PICDEM.net™ 2
Internet/Ethernet
Development Board
User's Guide

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.

- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.

- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.

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PICDEM.net™ 2 DEVELOPMENT BOARD USER'S GUIDE

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PICDEM.net™ 2 DEVELOPMENT BOARD USER'S GUIDE

Preface

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DSXXXXXA", where "XXXXX" is the document number and "A" is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® IDE on-line help. Select the Help menu, and then Topics to open a list of available on-line help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the Development Board. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Warranty Registration
- Recommended Reading
- The Microchip Web Site
- Development Systems Customer Change Notification Service
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes how to use the PICDEM.net 2 Development Board as a development tool to emulate and debug firmware on a target board. The manual layout is as follows:

- **Chapter 1. "Introduction to the PICDEM.net 2 Development Board"** – Describes what the PICDEM.net 2 Development Board is and what features are available on the board.
- **Chapter 2. "Getting Started with the PICDEM.net 2 Development Board"** – Describes how to connect and begin to use the PICDEM.net 2 Development Board.
- **Chapter 3. "Using the Microchip TCP/IP Stack Demo Application"** – Provides a brief overview of the TCP/IP Stack Demo Application firmware and source code, and how to modify the application and the demo web site.
- **Chapter 4. "Reconfiguring and Restoring the PICDEM.net 2 Development Board"** – Provides instructions on changing hardware configuration, loading a web page into the on-board EEPROM and reconfiguring the network settings.
- **Chapter 5. "Troubleshooting"** – Provides information on solving common problems.
- **Appendix A. "PICDEM.net 2 Development Board Schematics, Rev. 4"** – Provides schematic diagrams of the Development Board.

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	*"MPLAB® IDE User's Guide"*
	Emphasized text	...is the *only* compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	*File>Save*
Bold characters	A dialog button	Click **OK**
	A tab	Click the **Power** tab
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
Plain Courier New	Sample source code	`#define START`
	Filenames	`autoexec.bat`
	File paths	`c:\mcc18\h`
	Keywords	`_asm, _endasm, static`
	Command-line options	`-Opa+, -Opa-`
	Bit values	`0, 1`
	Constants	`0xFF, 'A'`
Italic Courier New	A variable argument	`file`.o, where `file` can be any valid filename
Square brackets [ ]	Optional arguments	`mcc18 [options] file [options]`
Curly brackets and pipe character: { | }	Choice of mutually exclusive arguments; an OR selection	`errorlevel {0|1}`
Ellipses...	Replaces repeated text	`var_name [, var_name...]`
	Represents code supplied by user	

WARRANTY REGISTRATION

Please complete the enclosed Warranty Registration Card and mail it promptly. Sending in the Warranty Registration Card entitles users to receive new product updates. Interim software releases are available on the Microchip web site.

RECOMMENDED READING

This user's guide describes how to use the PICDEM.net 2 Development Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

Readme for Development Kit

For the latest information on using the PICDEM.net 2 Development Board, read the `Readme for PICDEMnet 2.txt` file (an ASCII text file) on the *"PICDEM.net™ 2 Development Kit"* CD-ROM included with the Development Board kit. The Readme file contains updated information and known issues that may not be included in this user's guide.

Readme Files

For the latest information on using other tools, read the tool-specific Readme files in the Readmes subdirectory of the MPLAB® IDE installation directory. The Readme files contain updated information and known issues that may not be included in this user's guide.

***"PIC18F97J60 Family Data Sheet"* (DS39762)**

Consult this document for detailed information on Microchip's first family of 8-bit microcontrollers with on-chip Ethernet capability. Reference information found in this data sheet includes:

• Device pinout and packaging details
• Device electrical specifications
• Device memory map
• List of peripherals included on the device
• Practical information on using the Ethernet interface module in connectivity solutions

***"ENC28J60 Data Sheet"* (DS39662)**

Consult this document for detailed information on the non-microcontroller Ethernet interface. Reference information found in this data sheet includes:

• Device pinout and packaging details
• Device electrical specifications
• Device memory map
• Practical information on using the Ethernet interface module in connectivity solutions

***AN833, "The Microchip TCP/IP Stack"* (DS00833)**

This particular application note gives a detailed explanation of the free Microchip TCP/IP Stack on which the kit's firmware is based. It is referred to throughout this manual as a primary reference.

THE MICROCHIP WEB SITE

Microchip provides online support via our web site at www.microchip.com. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listing of Microchip sales offices, distributors and factory representatives

DEVELOPMENT SYSTEMS CUSTOMER CHANGE NOTIFICATION SERVICE

Microchip's customer notification service helps keep customers current on Microchip products. Subscribers will receive e-mail notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, access the Microchip web site at www.microchip.com, click on Customer Change Notification and follow the registration instructions.

The Development Systems product group categories are:

- **Compilers** – The latest information on Microchip C compilers and other language tools. These include the MPLAB® C18 and MPLAB C30 C compilers; MPASM™ and MPLAB ASM30 assemblers; MPLINK™ and MPLAB LINK30 object linkers; and MPLIB™ and MPLAB LIB30 object librarians.
- **Emulators** – The latest information on Microchip in-circuit emulators. This includes the MPLAB ICE 2000 and MPLAB ICE 4000.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debugger, MPLAB ICD 2.
- **MPLAB® IDE** – The latest information on Microchip MPLAB IDE, the Windows® operating system Integrated Development Environment for development systems tools. This list is focused on the MPLAB IDE, MPLAB SIM simulator, MPLAB IDE project manager and general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include the MPLAB PM3 and PRO MATE® II device programmers, the PICSTART® Plus development programmer and the PICkit® 1 starter kit.

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support
- Development Systems Information Line

Customers should contact their distributor, representative or Field Application Engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at: http://support.microchip.com.

DOCUMENT REVISION HISTORY

Revision A (September 2006)

- Initial Release of this Document.

Revision B (June 2007)

- Edits to **Section 1.3 "The Development Kit: What's In The Box"**.

NOTES:

Chapter 1. Introduction to the PICDEM.net 2 Development Board

1.1 INTRODUCTION

The PICDEM.net 2 Development Board was created to allow developers to examine Microchip's latest available technology in embedded Ethernet and Internet solutions. Using the free Microchip TCP/IP Stack source code, developers can experiment with the preprogrammed Microchip TCP/IP Demo Application and learn how to integrate connectivity into their applications.

1.2 HIGHLIGHTS

This chapter covers the following:
- The Development Kit: What's In The Box
- The PICDEM.net 2 Development Board
- The Development Kit CD

1.3 THE DEVELOPMENT KIT: WHAT'S IN THE BOX

Your Development Kit contains the following items:
1. The PICDEM.net 2 Development Board
2. A standard CAT5 "straight-through" network cable for networking the board
3. A CAT5 "crossover" network cable for networking the board directly to a computer
4. The *"PICDEM.net™ 2 Development Kit"* CD-ROM
5. A warranty registration card

1.4   THE PICDEM.net 2 DEVELOPMENT BOARD

The PICDEM.net 2 Development Board has all the features to begin developing Internet connectivity applications over an Ethernet connection. The preprogrammed firmware allows users to begin evaluating the board right out of the box with no additional programming or configuration. All that is required to begin exploring the board is a network-enabled computer with an Ethernet adapter and Internet browser software. (See **Chapter 2. "Getting Started with the PICDEM.net 2 Development Board"** for more specific information.)

FIGURE 1-1:   PICDEM.net™ 2 DEVELOPMENT BOARD LAYOUT
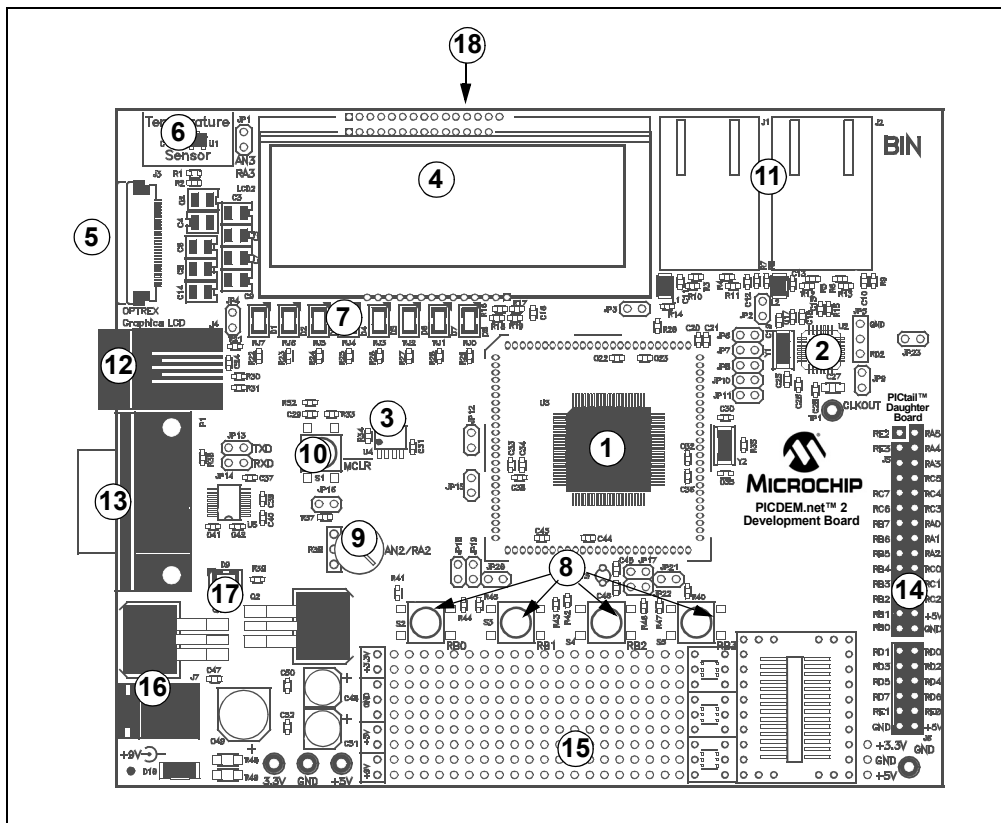
Features on the PICDEM.net 2 Development Board include:

1. **MICROCONTROLLER:** A Microchip PIC18F97J60 microcontroller with built-in Ethernet controller and transceiver is directly installed on the board (U3). The device is clocked at 25 MHz and has been preprogrammed with the Demo Application firmware using the Microchip TCP/IP Stack. Jumpers, JP15 and JP3, can be used to measure the current consumption of the microcontroller.

2. **ETHERNET CONTROLLER:** In addition to the PIC18F97J60, the PICDEM.net 2 Development Board also features a Microchip ENC28J60 stand-alone Ethernet controller. This device provides Ethernet connectivity for microcontroller-based applications using a standard SPI interface.

3. **MEMORY:** A Microchip 25LC256 serial EEPROM (U4) provides 256 Kbits (32 Kbytes) of storage for both web pages and nonvolatile configuration options. The 25LC256 is programmable via an SPI interface.

4. **LCD DISPLAY:** A two-line by 16-character dot matrix display shows diagnostic and error messages with the factory programmed firmware. It may be used for other applications with appropriate reprogramming.

5. **OPTIONAL EXTERNAL LCD CONNECTOR:** Space is provided on the board for the installation of a 30-pin, bottom contact FFC edge connector (Hirose FH12-30S-0.5SH or equivalent). This will allow the use of an external LCD character display module (such as one of the Optrex™ F-51320 series) to the board via a ribbon cable. Note that using an external LCD module will require appropriate changes to the application code, as well as the use of a ribbon cable compatible with the connector.

