Overview

The Spartan-3 MB Revision 2 functional test consists of three different bitstreams that collectively test all of the following: User I/O, RS232, USB, surface-mount oscillator, clock oscillator socket, eight DIP switches, three push buttons, four user LEDs, 2x7-segment display, PROM, DDR, Flash, Ethernet, two P160 slots, LCD, Piezo, and SystemACE programming port.

Additional Equipment Needed

- 5V Power Supply
- Parallel JTAG Programming Cable IV
- Serial Cable
- USB Cable
- Ethernet Cable (either standard or cross-over will work)
- Two P160 Prototyping Modules
- Four 2x20 ribbon cables
- 2x15 ribbon cable
- System ACE Kit
- P160 Communications Module 2 (pre-programmed with WebServer executable in flash)

Initial Experiment Setup

The following setup procedures are required to prepare the PC and accessory boards for the initial board test. These steps only have to be completed once.

Test File Setup

1. Unzip Memec_3S1500MB_Functional_Test_2_0.zip into any directory, referred to throughout this document as *<unzip_directory>*. In WinZip, be sure to check the box to "**Use folder names**." The *<unzip_directory>* contains eight items:

Filename	Description
3s1500mb_files	Test file subdirectory
com1_19200_8n1n.ht	HyperTerminal settings file
com10_115200_8n1n.ht	HyperTerminal settings file
CP2101_Drivers.exe	CP2101 USB chip driver installation
Memec_3S1500MB_erase.bat	DOS batch file for erasing PROMs
Memec_3S1500MB_Functional_Test_2_0.pdf	This test procedure document
Memec_3S1500MB_Rev2_sysace_test.ace	DOS batch file for automated testing
Memec_3S1500MB_Rev2_sysace_test.ace	SystemACE Programming file

The files in the **3s1500mb_files** subdirectory will not be manipulated directly by the user. This subdirectory contains nine files:

3s1500mb_files	
Filename	**Description**
3s1500mb_erase.cmd	iMPACT script for erasing PROMs
3s1500mb_mem_test.bit	FPGA bitstream for memory/ethernet test
3s1500mb_mem_test.cmd	iMPACT script for memory/ethernet test
3s1500mb_P160loopback.cmd	iMPACT script for P160 Loopback test
3SMB_P160_Loopback_0.mcs	XCF04S PROM image for P160 Loopback Test
3SMB_P160_Loopback_1.mcs	XCF01S PROM image for P160 Loopback Test
xc3s1500_fg676.bsd	BSDL for XC3S1500 FPGA
xcf01s_vo20.bsd	BSDL for XCF01S PROM
xcf04s_vo20.bsd	BSDL for XCF04S PROM

Initial Software Setup

The required software setup for this functional test is:
- Windows 2000 or Windows XP
- Xilinx iMPACT software, version 6.1i or later (included in ISE Foundation, ISE Alliance, ISE BaseX, or ISE WebPack)
- Silicon Labs / Cygnal CP2101 USB device driver (CP2101_Drivers.exe)

Xilinx iMPACT Software

The Xilinx 6.1i or later iMPACT software **MUST** be installed on the host PC. Earlier versions will not work. ISE WebPack is free and can be downloaded from www.xilinx.com. Follow the instructions from Xilinx to install this software.

CP2101 Device Driver

The CP2101 device driver is installed as follows:

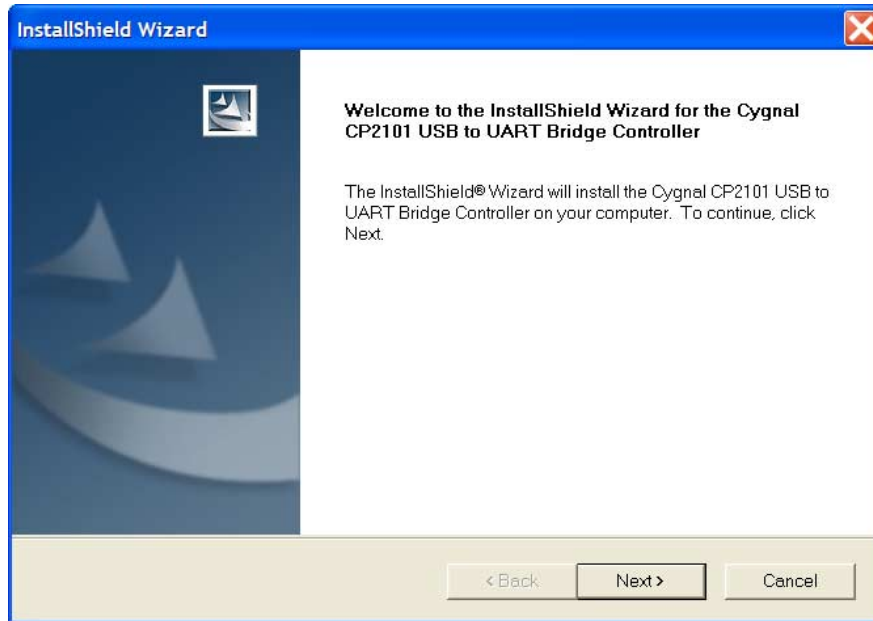1. Double-click CP2101_Drivers.exe.

Figure 1 – Launching CP2101 Driver Installation

2. Click Next.
3. Read the license agreement and then click Yes.

Figure 2 – Cygnal License Agreement

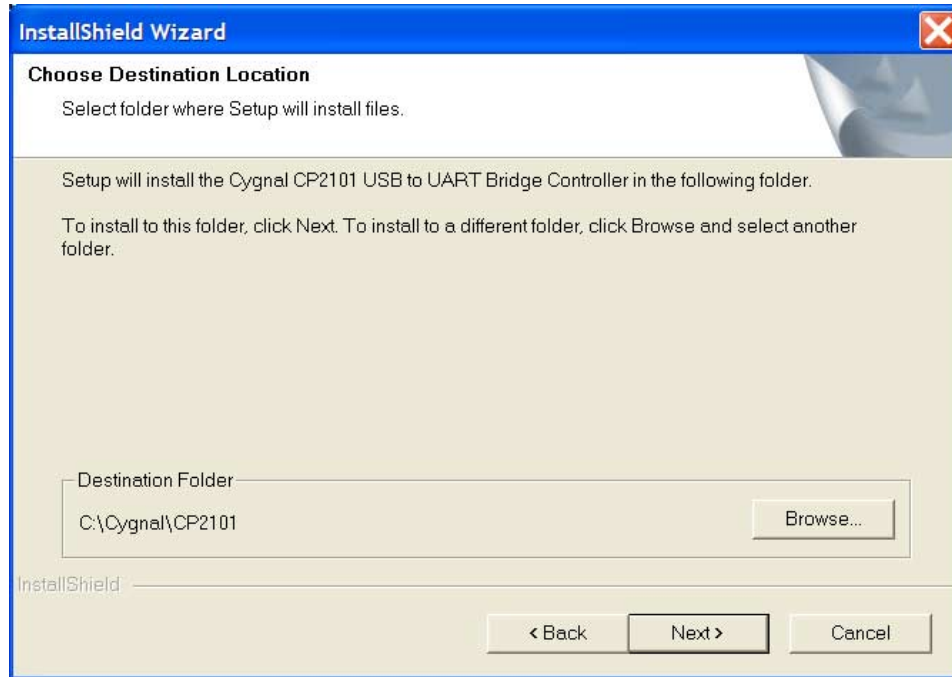4. Browse to an acceptable installation directory, then click Next.

