash memory and program it with the new application.
4. Bring Terminal Utility to front and click the “Open Serial Port” button.
5. For the application to run correctly, the MCU cannot be in debug mode. Therefore, close the Debugger window. Turn the board power switch OFF, then ON to power cycle the MCU. The MCU will now be running the Low Power application.
6. Observe output in Terminal Utility. Time should increase by 5 every 5 seconds.
7. Click button labeled “PTA3” on board to enter LPRun mode. The terminal updates will cease but the PTC0 LDE will continue to blink. Wait 5 or more seconds.
8. Click button labeled “PTA2” on board to enter normal run mode. The terminal updates will resume with accurate total count.
9. Click button labeled “PTD2” on board to enter stop3 mode. The MCU will wake from stop3 mode every 5 seconds and update the total count.
10. Click button labeled “PTD3” on board to enter stop2 mode. The MCU will wake from stop2 mode every 5 seconds and update the total count.
11. To exit from the stop2 mode, hold one of the other buttons down until the terminal window shows a change of mode. This may take up to 5 secs.
12. The MCU current can be measured in the different modes by replacing the shunt on jumper J24 (labeled on the bottom of the DEMOQE board) with a current meter.
13. Click the button labeled “RESET” to toggle the clock gates open and shut. When the gates are shut, the normal run mode current will be noticeably lower. You should not see a significant difference in the other modes. ***The RESET button should not be used when the DEMO is in stop2 mode.***