6. **TEMPERATURE SENSOR:** This analog temperature sensor, a Microchip TC1047 (U1), is connected to an analog I/O pin of the microcontroller. It can be disconnected by jumper.

7. **USER-DEFINED LEDs:** Eight LEDs are driven by digital I/O pins of the controller (PORTJ) and may be used to simulate a digital output to an embedded device. They may also be enabled or disabled by jumper selection on the board.

8. **USER-DEFINED PUSH BUTTONS:** These switches are connected to digital I/O pins on the microcontroller (PORTB<3:0>) and may be used to simulate a digital input in an embedded application.

9. **USER-DEFINED POTENTIOMETER:** One 10 kOhm potentiometer is connected to an analog I/O pin of the microcontroller. It can be used to simulate an analog input in an embedded application.

10. **RESET PUSH BUTTON:** This switch is tied to the $\overline{\text{MCLR}}$ pin on the controller, and is used to reset the board.

11. **RJ-45 (10Base-T) MODULAR CONNECTORS:** The PICDEM.net 2 Development Board is outfitted with two Integrated Connector Modules (ICMs), one each for the PIC18F97J60 and ENC28J60. These ICMs provide the modular jack, as well as the necessary transformers, EMI suppression and status LEDs, for Ethernet connectivity.

    Each ICM has its own ACTIVITY and LINK LEDs on the left and right sides of the ICM, respectively (as viewed from the top). These show if an Ethernet application is transmitting or receiving a packet, and if the Ethernet connection is active. The LEDs for the PIC18F97J60 (on J1) can be disconnected by jumpers if the I/O ports, RA0 and RA1, are to be used for another purpose.

12. **RJ-11 (Six-Wire) MODULAR CONNECTOR:** This allows the Development Board to be connected to Microchip MPLAB ICD 2 systems for in-system programming, as well as advanced application debugging.

13. **SERIAL PORT:** The PICDEM.net 2 Development Board includes an RS-232 port with a DB9 connector (P1) and appropriate level-shifting hardware (U5). This allows for the configuration of the board's IP and Ethernet address through a standard serial connection. This interface also allows users to download new web pages to the EEPROM.

14. **I/O AND PICtail™ DAUGHTER BOARD ACCESS**: A pair of female risers (J5 and J6) allow direct access to five of the microcontroller's I/O ports (PORTA through PORTE). The even pins of J5 also serve as a standard interface between the PICDEM.net 2 Development Board and any of Microchip's PICtail daughter board series.

15. **PROTOTYPE AREA:** A 9x20 grid with through-holes is provided for users to breadboard additional circuitry for development. Three SOT-23 pads and a SOIC-28 footprint are also provided for surface mounting common components. Connections are provided for +3.3 VDC, +5 VDC, +9 VDC and ground.

16. **ON-BOARD POWER:** Two on-board regulators provide separate 5 VDC and 3.3 VDC at 500 mA common current, from the 9 VDC supplied at J7.

17. **POWER-ON LED:** This LED (D9) shows the board is powered up.

18. **ETHERNET ID STICKERS (TRACE SIDE):** The numbers on the two stickers are used to form the unique Media Access Control (MAC) addresses used by the Ethernet transceivers to identify and filter packets. The number is the base 10 version of the last 6 hexadecimal digits of the 12-digit MAC address. For example, the sticker number, "12345", represents 003039h in the MAC address. One of these is assigned to the PIC18F97J60 and the other to the ENC28J60. These MAC addresses are provided for evaluation purposes; both addresses can be changed in software.

1.5   THE DEVELOPMENT KIT CD

The *"PICDEM.net 2 Development Kit"* CD contains:

• The complete source code for the free Microchip TCP/IP Stack Demo Application. To install the source code and necessary support files on your computer, run the installer file, `MCHPTCPStack 3.75.exe` (available when this manual was written; your kit may have a newer version). If you are restoring the Demo Application firmware and/or the demo web site as originally shipped from the factory, use the appropriate files as described in **Section 3.3 "The Source Code"**.

• Other example applications for use with PIC18F97J60 and ENC28J60 devices.

• The complete selection of technical documentation for Microchip's connectivity solution, located in the Doc folder. Included are the complete data sheets for the PIC18F97J60 microcontroller and ENC28J60 Ethernet controller. Also of note, in this folder is the Microchip Application Note *AN833, "The Microchip TCP/IP Stack"* (DS00833) which is referred to throughout this manual.

• This manual, in Adobe® Acrobat® format.

The most up-to-date information on demo solutions, as well as the latest version of the free Microchip TCP/IP Stack, are available on the Internet Solutions page of the Design Center at the Microchip web site:

http://www.microchip.com/Ethernet

or

http://www.microchip.com/tcpip

Chapter 2. Getting Started with the PICDEM.net 2 Development Board

2.1 HIGHLIGHTS

This chapter will cover the following topics:

- Network Precautions: Before You Start
- Using PICDEM.net 2 Development Board with a Local Host System
- Connecting the PICDEM.net 2 Development Board
- Configuring the PICDEM.net 2 Development Board
- Establishing Communications

2.2 NETWORK PRECAUTIONS: BEFORE YOU START

The PICDEM.net 2 Development Board provided in your kit is designed to demonstrate the possibilities of networking with embedded Microchip controllers over Ethernet and the Internet. As with any experimental system, however, some precautions are in order before you start.

Whenever new hardware or software is added to a network, it is always advisable to create a separate test network that is isolated from your LAN. This allows testing the new system in a controlled environment and minimizes the possibilities of network interference from the new equipment. The major sources of potential interference include:

- **Addressing** – Each device on the network must have a unique address. If Dynamic Host Configuration Protocol (DHCP) is in use, the PICDEM.net 2 Development Board will automatically acquire a valid IP address. If DHCP is not used, or a fixed address is required, adding the board to the network without assigning an address may create network conflicts.
- **Traffic Levels** – While the on-board Ethernet controller will filter out unwanted messages, a highly loaded network with many broadcast messages may place a sizable burden on the Development Board.
- **Data Security** – Although it is unlikely that the addition of a single device will compromise the integrity or privacy of sensitive information, it is always a good idea to perform extensive testing with new equipment before adding it to a secure network.
- **Experimentation** – Even as a simple microcontroller-based device, the Development Board is capable of generating a high volume of network traffic which may severely disrupt normal network operations.

2.3 USING PICDEM.net 2 DEVELOPMENT BOARD WITH A LOCAL HOST SYSTEM

Although the PICDEM.net 2 Development Board is ready to communicate on a DHCP-enabled Ethernet network out of the box, you may have reasons not to do this. Besides those already mentioned, there may be others, such as:

• You don't have an Ethernet network available to experiment with
• Your network doesn't use DHCP and the Development Board must be configured with an IP address before it's allowed on the network
• Your network administrator forbids you to put the board on the network

For these reasons, the PICDEM.net 2 Development Board can also communicate directly with a properly configured desktop system, known here as a *local host system*. In this configuration, the host system can communicate and configure the board through its network connection; it can also configure the board through the serial port. When configured this way, the setup is referred to as a *test system*.

The Development Board can also communicate to a network and a local host system separately. In this setup, the board participates on the network through its Ethernet connection. At the same time, it is connected to the local host system through the serial port, from which it can be directly configured.

To function as a local host, the system must meet the following basic requirements:

• Any computer system capable of network communication
• CD-ROM drive (for use with the accompanying CD)
• Standard Ethernet card or integrated adapter, capable of supporting 10 Mbps operation, with RJ45 connector
• One available standard serial port with a matching COM port available through the operating system
• Any operating system with TCP/IP Stack software
• Any Internet browser software supporting HTTP 1.1 or higher
• Any terminal emulation package, such as HyperTerminal for Microsoft® Windows® operating system (for optional serial configuration of the PICDEM.net 2 Development Board)

> **Note:** Throughout this chapter, as well as other places in this manual, we will give configuration examples in terms of Microsoft Windows operating system. This is, of course, not the only operating system capable of working with TCP/IP, but it is the one most generally found on desktop computers. Users of other operating systems should refer to the appropriate documentation for appropriate instructions, using the instructions provided as a guideline.

2.4   CONNECTING THE PICDEM.net 2 DEVELOPMENT BOARD

There are two basic network configurations for the PICDEM.net 2 Development Board: direct connection to a network and connection to a local host system through a cross-over cable. If DHCP is not enabled on the network, the board will need to be configured before a direct network connection can be used.

If you are connecting the Development Board to a DHCP-enabled network, follow the steps in **Section 2.4.1 "Connecting to a Network"**.

If you are using the board for the first time on a network using fixed IP addresses, follow the steps in **Section 2.4.2 "Connecting Directly to a Host System"**. Once the IP address is configured the first time, you will be able to connect the board directly to the network as described in **Section 2.4.1 "Connecting to a Network"** without using a local host.

If you are connecting the board to a local host in a test system configuration, you will also follow the steps in **Section 2.4.2 "Connecting Directly to a Host System"**. If DHCP is enabled on the local host, the board will configure itself. Otherwise, you will need to configure both the host and board IP addresses according to the directions in **Section 2.5 "Configuring the PICDEM.net 2 Development Board"**.

All of this assumes that the Development Board is running the preprogrammed Demo Application firmware. The general principles for hardware discussed in the following sections still apply and may be used as a guideline.

> **Note:** This section assumes that an Ethernet card has already been installed in the host system and is working properly, and that the TCP/IP protocol has been installed and bound to the card. If this has not been done, or if you are uncertain if this has been done, please contact your Information Systems support person for further assistance.

2.4.1   Connecting to a Network

This configuration is the basic method of networking the PICDEM.net 2 Development Board. This assumes there is a stable Ethernet network using TCP/IP for communications and that at least one DHCP server is present on the network.

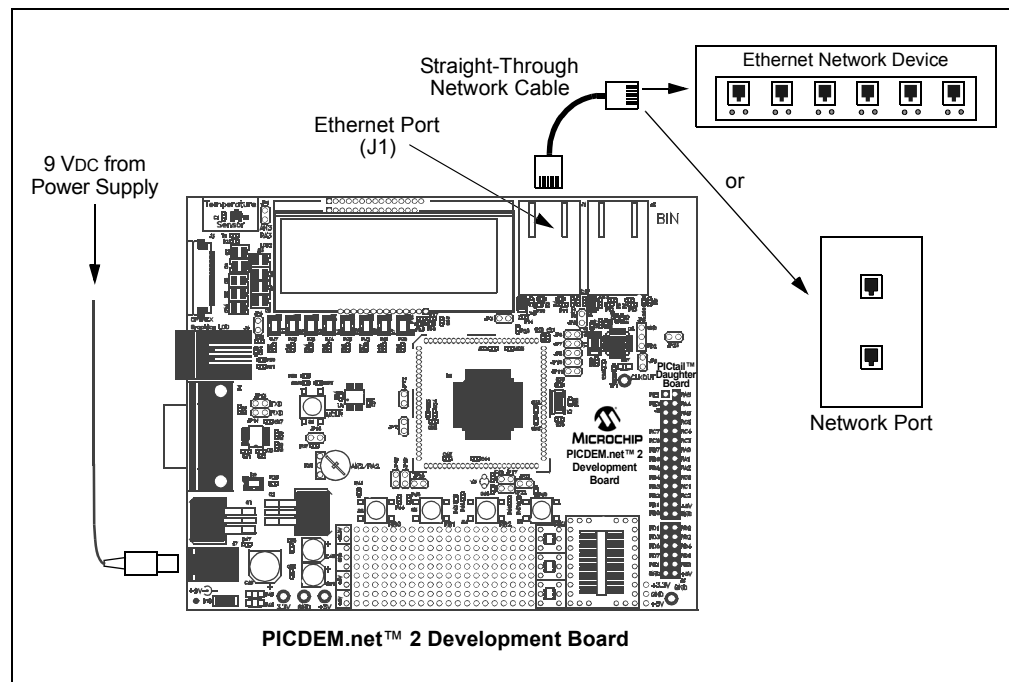To set up the board for direct networking (see Figure 2-1):

1. Unbox and unwrap the board, and set it on a non-conductive surface near the host computer.
2. Connect the straight-through Ethernet cable to the board at Ethernet connector J1, then to the Ethernet network. This can be at a network port or an available port on a network device (such as a hub, switch or router).

