



MICROCHIP

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

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PICDEM.net™ 2 DEVELOPMENT BOARD USER'S GUIDE

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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 “DSXXXXA”, where “XXXX” 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
- 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. “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 4. “Troubleshooting”** – Provides information on solving common problems.
- **Appendix A. “PICDEM.net 2 Development Board Schematics, Rev. 6”** – Provides schematic diagrams of the Development Board.

PICDEM.net™ 2 Development Board User's Guide

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 <i>only</i> 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	<u>File</u> > <i>Save</i>
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	<i>file.o</i> , where <i>file</i> can be any valid filename
Square brackets []	Optional arguments	mcc18 [options] <i>file</i> [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 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

Microchip TCP/IP Stack Help

This document provides information for getting started with the Microchip TCP/IP Stack. It also serves as a programmer's manual and reference documentation for the many features and functions of the stack. It is referred to throughout this manual as a primary reference. The Help file is included with the TCP/IP Stack installation (available at www.microchip.com/tcpip).

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

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”**.

Revision C (April 2008)

- Revised to refer to the Microchip TCP/IP Stack Help for software-specific documentation.

Revision D (April 2011)

- Revised schematic and text references for the latest hardware version (v6), which adds auto-polarity detection circuitry and an EMI filter. (Refer to the latest version of “*PIC18F97J60 Family Data Sheet*” (DS39762) for more information on these hardware additions.)
 - Deleted L1 1.5A, 60 Ohm Ferrite Bead
 - Added L1, L3 300 mA, 120 Ohm Ferrite Beads
 - Changed U3 to PIC18F97J60-I/PT (12x12x1 mm package)
 - Added C53, C54 56 pF Capacitors
 - Added U6, U7 Switches
 - Added R53, R54 100K Resistors
 - Change C19, C25, C30, C35 to 27 pF 5% Capacitors
 - Changed the incorrect value of C34. The correct value is 1 μ F.
- Removed references to the accompanying software CD (not available with the latest version of the Development Board) and replaced with references to the product-specific area of the Microchip corporate web site.

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PICDEM.net™ 2 DEVELOPMENT BOARD USER'S GUIDE

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
- Development Kit Firmware

1.3 THE DEVELOPMENT KIT: WHAT'S IN THE BOX

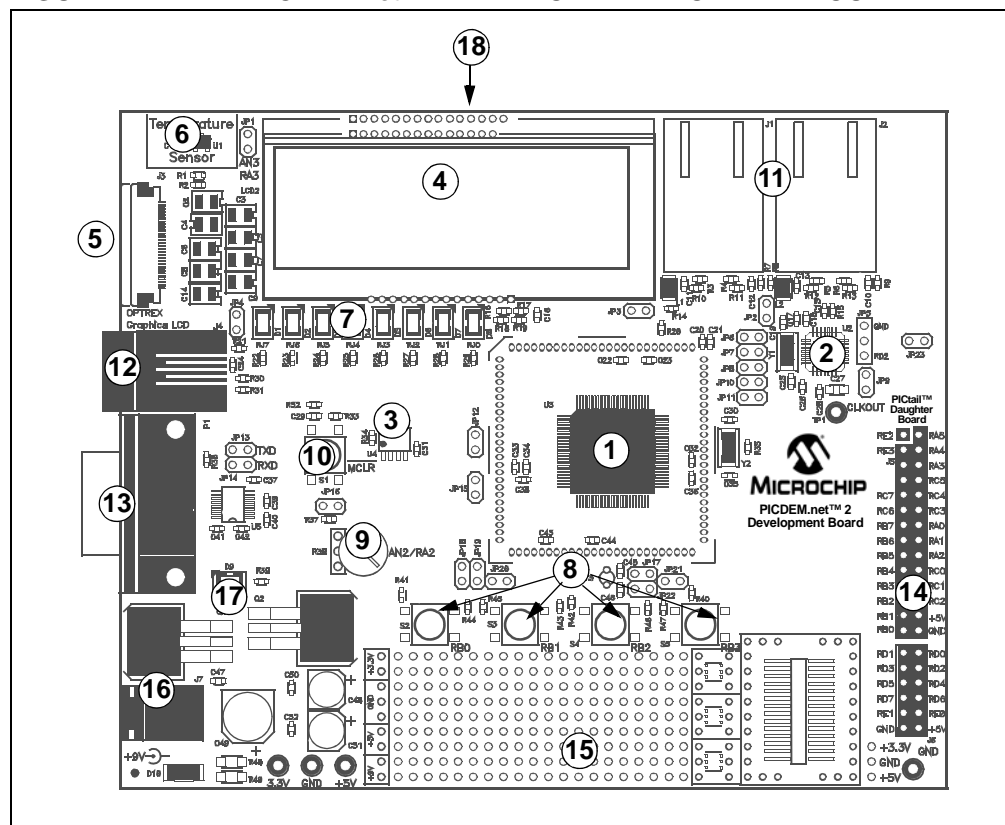
Your Development Kit contains the following items:

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. An "Important Information" card
5. "*Using the PICDEM.net™ 2 Development Board*" quick start guide
6. 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 41.67 MHz and has been preprogrammed with demonstration firmware from 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.

