



Embedded Microcontrollers

Flexis™ AC DEMOACKIT

Lab tutorial

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

1. Compile and program the 8-bit AC128 microcontroller with Accelerometer Application by clicking on "Debug" button, launching Debugger.
2. From Connection Manager menu, select "DEMOAC on USB1 (Name=Penmmmmn)" port and click on "Connect (Reset)."
3. From Loader Warning menu, click on "OK" to allow the debugger to mass erase the microcontroller's on-chip flash memory and program it with the new application.
4. Click on "Start/Continue (F5)" button in debugger to run application.
5. Bring Accelerometer Demo utility to front, click "Open Serial Port and Start Demo" button.
6. Move board around to demonstrate 3-axis accelerometer.
7. Observe output in Accelerometer Demo utility.

8. Click button labeled "SW1" on board to enable data averaging. Move board.
9. Click button labeled "SW2" on board to enable data filtering. Move board.

The accelerometer demo clearly shows the CPU performance gains of the 32-bit ColdFire V1 CPU over the 8-bit S08 CPU. In the data averaging and data filtering modes, a considerable amount of 16-bit and 32-bit math is required. The S08 CPU is capable of performing these tasks, but it requires a substantial portion of its bandwidth. The ColdFire V1 CPU performs the same tasks with only a very small portion of its bandwidth. Overall, the lab shows that with Flexis AC microcontrollers, you can pick and choose the CPU for your performance needs.

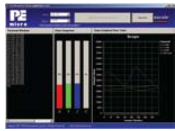
Learn More: For more information about Freescale products, please visit www.freescale.com/flexis

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Agile Number: 926-77696
Doc Number: DEMOACKLAB / REV 0

**Setup demo:**

1. Open CodeWarrior for Microcontrollers. From Windows start menu, you can locate it using the "Programs>Freescale CodeWarrior-CW for Microcontroller V6.1>CodeWarrior IDE.exe" path.
2. Click on "Load Example Project" from CodeWarrior startup dialog.
3. From example projects menu, open tree to select: "ColdFire V1>Evaluation Board Examples>DEMOAC>DEM051AC256_Accelerometer_test."
4. Create a new project name (ex. Lab3), set desired location, and click "Create Project." This will open the project for the Accelerometer Application for the 32-bit AC256 microcontroller.
5. Launch Accelerometer Demo utility from Windows start menu: Programs>P&E Embedded Multilink Toolkit>Utilities>Accelerometer Demo. *See DEMOAC User Manual for details on the Accelerometer Demo utility.
6. Set port to USB COM.
7. Set Baud rate to 115200.
8. Turn board power switch to OFF position.
9. Make sure the red 32-bit ColdFire V1® MCF51AC256 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.



Accelerometer Demo running on 32-bit AC256 in data averaging mode. The orange bar graph labeled "C" highlights the bus cycles required to average the last 16 readings of the 3 axes. The values shown in fourth column of text are the number of bus cycles in hex.

Run demo on the 32-bit ColdFire V1:

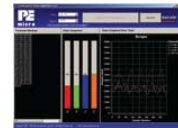
1. Compile and program the 32-bit AC256 microcontroller with Accelerometer Application by clicking on "Debug" button, launching Debugger.
2. From Connection Manager menu, select "USB1-DEMOAC (Penmmmmn)" port and click on "Connect (Reset)."
3. From Erase and Program Flash menu, click on "Yes" to allow the debugger to mass erase the microcontroller's on-chip flash memory and program it with the new application.

4. Click on the "Start/Continue (F5)" button in debugger to run application.
5. Bring Accelerometer Demo utility to front and click the "Open Serial Port and Start Demo" button.
6. Move board around to demonstrate 3-axis accelerometer.
7. Observe output in Accelerometer Demo utility.
8. Click button labeled "SW1" on board to enable data averaging. Move board.
9. Click button labeled "SW2" on board to enable data filtering. Move board.