> **Note:** Do NOT use the provided crossover cable if you are directly connecting the board to a network or network device. The crossover cable is intended only for connecting the board directly to a computer.

3. Apply power to the board (9 VDC) at J7.

> **Note:** The Development Kit does not include a power supply. An unregulated 2.5 mm center-positive DC supply of 7V to 12V (preferably 9V) with a current capability of 500 mA is sufficient. If an external supply is needed, use Microchip part number AC162039.

FIGURE 2-1:   **CONNECTING THE PICDEM.net 2™ DEVELOPMENT BOARD TO A NETWORK**

2.4.2   Connecting Directly to a Host System

This option is used under the following situation:

• Evaluation of the Development Board as part of a test system;
• Operation on an isolated network is desired or;
• Connection to a deployed network is not possible.

To set up the board for connection to a local host (see Figure 2-2):

1. Unbox and unwrap the board, and set it on a non-conductive surface near the host computer.
2. Connect a serial cable to the board, then to the available serial port on your computer.
3. Depending on the network connection to be used, do one of the following:

    For connections through an Ethernet hub or switch: Connect a standard Ethernet cable to the board, then to a port on the Ethernet device (Option "A" in Figure 2-2). The computer should already be connected to the hub or switch by a straight-through cable.

    For direct connections to a host system: Connect the Ethernet crossover cable (supplied in the kit) to the board, then to the computer (Option "B" in Figure 2-2).

4. Apply power to the board (9 V$_{DC}$) at J7. (See **Section 2.4.1 "Connecting to a Network"** for power supply requirements.)

FIGURE 2-2:   CONNECTING TO A HOST SYSTEM THROUGH AN ETHERNET DEVICE (A) OR A DIRECT CONNECTION (B)
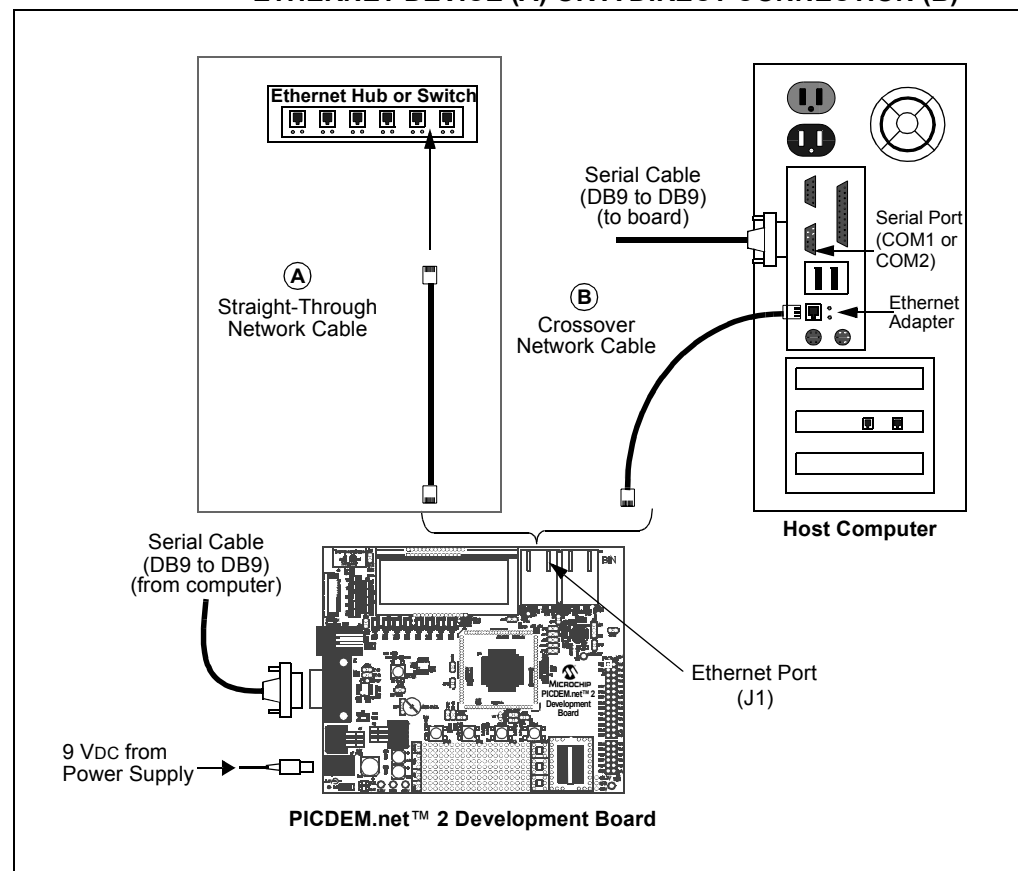
2.4.3 Confirming Operation

Once the PICDEM.net 2 Development Board is properly connected and powered up, you should see all of the following:

- User LED D8 (tied to RJ0) is blinking
- User LEDs D1 through D7 are dark
- The green LINK LED on J1 is lit
- The LCD display shows the message:
  TCPStack v3.75

  If the network uses DHCP, the display should change after a moment to:
  TCPStack v3.75
  ?.?.?.?

  where "**?.?.?.?**" is the board IP address as assigned by your network server.

> **Note:** The actual version of the firmware will be reflected in the first line of the LCD display. Version 3.75 is the revision available at the time this manual was prepared. Your display may differ.

If your board does not show all of these things, check all connections with the power supply and the board. For additional assistance, refer to **Chapter 5. "Troubleshooting"**.

If you are using a configuration with a local host system, power the system up now. If the board and/or local host require IP configuration, proceed to the next section. Otherwise, skip over to **Section 2.6 "Establishing Communications"**.

2.5 CONFIGURING THE PICDEM.net 2 DEVELOPMENT BOARD

Once the Development Board is properly connected, it needs to be configured to operate on the network or with the host system that it is connected to. As already mentioned, the board is factory-configured for DHCP operation; it should automatically acquire an IP address on DHCP-enabled networks and be available for immediate use. If this describes your configuration, you can proceed to **Section 2.6 "Establishing Communications"** and begin experimenting.

If your Development Board is connected to a network without DHCP support, you will need to assign an IP address to the board. Follow the directions in **Section 2.5.2 "Configuring the PICDEM.net 2 Development Board IP Address"**.

If your Development Board is directly connected to a host system, you will need to determine the IP address of the host system (or assign one, if necessary), and then configure the board's IP address accordingly. Start with the directions in **Section 2.5.1 "Obtaining the Host IP Address (Host System Configuration Only)"**, then configure the board as described in **Section 2.5.2 "Configuring the PICDEM.net 2 Development Board IP Address"**.

2.5.1 Obtaining the Host IP Address (Host System Configuration Only)

This process will vary, depending on the operating system used on the host system and the absence or presence of DHCP configuration on the host system. The procedure given here is specific to later versions of the Microsoft Windows operating system (i.e., Windows NT4/2000/XP). If you are unsure if your network uses DHCP to assign individual machine IP addresses, contact your network support group.

Regardless of the operating system, these steps only need to be done once before using the PICDEM.net 2 Development Board.

1. Open a Command Prompt window. From the Start menu, select *Programs>Accessories>Command Prompt*.

2. At the prompt, type the command, `ipconfig`. This will return the IP configuration for the host system, including the IP address tied to the Ethernet card (Figure 2-3).
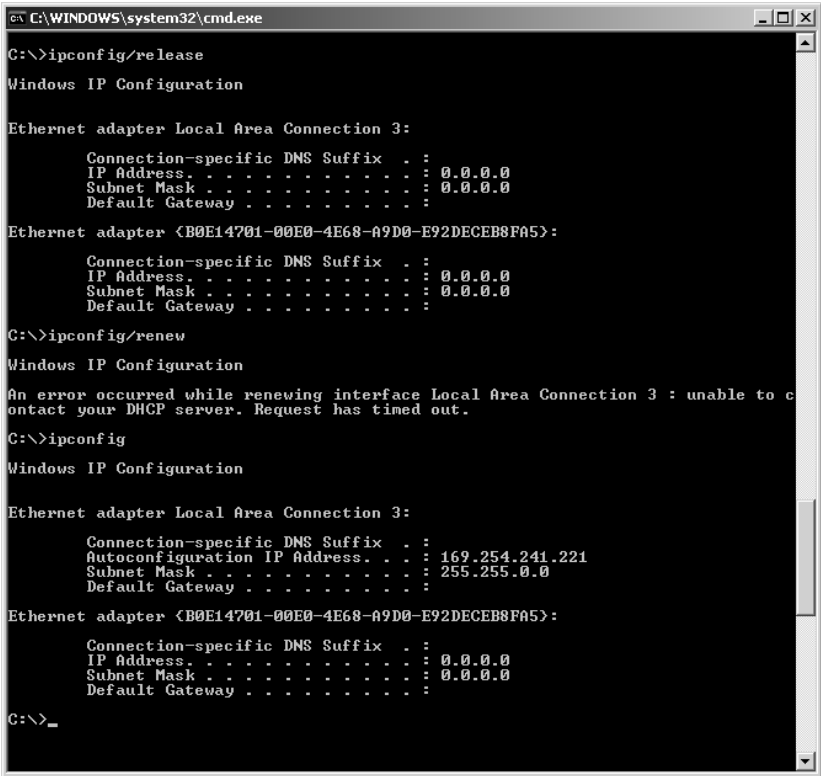
   If the IP address is 0.0.0.0, or the system is configured for DHCP: Continue with Step 3.

   If the IP address is anything except 0.0.0.0: Make a note of the IP address and continue with the appropriate procedure described in **Section 2.5.2 "Configuring the PICDEM.net 2 Development Board IP Address"** (page 18).

3. Type the command, `ipconfig/release`, and press <ENTER>. You may receive a message that addresses were automatically configured and cannot be released; this is normal.

4. Type the command, `ipconfig/renew`, and press <ENTER>. Wait for about one minute for the system to return a command prompt. You may receive a message that the DHCP server was unavailable; this is also normal.

5. Close the window, then open a new Command window.

6. Type the command, `ipconfig`, and press <ENTER>. The new IP address is now a non-zero address. Make a note of this.

> **Note:** The example shown in Figure 2-3 is specific to Windows XP. The prompts and command responses shown differ slightly for other Windows operating systems, however, the IP address will always be clearly identified as such.