Introduction to the PICDEM.net 2 Development Board

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 a 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. 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, MPLAB ICD 3 or MPLAB REAL ICE™ in-circuit emulator 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 can be used for debugging or application development purposes, as needed.
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 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 (BACK 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. The board's full address is formed by appending the number on the sticker to the hex prefix "00:04:A3" (Microchip's MAC address prefix). For example, the sticker number, "12345", represents 003039h; the full MAC address for the board is thus "00:04:A3:00:30:39".

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 DEVELOPMENT KIT FIRMWARE

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 Microchip web site:

<http://www.microchip.com/tcpip>

This firmware installer includes:

- The complete source code for the free Microchip TCP/IP Stack Demo Application. 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 the Stack's Help file.
- Other example applications for use with PIC18F97J60 and ENC28J60 devices.
- Technical documentation for Microchip's TCP/IP Stack.

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 Test Network
- Connecting 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 TEST NETWORK

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
- 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 desktop system, known here as a *test network*. In this configuration, the Development Board acts as a DHCP server for your local desktop system.

Note: The DHCP server in the Microchip TCP/IP Stack can only provide a single address to a single remote node. If it detects another DHCP server on the network, it will automatically disable itself. This feature is enabled by default in the factory preprogrammed demo based off of the TCP/IP Stack version at the time of this writing (Version 5.31). Future Stack releases may change; please check the TCP/IP Stack Help file for up to date information.

To function in a test network, the local system must meet the following basic requirements:

- Any operating system capable of TCP/IP network communication
- Standard Ethernet card or integrated adapter, capable of supporting 10 Mbps operation, with a RJ45 connector
- Any Internet browser software

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 a test network connection to a PC through a crossover cable.

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 connecting the board directly to a PC in a test network configuration, follow the steps in **Section 2.4.2 “Connecting Directly to a Host System”**.

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 for other applications 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.

Getting Started with the PICDEM.net 2 Development Board

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):

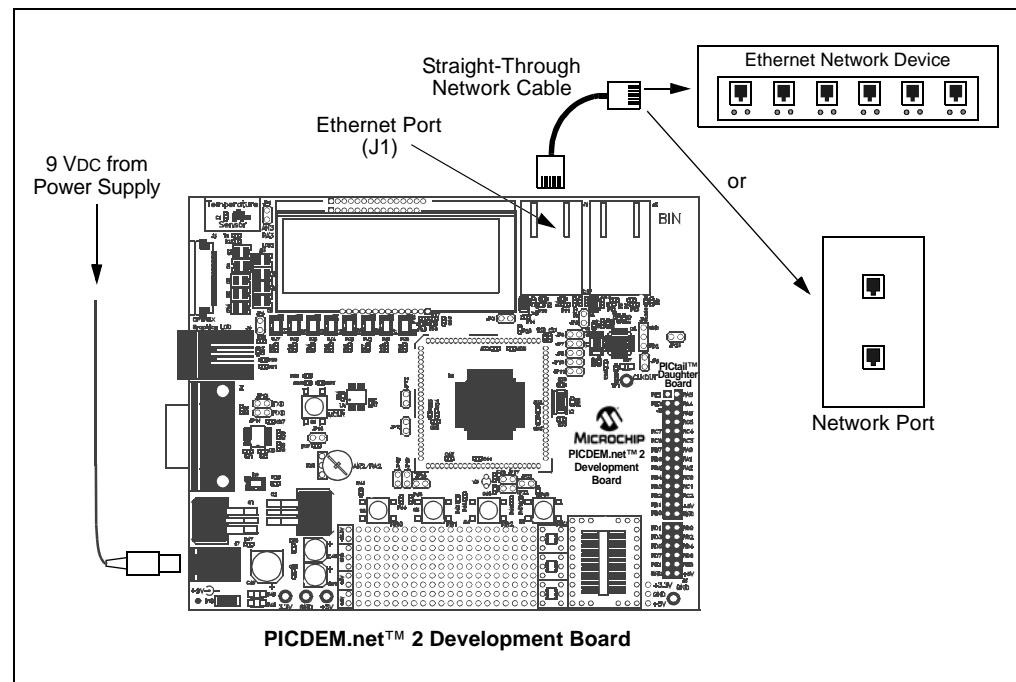
1. Unbox and unwrap the board, and set it on a non-conductive surface near the host computer.
2. Connect the straight-through Ethernet cable to the board at Ethernet connector, J1, then to the Ethernet network. This can be at a network port or an available port on a network device (such as a hub, switch 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 either Microchip part number AC002014 or 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):