Figure 3 – CP2101 Destination Location

5. The drivers are extracted to the selected directory. Click Finish once the extraction completes.
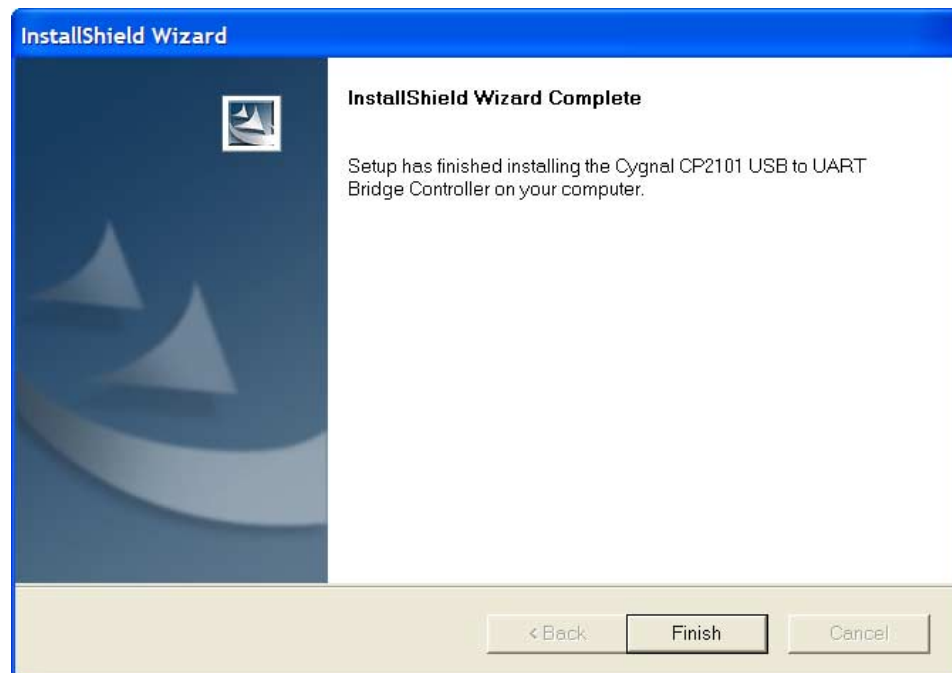

Figure 4 – CP2101 Installation Successful

6. To finish the installation, remove all J1 jumpers and plug-in power on a Spartan-3 MB board. Next, plug-in the USB cable. Slide the power switch SW1 to the ON position. Once plugged in, LED DS12 (USB POWER) lights.

7. The **Found New Hardware Wizard** launches. Click the radio button to **Install the software automatically (Recommended)** (see Figure 5) and then click Next.
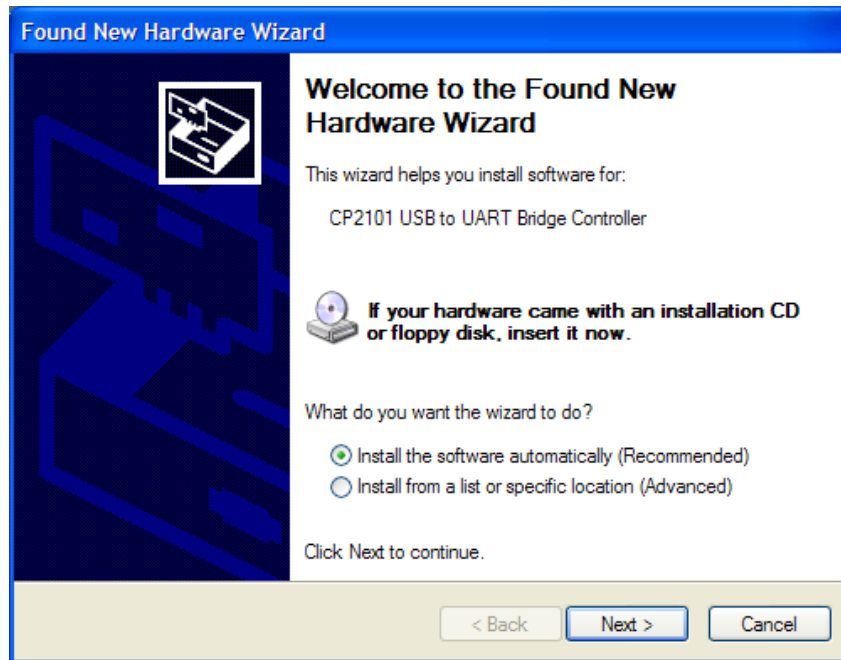
Figure 5 – Found New Hardware Wizard

8. The driver installation begins. If installing on WindowsXP, a warning is received stating that Windows Logo testing has not passed, as shown in Figure 6. Click **Continue Anyway**.

Figure 6 – Windows Logo Testing Not Passed

9. The driver installation completes at this point. Click Finish in the **Found New Hardware Wizard**.
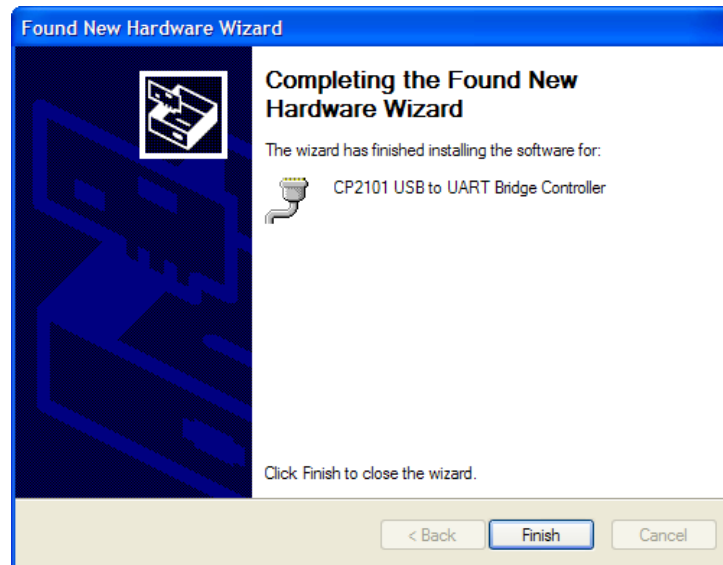
Figure 7 – CP2101 Driver Installation Complete

10. Open the Device Manager (Control Panel → System → Hardware tab → Device Manager).
11. Under the **Ports** heading, a new device shows up, called **CP2101 USB to UART Bridge Controller**.
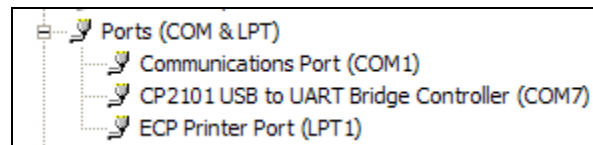
Figure 8 – CP2101 Recognized as COM Port

12. If the CP2101 does not show up under ports, it may show up under "Other Devices" with a yellow exclamation mark. In this case, unplug the USB cable, run the setup manually (C:\Cygnal\CP2101\WIN\Setup.exe), and then plug the USB cable back in.
13. The O/S automatically assigns a COM Port number, typically between COM3 and COM7. For consistency, the COM number will be manually changed. Right click on **CP2101 USB to UART Bridge Controller** and select **Properties**.
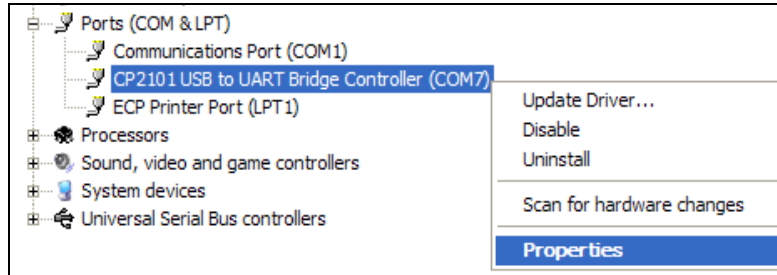
Figure 9 – COM Port Properties

