



MICROCHIP

**PICDEM™ CAN-LIN 2
Development Kit
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.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

Trademarks

The Microchip name and logo, the Microchip logo, dsPIC, FlashFlex, flexPWR, JukeBlox, KEELOQ, KEELOQ logo, Kleer, LANCheck, MediaLB, MOST, MOST logo, MPLAB, OptoLyzer, PIC, PICSTART, PIC³² logo, RightTouch, SpyNIC, SST, SST Logo, SuperFlash and UNI/O are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

The Embedded Control Solutions Company and mTouch are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Analog-for-the-Digital Age, BodyCom, chipKIT, chipKIT logo, CodeGuard, dsPICDEM, dsPICDEM.net, ECAN, In-Circuit Serial Programming, ICSP, Inter-Chip Connectivity, KleerNet, KleerNet logo, MiWi, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, RightTouch logo, REAL ICE, SQI, Serial Quad I/O, Total Endurance, TSHARC, USBCheck, VariSense, ViewSpan, WiperLock, Wireless DNA, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

Silicon Storage Technology is a registered trademark of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.

© 2007-2015, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

ISBN: 978-1-63277-575-7

QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
== ISO/TS 16949 ==

Microchip received ISO/TS-16949:2009 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC[®] MCUs and dsPIC[®] DSCs, KEELOQ[®] code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

Table of Contents

Preface	5
Chapter 1. Introduction to the PICDEM™ CAN-LIN 2 Board	
1.1 Introduction	11
1.2 Highlights	11
1.3 PICDEM CAN-LIN 2 Development Kit Contents	11
1.4 Overview of the PICDEM CAN-LIN 2 Board	12
1.4.1 Benefits of Using the PICDEM CAN-LIN 2 Board	12
1.5 PICDEM CAN-LIN 2 Board Features	13
1.1 CANKing Host Software	16
Chapter 2. Getting Started with the PICDEM CAN-LIN 2 Board	
2.1 Highlights	17
2.2 Host Computer Requirements	17
2.3 Using the PICDEM CAN-LIN 2 Board for the First Time	17
2.3.1 Installing the Host Software	18
2.3.2 Connecting the PICDEM CAN-LIN 2 Board	18
2.3.3 Starting the Host Software for the First Time	20
2.4 Checking the Board in Evaluation Mode	23
Chapter 3. Getting Started with the CANKing Software	
3.1 Highlights	25
3.2 Software Overview	25
3.3 Starting the Program	25
3.4 Introduction to the Templates	26
3.4.1 PIC® MCU Register View Template	26
3.4.2 Basic Template	26
3.4.3 PIC18+CAN Evaluation Board Template	26
3.5 The Main Menu	26
3.6 The Output Window	27
3.7 Customizing Projects	28
Chapter 4. Using the CANKing Templates	
4.1 Highlights	29
4.2 PIC MCU Register View Template	29
4.2.1 PIC18+CAN Evaluation Board	30
4.2.2 PIC18+CAN Message Filters	30
4.2.3 PIC18+CAN Physical Layer	31
4.2.4 PIC18+CAN Receive Buffer	32
4.2.5 PIC18+CAN Status Window	32
4.2.6 PIC18+CAN Transmit Buffer	33
4.2.7 PIC18+CAN Configuration	34
4.3 The Basic Template	34

PICDEM™ CAN-LIN 2 Development Kit User's Guide

4.3.1 PIC18+CAN Evaluation Board	35
4.3.2 PIC18+CAN Controller	36
4.3.3 Select Formatters Window	37
4.3.4 Output Window	37
4.3.5 History List	38
4.3.6 Timed Transmission	38
4.4 PIC18+CAN Evaluation Board Template	39
4.4.1 Putting the Board in Evaluation Mode	39
4.4.2 PIC18+CAN Evaluation Board Window	40
4.4.3 Node0 Eval Board (Control) Window	40
4.4.4 Node1 Eval Board (Control) Window	42
4.4.5 Node2 Eval Board (Control) Window	43
4.4.6 PIC18+CAN Controller	43
4.4.7 Select Formatters	43
4.4.8 History List	43
4.4.9 Timed Transmission	43
4.4.10 Output Window	43
4.5 Template-Specific Variations in the Main Menu	44
Chapter 5. Reconfiguring the PICDEM CAN-LIN 2 Hardware	
5.1 Highlights	45
5.2 Node Configurations	45
5.2.1 Two CAN Nodes, One LIN Node, Embedded System	45
5.2.2 Two CAN Nodes, One LIN Node, Distributed System	45
5.2.3 Two CAN Nodes, Embedded System	45
5.2.4 Two CAN Nodes, Distributed System	45
5.3 Oscillator Configurations	46
5.3.1 Crystal Oscillator	46
5.3.2 RC Oscillator	46
5.4 Jumper Settings	46
5.5 Restoring the PICDEM CAN-LIN 2 Firmware	47
Chapter 6. Troubleshooting	
6.1 Highlights	49
6.2 Common Problems	49
A.1 Highlights	51
A.2 PICDEM CAN-LIN 2 Block Diagram	51
A.3 PICDEM CAN-LIN 2 Board Schematics	52
B.1 Highlights	59
B.2 FAQs	59
C.1 Highlights	61
C.2 What's on the CD	61
Worldwide Sales and Service	63