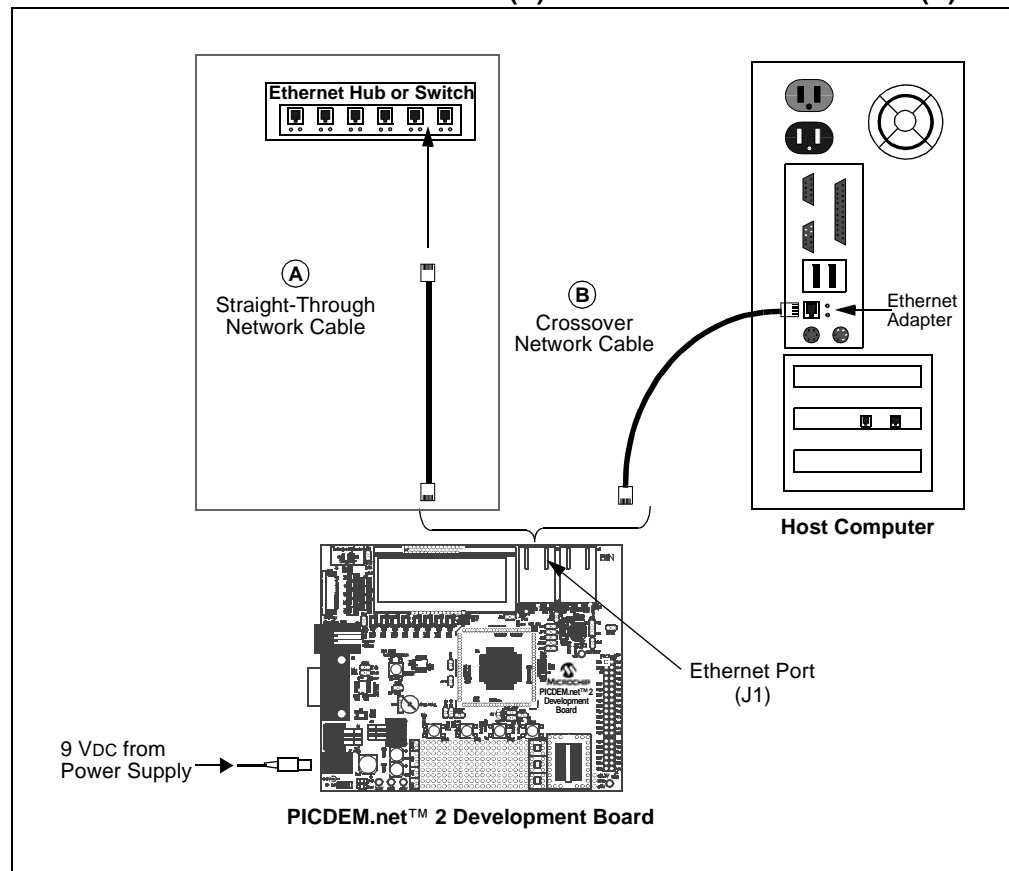
1. Unbox and unwrap the board, and set it on a non-conductive surface near the host computer.
2. Depending on the network connection to be used, do one of the following:

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).

3. Apply power to the board (9 VDC) 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 vx.xx
?.?.?.?

where “?.?.?.?” is the IP address currently in use by the board. This address is either assigned by a DHCP server, automatically configured by the AutoIP module, or the value defined in the `TCPIPConfig.h` configuration file.

Note: The actual version of the firmware will be reflected in the first line of the LCD display. 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 4. “Troubleshooting”**.

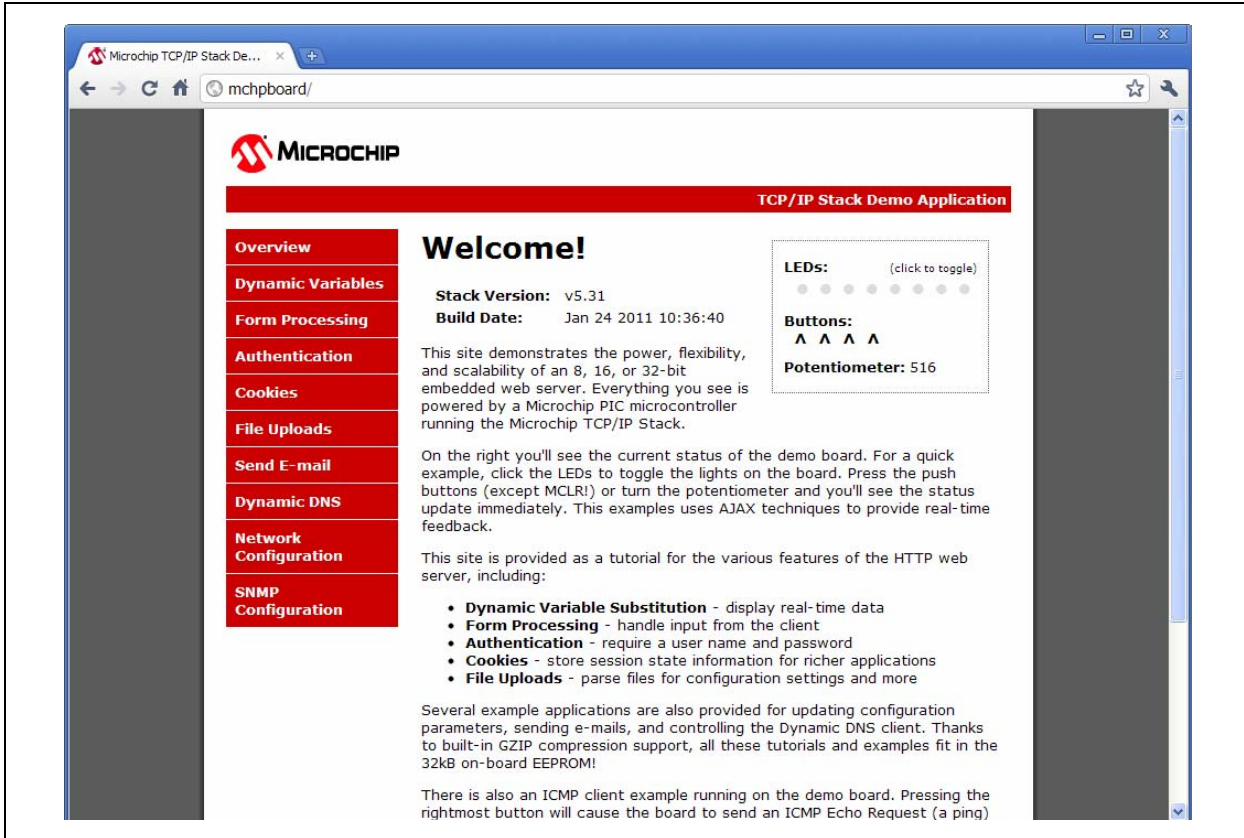
2.5 ESTABLISHING COMMUNICATIONS

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 connect to the board.