FIGURE 2-3: THE `IPCONFIG` SCREEN (WINDOWS® XP)

2.5.2 Configuring the PICDEM.net 2 Development Board IP Address

By default, the PICDEM.net 2 Development Board uses serial configuration to assign a permanent IP address to the board. The IP configuration is written to the board's EEPROM using a direct serial connection between the board and a host system.
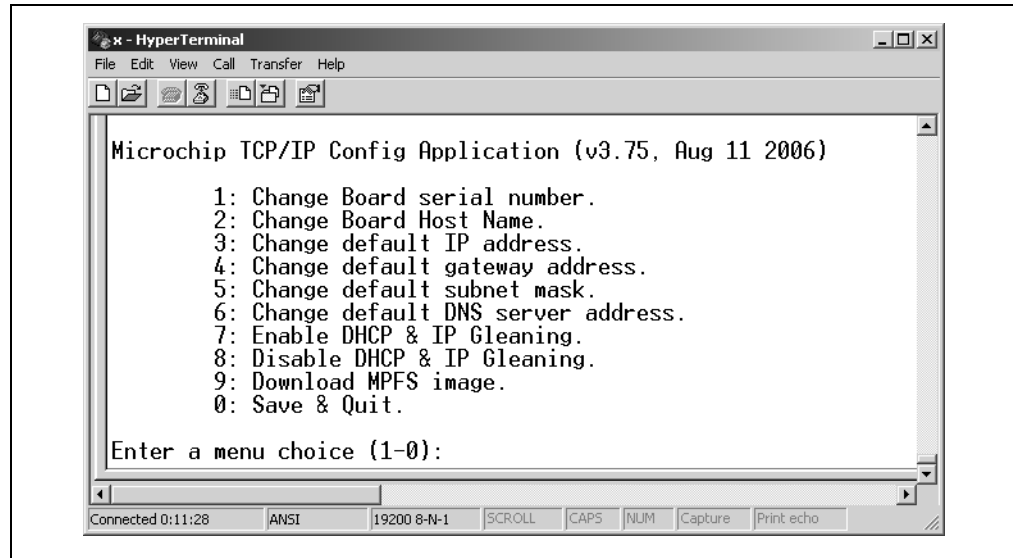
The Microchip TCP/IP Stack can also use a method known as "IP Gleaning" to obtain an IP address. IP Gleaning is not enabled in the software shipped in the Development Kit, but it remains available as a compile-time option. Users who may be interested in using IP Gleaning should refer to Microchip Application Note *AN833, "The Microchip TCP/IP Stack"* (DS00833) for detailed information.

> **Note:** These instructions are written specifically for use with the HyperTerminal emulator package that ships with Windows operating systems. If you are using another terminal emulation package, the procedure you use to configure a terminal session may vary slightly. Please consult the documentation for the terminal software for additional information.

To configure the board through the serial port:

1. From the Start menu, select *Programs>Accessories> Communications>HyperTerminal* (for some operating systems, *Programs>Accessories>HyperTerminal*).

2. At the initial "Connection Description" dialog box, enter a name for the connection. You may call the terminal session any name that you can easily remember. Click **OK**.

3. At the "Connect To" dialog box that follows, choose the appropriate COM port from the drop-down menu. Click **OK**.

4. At the "COM Properties" dialog box that follows, select the following settings:

   Bits per second: 19200
   Data bits: 8
   Parity: none
   Stop bits: 1
   Flow Control: none

   Click **OK**. The Terminal window opens with a flashing cursor. The message, "Connected", appears in the status bar at the bottom of the Terminal window, along with an elapsed time display.

5. From the menu bar, select *Files>Properties*, then the **Settings** tab on the "Properties" dialog. Click on the **ASCII Setup** button and check the **Echo typed characters locally** check box in the following dialog box. Click on **OK** to exit the dialog, then **OK** to exit the "Properties" dialog.

6. Press and hold button RB3 on the board. While holding, press and release the MCLR button. The terminal responds with the serial configuration menu (Figure 2-4). At the same time, the LCD displays:

   TCPStack v3.75

   At this point, release RB3.