PICDEM™ CAN-LIN 2 DEVELOPMENT KIT 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 “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 online help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the PICDEM™ CAN-LIN 2. 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
- Revision History

PICDEM™ CAN-LIN 2 Development Kit User's Guide

DOCUMENT LAYOUT

This document describes how to use the PICDEM™ CAN-LIN 2 as a development tool to emulate and debug firmware on a target board, as well as how to program devices. The document is organized as follows:

- **Chapter 1. “Introduction to the PICDEM™ CAN-LIN 2 Board”** – What the PICDEM™ CAN-LIN 2 Board is, what makes it a desirable development tool and what features are available
- **Chapter 2. “Getting Started with the PICDEM CAN-LIN 2 Board”** – Describes how to connect and begin to use the PICDEM CAN-LIN 2 board
- **Chapter 3. “Getting Started with the CANKing Software”** – Gives a brief overview of the CANKing host software and the concept of the predefined templates
- **Chapter 4. “Using the CANKing Templates”** – Provides a more detailed description of the individual templates and how to use them
- **Chapter 5. “Reconfiguring the PICDEM CAN-LIN 2 Hardware”** – Describes various multi-node configurations of the board and how to customize certain features
- **Chapter 6. “Troubleshooting”** – Provides information on solving common problems
- **Appendix A. “PICDEM CAN-LIN 2 Board Technical Information”** – Provides the block diagram and detailed schematics of the PICDEM CAN-LIN 2 board
- **Appendix B. “FAQs on Configuring the PIC18FXX8X”** – Provides a list of the most commonly encountered issues when programming PIC18FXX8X microcontrollers, as well as some solutions
- **Appendix C. “PICDEM CAN-LIN 2 Software CD”** – Provides a summary of the software. The software CD can be found on <http://www.microchip.com/DM163011>

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	<i>MPLAB[®] IDE User's Guide</i>
	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><i>File>Save</i></u>
Bold characters	A dialog button	Click OK
	A tab	Click the Power tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.	4'b0010, 2'hF1
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	void main (void) { ... }

PICDEM™ CAN-LIN 2 Development Kit User's Guide

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 at the Microchip web site.

RECOMMENDED READING

This user's guide describes how to use PICDEM™ CAN-LIN 2. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

MPLAB® IDE Simulator, Editor User's Guide (DS51025)

This is a comprehensive guide that describes installation and features of Microchip's MPLAB® Integrated Development Environment (IDE), as well as the editor and simulator functions in the MPLAB IDE environment.

MPASM™ Assembler, MPLINK™ Object Linker, MPLIB™ Object Librarian User's Guide (DS33014)

This user's guide describes how to use the Microchip PIC® MCU MPASM assembler, the MPLINK object linker and the MPLIB object librarian.

PICmicro® Mid-Range MCU Family Reference Manual (DS33023) and PICmicro® 18C MCU Family Reference Manual" (DS39500)

These manuals explain the general details and operation of the mid-range and advanced MCU family architecture and peripheral modules. They are designed to complement the device data sheets.

Microsoft® Windows® Manuals

This manual assumes that users are familiar with the Microsoft Windows operating system. Many excellent references exist for this software program and should be consulted for general operation of Windows.

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, listings 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, assemblers, linkers and other language tools. These include all MPLAB C compilers; all MPLAB assemblers (including MPASM™ assembler); all MPLAB linkers (including MPLINK™ object linker); and all MPLAB librarians (including MPLIB™ object librarian).
- **Emulators** – The latest information on Microchip in-circuit emulators. This includes the MPLAB REAL ICE™ and MPLAB ICE 2000 in-circuit emulators.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debuggers. This includes MPLAB ICD 3 in-circuit debuggers and PICkit™ 3 debug express.
- **MPLAB® IDE** – The latest information on Microchip MPLAB IDE, the Windows® Integrated Development Environment for development systems tools. This list is focused on the MPLAB IDE, MPLAB IDE Project Manager, MPLAB Editor and MPLAB SIM simulator, as well as general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include production programmers such as MPLAB REAL ICE in-circuit emulator, MPLAB ICD 3 in-circuit debugger and MPLAB PM3 device programmers. Also included are nonproduction development programmers such as PICSTART® Plus and PICkit 2 and 3.

PICDEM™ CAN-LIN 2 Development Kit User's Guide

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

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://www.microchip.com/support>.

REVISION HISTORY

Revision A (July 2003)

Initial release of the document.