Change device to 8-bit S08:

1. Click "Close Port" in Accelerometer Demo utility.
2. Close the "True-Time Simulator & Real-Time Debugger" window.
3. Bring CodeWarrior IDE window to front with Accelerometer Application project for 8-bit microcontroller.
4. Click the "MCU Change Wizard" button to switch project to 8-bit microcontroller.
5. From Wizard, change microcontroller selection from 32-bit "MCF51AC256" to 8-bit "MC9S08AC128" in the "Flexis-AC Family" tree. Make sure "P&E Multilink/Cyclone Pro" is selected as the default connection.

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. Replace the 80-Pin LQFP 32-bit ColdFire® V1 AC256 microcontroller with an 80-Pin LQFP 8-bit S08 AC128 microcontroller in the daughter card.
9. Turn board power switch to ON.



Accelerometer Demo running on 8-bit S08 AC128 in data averaging mode. The orange bar graph labeled "C" highlights the bus cycles required to average the last 16 readings of the 3 axes. The values shown in fourth column of text are the number of bus cycles in hex.



DEMOACKIT

LAB 1

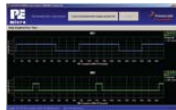
Learn How to Use the DEMOAC Board Toolkit Utilities

This lab will show you how to use one of several graphical utilities in the DEMOAC Board Toolkit included with your board. Instructions to download these utilities to your computer are provided in Step 2 of the Quick Start Guide (DEMOACQSG.pdf).

We will use the CodeWarrior IDE to program a new software example into the AC256 and use the DEMOAC Logic Analyzer utility. This PC-based utility graphs the IN0 and IN1 signals on the board. For convenience, if both DATA1 and DATA2 jumpers are installed, IN0 graphs PTF2 activity and IN1 graphs PTF3 activity. To graph other microcontroller signals, use wire jumpers from the USB side of DATA1 and DATA2 to the respective signals on the board's MCU PORT.

1. Open CodeWarrior for Microcontrollers. From Windows start menu you can locate it using the "Programs>Freescale CodeWarrior-CW for Microcontroller V6.1>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 "ColdFire V1>Evaluation Board Examples->DEMOAC->DEMO51AC256_Logic_Analyzer"
4. Create a new project name (ex. Lab1), set desired location and click "Create Project". This will open the project for the logic analyzer application for the 32-bit microcontroller.
5. Ensure the 80-Pin LQFP 32-bit ColdFire® V1 AC256 microcontroller daughter card is installed on the DEMOAC board.
6. Turn board power switch to ON.
7.  Compile and program the logic analyzer application by clicking on "Debug" button.
8. From Connection Manager menu, select "USB1-DEMOAC(Pennmmnn)" port and click on "Connect (Reset)."
9. From Loader menu, click on "OK" to allow the debugger to mass erase the microcontroller's on-chip flash memory and program it with the new application.
10.  Click on "Start/Continue (F5)" button in debugger to run application.

11. Open the DEMOAC Board Logic Analyzer utility from Windows start menu: Programs>P&E Embedded Multilink Toolkit>Utilities>Logic Analyzer Utility.
12. In the utility, click on the "Connect to Embedded Multilink Analyzer and Graph Pins" button to begin graphing IN0 and IN1. These signals will be continually graphed at a sampling rate of 10Khz.
13. Rotate the potentiometer RV1 clockwise and counter-clockwise. This will change the duty cycle of the variable pulse-width modulation signals output on the PTF2 and PTF3 pins. The PTF2 waveform is shown on analyzer channel IN0.