FIGURE 2-4:   THE SERIAL CONFIGURATION MENU


```
x - HyperTerminal
File  Edit  View  Call  Transfer  Help

Microchip TCP/IP Config Application (v3.75, Aug 11 2006)

        1: Change Board serial number.
        2: Change Board Host Name.
        3: Change default IP address.
        4: Change default gateway address.
        5: Change default subnet mask.
        6: Change default DNS server address.
        7: Enable DHCP & IP Gleaning.
        8: Disable DHCP & IP Gleaning.
        9: Download MPFS image.
        0: Save & Quit.

Enter a menu choice (1-0):

Connected 0:11:28      ANSI      19200 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```

> **Note:** The actual version of the Demo Application firmware and the current date will be reflected in the first line of the display. Version 3.75 is the revision available at the time this manual was prepared. Your display may differ.

7. Select item 3. At the prompt, enter the board's new IP address based on the configuration you are using:

   If the board is connected to the local host system through a crossover cable: Use your host system's IP address, incremented by one, in the final position. For example, if the host system's IP address is "169.225.150.10", enter "169.225.150.11".

   If the board is connected to a fixed address network: Use the IP address assigned by your system administrator.

   Press <ENTER>.

8. Select option 8 to disable DHCP and IP Gleaning. This menu will configure the board to use the manually assigned IP address.

9. Select option 0 to save changes and quit. The LCD should change to:
   TCPStack v3.75
   ?.?.?.?
   where "**?.?.?.?**" is the IP address you just assigned to the board.

10. Close the terminal session. For your convenience, you may save the terminal session when prompted. You are now ready to communicate with the board.

2.6   ESTABLISHING COMMUNICATIONS

Your PICDEM.net 2 Development Board has already been programmed with the Demo Application using the Microchip TCP/IP Stack. The on-board external data EEPROM is also preprogrammed with the demo web site. Once it is hooked up, it is ready to go – no further software programming is required. At this point, all that remains is to "log on".

If you are trying to contact the demo web site across the network, you can do it the same way you would browse for any site with a hard IP address: enter `http://x.x.x.x` in the browser's address bar, where "`x.x.x.x`" is the IP address of the board (check the board's LCD display for the address).

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If the Development Board is connected to a local host system using a crossover cable, it will be necessary to make some minor changes to your browser's configuration.

> **Note:** These instructions are written specifically for use with Microsoft Internet Explorer. If you are using Netscape Navigator or another web browser, the procedure you use will vary. Please consult the documentation for your browser for additional information.

1. Access the browser's configuration settings in one of two ways:
   a) From the Start menu, select _Settings>Control Panel_, then click on the Internet Options applet; or
   b) Launch the browser, then select _Tools>Internet Options_ from the menu.
2. Select the **Connections** tab, then click on the **LAN Settings** button.
3. Verify that the "Use a Proxy Server" box is deselected.
4. Click **OK**, then **OK** to close the "Internet Properties" dialog box.
5. Launch the web browser (if not running already).

> **Note:** For users of later versions of Internet Explorer, a message that "No connection to the Internet is currently available...." may appear. There will be a choice of two buttons, "Work Offline" or "Try Again"; _always_ choose "Try Again". If you choose "Work Offline", you will not be able to establish an external connection and will need to close and restart the browser.

6. At the address bar, enter `http://x.x.x.x,` where "`x.x.x.x`" is the IP address of the Development Board. Press <Enter>.
7. After a moment, the Microchip TCP/IP Stack page appears:

FIGURE 2-5: MICROCHIP TCP/IP STACK PAGE
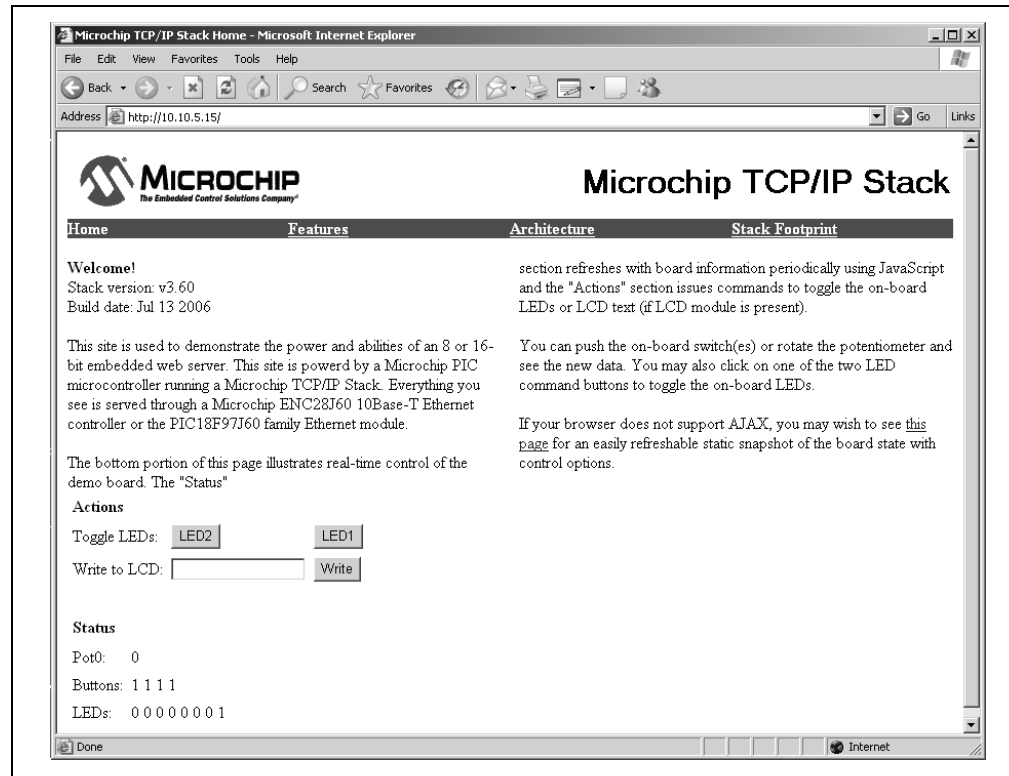
You are now ready to experiment with the PICDEM.net 2 Development Board.

Chapter 3. Using the Microchip TCP/IP Stack Demo Application

3.1   HIGHLIGHTS

This chapter will cover the following topics:

- Overview
- The Source Code
- Experimenting With Demo Application Firmware
- Experimenting with the Demo Web Site

3.2   OVERVIEW

The PICDEM.net 2 Development Board's preprogrammed firmware (referred to throughout this manual as the "Demo Application") makes it functional directly out of the box. Some of the main features are:

- Based on the free Microchip TCP/IP Stack
- Portable across Microchip microcontrollers
- Includes HTTP Server, FTP Server, DHCP Client, IP Gleaning
- User-configurable over RS-232 serial connection
- Web site updatable over RS-232 or Ethernet

This on-board firmware utilizes the free Microchip TCP/IP Stack. In addition to firmware programmed into the microcontroller, the Demo Application uses the on-board external serial data EEPROM to store configuration data and demo web site pages.

Your PICDEM.net 2 Development Board is factory-configured with the correct board serial number and demo web site image. All PICDEM.net 2 Development Boards are factory programmed to make use of DHCP module. As a result, you can simply connect the board to a DHCP-enabled network and start evaluating the hardware.

3.3   THE SOURCE CODE

The complete source code for the TCP/IP Stack Demo Application can be installed on any PC-compatible system by running the installer file, `MCHPTCPStack 3.75.exe` (or later version). By default, the Stack uses the ENC28J60 driver (`ENC28J60.c`), while the Demo Application uses the Ethernet driver for the PIC18F97J60 family, `ETH97J60.c`. Therefore, it is important to verify that `ETH97J60.c` is included in the application project, instead of `ENC28J60.c`. In addition, the precompiler constant, `PICDEMNET2`, must be defined. To define this constant, first open a workspace in the `\MCHPTCPStack 3.75` directory. Then, in MPLAB IDE, click *Project>Build Options...\Project*. Select the **MPLAB C18** tab, then under the Macro Definitions box, add "PICDEMNET2". Make sure to remove other board definitions, such as "HPC_EXPLORER" or "EXPLORER16", if they exist.

The Demo Application can be built and compiled in several different configurations. To do this, you will need MPLAB IDE to open and compile Demo Application projects. In addition, you will need a device programmer (such as Microchip PROMATE® 3 device programmer or MPLAB ICD 2) to program the microcontroller with the application code.

There are several MPLAB IDE project files designed to illustrate all of the different configurations in which the Demo Application can be compiled. These are listed in Table 3-1. For more information about the Demo Application, refer to Microchip Application Note *AN833, "The Microchip TCP/IP Stack"* (DS00833).

TABLE 3-1:   WORKSPACE FILES FOR THE DEMO APPLICATION

Project Name	Purpose
`C18EEPROM.mcw`[(1)]	Demo Application using external serial EEPROM as web site storage – Microchip C18 Compiler
`C18ProgramMem.mcw`	Demo Application using program memory as web site storage – Microchip C18 Compiler
`HTC18EEPROM.mcw`	Demo Application using external serial EEPROM as web site storage – HI-TECH PICC-18™ C compiler
`HTC18ProgramMem.mcw`	Demo Application using program memory as web site storage – HI-TECH PICC-18 C compiler

Note 1:   The PICDEM.net 2™ Development Board uses this workspace file.

3.4   EXPERIMENTING WITH DEMO APPLICATION FIRMWARE

You may modify supplied Demo Application code to your requirements. The core of the Demo Application is implemented by the file, `MainDemo.c`, which in turn calls the standard Microchip TCP/IP Stack files. The Stack modules are configured in the header file, `StackTask.h`. The selection of appropriate Microchip TCP/IP Stack modules is done as command-line macro definitions in the compiler settings tab of MPLAB IDE. To change the Demo Application, it is only necessary to modify `MainDemo.c`, unless you also want to modify the individual TCP/IP Stack modules.

A complete discussion of the Microchip TCP/IP Stack and the Demo Application is out of the scope of this user's guide. Users who are interested in the details of the Microchip Stack are encouraged to read Microchip Application Note *AN833 "The Microchip TCP/IP Stack"* (DS00833).

3.4.1   Changing the FTP Login Account

The default login values for the Demo Application are "ftp" for the FTP user name and "microchip" for the password. These text values are stored in the file, `MainDemo.c`, in the variables, `FTP_USER_NAME` and `FTP_USER_PASS`, respectively. You may modify one or both of these values as needed. You must rebuild the project and reprogram the device for the changes to take effect.

3.4.2   Changing the Default IP Configuration

In the versions that do not use the external EEPROM, the Demo Application uses hard-coded IP configuration values as the default. These may be modified as needed by changing the values of `MY_DEFAULT_???` in the header file, `StackTsk.h`. You must rebuild the project and reprogram the device for the changes to take effect.

3.5   EXPERIMENTING WITH THE DEMO WEB SITE

The PICDEM.net 2 Development Board web site is written in HTML. The complete source files are available in the `\MCHPTCPStack 3.75\WebPages` install directory. You must have working knowledge of HTML in order to correctly modify or create new web pages. You may design the page by hand (using a text editor) or use a web authoring tool.

The demo web site is organized as multiple files within a single directory. The Demo Application includes a special command-line utility program, `MPFS.exe`. The utility is written for 32-bit versions of Microsoft Windows operating systems (such as Windows 2000 and Windows XP) to convert a group of files into a Microchip File System (MPFS) image. Depending on where the MPFS will ultimately be stored, the utility gives you the option to generate either a data file in C, or a binary file representing the MPFS image.

The complete command line syntax for the utility is:

`mpfs [/?] [/c] [/b] [/r<Block>] <InputDir> <OutputFile>`

where:　　`/?` Displays command-line help

`/c` Generates a data file in C as output

`/b` Generates a binary data file as output (default)

`/r` Reserves a block of memory at the beginning of the file (valid only in Binary Output mode with a default value of 64 bytes)

`<InputDir>` The directory containing the files for creating the MPFS image

`<OutputFile>` The output file name

For example, the command:

`mpfs /c <Your Webpage Dir> mypages.c`

generates the MPFS image as a data file, `mypages.c`, from the content of the directory "Your Webpage Dir". In contrast, the command:

`mpfs <Your Webpage Dir> mypages.bin`

generates a binary file of the image with a 64-byte reserved block, while:

`mpfs /r128 <Your Webpage Dir> mypages.bin`

generates the same file with a 128-byte reserved block.

> **Note:**　The current version of the Microchip Stack at the time of this writing utilizes a 64-byte reserve block. Using a reserve block size other than the default size of 64 bytes requires a change to the compiler define, `MPFS_RESERVE_BLOCK`, in the header file, `StackTsk.h`. The default reserve block size may change in future revisions of the Stack.

If the MPFS image is to be stored in internal program memory, the generated C data file must be compiled with the application project. If the image is to be stored in an external serial data EEPROM, the binary file must be downloaded there.

Modifying the content of the static pages, or even adding additional static pages, only requires minor changes to the demo web site files, but it will be necessary to rebuild the MPFS image using the MPFS utility and download it into the external EEPROM. If you want to display additional real-time information, or support additional HTML forms, you must also modify the HTTP server callback functions in `MainDemo.c`. For more information on the callback function, refer to the Microchip Application Note *AN833, "The Microchip TCP/IP Stack"* (DS00833).

NOTES:

Chapter 4. Reconfiguring and Restoring the PICDEM.net 2 Development Board

4.1 HIGHLIGHTS

This chapter covers the following:

• Reconfiguring the PICDEM.net 2 Development Board Hardware
• Reconfiguring The PICDEM.net 2 Development Board Firmware
• Reprogramming and Restoring the Application Firmware

4.2 RECONFIGURING THE PICDEM.net 2 DEVELOPMENT BOARD HARDWARE

The PICDEM.net 2 Development Board is provided with a range of hardware features for manual interaction, as well as a choice of two Ethernet interfaces. In its original state, the main port (J1) is active and all interactive options are enabled. To allow the greatest amount of hardware flexibility in developing new applications, users can change any or all of these configuration options to suit the needs of their application.