Revision B (July 2007)

Revision C (July 2015)

Updated document titles in the Recommended Reading Section; Replaced MCP201 with MCP2021A across the document; Updated Sections 2.2, 2.3.1, 2.3.3, 5.5; Replaced C41 value from 10 μ F to 160 pF in Figure A-4; Added notes to Figure A-4 and Section C.1.

Chapter 1. Introduction to the PICDEM™ CAN-LIN 2 Board

1.1 INTRODUCTION

The PICDEM™ CAN-LIN 2 Development Kit has been revised for the evaluation or development of CAN network nodes utilizing Microchip's PIC18FXX8X family of 28 and 40-pin microcontrollers. This tool is ideal for beginning CAN designers, as well as those new to the PIC18FXX8X family.

The Demonstration Board provides three nodes (two CAN and one LIN bus) that can be configured in numerous ways through jumpers and component selection. The CAN nodes implement basic input and output functionality, and can send and receive CAN bus messages. The host software included with the kit allows fine manipulation of the PIC18F4680 devices down to the bit level, as well as high-level control of the microcontroller. It also provides predefined templates for demonstration, evaluation and development uses.

1.2 HIGHLIGHTS

This chapter discusses:

- PICDEM CAN-LIN 2 Development Kit Contents
- Overview of the PICDEM CAN-LIN 2 Board
- PICDEM CAN-LIN 2 Board Features
- CANKing Host Software

1.3 PICDEM CAN-LIN 2 DEVELOPMENT KIT CONTENTS

Your PICDEM CAN-LIN 2 Development kit contains the following items:

1. PICDEM CAN-LIN 2 Development Board, complete with three Microchip microcontrollers (two PIC18F4680 controllers and one PIC16C432) preprogrammed with demo firmware.
2. A universal power supply (110-230 VAC input, 12 VDC output) and power cable for the Development Board.
3. A male-to-female DB9 serial cable for use in communicating with the board.
4. The PICDEM CAN-LIN 2 CD-ROM with CANKing host software, User's Guide and other supporting documents, which can be found at:
<http://www.microchip.com/DM163011>
5. A warranty registration card.

1.4 OVERVIEW OF THE PICDEM CAN-LIN 2 BOARD

Most demonstration or evaluation systems use a single microcontroller, and are designed to show off that controller's features. While this makes sense in most situations, it also means that users must set up several boards to evaluate even a simple network of a few nodes. The drawbacks to this arrangement should be obvious.

In contrast, PICDEM CAN-LIN 2 provides three network nodes on one circuit board. By using a common power supply, and allowing the nodes to be configured in multiple ways, the process of evaluating and developing network nodes can be significantly streamlined.

The three nodes on the PICDEM CAN-LIN 2 board are:

- Node0, a CAN node implemented with either a 28-pin PIC18F2585/2680 or 40-pin PIC18F4585/4680 microcontroller. This node interfaces to the external host computer through a standard serial (RS-232) interface, and is directly controlled by the host software. It monitors both the on-board and external CAN busses, and can be used for basic PIC18FXX8X evaluation/development.
- Node1, a CAN node also implemented with either a PIC18F2585/2680 or PIC18F4585/4680 device. This node communicates with Node0 over the on-board CAN bus. It also implements the CAN-to-LIN bus gateway to Node2 (below), and acts as the LIN bus master node. Like Node0, Node1 can also be used for basic PIC18FXX8X evaluation/development.
- Node2, a LIN bus slave node, is implemented with the 20-pin PIC16C432 microcontroller with integrated LIN bus transceiver. It communicates to Node1 via the LIN bus.

Both the CAN and LIN busses are routed off-board through a connector, which allows the board to be connected to an external bus.

1.4.1 Benefits of Using the PICDEM CAN-LIN 2 Board

Putting three nodes on one board gives the developer some definite benefits:

MULTIPLE HARDWARE CONFIGURATIONS WITH ONE BOARD: Of course, the PICDEM CAN-LIN 2 board accommodates a large selection of CAN and LIN node combinations. When all three nodes are used, sixteen different combinations of microcontrollers are possible, depending on which sockets are populated for the CAN nodes. In addition, users can implement any one of three oscillator configurations for the CAN nodes, or easily add other hardware to the board using the prototyping area and headers.

Many of these configuration changes are performed with jumpers, while others require component additions or removals. The board configurations and jumper locations are discussed in detail in [Chapter 5. "Reconfiguring the PICDEM CAN-LIN 2 Hardware"](#) and [Chapter 6. "Troubleshooting"](#).

EASIER CAN NODE EVALUATION: The CANKing host software, included with the PICDEM CAN-LIN 2 Development Kit, allows for fast evaluation of CAN node operation, as well as the CAN protocol. Using one of the included template sets, users can evaluate everything from bit level status of registers to node operation and bus status. The host software and the templates are discussed in detail in [Chapter 3. "Getting Started with the CANKing Software"](#) and [Chapter 4. "Using the CANKing Templates"](#).

