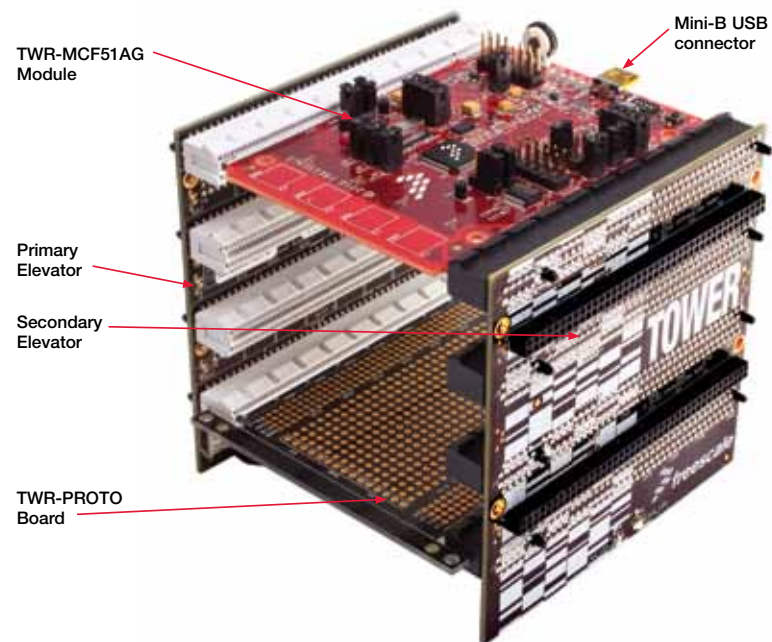




## About the Tower System



## Get to Know the TWR-MCF51AG



### TWR-MCF51AG-KIT Freescale Tower System

The TWR-MCF51AG module is part of the Freescale Tower System, a modular development platform that enables rapid prototyping and tool re-use through reconfigurable hardware. Take your design to the next level and begin constructing your Tower System today.

10. Input the "pot" command and the potentiometer demo in lab 4 will be demonstrated. The following message will appear in the HyperTerminal window. (Figure 14)

```
Type help for help messages
dBUG>pot

Potentiometer test mode

Press any key to exit test.
ADC result: 0x60
```

Figure 14 Potentiometer Demo Message

The ADC conversion result will appear in the window.

Press any key to exit the demo mode.

## About TWR-MCF51AG-KIT Labs

The following labs assume you have followed the instructions in the quick start guide, constructed the Tower system, installed CodeWarrior, the service pack for MCF51AG128 and the USB driver for OSBDM.

This lab includes information on the following:

- How to build the CodeWarrior project, download and run the code
- Touch sensor demo
- Accelerometer demo
- Potentiometer demo
- Start a different demo by the RS232 port

### Learn More:

For more information about the TWR-MCF51AG128-KIT and other Freescale appliance products, please visit [freescale.com/MCF51AG](http://freescale.com/MCF51AG), [freescale.com/appliance](http://freescale.com/appliance) or [freescale.com/Tower](http://freescale.com/Tower).

# MCF51AG—Lab Tutorials 1–5 (sheet 1 of 2)

**LAB 1**

## Build the CodeWarrior Project and Run the Code

**Introduction**  
This lab will guide you through the general use of the CodeWarrior integrated development environment and will familiarize you with the general compiler and download process.

1. Launch the CodeWarrior for Microcontroller V6.3 IDE environment. Open the "MCF51AG128\_DEMO.mcp" by using menu "File > Open".
2. Use the USB cable to connect the PC and TWR-MCF51AG. Make sure the DIP-SW is in default configuration (Figure 1).



Figure 1 Default configuration of DIP-SW

3. Click the make button in project pane (or in tool bar) to build the project.
4. In the project pane, select the "CFV1 FSL Open Source BDM" debugger. See Figure 2.

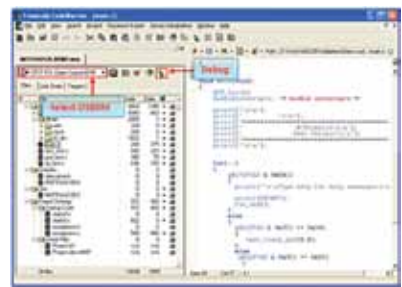


Figure 2 CodeWarrior IDE

5. Click the debug button in the project pane (or the icon in the tool bar) to download the code to flash.
6. If the following popup window appears, click "OK."

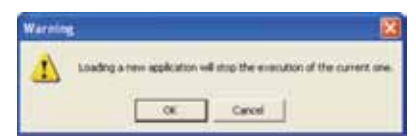


Figure 3 Warning window before download

7. In the True-Time Simulator & Real-Time Debugger window, click (start and continue) to run the application. LEDs 1 to 4 will be illuminated one by one.
8. In the same debugger window, you can click on to halt the application. The source window will stop at the line of code where you halt the application.
9. left align buttons: allow you to do Single Step, Step Over, Step Out, and Assembly Step in your project.

**LAB 2**

## Touch Sensor

**Introduction**  
The touch sensor silicon MPR121 is integrated on the TWR-MCF51AG board for demonstration. Four touch pads (E1–E4) are distributed on the top side of the board, and four LEDs (D11, D12, D13, D14) are assembled on the bottom side. The LED status can be observed via the holes from the top of the board.

In this lab, the AG128 CPU configures the MPR121 via I<sup>2</sup>C bus. After the MPR121 is started, AG128 checks the status of the touch pad and controls LEDs D11 to 14. LEDs 1 to 4 are also used to reflect the touch status.