4.2.1 Configuring the Hardware Options

The Development Board can be configured to enable or disable its various hardware features. A total of 23 jumper locations are provided in various places around the board. As shipped from the factory, all of the locations are bridged by circuit traces, and all of the features are enabled (with the exception of JP9, discussed below). To change this, the user will need to cut the traces, and install pins and block jumpers. Afterwards, the features can be enabled or disabled easily by installing or removing the jumpers.

In some instances, a single function (such as the USART) is connected to the rest of the board through more than one jumper. This allows selective tailoring of the controller's I/O ports to any application that the user may develop. Specific cases are discussed in the following sections.

The functions of the jumpers are listed in Table 4-1; their locations are shown in Figure 4-1.

TABLE 4-1:   JUMPER DESCRIPTIONS

Number	Board ID(s)	Type	Description
1	JP1	Bridge	U1 (temperature sensor) to RA3
2	JP2	Bridge	J2 Power (ENC28J60 Ethernet jack)
3	JP3	Bridge	J1 Power (PIC18F97J60 Ethernet jack)
4	JP4	Bridge	LED Bank (D1 through D8)
5	JP5	2-way	Select ENC28J60 Reset Control (RD2) or Device Disable
6	JP6	Bridge	J1 Ethernet Activity LED Enable (LEDA)
7	JP7	Bridge	RA0/LEDA to PICtail™ Daughter Board Header
8	JP8	Bridge	J1 Ethernet Link LED Enable (LEDB)
9	JP9	Bridge	ENC28J60 $\overline{INT}$ to RB0 (**normally open**)
10	JP10	Bridge	RA1/LEDB to PICtail Daughter Board Header (LEDB)
11	JP11	Bridge	ENC28J60 Power
12	JP12	Bridge	U4 (EEPROM) SPI Chip Select to RD7
13	JP13	Bridge	USART Transmit (microcontroller perspective)
14	JP14	Bridge	USART Receive (microcontroller perspective)
15	JP15	Bridge	PIC18F97J60 Power
16	JP16	Bridge	R38 (potentiometer) to RA2
17	JP17, JP22	Bridge	Y3 (Timer1 oscillator)
18	JP18	Bridge	S2 (RB0 user-defined push button)
19	JP19	Bridge	S3 (RB1 user-defined push button)
20	JP20	Bridge	S4 (RB2 user-defined push button)
21	JP21	Bridge	S5 (RB3 user-defined push button)
22	JP23	Bridge	ENC28J60 SPI Chip Select to RD3

FIGURE 4-1:   JUMPER LOCATIONS ON THE DEVELOPMENT BOARD
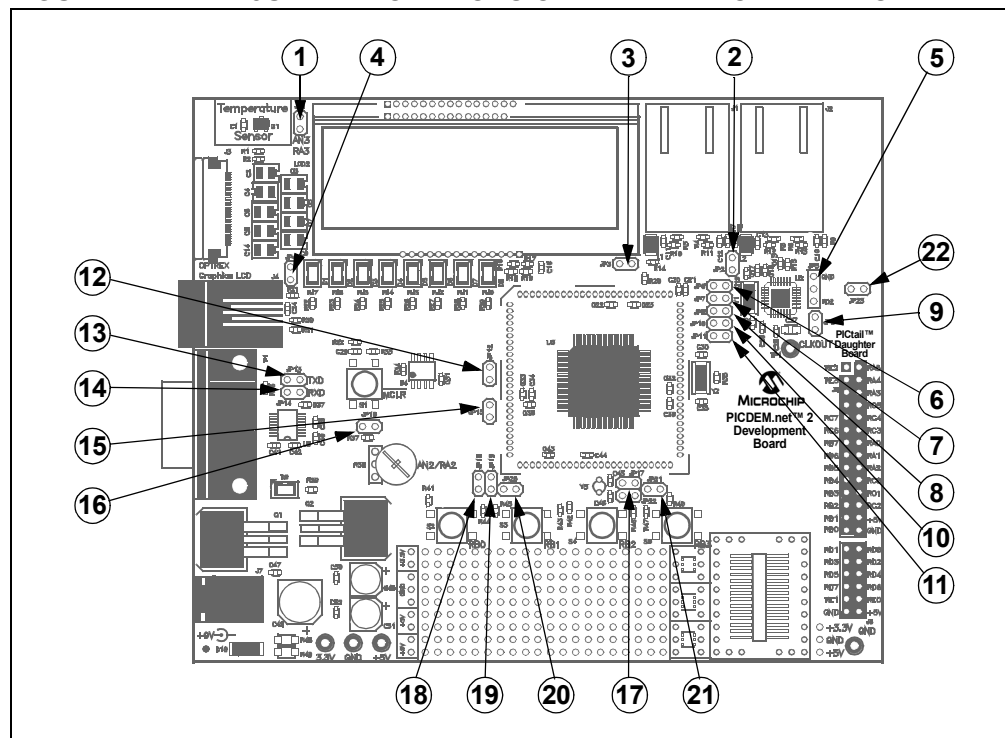
4.2.1.1 USER-DEFINED CONTROLS AND THE LED BANK

The potentiometer and the user-defined push buttons are each connected to the PIC18F97J60 through their own individual jumpers. They may be selectively disabled to allow individual ports to become available for general I/O purposes.

The LED bank (D1 through D8) is enabled as a group with one jumper (JP4).

4.2.1.2 TIMER1 OSCILLATOR (Y3)

By default, ports RC0 and RC1 are configured for use by the Timer1 oscillator. An appropriate oscillator circuit, including Y3, C45 and C46, is connected across these pins. Removing jumpers, JP17 and/or JP22, disconnects the circuit and makes one or both pins available as I/O ports.

4.2.1.3 ETHERNET LEDs

As shipped, the PICDEM.net 2 Development Board uses pins RA0 and RA1 of the microcontroller to drive the Ethernet LEDs in J1, generically known as LEDA (the Activity LED) and LEDB (the Link LED). These signals are also present on RA0 and RA1 of the PICtail Daughter Board header. Jumpers, JP6, JP7, JP8 and JP10, are used to connect or disconnect the microcontroller from either the LEDs or the header, or from both. This is useful in situations when RA0 and RA1 are being used as general I/O pins and are not needed for network indication.

4.2.1.4 ENC28J60 OPERATION

The Reset state of the ENC28J60 controller is determined by jumper JP5. There are three possible configurations:

- RD4 (1-2 bridged): The $\overline{RESET}$ pin is tied to RD4 of the PIC18F97J60. This allows the microcontroller to execute hardware Resets of the ENC28J60 and use it as an external Ethernet transceiver.
- Disabled (2-3 bridged): The $\overline{RESET}$ pin is tied to ground, holding the ENC28J60 in permanent Reset and effectively disabling it.
- Open (no jumper): The $\overline{RESET}$ pin is disconnected, preventing hardware Resets but still allowing software device Resets from the SPI bus. This setting also allows the PIC18F97J60 to use the ENC28J60 as an Ethernet transceiver.

By default, JP5 is configured as "Open" (no jumper).

4.2.2 Using the ENC28J60 as the Ethernet Interface

As shipped, the Development Board uses the Ethernet interface module on the PIC18F97J60 controller for network connectivity. In this state, J1 is the only active Ethernet port; J2 is not functional.

It is possible to configure the board to bypass the microcontroller's on-chip Ethernet module and use the ENC28J60 interface for connectivity. All of the necessary circuit connections on the board have already been made. The main factor preventing the ENC28J60 from being used is that the preprogrammed Microchip TCP/IP Demo Application has been designed to use the microcontroller's on-chip Ethernet module.

To use the ENC28J60, it is necessary to program the PIC18F97J60 with a new Demo Application that uses `ENC28J60.c`, the required driver for controlling the ENC28J60, instead of `ETH97J60.c`. As with other projects using the PIC18F97J60, it is also important that the precompiler constant, `PICDEMNET2`, is defined. Once the PIC18F97J60 is programmed with the new firmware, J1 will become inactive and J2 will be the functional Ethernet port.

4.3   RECONFIGURING THE PICDEM.net 2 DEVELOPMENT BOARD FIRMWARE

To be ready for use out of the box, the PICDEM.net 2 Development Board is shipped with preloaded firmware. The firmware has three different components:

• The demo web site page, written in HTML and stored in the external EEPROM.
• The IP configuration, written in binary and also stored in the external EEPROM.
• The PICDEM.net 2 Development Board operating firmware (including the Microchip TCP/IP Stack and the Demo Application), stored in the program memory of the microcontroller.

Once in Configuration mode, you can choose to download a new/modified web site or change network configuration without affecting the operating firmware.

4.3.1   Entering Configuration Mode

In order to change the web site or the network settings, it is necessary to first put the board into Configuration mode. To do this:

1. Connect the board to the local host system if this is not already done (see **Section 2.4.2 "Connecting Directly to a Host System"**, page 15).
2. Connect to the board through the serial port via the terminal emulator (**Section 2.5.2 "Configuring the PICDEM.net 2 Development Board IP Address"**, page 18).
3. Press and hold the user push button (RB3).
4. While holding RB3, press and release the Reset push button.
5. The terminal responds with the Configuration mode menu (Figure 4-2).
6. Release RB3.

FIGURE 4-2:   THE SERIAL CONFIGURATION SCREEN
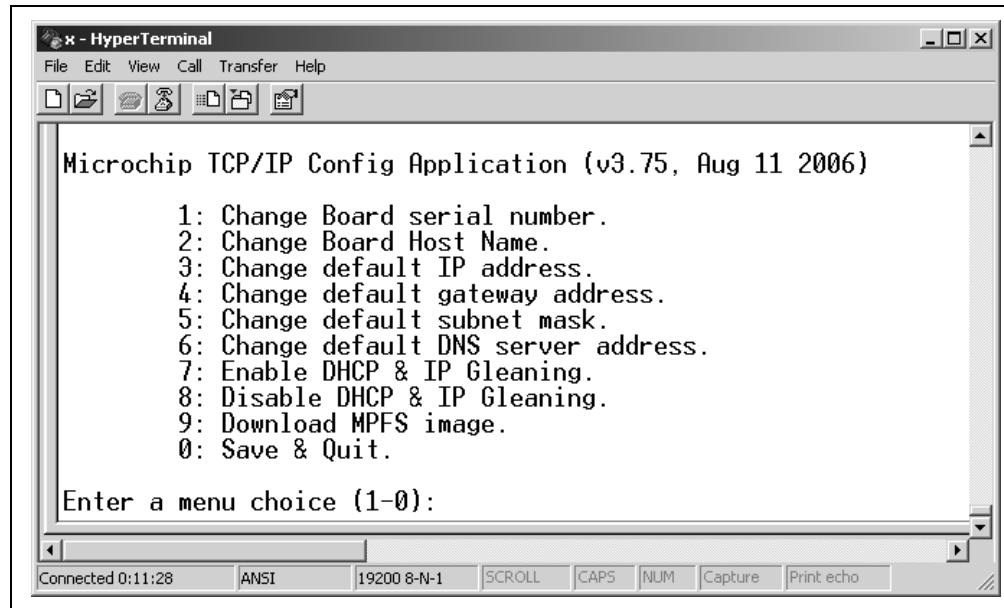
4.3.2   Changing the Network Configuration

At this point, the PICDEM.net 2 Development Board's network configuration can be changed.

To change the Development Board's serial number:

1. Enter '1'.
2. At the "Serial Number (x):" prompt, enter the serial number from the Ethernet ID sticker on the board or a new Ethernet ID number. The current value of the serial number will be displayed in the prompt string.
3. Press <ENTER> to submit the changes. Alternatively, simply press <ENTER> to leave the serial number unchanged.

    If the input consists of a non-numerical string, a value of zero will be used.

To change the default IP address:

1. Select item 3.
2. At the "Default IP Address (x.x.x.x):" prompt, enter a new IP address in dotted decimal notation. The current value of the default IP address will be displayed in the prompt string. Alternatively, simply press <ENTER> to leave the IP address unchanged.

    If the input does not conform to the standard IP address format, it will be ignored; no error message will be given.

> **Note:** The factory default address is 169.254.254.254.

To change the default gateway address:

1. Select item 4.
2. At the "Default Gateway Address (x.x.x.x):" prompt, enter the new gateway address in dotted decimal notation. The current value of the default gateway address will be displayed in the prompt string.

    Alternatively, press <ENTER> to leave the IP address unchanged. If the input does not conform to the standard IP address format, it will be ignored.

To change the default subnet mask:

1. Select item 5.
2. At the "Default Subnet Mask (x.x.x.x):" prompt, enter a new subnet mask value in dotted decimal notation. The current value of the subnet mask will be displayed in the prompt string.

    Alternatively, press <ENTER> to leave the subnet mask value unchanged. If the input does not conform to the standard IP address format, it will be ignored.

To change DHCP and IP Gleaning modes:

Enter 7 to enable or enter 8 to disable.

To finish configuration:

Enter 0. The new network configuration is now programmed into the controller's EEPROM.

NOTES ON IP ADDRESS CONFIGURATION:

- If more than one PICDEM.net 2 Development Board is being evaluated, give each board a different IP address – even if one is connected at a time. The system may become confused with different Ethernet IDs being linked to a single IP address.
- Rapid changes in Ethernet IDs and/or IP addresses, especially when more than one Development Board is being evaluated, may cause a situation where the boards no longer respond to the test system. This is due to ARP caching by the host system, where it temporarily retains a stale mapping of MACs and IP addresses.

4.3.3   Loading (or Reloading) the Web Page

Before loading the web page, the HTML file(s) must be translated into the appropriate binary format using the Microchip File System (MPFS) software utility. The software utility is included in the \MCHPTCPStack 3.75 install directory.

In general, creating a new web page involves the following:

1. Create or modify existing web pages. You can add as many new files as you want, provided that the total size does not exceed the external data EEPROMs capacity of 32 Kbytes. There is no restriction on the size of any of the files, as long as they fit in the available EEPROM space. You may handwrite your pages or use professional web authoring tools.
2. Place the files into a single directory.
3. Use the MPFS utility to create an MPFS image of your web site. Refer to **Section 3.5 "Experimenting with the Demo Web Site"** for details on using MPFS.
4. Verify that the size of the finished file is within the capacity of the EEPROM (32 Kbytes). The MPFS utility will display the actual size of the image.

If you are reloading the original demo web site, the file image is available at \MCHPTCPStack 3.75\MPFSIMG.bin.

> **Note:**   Your terminal emulation software must support the standard XMODEM protocol. Variants, such as XMODEM-1K or any of the CRC variants, will not work. HyperTerminal supports both XMODEM and XMODEM-1K.

The web site image can be loaded in one of two ways: Serial Configuration mode (RS-232) from a local host system, or File Transfer Protocol (FTP) over the network.

To Load a Web Site Using Serial Configuration:

1. Connect the board to the host system and enter Configuration mode (page 28).
2. Select item 9 from the Serial Configuration menu to download the MPFS image. The board returns the prompt "Ready to download MPFS image - Use Xmodem protocol".
3. Select *Transfer>Send File* from the main menu for HyperTerminal (the "Send File" command for other terminal emulators). Specify the location of the file and select "XMODEM" for the transfer protocol.
4. After the transfer has finished, the Configuration menu is displayed. Select item 0 to exit Configuration mode.

To Load a Web Site Using FTP:

1. Check that the board is powered up and connected. The order of connections is not important, as long as the proper network connection for the configuration (crossover cable to host system, straight cable to network) has been made.
2. Open a Command window.
3. At the command prompt, type the command, ftp x.x.x.x., where "x.x.x.x" is the IP address of the PICDEM.net 2 Development Board. Press <ENTER>.
4. When prompted, enter the FTP user name and password (the defaults values are "ftp" and "microchip", respectively).
5. After successfully logging in, type the command, put xxxxx.bin, where "xxxxx.bin" is the name of the MPFS binary image file. Press <ENTER>.
6. After notification that the transfer is complete, type "quit" to log off.

A typical exchange between a user and the board is shown in Figure 4-3. FTP client actions (i.e., manual input from the user) are shown in **bold**. System prompts and FTP server responses are shown in plain font face.

FIGURE 4-3: **EXAMPLE OF AN FTP SESSION WITH THE PICDEM.net 2 DEVELOPMENT BOARD**