ENHANCED CAN NODE DEVELOPMENT: Including two CAN nodes on the PICDEM CAN-LIN 2 board provides an additional tool for developing PIC18FXX8X-based CAN nodes, either by themselves or together. For example, a user might use the controller in Node1 to prototype a CAN node, while using Node0 as a simple bus monitor (using the basic template). Node0 could also be used as a tool to set or verify bit timings, masks or filters.

Introduction to the PICDEM CAN-LIN 2 Board

The possibilities are not limited to what can be developed with just the nodes on the board, either. For example, Node0 can be included as part of a more complex developmental network of many CAN nodes, and serve as the “tap point” for monitoring the entire network.

1.5 PICDEM CAN-LIN 2 BOARD FEATURES

As mentioned, the PICDEM CAN-LIN 2 board consists of two CAN nodes and one LIN node. Node0 acts as the main node. It interfaces with the host software through a serial connection (RS-232), and either executes commands from the host system or passes them to Node1. Node0 also interfaces with the on-board LCD header. If an LCD is connected, Node0 can display text messages under host software control.

Node1 also acts as a CAN node, and demonstrates a CAN-to-LIN bridge. This node is controlled via Node0, which relays commands for Node1 from the host system. Node1 receives these messages and performs the appropriate actions. This node also acts as a LIN master mode and provides CAN-to-LIN bridge functionality to Node2. As a LIN master, it receives messages from Node0 and relays them to the LIN slave node.

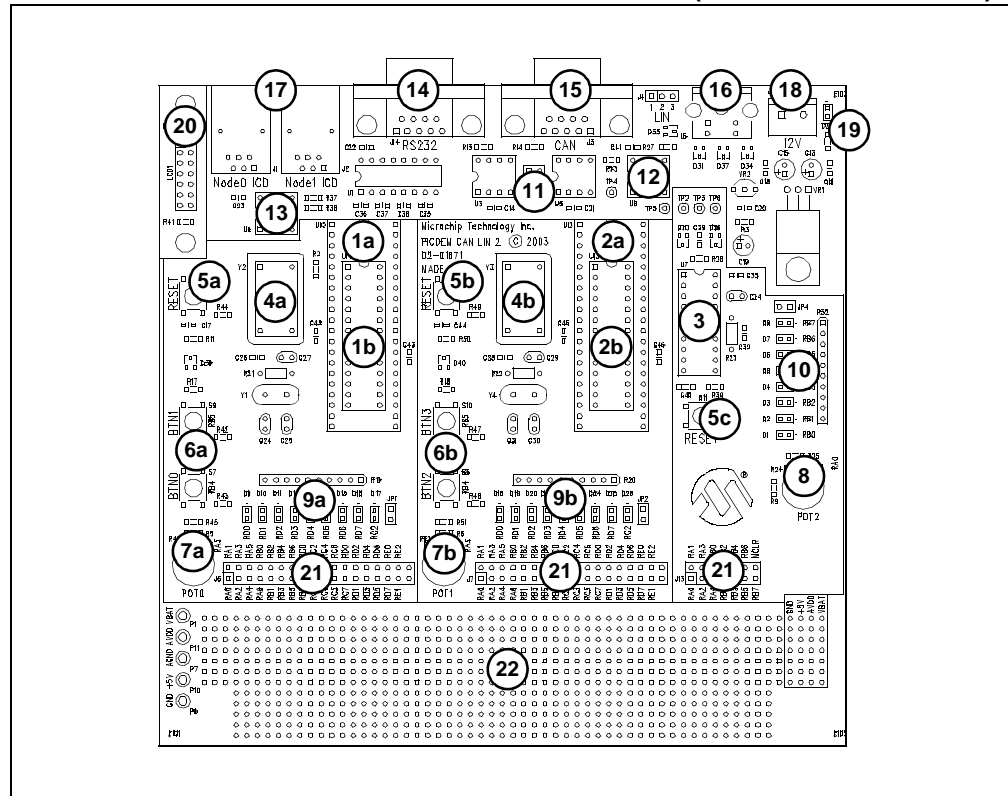
Node2 is a LIN slave node implemented by the PIC16C432. This node contains an integrated LIN bus transceiver. It waits for commands from Node1 and performs the appropriate actions.

As configured from the box, the behavior of the CAN nodes is determined by its hardware configuration. While Node0 and Node1 both execute the exact same code, the function of the node is decided by its hardware configuration. When either node is reset, its firmware attempts to communicate with the external EEPROM. If the EEPROM is found, the code assumes the role of Node0 and uses the USART to communicate with the host system. If the EEPROM is not found, it assumes the role of Node1 and uses the USART for LIN bus communication. Since the EEPROM is hard-wired to the Node0 controller, this essentially ensures that this controller will always be Node0.