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).

Note: If the Development Board is connected in a test network setup, and your internet browser is currently configured to access through a proxy server, you may need to disable this proxy server in order to access the device. Refer to your browser’s Help documentation for further information.

FIGURE 2-3: MICROCHIP TCP/IP STACK PAGE



You are now ready to experiment with the PICDEM.net 2 Development Board. For more information about the TCP/IP Stack or the Demo Application, please refer to the Microchip TCP/IP Stack Help included with the Microchip Applications Library (see **Section 1.5 “Development Kit Firmware”** for more information).

Chapter 3. Reconfiguring and Restoring the PICDEM.net 2 Development Board

3.1 HIGHLIGHTS

This chapter covers the following:

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

3.2 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.

3.2.1 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.

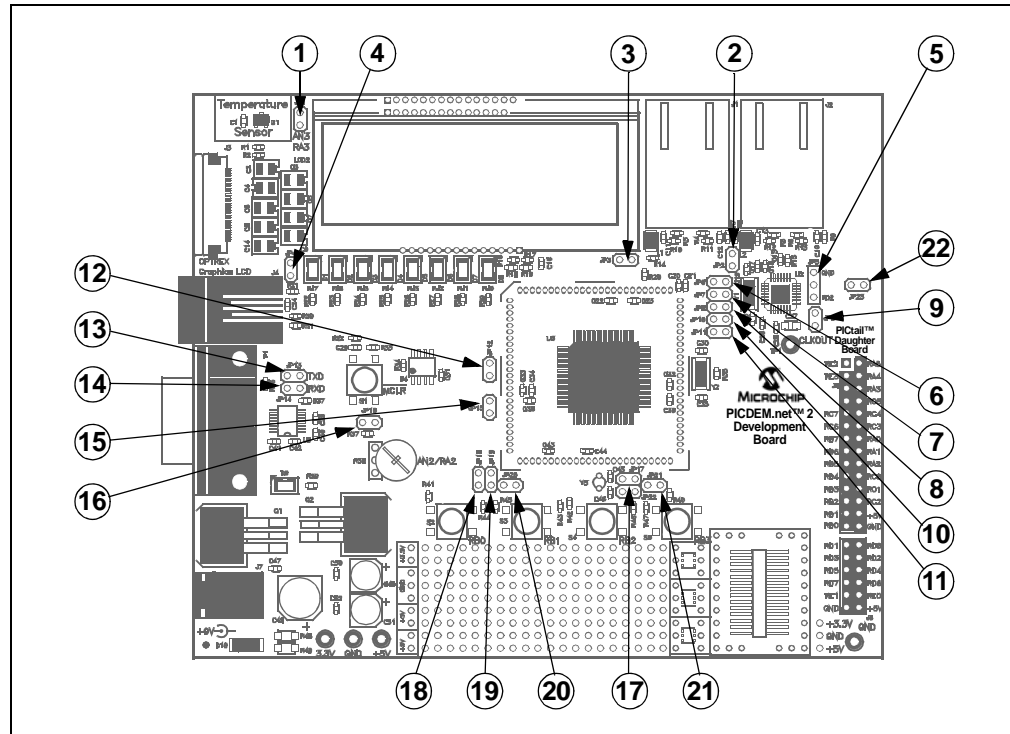
In some instances, a single function (such as the USART) is connected to the rest of the board through more than one jumper. This allows selective tailoring of the controller's I/O ports to any application that the user may develop. Specific cases are discussed in the following sections.

The functions of the jumpers are listed in Table 3-1; their locations are shown in Figure 3-1.

TABLE 3-1: 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 3-1: JUMPER LOCATIONS ON THE DEVELOPMENT BOARD



3.2.1.1 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).

3.2.1.2 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.

3.2.1.3 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.

3.2.1.4 ENC28J60 OPERATION

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

- RD4 (1-2 bridged): The $\overline{\text{RESET}}$ 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 $\overline{\text{RESET}}$ pin is tied to ground, holding the ENC28J60 in permanent Reset and effectively disabling it.
- Open (no jumper): The $\overline{\text{RESET}}$ 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).

3.2.2 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, the TCP/IP Stack must first be installed so that the source code may be edited. Once the stack has been installed, consult the TCP/IP Stack Help file for additional information about reprogramming your board to use the ENC28J60.

3.3 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 is preprogrammed with an Ethernet bootloader. For more information on using this bootloader, please refer to the Microchip TCP/IP Stack Help file. Besides this bootloader, the Development Board does not include tools for clearing and reprogramming the entire microcontroller. You must use an appropriate device programmer or a development tool, such as the MPLAB ICD 3 with MPLAB IDE, which provides a complete set of tools for programming and debugging. To ensure proper programming support of the PIC18F97J60, it is recommended to use the latest version of the MPLAB IDE; newer versions of the TCPIP Stack generally require the latest version.

