MCF51CN128—Lab Tutorials 1 & 2 (sheet 1 of 2)

Security System, Freescale MQX™ RTOS for MCF51CN128

Introduction
This lab will guide you through the general use of the Freescale MQX™ operating system under the CodeWarrior™ integrated development environment and will familiarize you with the general compile and download process. This lab will simulate an Ethernet-enabled home security system that is accessed over telnet.

Step by Step Instructions
1. Install CodeWarrior for Microcontrollers 6.2 Professional (30 day evaluation version available. Basic version or higher is required for MCB Lab Tutorials). Then load the latest Processor Expert Update. After that, install the CodeWarrior 6.2.2 patch and then install MQX 3.2 or later. Then open CodeWarrior.
2. Press the card edge connector of the MCU module into a slot on the Elevator—take care to match the primary connector card edges and plug them into a functional Elevator. Do the same for the serial module. A module may be placed into any slot on the Elevator, but it is recommended to put the MCU module on the top for easier access to the switches and LEDs.
3. Then press the Dummy Elevator onto the switch edges labeled secondary.
4. Make the following connections from the MCF51CN128 Tower System to the computer.
   a. USB cable between the OSBDM debugger (J14 on the TWR-MCF51CN128 module) and a USB port on PC
   b. Ethernet cable between the Ethernet port on the TWR-SER module and an Ethernet port on PC
5. The first time you connect the USB debugger cable to your PC, Windows will install a driver for the debugger. Follow the prompts to automatically detect and install the driver.
6. If you are running the board for the very first time, the telnet demo has already been loaded on the board. Skip to Step 8 to setup the telnet network, and then skip to Step 16 to run the demo. If you would like to re-flash the board with the original demo code, then continue onto the next step.
7. If you did not install the MQX project in the default C:\Program Files\Freescale\Freescale MQX 3.2\demo\security_webserver\twrmcf51cn.mcp directory during installation, you must first recompile the MQX libraries. See the release notes for more information.
8. Open the lab project by selecting the File > Open menu, and opening: C:\Program Files\Freescale\Freescale MQX 3.2\demo\security_webserver\twrmcf51cn.mcp
9. In the project pane, select the “SecTelnet - OSBDM Debug Int Flash” build target. See Figure 2.
10. Open the Security.h file in the CodeWarrior window. Double-click the file item located in the “Source” group in the CodeWarrior project tree. See Figure 2.
11. If you would like to change the default IP address of the board, locate the line of code starting with define ENET_IPADDR and specify your target IP address and IP mask address by using the PDAR3 macro. The default IP address is 169.254.3.3 and subnet mask is 255.255.0.0
12. Compile the project by pressing the F7 key or by clicking the Make icon on the project pane toolbar. This icon is identified in Figure 2.
13. Now start debugger by clicking the Debug icon. This icon is identified in Figure 2.
14. The V1 ColdFire debugger will appear with a dialog box asking if you would like to erase the flash and load it with the new software. Select OK.
15. After the code has been flashed to the board, you will see the MQX entry-point function in the code window. Hit the “Start” button as seen in Figure 5. Pressing the “Start” button twice may be required in some cases.
16. A simple Security system has been implemented as the example application to demonstrate the features of the MQX RTOS. It detects button presses and movement of the tower system, keeps a log of the events and provides a user interface over telnet.
17. The LEDs on the MCU board represent the current state of the system.
18. The LEDs on the MCU board represent the current state of the system.
19. When the tower system is tilted, LED1, LED2, and LED3 represent how far the board is tilted in the Y-axis direction.
20. LED3 represents the Door (SW2) or Window (SW3) status as OPEN or CLOSED.

Demonstrates
• MQX project in CodeWarrior IDE
• Project build, download and run in CodeWarrior IDE
• Accelerometer
• I/O Task
• MQX shell
• MQX GPIO driver (push button and LEDs)
• MQX RTCS TCP/IP network stack
• Telnet server functionality

Step by Step Instructions
1. Follow steps 1 through 4 in Lab 1 to setup the tower system.
2. Open the Web Server Lab Project by selecting the File > Open menu, and opening: C:\Program Files\Freescale\Freescale MQX 3.2\demo\security_webserver\twr-amc51cn.mcp
3. In the project pane, select “SecWebserver - OSBDM Debug Int Flash” build target. See Figure 1.
4. Shake the Tower vigorously for a few seconds. Now type displaylog again.
5. Continue on reverse side...
4. The default IP address will be 169.254.3.3. If you would like to change the IP address, open the file security.h, and follow the directions in Steps 9 to 11 of Lab 1.

5. Compile and load project on the Tower board by following steps 12 through 15 in Lab 1.

6. Open up an Internet browser and navigate to the target device address. In this case, 169.254.3.3. Turn off any proxy settings that may be enabled for your browser.

7. You should see the Web server welcome page in the browser window, as seen in Figure 2.

8. Try pressing buttons and tilting the board. You will see the state of the inputs change on the Web page, as well as a running log of the actions performed.