Node0 and Node1 are connected via the on-board CAN bus, which is also available to an external CAN bus through a D-shell connector. Node1 and Node2 are connected via the on-board LIN bus. Node1 uses a separate LIN transceiver while Node2 uses an integrated LIN transceiver. The board routes the on-board LIN bus to a 3-pin header for connection to external LIN devices.

The overall layout of the board is shown in [Figure 1-1](#).

FIGURE 1-1: THE PICDEM™ CAN-LIN 2 BOARD (TOP ASSEMBLY VIEW)



The main features of the board include:

1. **Node0 Microcontroller:** The board is equipped with a pair of nested DIP sockets, designed to accommodate the 40-pin PIC18F4585/4680 (1a) or the 28-pin PIC18F2585/2680 (1b); each includes an integrated CAN module. The Node0 microcontroller also handles the communications to the host computer (via RS-232), as well as the external serial EEPROM and the optional LCD module.
2. **Node1 Microcontroller:** This is also a nested DIP socket pair that can accommodate either the PIC18F4585/4680 (2a) or PIC18F2585/2680 (2b). This node communicates with Node0 and any external CAN nodes over the on-board CAN bus. It also serves as the LIN master, and communicates to Node2 and other external LIN nodes over the on-board LIN bus.
3. **Node2 Microcontroller:** This is a 20-pin DIP PIC16C432 with integrated LIN bus transceiver. It acts as a LIN slave and transfers data to and from Node1.
4. **Oscillators:** Node0 and Node1 each support three different oscillator configurations (crystal, RC and canned). The board is factory equipped with 25 MHz canned oscillators for both of the CAN nodes. If a different oscillator type is required, the board hardware must be reconfigured (see [Section 5.3 “Oscillator Configurations”](#) for more information). Node2 uses an RC oscillator only (not shown); it cannot be reconfigured.
5. **Reset Push Buttons:** Each of the microcontrollers has its own Reset push button switch, tied to the MCLR pin. Pressing the switch causes a hard controller Reset.
6. **CAN Node User-Defined Switches:** Two push button switches are connected to each the CAN nodes to simulate digital inputs. Their status can be monitored through the host software.

Introduction to the PICDEM CAN-LIN 2 Board

7. **CAN Node Potentiometers:** These analog potentiometers (7a and 7b) are connected to Node0 and Node1, respectively. These potentiometers simulate analog inputs for their controllers, and control the brightness of the PWM-controlled LED on the *other* CAN node (i.e., the Node0 potentiometer controls the brightness of Node1's LED and vice versa). Their real-time status is also displayed by the host software.
8. **Node2 Potentiometer:** This analog potentiometer is connected to Node2. When Node2 is configured for "Poll Automatically" option, the real-time status of this potentiometer is displayed by the host software.
9. **CAN Node LED Banks:** Both Node0 and Node1 are connected to their own bank of nine LEDs: one 8-bit LED port and one PWM-controlled LED. The 8-bit LED shows the (digital) status of PORTD of the controller, and can be modified under software control. The output of the PWM-controlled LED is continuously variable, and is determined by the value of the *other* CAN node's potentiometer (7a or 7b), as noted. For the LEDs to function, their associated LED enable jumper (JP1 or JP2) must be installed.
10. **Node2 LED Bank:** An 8-bit LED port is connected to PORTB of the LIN slave node and shows its (digital) status. The display can be modified under software control. The LED enable jumper, JP4, must be installed for the bank to function.
11. **CAN Transceivers:** The MCP2551 transceivers (one for each CAN node) convert the differential signal on the CAN bus to levels that are compatible with the PIC18 microcontrollers.
12. **LIN Transceiver:** The MCP2021A transceiver converts the high-voltage signals from the LIN bus to levels compatible with the PIC16 microcontroller.
13. **External EEPROM:** A 24LC16 serial EEPROM is included for the use of developers in creating a full range of prototype devices. This is a 16 Kbit device which is programmable by a two-wire I²C™ interface. The EEPROM memory is controlled by Node0. Its contents may be read or modified via the host software interface.
14. **RS-232 (DB9F) Port:** A standard D-shell connector provides a serial connection to control and monitor the Demonstration Board. Since it uses a standard 232 level shifter, this connector can also be used as a standard serial port for prototype applications.
15. **CAN Connector (DB9M):** This connector allows the on-board CAN nodes to be connected to an external CAN bus.
16. **LIN Connector (3-pin) Pad:** A space is provided to add a 3-pin connector, allowing the on-board LIN node to connect with an external LIN bus.
17. **ICD Connectors:** These two 6-wire RJ-11 connectors allow the CAN Node microcontrollers to be connected to an external programmer and programmed on the board.
18. **Power Connector:** Power (12 VDC) is supplied to the board from the power adapter through a 4-pin mini-DIN jack. Alternatively, external power can be provided through the 2-pin terminal block. On-board regulators provide separate +5 VDC sources for analog and digital circuits. Both inputs are protected from accidental polarity reversal. Direct 12 VDC is also available to appropriate circuits.
19. **Power LED (Red):** This is lit to show that power is being supplied to the Demonstration Board.
20. **LCD Connector:** This 14-pin header allows the addition of a standard LCD controller module (such as Hitachi HD4478 or equivalent) to the demonstration board.