```
c:\ftp 169.254.254.254
220 ready
User (169.254.254.254: (none)): ftp
331 Password required
Password: microchip
230 Logged in
ftp> put mpfsimg.bin
200 ok
150 Transferring data...
226 Transfer complete
ftp> 16212 bytes transferred in...
ftp> quit
221 Bye
```

> **Note 1:** The FTP server does NOT echo back the password as the user types it in. In the instance above, it is shown to illustrate what the user would enter.
>
> **2:** See **Section 3.4.1 "Changing the FTP Login Account"** for instructions on changing the FTP account login from the default values shown.
>
> **3:** This example assumes that the MPFS binary image is located in the root of `c:\`. If the file is located elsewhere, be sure to include the full path.

4.4 REPROGRAMMING AND RESTORING THE APPLICATION FIRMWARE

After investigating the PICDEM.net 2 Development Board and the Demo Application, you may be ready to modify the application, or perhaps design your own. To do this, it will be necessary to clear the existing firmware in the Flash program memory of the PIC18F97J60 microcontroller.

The Development Board does not include the tools for clearing and reprogramming the microcontroller. You must use an appropriate device programmer or a development tool, such as the MPLAB IDE, which provides a complete set of tools for programming and debugging. To ensure proper programming support of the PIC18F97J60, it is necessary to use MPLAB IDE, version 7.30, at a minimum.

If you have the appropriate development tools (device programmer, development environment, etc.), you already have everything you need to begin immediately.

To restore the Demo Application, use the hex file, `C18EEPROM PICDEMNET2 PIC18F97J60.hex` (located in the `\MCHPTCPStack 3.75` install directory), to program the microcontroller. Follow the standard procedure for your device programmer when programming the microcontroller. Make sure that the following configuration options are set:

- Oscillator: OSC1/OSC2 as Primary, HS+PLL Oscillator
- Watchdog Timer: Disabled

After programming the controller, reconnect the board to the network or local host system and verify that the Demo Application is working correctly.

NOTES:

Chapter 5. Troubleshooting

5.1 HIGHLIGHTS

This chapter will cover the following operational issues and how to resolve them:

• Common Issues

5.2 COMMON ISSUES

1. **User LED D8 does not light or flash when power is applied to the board.**

   Check the PICDEM.net 2 Development Board for power:

   • Verify that the power supply is plugged in and the wall outlet has power.
   • Check that voltage is available (9 V$_{DC}$) at the barrel plug.
   • Check that the regulated voltages (3.3 V$_{DC}$ and 5 V$_{DC}$) are available at the connectors at the prototype area of the board.

   Make sure that the microcontroller is programmed correctly. This includes verifying that the device configuration specified by the Flash Configuration Words is appropriate for the application.

   If a programming device is connected via the ICSP™ interface (J4), verify that the programmer is not holding the device in Reset.

2. **The Link LED on the active Ethernet ICM is not lit, or only lights intermittently.**

   Check the board for power (see Issue 1, above).

   Make sure that the microcontroller is programmed correctly.

   Verify that the Ethernet cable is connected to the proper ICM for the firmware being used.

   Verify the connection between the board and the network or local host.

   Verify that the correct Ethernet cable is being used:

   • When the Development Board is directly connected to the host system, a crossover cable must be used.
   • When the Development Board is connected to the host system through a network device (such as a hub or switch), a "straight-through" cable must be used.

   > **Note:** If you suspect that one of the Ethernet cables supplied with the kit is damaged, be certain to replace it with the same type of cable (either straight-through or crossover). An Ethernet straight-through cable may not work if the Development Board is directly connected to a host system.

3. **The LCD doesn't display a message when power is applied to the PICDEM.net 2 Development Board.**

   Check the board for power (see Issue 1, above).

   If the board functions normally otherwise (including connectivity to the host system), the LCD display itself may be faulty. Contact Customer Service for additional assistance.

4. **The PICDEM.net 2 Development Board will not communicate with the host system.**

   Verify that the correct Ethernet cable is being used (see Item 2, above).

   Verify that the Ethernet cable is connected and undamaged.

   Verify that the IP address as displayed on the LCD is used to communicate.