9. Click on the links to the left to get more information on the MCF51CN128 microprocessor and the Tower System.

10. The Web pages are stored in the /demo/security_webserver/web_pages directory. You can edit them with any text editor. Then double click on Build_Webpages.bat which calls mktfs.exe, and that script will convert the Web pages into a C array that is stored in the tfsdata.c file.

11. Then recompile the project, and the new Web pages will appear when you re-run the code. The Web server's default page is mqx.html.

See more Lab Tutorials (3 & 4) on sheet 2, and at www.freescale.com/tower.
MCF51CN128 - Lab Tutorials 3 & 4 (sheet 2 of 2)

**Low-Power e-mail-Enabled Security, Freescale MQX RTOS for MCF51CN128**

**Introduction**

This lab demonstrates the MCF51CN128 Tower System by sending out an e-mail when one of the push buttons are pressed. It also updates itself to the current time using the SNTP protocol, and acquires an IP address off a network via DHCP. It will conserve power in Stop2 sleep mode and wake at the press of a button.

Please note that this lab requires basic knowledge about your network setup and e-mail configuration. These values will vary from network to network, and not all networks will have an e-mail server or SMTP server. Also some corporate networks are located behind a firewall or proxy, which may inhibit the functionality of this lab. Please contact your system administrator for more information on your network configuration.

**Step by Step Instructions**

1. If you haven’t done so already, install the software as described in Step 1 of Lab 1.
2. Construct the TWR-MCF51CN-KIT as instructed in Step 2 of Lab 1. Then make the following connections from the TWR-MCF51CN-KIT to the computer. See Figure 1 on reverse side.
   - a. USB cable between the OSBDM debugger U14 on the TWR-MCF51CN module and a USB port on PC
   - b. Ethernet cable between the TWR-SER module and an Ethernet port on an external network
   - c. Serial Port on the TWR-SER module to a Serial Port on PC (optional, cable not included)
3. The first time you connect the USB debugger cable to your PC, Windows will install a driver for the debugger. Follow the prompts to automatically detect and install the driver.
4. If you did not install the MQX project in the default C:\Program Files\Freescale\Freescale MQX 3.2\directory during installation, you must first recompile the MQX libraries to reflect the new path name. See the release notes for more information before continuing on with the lab.
5. Open the Lab Project by selecting the File > Open menu, and opening C:\Program Files\Freescale\Freescale MQX 3.2\demo\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_email\security_em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2. Construct the TWR-MCF51CN-KIT as instructed in Step 2 of Lab 1. Then make the following connections from the TWR-MCF51CN-KIT to the computer. See Figure 1 at the bottom of this page.
   a. USB cable between the OSBDM debugger (J14 on the TWR-MCF51CN module) and an USB port on PC
   b. Ethernet cable between the TWR-SER module and an Ethernet port on an external network
   c. Serial Port on the TWR-SER module to a Serial Port on PC (cable not included)

3. The first time you connect the USB debugger cable to your PC, Windows will install a driver for the debugger. Follow the prompts to automatically detect and install the driver.

4. If you did not install the MQX project in the default directory, you must first recompile the MQX libraries to reflect the new path name. See the release notes for more information before continuing the lab.

5. Open the Lab Project by selecting the File > Open menu, and opening:
   C:\Program Files\Freescale\Freescale MQX 3.2\demo\telnet_to_serial\codewarrior\telnet2ser_twrmc51cn.mcp

6. In the project pane, select "Telnet2Ser - OSBDM Debug Int. Flash" build target.

7. The default IP address of the board is 169.254.3.3. Typically, when you connect your computer directly to the board, the computer will default to an auto IP address on the same subnet as the board (169.254.x.x), therefore requiring no setup. Note: The PC may take a few minutes to default to the auto IP address and make the connection. However, if you have trouble connecting, you may configure the IP address of the computer manually. Select Start > Control Panel > Network Connections > Local Area Connection. Open up the TCP/IP properties, note your original TCP/IP settings, and then set your IP address to 169.254.3.4 and your subnet mask to 255.255.0.0.

8. Open the config.h file in the CodeWarrior window. Double-click the file item located in the "Source" group in the CodeWarrior project tree. See Figure 2.

9. If you would like to change the default IP address of the board, locate the line of code starting with #define ENET_IPADDR and specify your target IP address and IP mask address by using the IPADDR macro. The default IP address is 169.254.3.3 and subnet mask is 255.255.0.0.

10. Compile and load the project on the tower board by following steps 12 through 15 in Lab 1.

11. Open a Command Prompt on the PC (Start > All Programs > Accessories > Command Prompt). At the prompt invoke a telnet session to the board by typing telnet 169.254.3.3. You are now connected to the MQX shell via telnet.

12. Now open up a serial console by following steps 15 and 16 from Lab 3.

13. The serial console and the telnet sessions should be "bridged." Type some characters into the telnet session, and you should see the characters appearing on the console terminal window. See Figure 4 for how it would appear.

14. Then try typing into the console terminal window, and you will see the characters appearing in the telnet session.

The TWR-MCF51CN 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.

About the Tower System

Get to know the TWR-MCF51CN