21. **Prototype Headers:** These connector pads are provided for users to directly access the I/O port signals for all the microcontrollers. As an option, headers may be installed in these locations.
22. **MCU Prototype Area:** This grid is provided for prototyping controllers that are not supported by the existing sockets. The area is provided with connections for analog and digital power (separate +5 VDC sources), VBAT for LIN (up to +12 VDC) and ground connections.

1.1 CANKing HOST SOFTWARE

Included with the Development Kit is the CANKing host software. Developed by Kvaser AB, the CANKing package allows users to examine and control the board's operation in detail, as well as monitor CAN node operations. Interfaces are implemented through a series of three predesigned templates, which are grouped by functionality (CAN node evaluation and control, board-level control, etc.). CAN-related templates are designed around the CAN Kingdom upper-layer protocol primitives. Previous experience with this CAN design system is helpful, but not strictly necessary.

Installation and overall operation of the host software is discussed in [Chapter 3. "Getting Started with the CANKing Software"](#). The CANKing templates are detailed in [Chapter 4. "Using the CANKing Templates"](#).

Chapter 2. Getting Started with the PICDEM CAN-LIN 2 Board

2.1 HIGHLIGHTS

This chapter covers the following topics:

- Host Computer Requirements
- Using the PICDEM CAN-LIN 2 Board for the First Time
- Checking the Board in Evaluation Mode

2.2 HOST COMPUTER REQUIREMENTS

To communicate with and program the PICDEM CAN-LIN 2 Development Board, you must have a system that meets the following hardware and software requirements:

- PC-compatible system with an Intel® 80486 class or higher processor, or equivalent
- One available standard serial port, with a matching COM port available through the operating system
- Microsoft® Windows® 95, or any 32-bit version of Microsoft Windows operating system (Windows 98, Windows NT®, Windows 2000, Windows XP or Windows 7)

2.3 USING THE PICDEM CAN-LIN 2 BOARD FOR THE FIRST TIME

For evaluating the PICDEM CAN-LIN 2 board, the simplest configuration uses a host computer connected directly to the board using a crossover cable. Creating this setup involves the following steps:

1. Installing the CANKing Host Software.
2. Connecting the PICDEM CAN-LIN 2 Development Board to the host system.
3. Starting the Host Software.

2.3.1 Installing the Host Software

Note: It is possible that some organizations may implement a desktop computer policy sufficiently restrictive to prevent the user from loading any software at all. In theory, this can be done with **any** 32-bit Windows operating system on a network – including Windows 95. If this describes your situation, contact your local Information Services provider for assistance in installing this software.

To install the host software:

1. Download the PICDEM CAN-LIN2 CD from <http://www.microchip.com/DM163011>
2. Unzip the file PICDEM CAN-LIN 2.zip
3. Double-click on the wc32mchip_pic.exe icon from the unzipped folder PICDEM_CAN_LIN2

Install will proceed automatically.

The installation process will install the host software package, as well as the templates and help files. By default, all files are installed by default in the directory Program Files\Microchip under the root level of your hard drive. A shortcut for the host software is also installed under *Programs* from the Start menu (*Programs > Microchip > CANKing*).

Note: Always use the suggested default path for installing the host software. Because of certain software dependencies, it may not work correctly if installed elsewhere.