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, follow the instructions for compiling, programming and running demonstration projects in the “Getting Started” section of the TCP/IP Stack Help file. 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, you may also wish to reprogram the EEPROM with the Demo Application web pages. Refer to the Microchip TCP/IP Stack Help file for instructions.

Chapter 4. Troubleshooting

4.1 HIGHLIGHTS

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

- Common Issues

4.2 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 VDC) at the barrel plug.
- Check that the regulated voltages (3.3 VDC and 5 VDC) 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.

<p>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.</p>
--

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 3.3 "Reprogramming and Restoring the Application 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 pages to the EEPROM as described in the Microchip TCP/IP Stack Help.

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 as described in the Microchip TCP/IP Stack Help.

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.

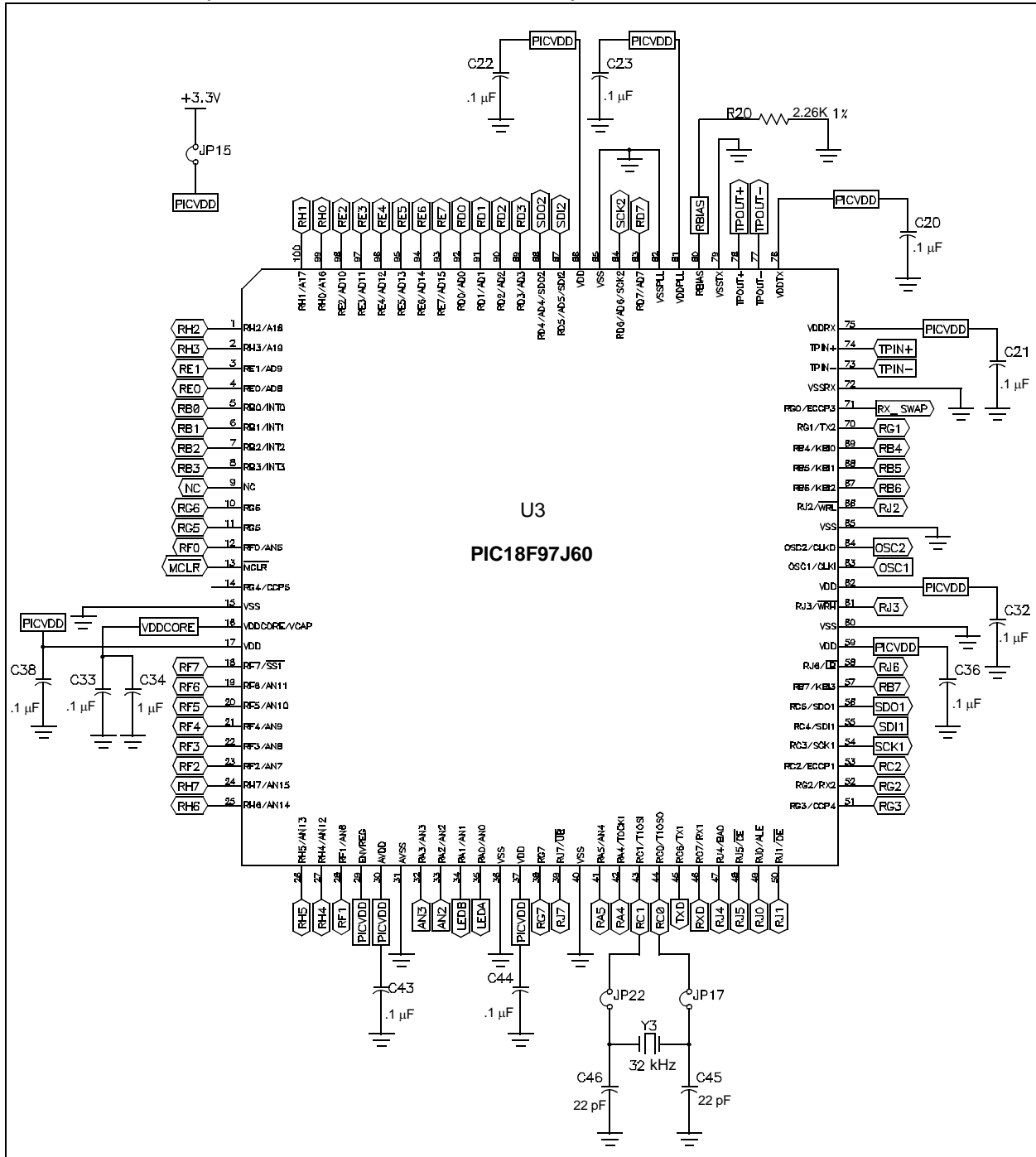
Verify that the host system is set up correctly.

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 3.3 "Reprogramming and Restoring the Application Firmware"** for more information.