14. Change to the **Port Settings** tab and select **Advanced**.
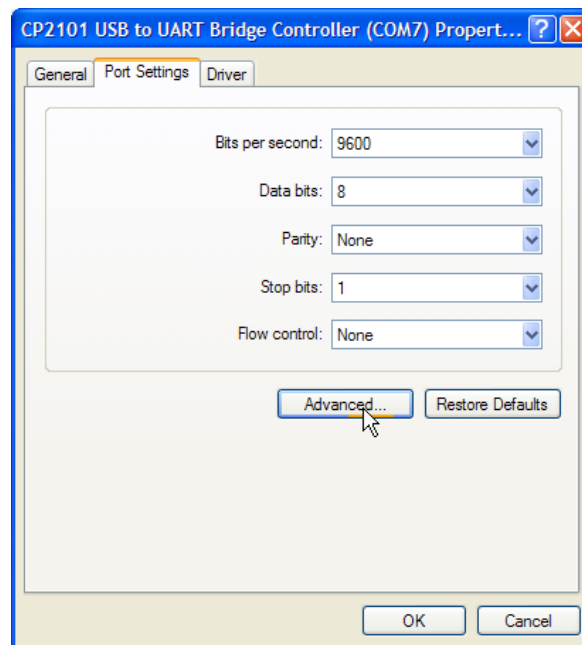
Figure 10 – Port Settings - Advanced

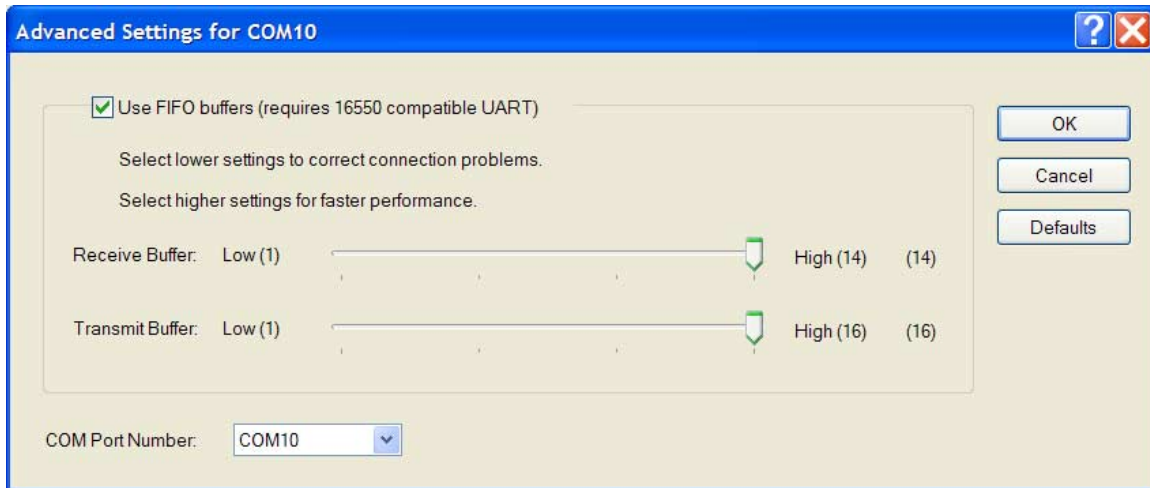15. Select COM10 in the **COM Port Number** field, then click OK twice.

Figure 11 – Changing the COM Port Number

16. Close the Device Manager, and then re-open it. Under **Ports**, the CP2101 USB to UART Bridge Controller is now assigned to COM10, as shown in Figure 12.
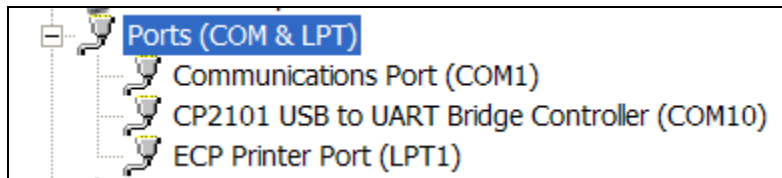

Figure 12 – CP2101 Assigned to COM10

17. Unplug the USB cable, replace the J1 jumpers, and close the Device Manager.

Test Station IP Address

The Test Station PC's IP Address must be set to 1.2.3.9, and the Subnet Mask must be set to 255.255.255.0 for the Ethernet Test to function properly. To accomplish, do the following steps on the PC that will be used during the testing:

1. Open the Control Panel.
2. Double-click on "Network Connections" item.
3. Right-click on "Local Area Connection" and select "Properties" as shown in Figure 13.
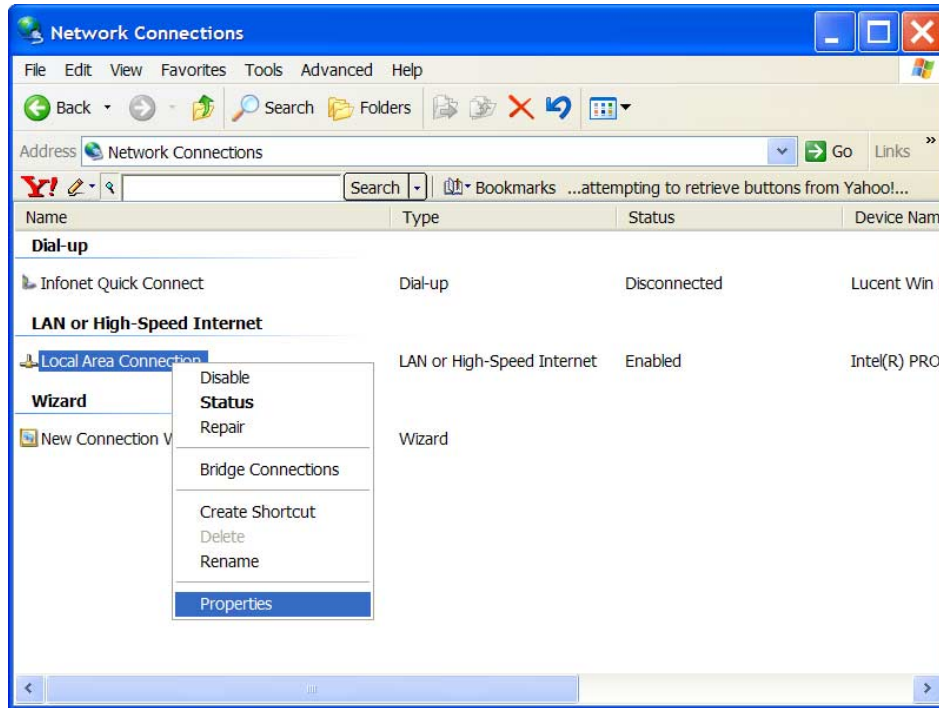
Figure 13 – Network Connections Window

4. Select the "Internet Protocol (TCP/IP)" connection item and then select properties.
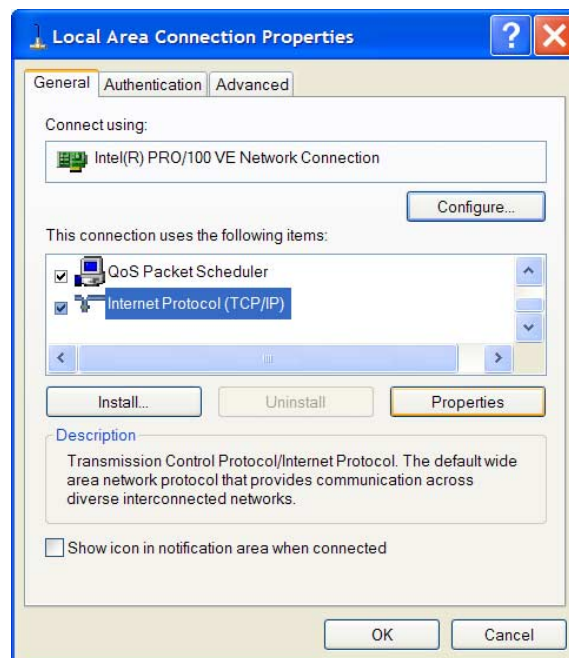
Figure 14 – TCP/IP Properties