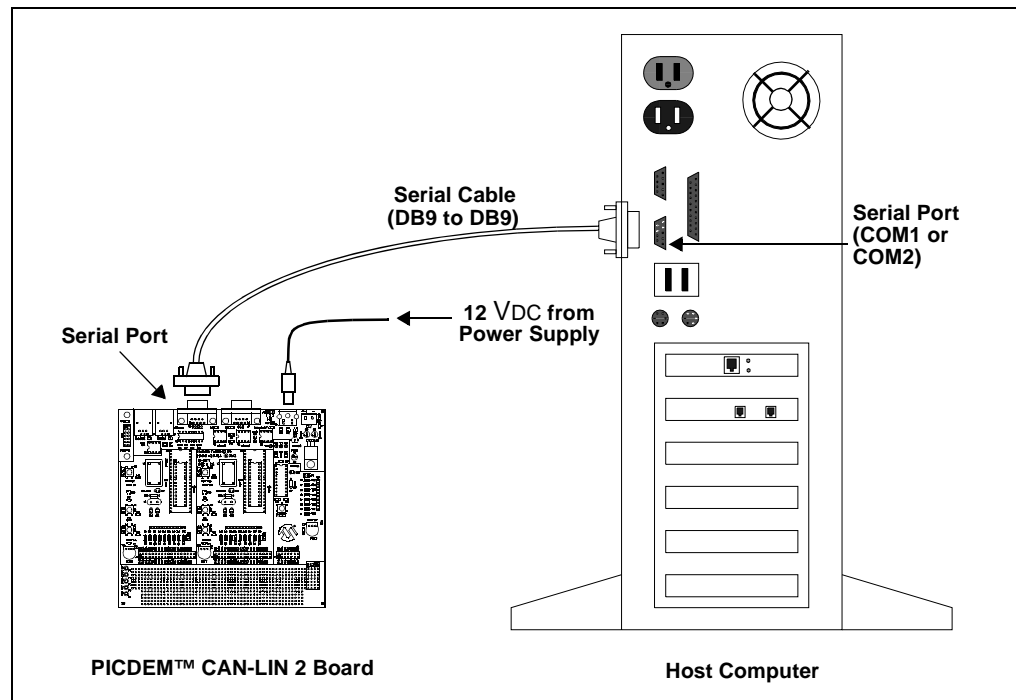
2.3.2 Connecting the PICDEM CAN-LIN 2 Board

The basic connections are shown in [Figure 2-1](#).

1. Power-down the host system. (This is not strictly necessary, but it is always a good safety idea – particularly if you need to rearrange cables or move the system.)
2. Unbox and unwrap the board, and set it on a non-conductive surface near the host system.
3. If they are not installed already, install the microcontrollers in their respective sockets. Check that they are completely seated and that all pins are making contact.

Getting Started with the PICDEM CAN-LIN 2 Board

FIGURE 2-1: CONNECTIONS BETWEEN THE PICDEM™ CAN-LIN 2 BOARD AND THE HOST COMPUTER



4. Connect the serial cable (supplied in the kit) to the RS-232 connector on the board, then to the open serial port on your computer.

Note: If your available serial port is a DB25 male connector, you will need to use a DB25F-to-DB9M port adapter, sometimes known as an “external modem adapter”. Check with your local electronics parts store or your Information Services provider for additional information.

5. Connect the mini-DIN plug of the power supply to the power input jack on the board.
6. Plug the power adapter into your wall socket or power strip.
7. Check the board. The red power LED should light, and the Node0 port LEDs should briefly flash once. If they don't, check all connections with the power supply and the board. For additional assistance, refer to [Chapter 6. “Troubleshooting”](#).
8. Power-up the host system.

2.3.3 Starting the Host Software for the First Time

With the software installed and the PICDEM CAN-LIN 2 board connected, start the host software and confirm communications. If an error message is encountered when opening up the program in Windows 7, close it. Then reopen it by right-clicking on the installed CANKing icon (or *C:\Program Files\Microchip\wc32.exe*) and choose “Run as administrator”

1. From the Start menu, select *Programs > Microchip > CANKing*;

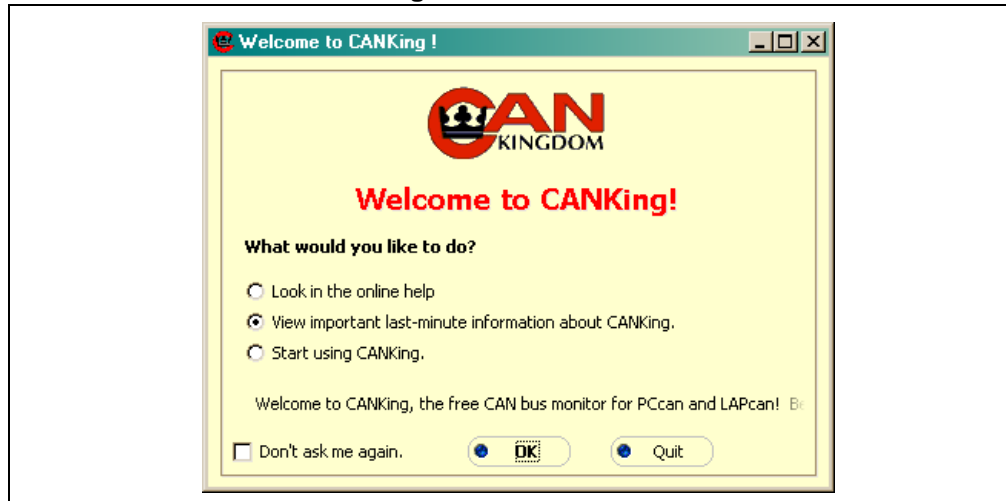
OR

From a Command window (DOS® window on Windows 95/98), navigate to the directory `\program files\microchip`, then enter:

```
wc32
```

However it is started, the CANKing welcome dialog box appears (Figure 2-2).