Appendix A. PICDEM.net 2 Development Board Schematics, Rev. 6

FIGURE A-1: PICDEM.net 2 DEVELOPMENT BOARD SCHEMATIC, SHEET 1 OF 5 (PIC18F97J60 MICROCONTROLLER)



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FIGURE A-2: PICDEM.net 2 DEVELOPMENT BOARD SCHEMATIC, SHEET 2 OF 5 (PIC18F97J60 MICROCONTROLLER, ASSOCIATED COMPONENTS)

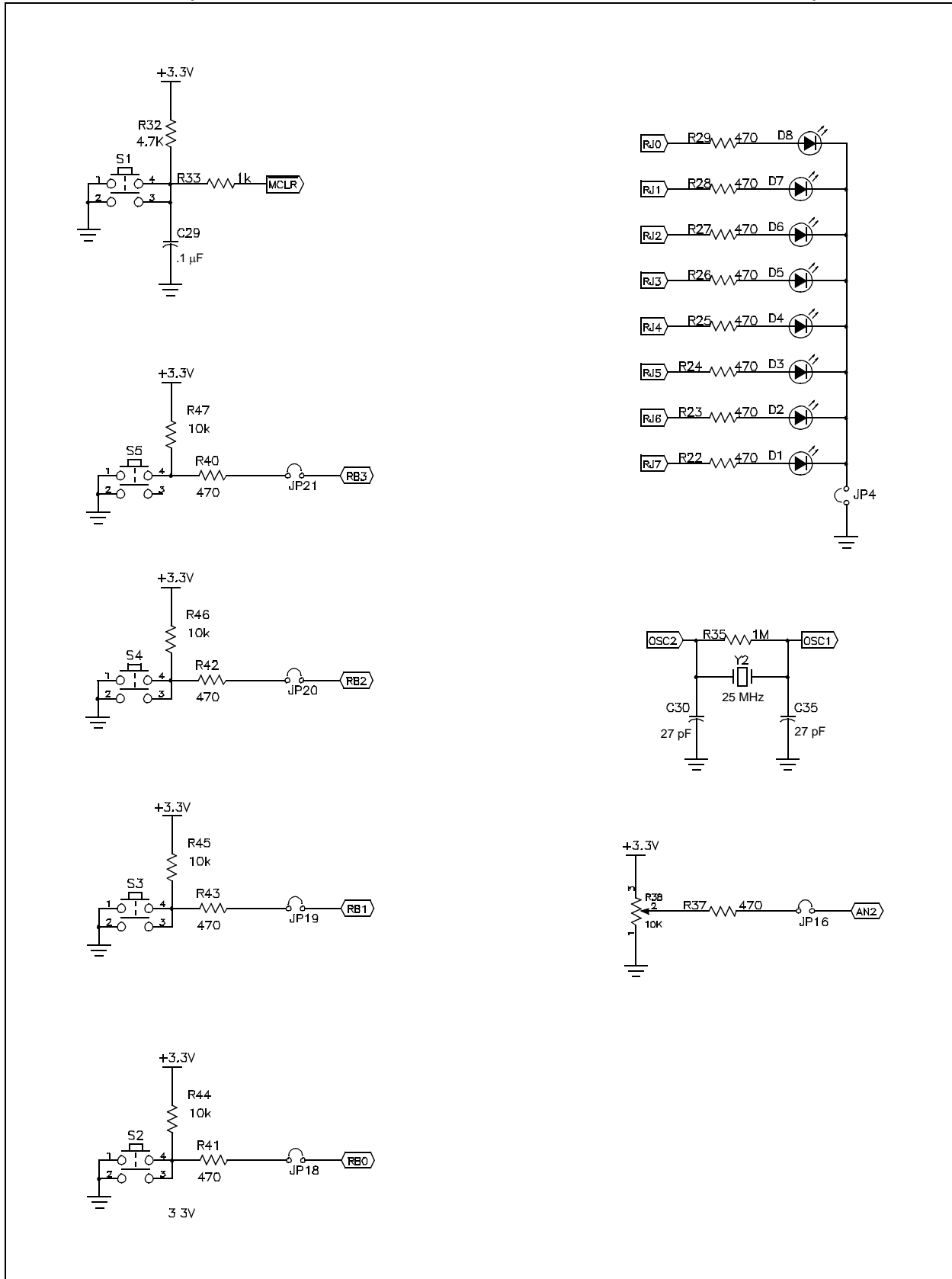
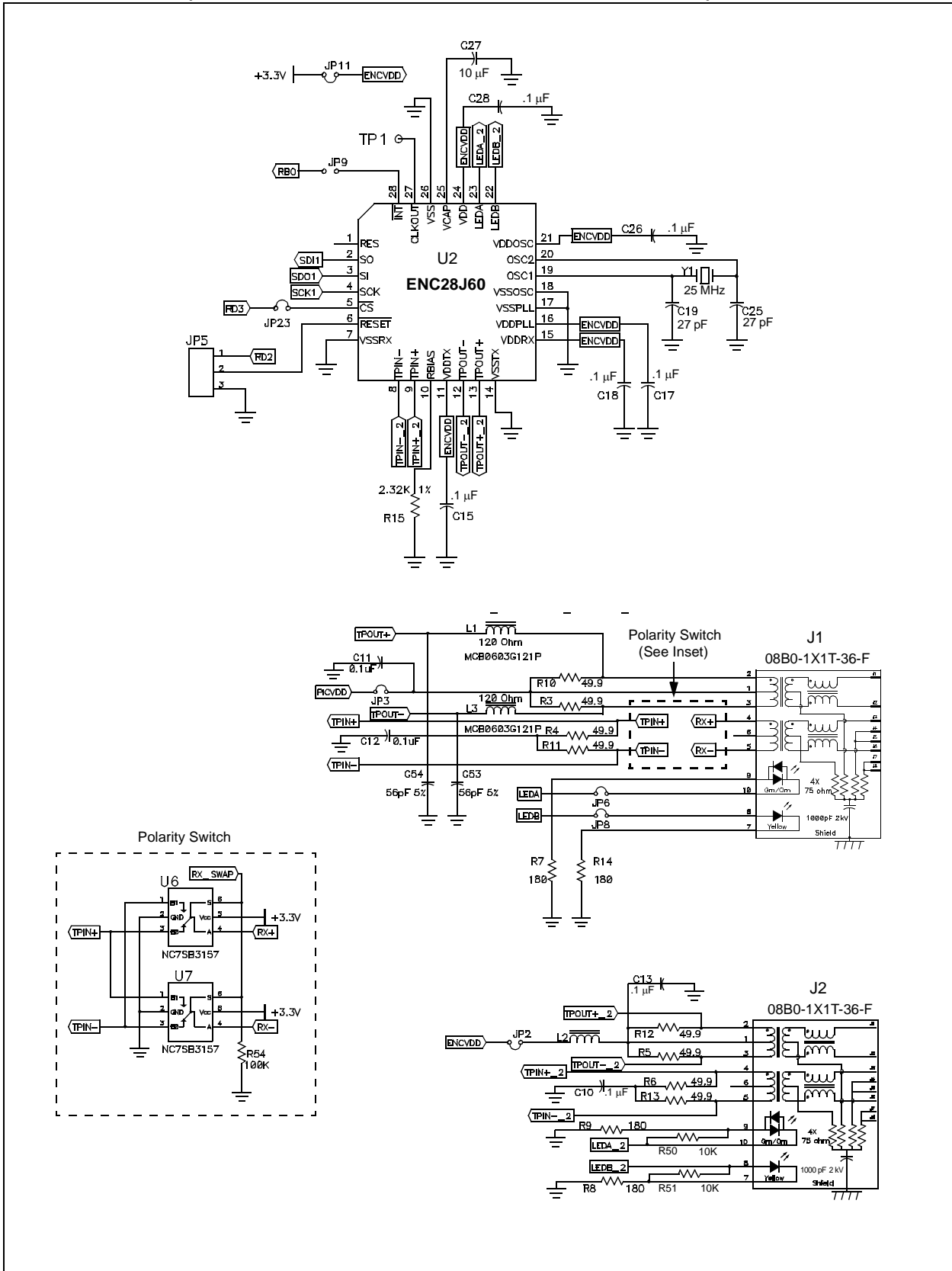