5. Select the button for "Use the following IP address:" and set the IP address and Subnet mask as shown in Figure 15. Click **OK** and then **Close**.
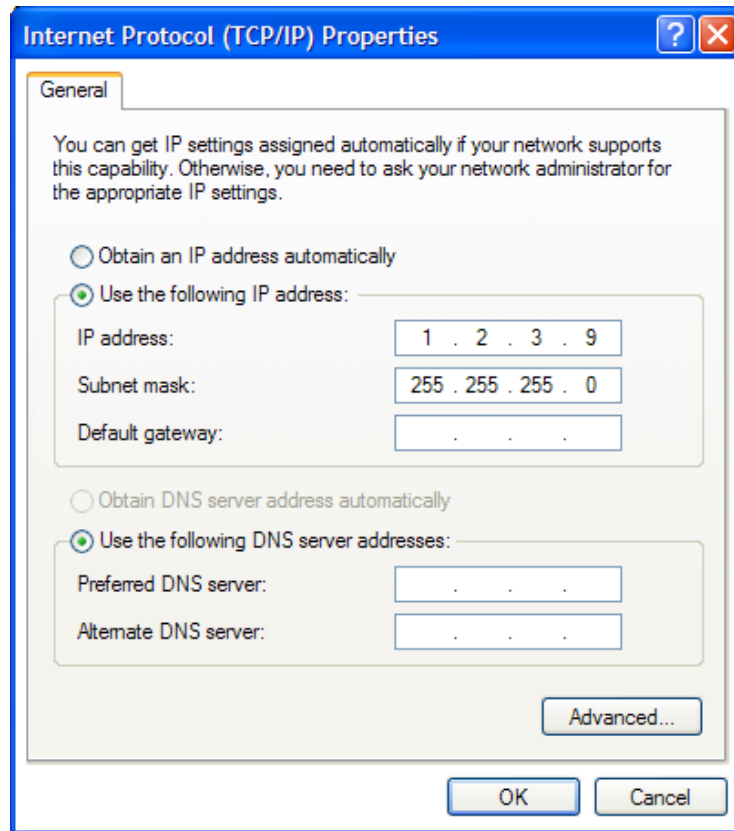

Figure 15 – Setting the IP Address and Subnet Mask

Initial Hardware Setup

SystemACE Module Setup

1. Connect the USB CompactFlash Adapter to the USB port of the PC and insert the 128MB CompactFlash card into the CompactFlash Adapter.
2. Open a "Windows Explorer" window and double click on "My Computer." The CompactFlash should show up as a "removable drive" under My Computer.
3. Delete all ***.ace** files on the CompactFlash card.
4. Copy the **<unzip_directory>\Memec_3S1500MB_Rev2_sysace_test.ace** file onto the CompactFlash drive. When copying is completed, disconnect the drive in Windows and then remove the CompactFlash from the CompactFlash Adapter.
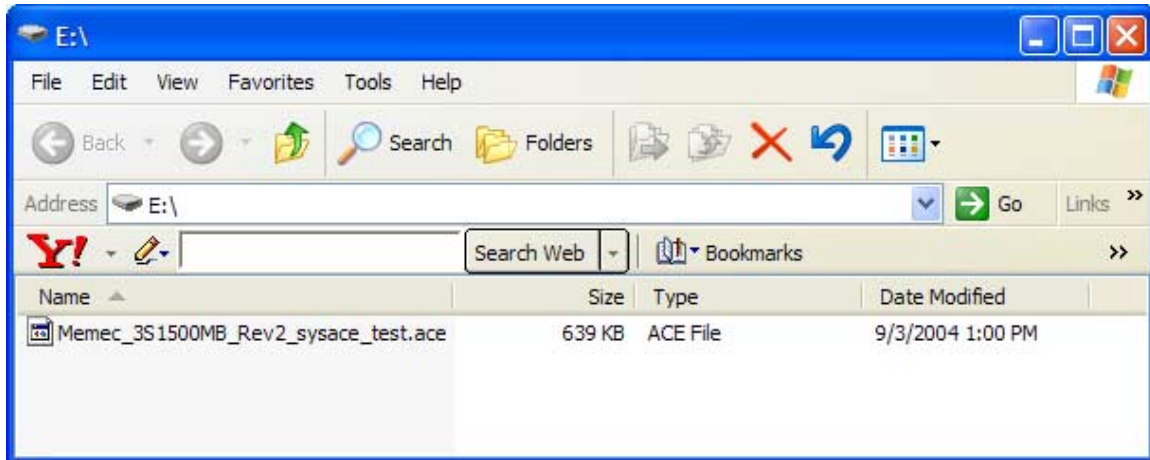
Figure 16 – File System on CF Card

5. Insert the CompactFlash card into the SystemACE Module (SAM)
6. Install a jumper on SystemACE Module header JP1 for 3.3V operation (pins 2-3).
7. Set the SystemACE Module rotary switch SW1 to position 0.
8. No other SystemACE Module jumpers should be installed.

P160 I/O Loopback Setup

1. Install a 2x20 cable to connect J4 to J5 on each P160 Prototype Module.
2. Install a 2x20 cable to connect J3 to J6 on each P160 Prototype Module.

Functional Test

The Memec 3SMB Functional test consists of four sections:
1. 3SMB Board Setup
2. SystemACE Module Test
3. DDR, Flash, and Ethernet Test
4. P160 Loopback and I/O Test