1. Download the demo code to the AG128 as described in Lab1. If you start from this lab, please follow Lab 1 to open the demo project (MCF51AG128\_DEMO.mcp) and download the code to the CPU.
2. Change the configuration of DIP\_SW (figure 4) switch the S2 to ON position



Figure 4 DIP SW configuration for touch sensor demo

3. Once the S2 is switched to ON position, the AG128 will stop to light the LEDs 1 to 4 in turn, and then begin to initialize the MPR121.
4. After a short while, you can touch the PAD E1 to E4. The LEDs next to each PAD will illuminate when the pads are touched.

PAD	LED (driven by MPR121)	LED
E1	D14	LED1(D5)
E2	D13	LED2(D6)
E3	D12	LED3(D9)
E4	D11	LED4(D10)

Table 1 The LEDs controlled by touch pads

**LAB 3**

## Accelerometer

**Introduction**  
The TWR-MCG51AG board includes one 3-axis accelerometer sensor. The analog output of accelerometer is connected to the ADC input of AG128. In this lab, the AG128 sampled the output of the accelerometer, and illuminated LEDs 1 to 4 to reflect the position of TWR-MCF51AG board.

1. Ensure the demo code has been downloaded. (If not, follow the instructions in Lab1 to download the code. The code for all labs is integrated in one CodeWarrior project.)
2. Change the configuration of DIP SW. Switch the S3 to the ON position (figure 5).



Figure 5 DIP SW configuration for accelerometer demo

3. You may change the position of the TWR-MCF51AG vertically or horizontally. LEDs 1 to 4 will be illuminated according to different position.
  - No LED will be illuminated when the board is held flat
  - LED2, LED3 and LED4 represent how far the board is tilted in direction of the Y-axis or X-axis

**LAB 4**

## Potentiometer

**Introduction**  
One potentiometer is connected to the ADC channel of AG128. LEDs 1 to 4 will be switched ON or OFF according to the ADC conversion result in this lab.

1. If the demo code has not been downloaded, please return to Lab 1. Otherwise, please continue.
2. Change the configuration of DIP\_SW. Switch the S4 to the ON position (figure 6).



Figure 6 DIP SW configuration for potentiometer demo

3. Adjust the potentiometer so that LEDs 1 to 4 will be switched ON or OFF according to the ADC conversion result.

**LAB 5**

## Start the Demo Via the RS232

**Introduction**  
The different demo examples in Labs 2 to 4 can be launched by the command line via a serial communication port. In this lab, you will experience how to send the command to AG128 from the HyperTerminal window and start the demo in Labs 2 to 4.

To run this lab, the serial port must be connected to the Tower System or the J15 (RS232 port) on TWR-MCF51AG board.

1. Power off the TWR-MCF51AG-KIT. Build the Tower System if you have the TWR-SER board as shown in Figure 7. Please jump to step 3 if you have no TWR\_SER board.
2. Connect the serial port from PC to the DB9 serial port on the TWR-SER board. Jump to step 4.



Figure 7 Connecting the serial port to TWR\_SER

3. Use the cable in Figure 7 to connect the serial port between the PC and TWR-MCF51AG.



Figure 8 DB9-DB10 converter

Plug the DB10 to the J15 on TWR-MCF51AG board (the red side of the cable should match pin 1 of the J15 connector). Change the jumper J12 and J13 to position 1 and 2.

4. Change the configuration of DIP\_SW. Switch the S1 to the ON position (Figure 9).



Figure 9 DIP SW configuration for Lab 5

5. Open a command prompt on the PC (Start > Programs > Accessories > Communications > HyperTerminal)

Set the serial port with the following parameters:

- Baud rate: 115200 bps
- Parity: No
- Data bits: 8
- Stop bit: 1

6. Power on the TWR-MCF51AG-KIT. The following will appear in the HyperTerminal window (Figure 10).

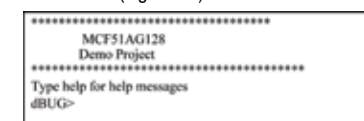


Figure 10 Start Message

7. Type "Help" in the HyperTerminal window. The following command will appear:

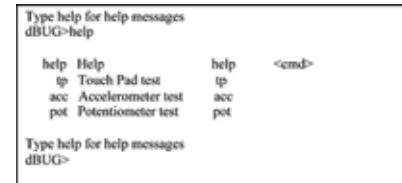


Figure 11 Help message

8. Input the "tp" command and the touch sensor demo in lab 2 will be demonstrated. The following message will appear in the HyperTerminal. An X will appear below E1 to E4 when each related pad is touched (Figure 12).

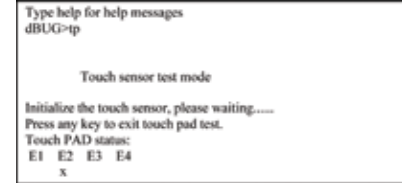


Figure 12 Touch sensor demo message

In this mode, press any key to exit the AG128 demo mode.

9. Input the "acc" command to start the accelerometer demo in Lab 3. The following message will appear in the HyperTerminal window (Figure 13).

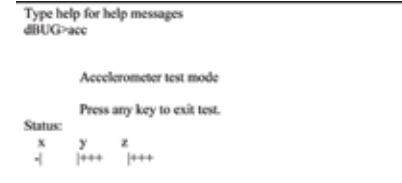


Figure 13 Accelerometer demo message

The characters "+" and "-" below the X, Y, Z reflect the signal on the three accelerometer outputs.

In this mode, press any key to return to the AG128 command input status.