14. Click on "Close Port" button when finished.

For more information on the DEMOAC Board Toolkit read the board user manual (DEMOAC_UM.pdf) on www.freescale.com/flexis or on the DVD under Documentation > Development System Documentation > DEMOAC User Manual of the DVD menu. For new and upgraded utilities to the DEMOAC Board Toolkit, visit <http://www.pemicro.com/>


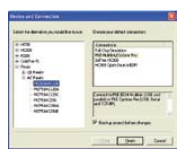
LAB 2



Migrate Quickly from 32-bit to 8-bit Using the Quick Start Application

This lab will show you how to quickly migrate any application using the Flexis™ AC microcontrollers. The Flexis brand delivers pin to pin compatibility, one development tool, and the same peripherals between 8-bit and 32-bit devices. It demonstrates an downward migration from 32-bit to 8-bit, although upward migration is just as simple. Continuing with the Quick Start Application that is pre-loaded in the microcontroller's on-chip flash memory you will now use the CodeWarrior® MCU Change Wizard to

retarget and rebuild your project from the 32-bit AC256 microcontroller to the 8-bit AC128 microcontroller.

Setup demo:

1. Open CodeWarrior for Microcontrollers. From Windows start menu you can locate it using the "Programs>Freescale CodeWarrior-CW for Microcontroller V6.1>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 "ColdFire V1>Evaluation Board Examples->DEMOAC->DEMO51AC256_Logic_Analyzer"
 4. Create a new project name (ex. Lab2), set desired location and click "Create Project". This will open the project for the logic analyzer application for the 32-bit microcontroller.
 5.  Click on the "MCU Change Wizard" button to switch project to 8-bit microcontroller.
 6. From Wizard, change microcontroller selection from 32-bit "MCF51AC256" to 8-bit "MC9S08AC128" in the "Flexis-AC Family" tree as show in image below. Make sure "P&E Multilink/Cyclone Pro" is selected as the default connection.
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7. Click "Finish." In the background, CodeWarrior will transform your project to the 8-bit microcontroller with no software changes needed. A "Project Messages" window may appear letting you know that changes have been made to the project.
 8. Click on "Close Port" on Logic Analyzer utility if open.
 9. Turn board power switch to OFF.
 10. Replace the 80-Pin LQFP 32-bit ColdFire® V1 AC256 microcontroller with an 80-Pin LQFP 8-bit S08 AC128 microcontroller in the daughter card.
 11. Turn board power switch to ON.

12.  Compile and program the 8-bit AC128 microcontroller with transformed logic analyzer application by clicking on "Debug" button.
13. From Connection Manager menu, select "DEMOAC on USB1 (Name=Penmmnnn)" port and click on "Connect (Reset)."
14. From Loader Warning menu, click on "OK" to allow the debugger to mass erase the microcontroller's on-chip flash memory and program it with the new application.
15.  Click on "Start/Continue (F5)" button in debugger to run application.
16. Repeat Quick Start Guide Step 4 instructions to observe the 8-bit AC128 device run the same application as the 32-bit AC256 device.

LAB 3

Measure Performance Improvement Between 8-bit and 32-bit with the Accelerometer Application

This lab will highlight the performance differences between the 8-bit and 32-bit AC microcontrollers and show how these microcontrollers can easily interface with a sensor. This lab will also detail how to use another one of several software utilities included with your board to help you in your development. Instructions to download these utilities to your computer were provided in Step 2 of the Quick Start Guide.

The Accelerometer Application reads the X, Y, and Z axes of the 3-axis accelerometer on the DEMOAC board using the microcontroller's A/D converter. It outputs a processed version of the accelerometer data on the microcontroller's serial communication interface. This processed data is a rolling average of the raw accelerometer data, or a filtered version of the raw accelerometer data, depending on the selected mode.



DEMOAC Labs

These labs will show you how to get the most out of your DEMOAC board toolkit. The DEMOAC board comes in several versions depending on the target AC family MCU:

- DEMOS08AC16KIT
- DEMOS08AC60KIT
- DEMOS08AC128KIT
- DEMO51AC256KIT
- DEMOACKIT which includes both the MC9S08AC128 and MCF51AC256

This lab document applies to DEMOACKIT.

Start each lab with the board powered ON. Make sure to use only one utility at a time, as they share the same USB source. Familiarize yourself with these buttons:

-  Start/Continue (F5) button
-  MCU Change Wizard button
-  Debug button