3s1500mb Board Setup

Refer to Figure 17 for jumper locations.
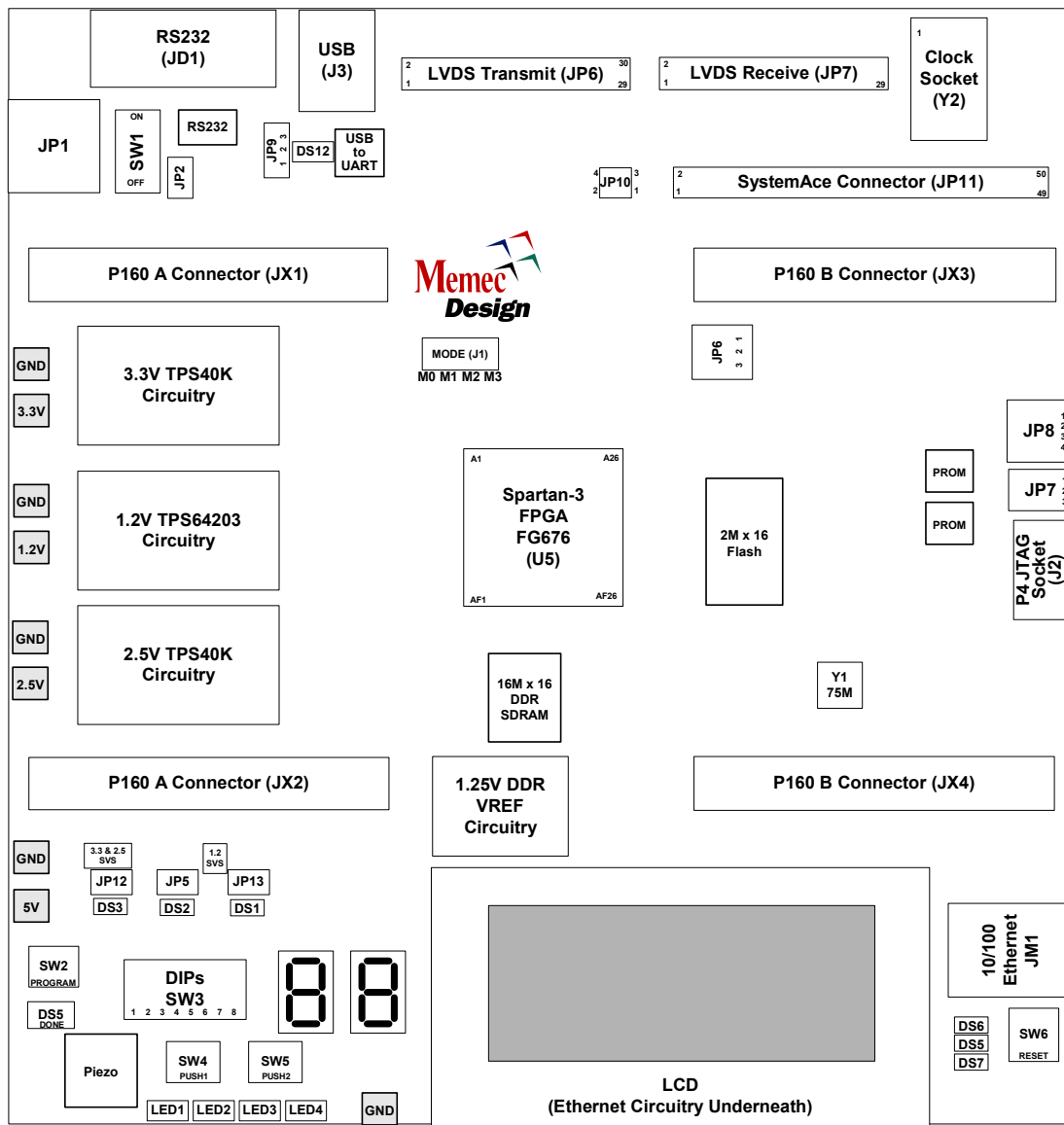
Figure 17 – Memec Spartan-3 MB Jumper Locations

The Memec Spartan-3 MB board should be configured as follows:

1. Install three jumpers on J1, locations M0, M1, and M2 (FPGA mode select jumpers). M3 should not have a jumper.
2. Install a jumper on JP9 in the "BOARD" position (pins 1-2).
3. Install a jumper on JP10, pins 1-3.
4. Install two jumpers on JP8.
5. Install a jumper on JP7 in the "PROM ENABLE" position (pins 1-2).
6. Install a jumper on JP6 in the 3.3V position (pins 1-2).
7. No other jumpers should be installed.
8. Connect a straight through RS232 cable to the board DB-9 connector (JD1) and the serial port of the PC.
9. Verify the Power switch (SW1) is in the OFF position.
10. Connect the AC/DC adapter to JP1.
11. Slide the power switch to the ON position.
12. Verify the three power LEDs labeled 1.2V (DS3), 2.5V (DS2), and 3.3V (DS1) turn on.
13. Slide the power switch to the OFF position.

SystemACE Module Test

14. Launch a HyperTerminal window by double-clicking **<unzip_directory>\com1_19200_8n1n.ht** (if COM1 is not an available serial port, launch HyperTerminal manually, using an available COM port with 19200 baud, 8 data bits, no parity, 1 stop bit, and no flow control). HyperTerminal is displayed as shown in Figure 18.
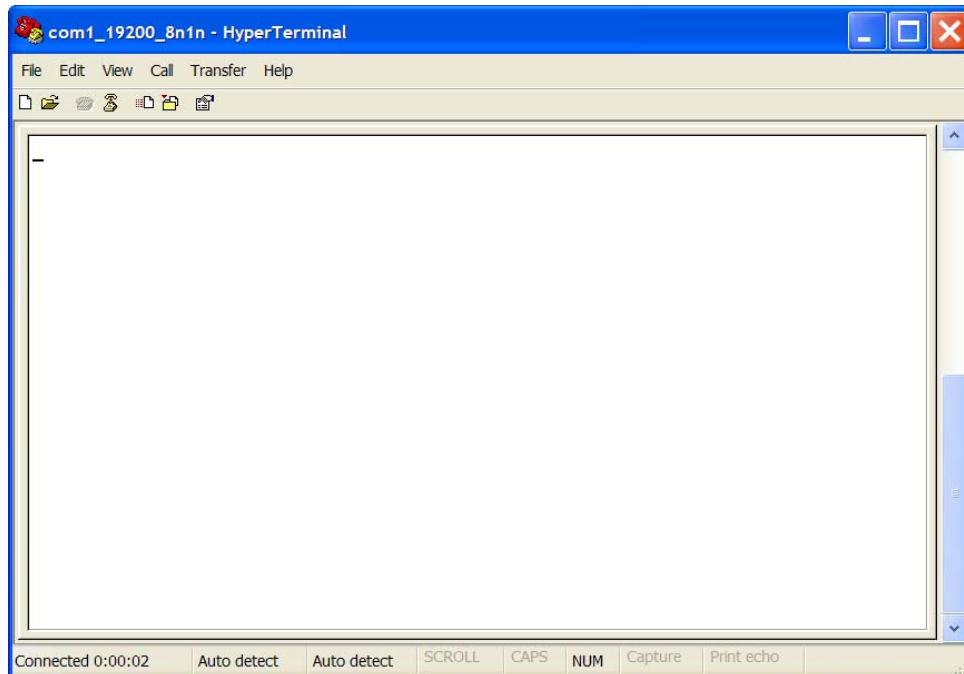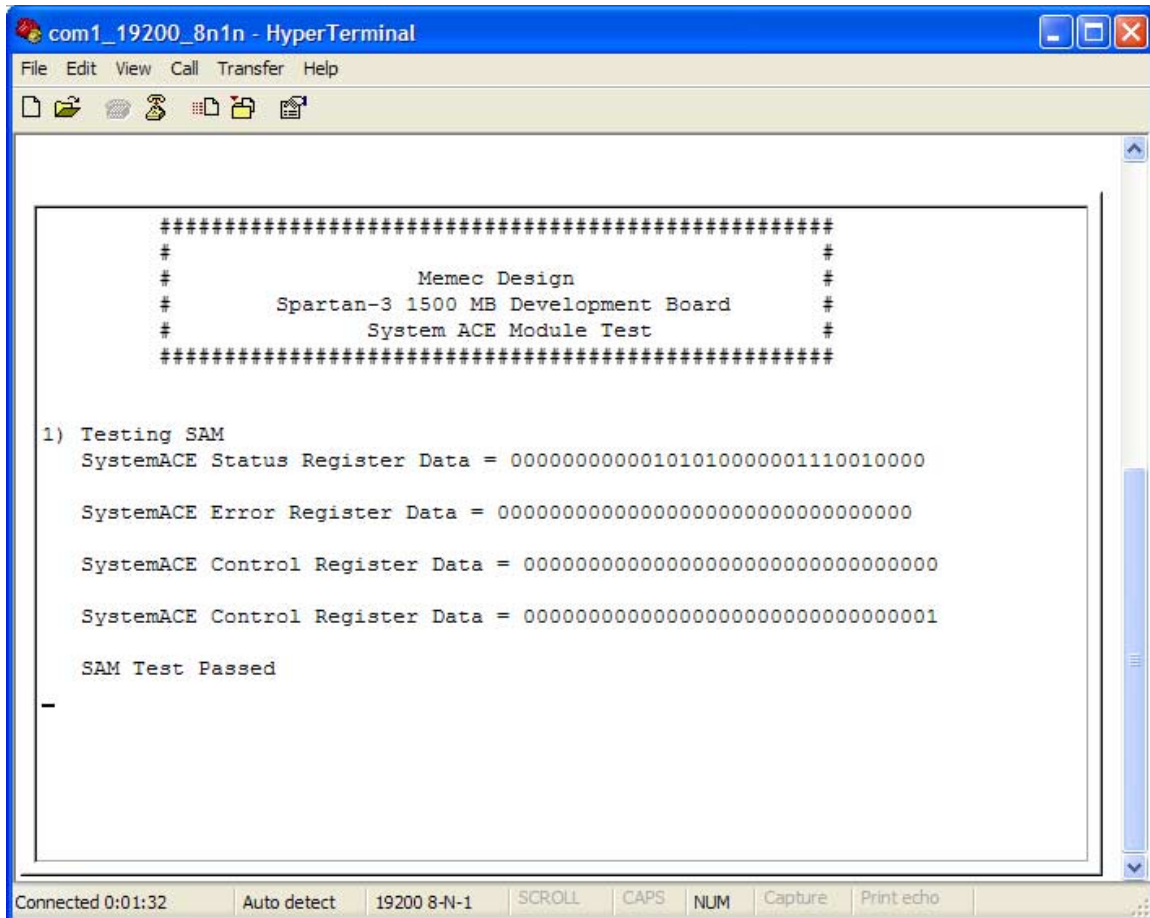
Figure 18 – HyperTerminal Launched