FIGURE A-3: PICDEM.net 2 DEVELOPMENT BOARD SCHEMATIC, SHEET 3 OF 5 (ENC28J60 INTERFACE AND ETHERNET MAGNETICS)



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FIGURE A-4: PICDEM.net 2 DEVELOPMENT BOARD SCHEMATIC, SHEET 4 OF 5 (RS-232, EEPROM, TEMPERATURE SENSOR, LCD OPTIONS AND POWER SUPPLY)

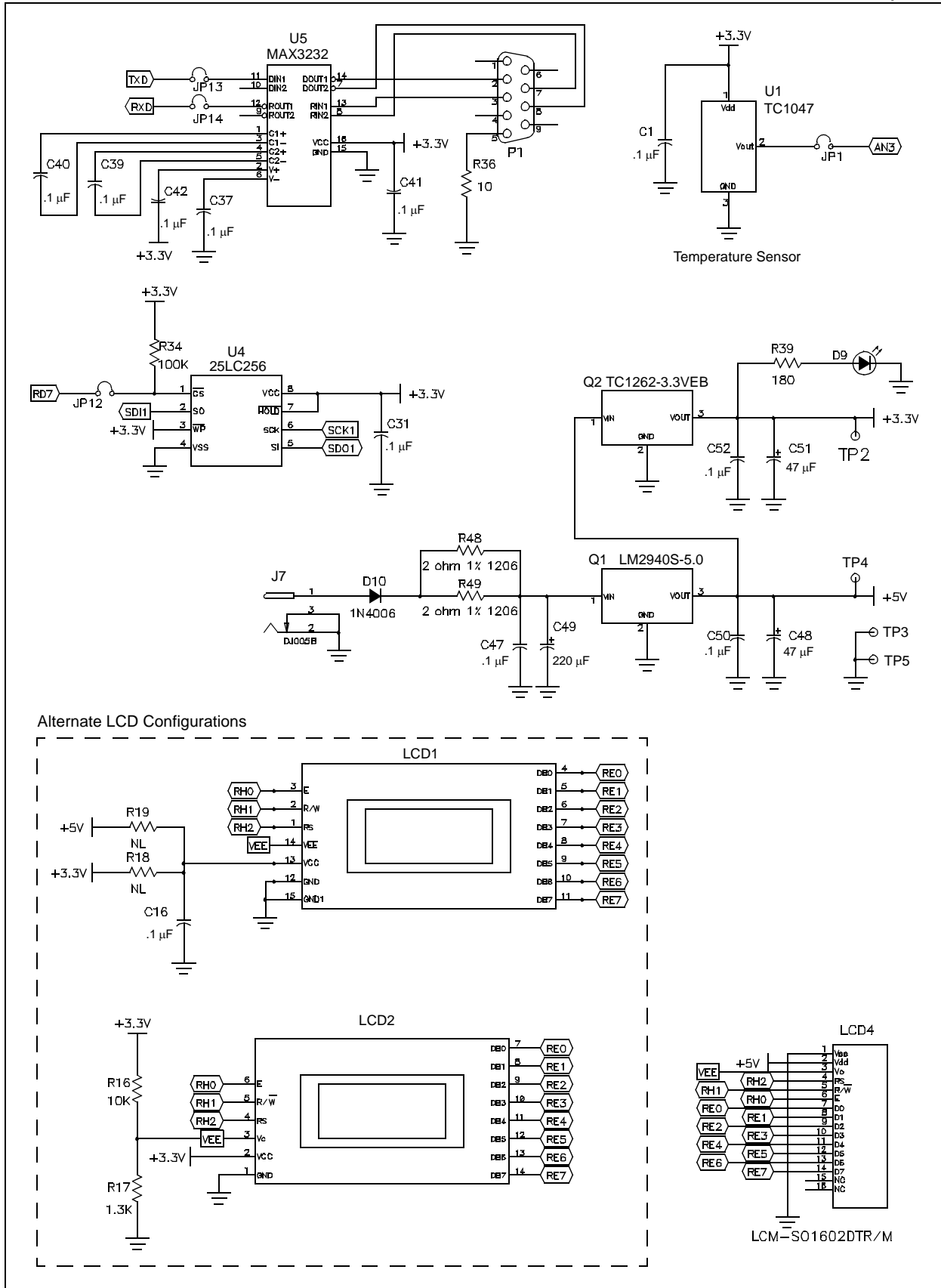
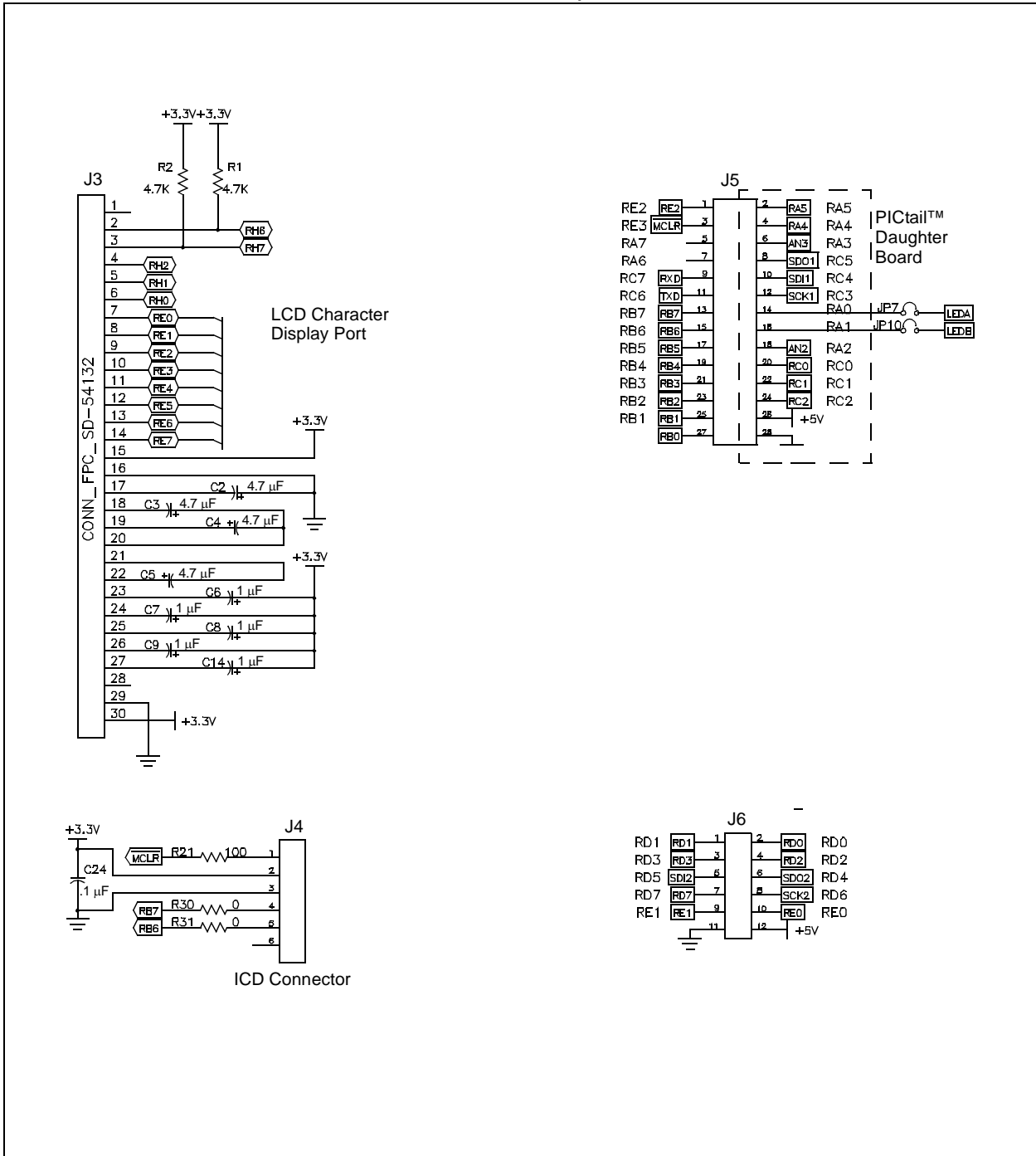


FIGURE A-5: PICDEM.net 2 DEVELOPMENT BOARD SCHEMATIC, SHEET 5 OF 5 (ICD, ICSP™, LCD DISPLAY, MICROCONTROLLER HEADER AND PICtail™ DAUGHTER BOARD CONNECTORS)



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