   If the board fails when connected through a network device, verify that the device is working properly. If it is, try connecting the host system directly to the Ethernet board, as described in **Chapter 2. "Getting Started with the PICDEM.net 2 Development Board"**. Also, check that the proper cable is being used (see above).

   Check TCP/IP connectivity with the `ping` command:

   1. Launch a DOS (or Command Prompt) window.
   2. Type `ping x.x.x.x`, where "`x.x.x.x`" is that of the Development Board.

   If `ping` returns the message "Request timed out", check the Activity LED on the active Ethernet ICM:

   - If the LED blinks during attempted communications, the IP addressing may be wrong (i.e., the board and the host are not in the same subnet).
   - If the LED does NOT blink, the Ethernet cable is defective, or the wrong type, or the host system has not been properly configured for TCP/IP.

   Verify the operation of the Ethernet card. In Microsoft Windows operating systems, this is done through the System or Network applet in the Control Panel (the exact applet and method of getting there varies from version to version). Other operating systems may use different methods. Consult the documentation for your operating system to get detailed information:

   Check the Development Board for power (see Issue 1, above).

   If all else fails, reconfigure the Development Board's network settings using the default Ethernet ID and IP address. See **Section 4.3 "Reconfiguring The PICDEM.net 2 Development Board Firmware"** for more information.

5. **The host system communicates with the board, but the demo web site is not present or does not function correctly.**

   If the external serial data EEPROM is blank or absent, any attempt to access the demo web site will result in the message "File Not Found". If this message appears, reload the web site to the EEPROM (see **Section 4.3.3 "Loading (or Reloading) the Web Page"** for more information).

   If the web page display is "broken" (disjointed display, error messages displayed), use your browser's "Reload" command to refresh the page. If the page is still broken, reload the EEPROM (see **Section 4.3.3 "Loading (or Reloading) the Web Page"**).

6. **The board will not communicate with the host system after changing the IP address and/or Ethernet ID.**

   Check the Development Board and host system as in Issue 4, above.

   Verify that the host system is set up correctly.

   Clear the host system's ARP cache. For Windows operating systems, open a Command window, type `arp -d` * and hit <ENTER>.

   If these steps don't work, restore the Development Board's default network configuration to see if communications can be re-established.
   See **Section 4.3 "Reconfiguring The PICDEM.net 2 Development Board Firmware"** for more information.

7. **Unable to initiate a serial connection with the PICDEM.net 2 Development Board.**

Carefully review the instructions for the terminal emulation software you are using. Make certain that the software is correctly installed, and that you are able to successfully configure a session.

Verify that you are using the correct serial port. Check that the COM port you have selected in the terminal software is actually the physical port that the serial cable is connected to.

Verify that the serial cable is properly connected at the host system and the Development Board, and that the cable is undamaged.

8. **Occasionally the demo web site displays "Service Unavailable".**

When the Development Board is updating the web site image via an FTP transfer, all attempted access to the web site will result in the "Service Unavailable" message. Refresh the page after the FTP transfer is finished.

NOTES:

Appendix A. PICDEM.net 2 Development Board Schematics, Rev. 4

FIGURE A-1: PICDEM.net 2 DEVELOPMENT BOARD SCHEMATIC, SHEET 1 OF 5
(PIC18F97J60 MICROCONTROLLER)
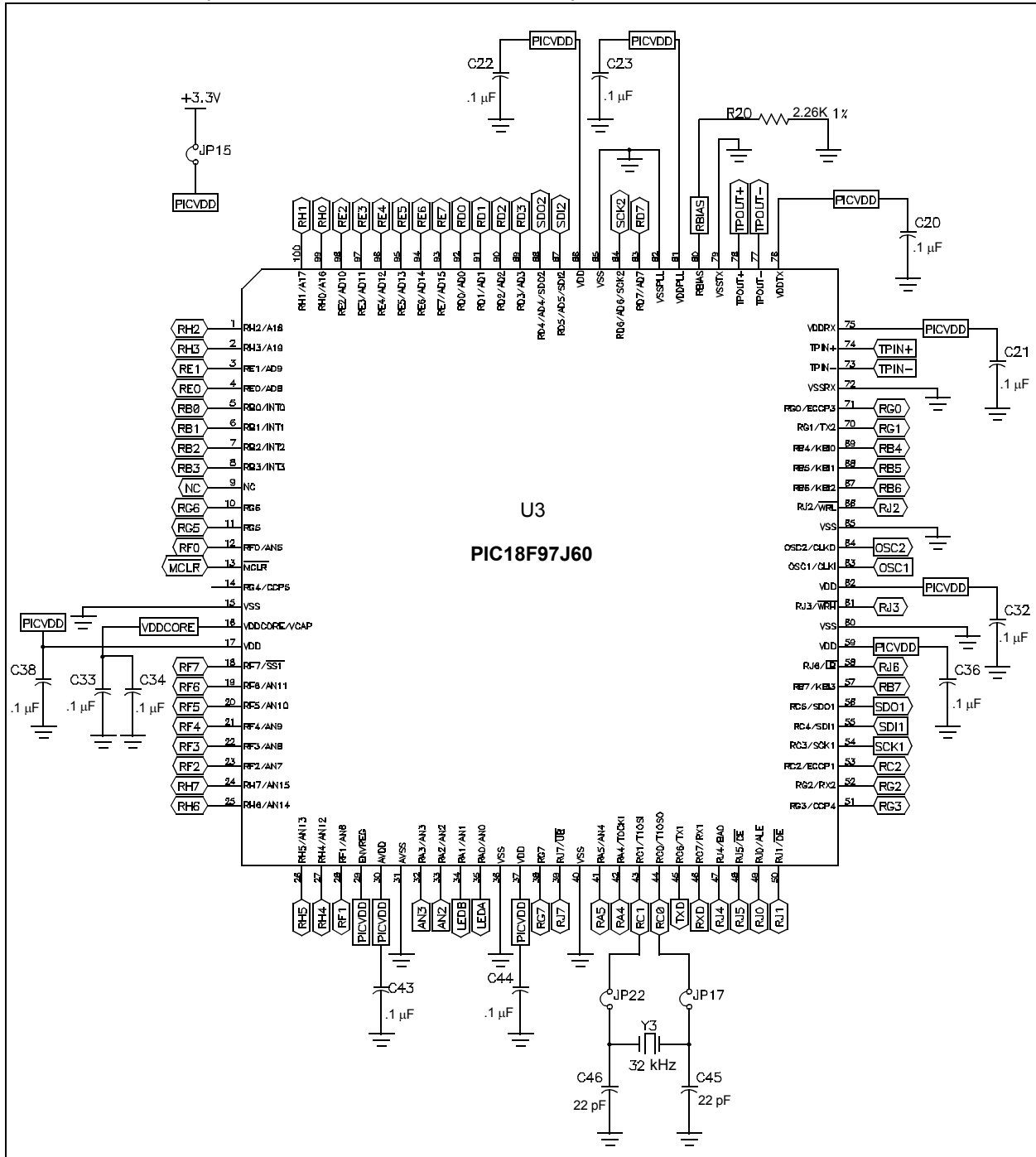
FIGURE A-2: **PICDEM.net 2 DEVELOPMENT BOARD SCHEMATIC, SHEET 2 OF 5 (PIC18F97J60 MICROCONTROLLER, ASSOCIATED COMPONENTS)**
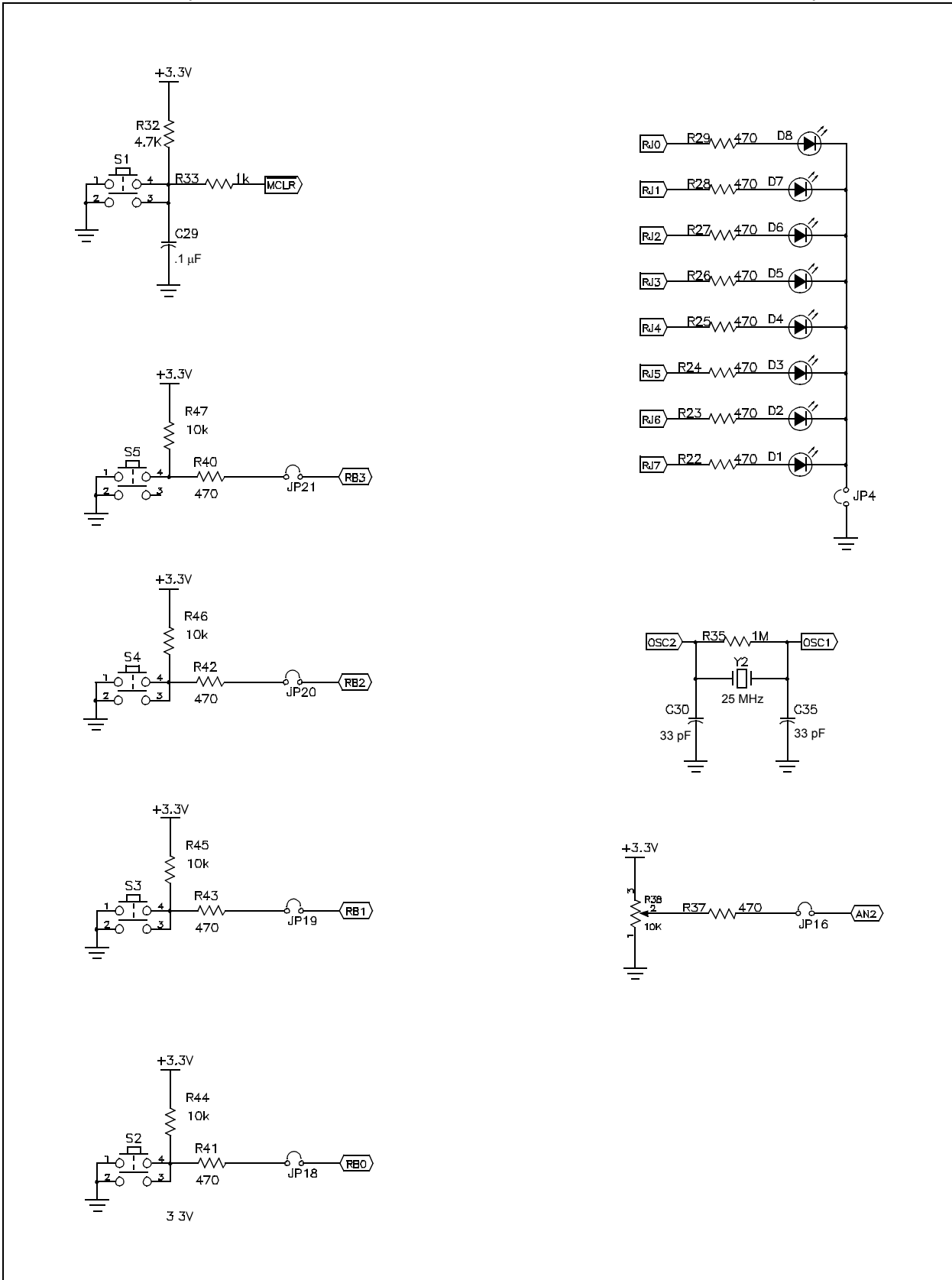
FIGURE A-3: **PICDEM.net 2 DEVELOPMENT BOARD SCHEMATIC, SHEET 3 OF 5 (ENC28J60 INTERFACE AND ETHERNET MAGNETICS)**
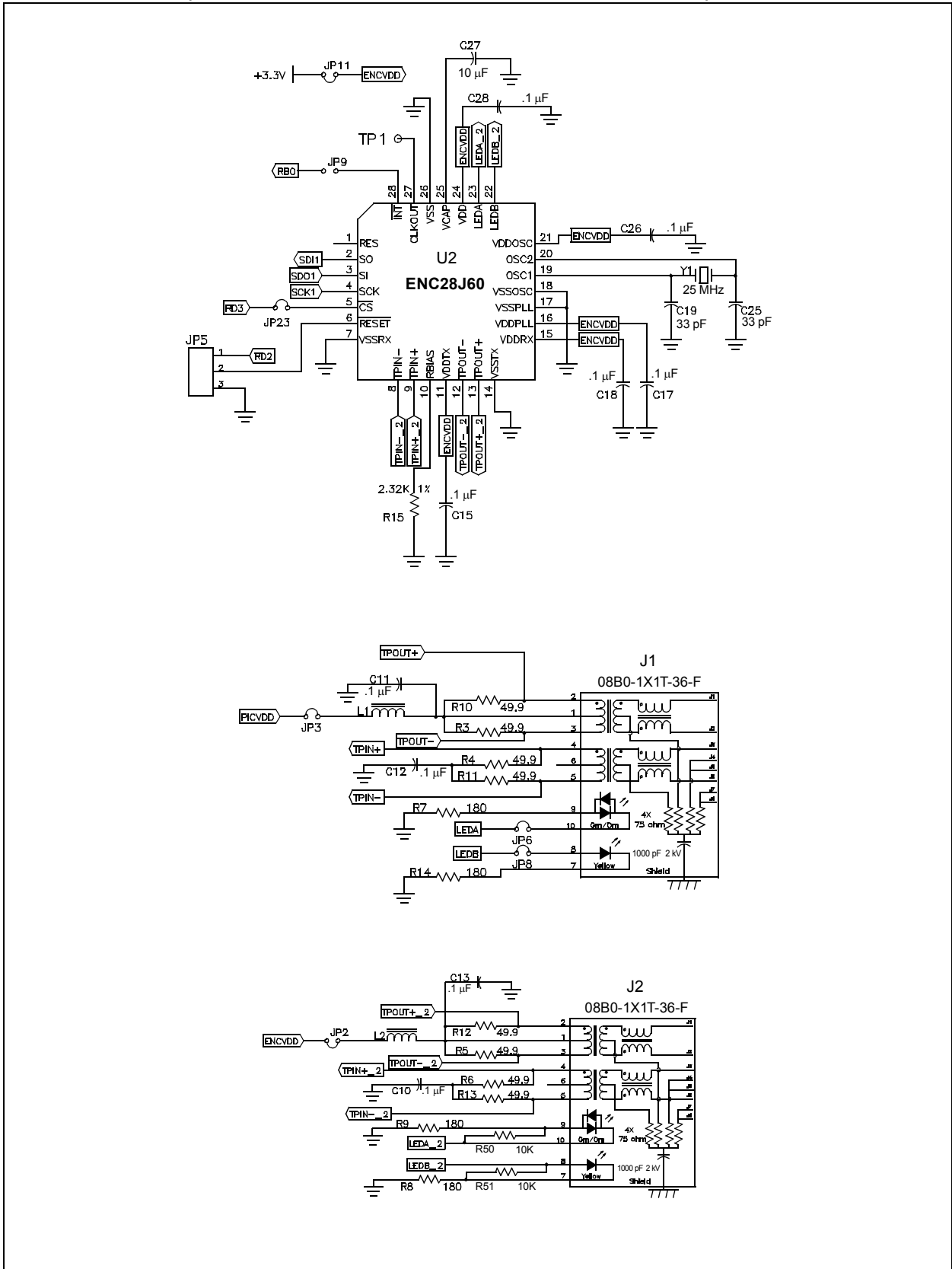
FIGURE A-4: PICDEM.net 2 DEVELOPMENT BOARD SCHEMATIC, SHEET 4 OF 5 (RS-232, EEPROM, TEMPERATURE SENSOR, LCD OPTIONS AND POWER SUPPLY)
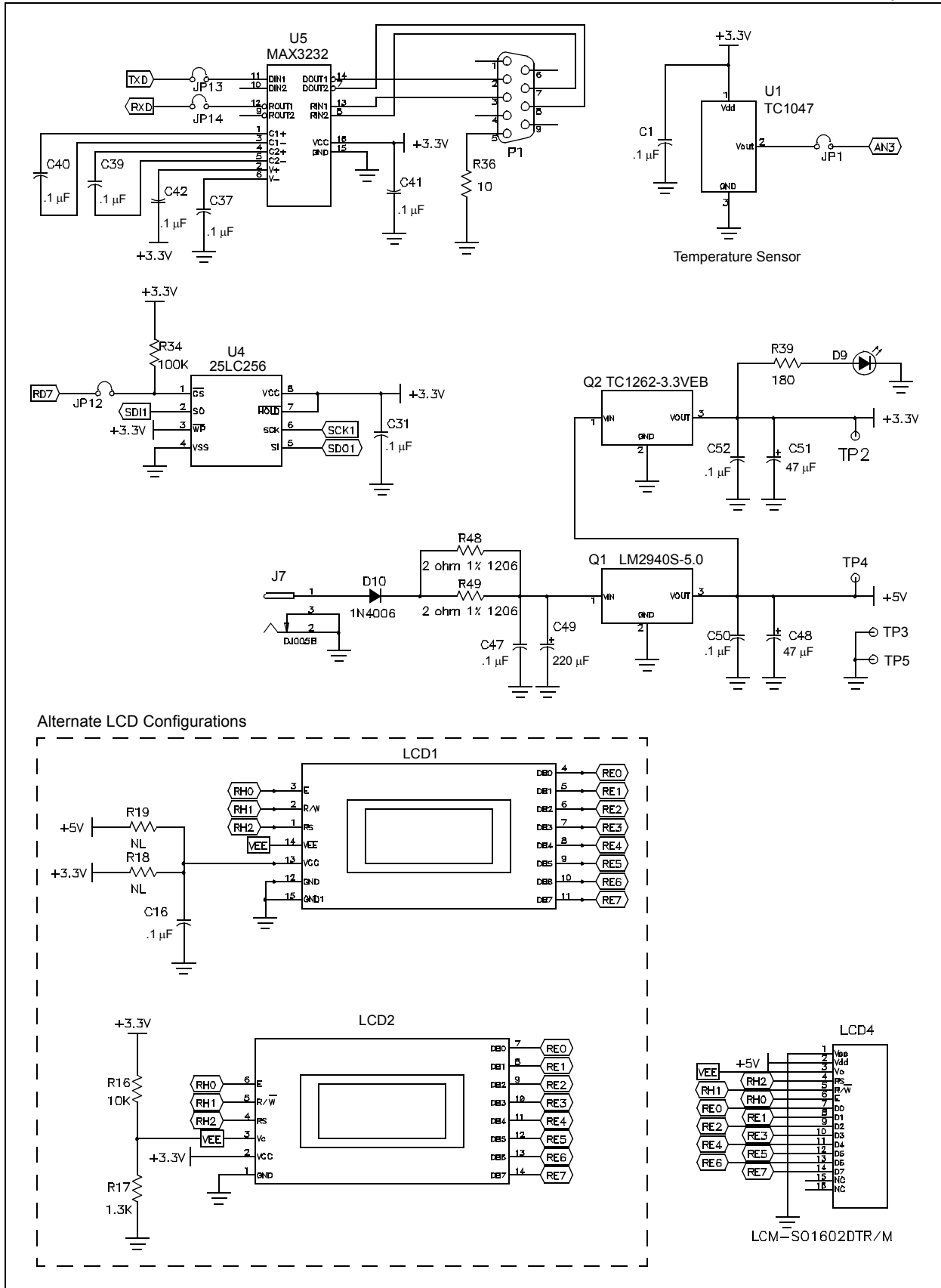
FIGURE A-5: **PICDEM.net 2 DEVELOPMENT BOARD SCHEMATIC, SHEET 5 OF 5 (ICD, ICSP™, LCD DISPLAY, MICROCONTROLLER HEADER AND PICtail™ DAUGHTER BOARD CONNECTORS)**

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PICDEM.net™ 2 Development Board User's Guide

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