15. Install the SystemACE Module onto the 3SMB board's SystemACE header (JP11) such that the component side of the SystemACE Module faces away from the 3SMB board.
16. Slide the power switch to the ON position. A passing test will display the contents of the HyperTerminal shown in Figure 19.
17. Upon completion of the SystemACE test, slide the Power switch to the OFF position.
18. Uninstall the SystemACE Module.

Figure 19 – SystemACE Test Results

Flash, DDR SDRAM, & Ethernet Test

19. Connect a Parallel-IV JTAG cable to J2 and the parallel port of the PC.
20. Connect an ethernet cable to the board (JM1) and the PC.
21. Install the P160 Comm2 in P160 Slot A, which is JX1 and JX2.
22. Turn power on to the board by sliding SW1 to the ON position.
23. Program the FPGA by double-clicking **<unzip_directory>\ Memec_3S1500MB_test.bat**   A command prompt window will be displayed.

Near the bottom of the screen, look for the phrase, "**'3': Programmed successfully.**" The DONE LED (DS4) should also be lit.

24. The testing results will be displayed in the HyperTerminal window. Successful test results are shown in Figure 20. Look for the messages, "Flash Test PASSED!" and "DDR SDRAM Test PASSED!"

Figure 20 –Flash and DDR Test Results

25. Open an Internet Explorer window.
26. As instructed by the HyperTerminal display, browse to http://1.2.3.4:8080 . A passing ethernet test will display as shown in Figure 21.
27. Select a number in the dialog box, change the DIP switch settings on the board, and then click submit. Verify that the LEDs and 7-segment display the selected number and verify the DIP settings are properly displayed in Explorer.
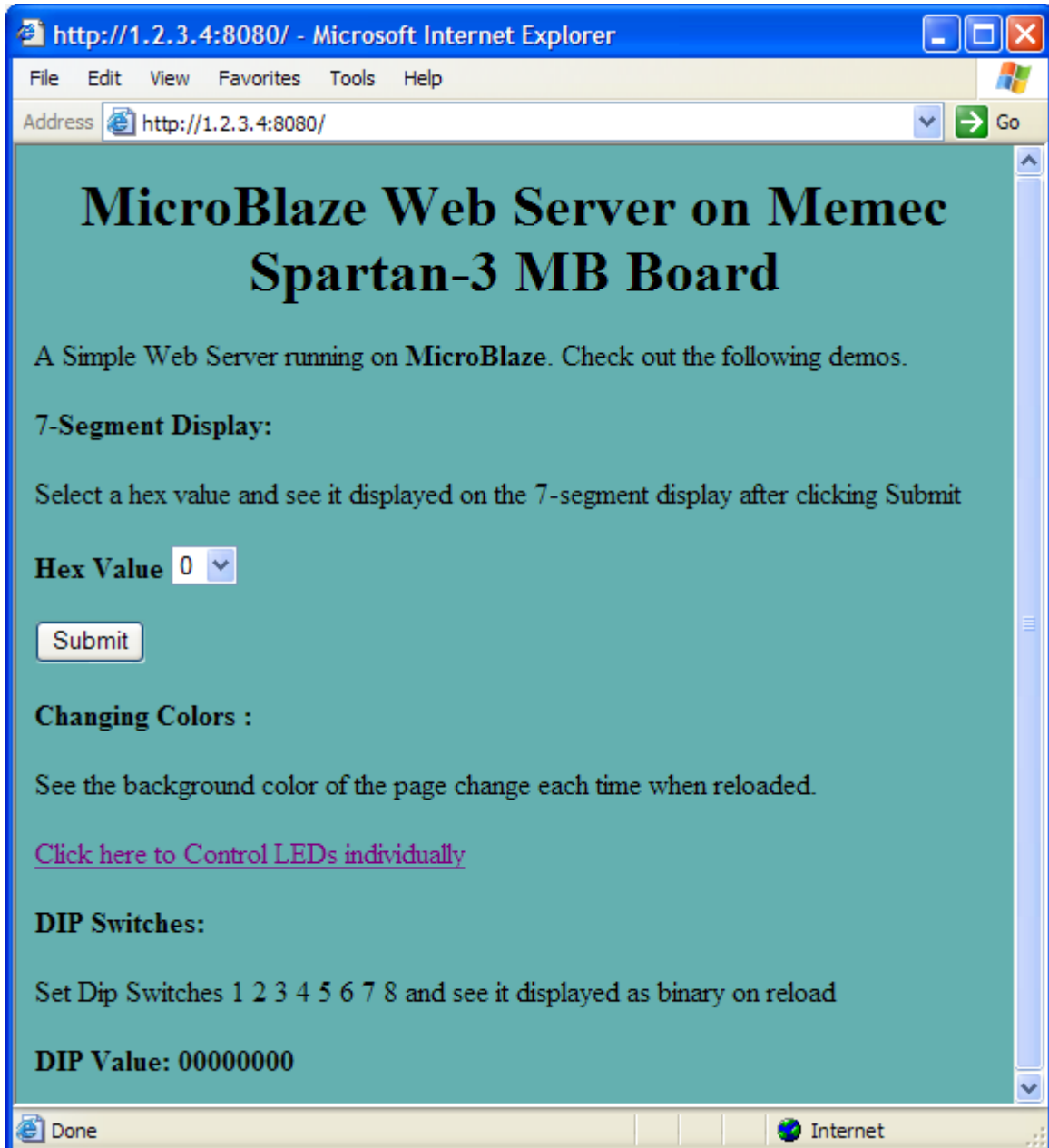
Figure 21 – Ethernet Test: 3SMB WebServer

28. Click on the link to Click here to Control LEDs individually. This will display the page as shown in Figure 22.
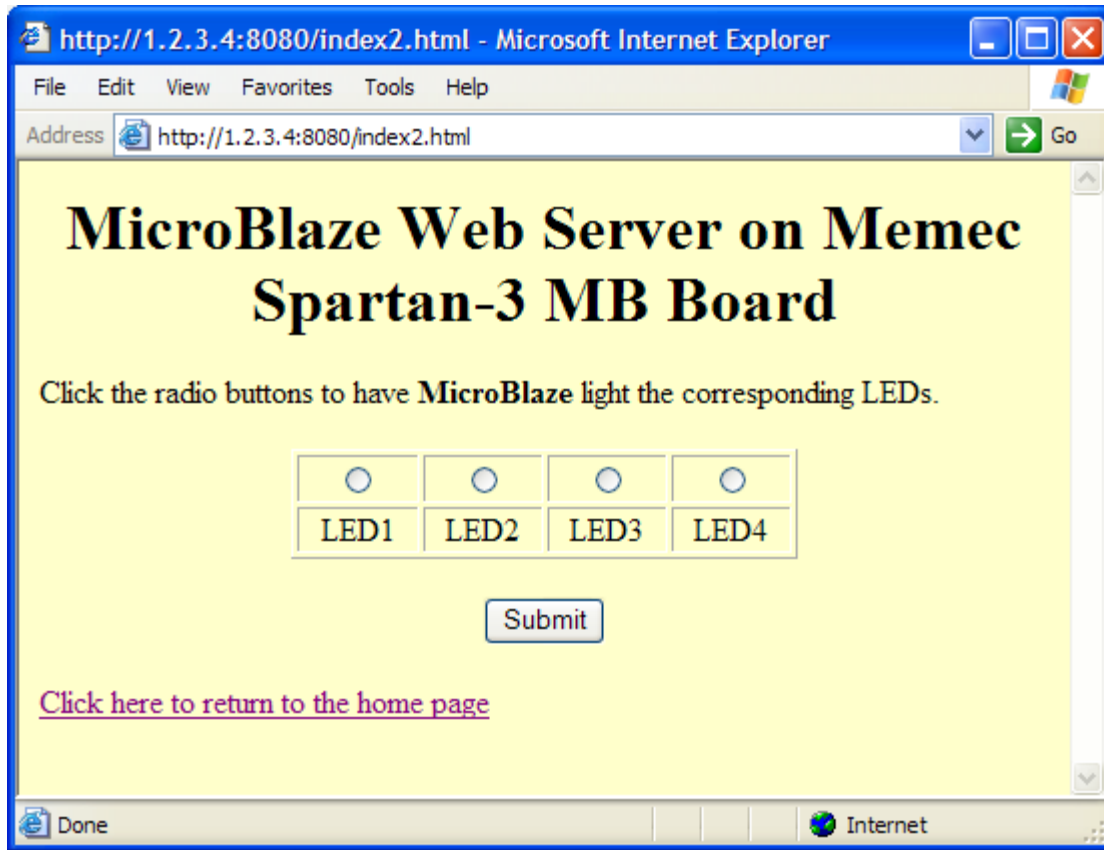
Figure 22 – 2ⁿᵈ Page of the WebServer

29. Slide the power switch to the OFF position.
30. Unplug the P160 Comm2 module.
31. Unplug the ethernet cable.

P160 Loopback, I/O, and LCD Test

32. Install both P160 Prototyping Modules with loopback cables installed.
33. If previously opened, close the COM10 HyperTerminal or click on the Disconnect

    icon   . (A HyperTerminal actively connected to COM10 will prevent the
    3SMB USB from being properly recognized.)
34. Plug in the USB cable to the PC and the 3SMB board.
35. Install the 2x15 Ribbon cable between the LVDS TRANSMIT (J6) and the LVDS
    RECEIVE (J7) headers such that the red stripe on the ribbon cable aligns with pin
    1 on each header.
36. Slide the power switch to ON.
37. DS1, DS2, DS3, and DS12 should all light. The previously installed CP2101
    drivers should have been detected and a virtual COM port installed, as discussed
    in the Initial Software Setup section.
38. If not already open, launch a HyperTerminal window by double-clicking
    <unzip_directory>\com10_115200_8n1n.ht (assuming COM10 is the port

previously assigned to the 3SMB USB). The HyperTerminal settings are 115200 baud, 8 data bits, no parity, 1 stop bit, and no flow control. If previously opened, click the Call icon ☎ to reconnect to COM10.

39. In the Command Prompt window that was opened during the Flash, DDR SDRAM, & Ethernet Test, hit any key to continue. The script will erase, program, and verify both PROMs. Approximately 12 lines from the bottom, the Command Prompt window should display, "**'2': Programming completed successfully.**" The script will also automatically launch the FPGA configuration and operation after a successful download.

40. A short audio sequence repeated three times verifies that the Piezo (PT1) test passes.

41. Verify in the COM10 HyperTerminal that the P160B Module Loopback Test Passed and that the USB UART is operating. See Figure 23.
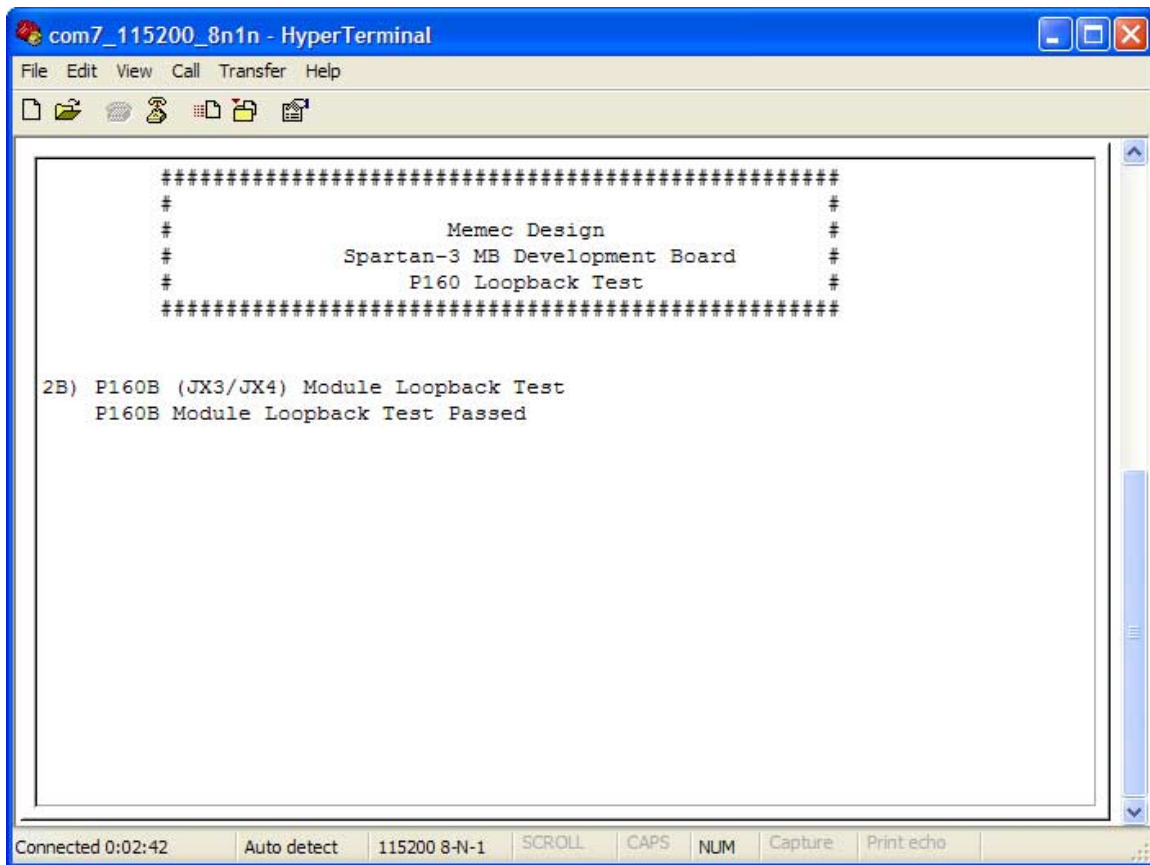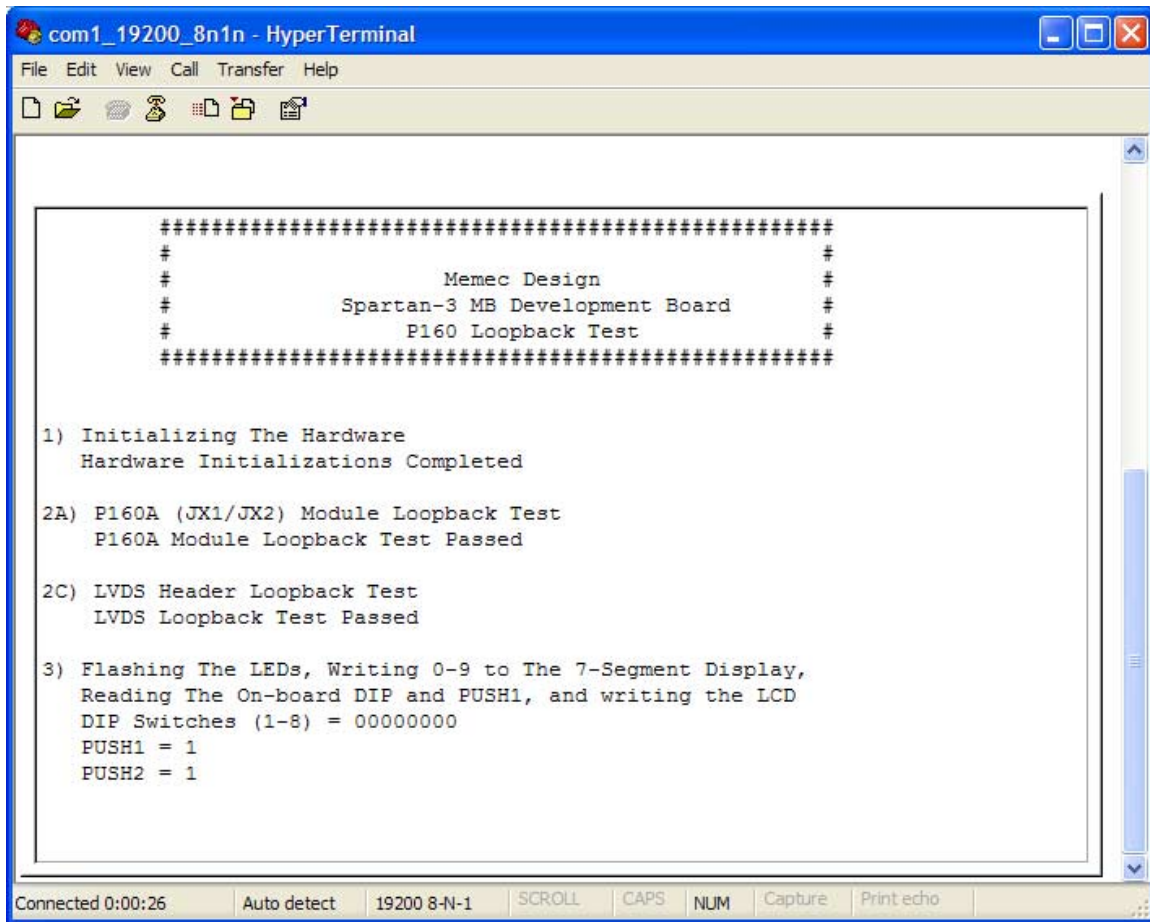
Figure 23 – P160B Module Loopback Test Passed
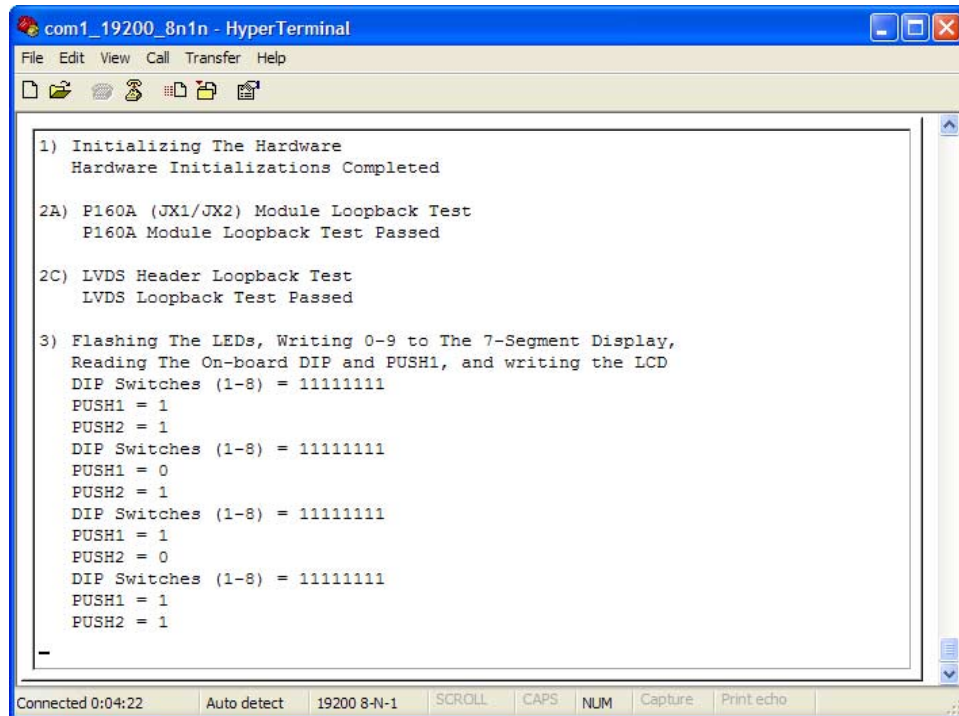
42. Since the results displayed in the COM1 HyperTerminal will have scrolled past by now, press RESET (SW6) to restart the test, while looking at the Results in COM1.

43. Verify in the COM1 HyperTerminal that the P160A Module Loopback Test and LVDS Loopback Test passed, as shown in Figure 24.

Figure 24 – P160A, LVDS Header, and I/O Tests

44. Verify that the USER LED on both P160 Prototyping Modules are lit.
45. Push PUSH1 (SW4), which should show as "PUSH1 = 0" in the COM1 HyperTerminal. See Figure 25.
46. Push PUSH2 (SW5), which should show as "PUSH2 = 0" in the COM1 HyperTerminal. See Figure 25.
47. Toggle each of the DIP switches (SW3) and verify the value in the HyperTerminal changes. See Figure 26.
48. Verify that both 7-segment displays (DD1 and DD2) display all 16 hexadecimal numbers {0,1,2,3,4,5,6,7,8,9,A,b,C,d,E,F} properly. DD1 counts up while DD2 counts down.
49. Verify that LED1 (DS8), LED2 (DS9), LED3 (DS10), and LED4 (DS11) each toggle ON and OFF.

Figure 25 – Push Button Test

Figure 26 – Toggling DIP Switches

50. Verify the display on the LCD, which initially says:

```
>>> MEMEC <<<
 Spartan-3 MB
```

During the test loop, the LCD will display the following message, after which the entire message will be shifted to the right, blanking the screen momentarily:

```
Testing 3SMB LCD
0123456789AbCdEF
```

51. Upon completion of the P160 Loopback test, slide the power switch to OFF.
52. Unplug the P160 Prototyping Modules.
53. In the Command Prompt window, hit any key to close the window.
54. Remove all cables.

The test is now complete. To test another board, complete the Functional Test.

Revision History

Date	Version	Revision
09/04/04	2.0	Initial Memec release of 3s1500mb Functional Test (bhf)
09/14/04	2.1	Removed reference to JP32 in CP2101 setup; Added setting for JP6 (bhf)