FIGURE 2-2: THE CANKing WELCOME DIALOG



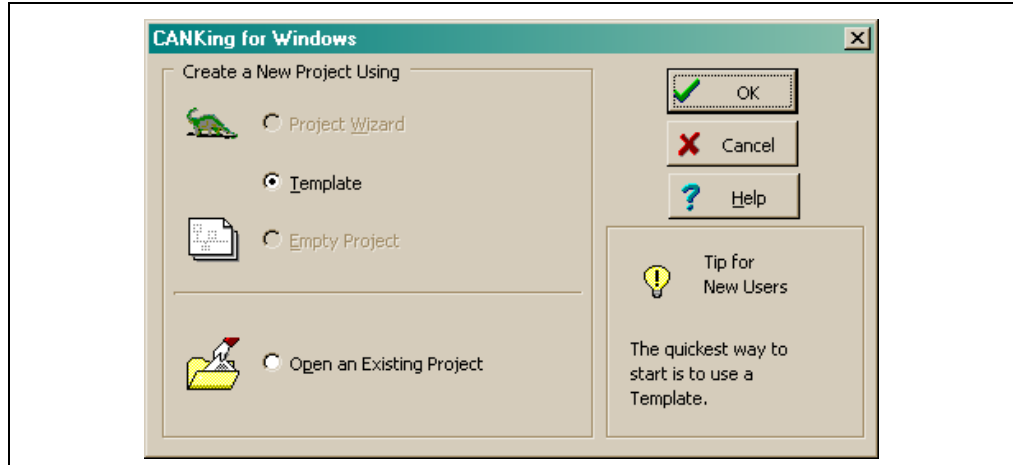
2. Select the “Start using CANKing” option. Optionally, to remove the dialog from future start-ups, check the **Don't ask me again** box. Click on **OK**.
3. At the subsequent “Warning!” dialog, click on **OK, I Know What I'm Doing** to proceed. Optionally, check **Don't show me this warning in the future** to remove this dialog from future start-ups.

Note: The cautions against personal injuries in this dialog refer to those cases where the PICDEM™ CAN-LIN 2 board is being used in the evaluation and development of live automotive and industrial networks. Obviously, this doesn't apply to situations where the board is being used in isolation to prototype network nodes.

4. At the next dialog box (Figure 2-3), select the **Template** option under “Create a New Project Using”. Click **OK**.

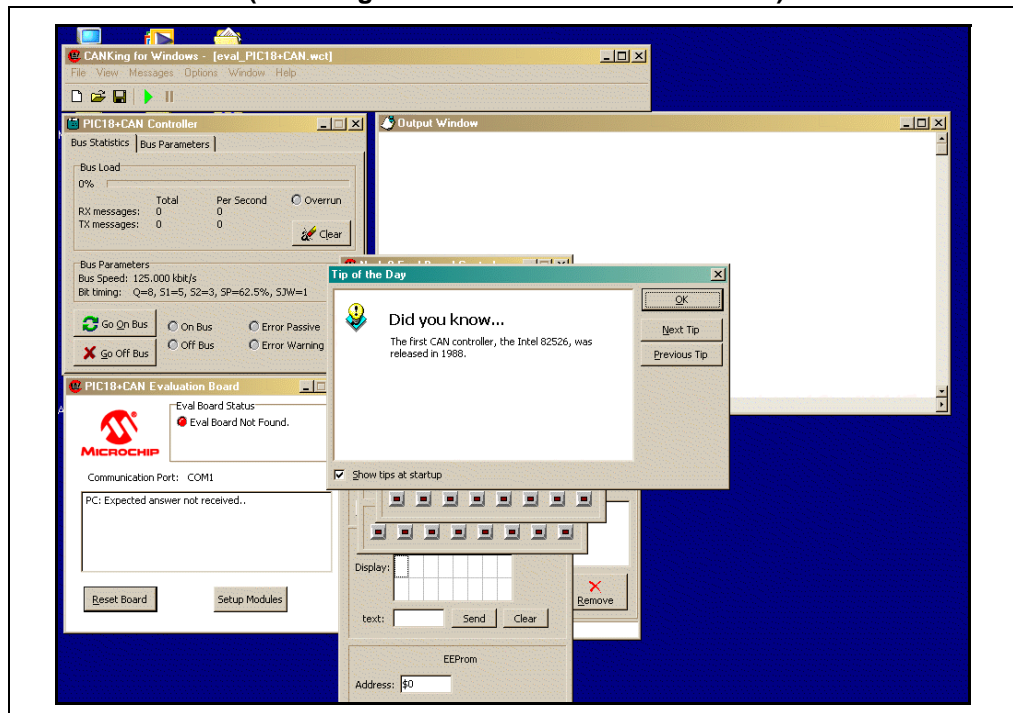
Getting Started with the PICDEM CAN-LIN 2 Board

FIGURE 2-3: CREATING A NEW PROJECT



5. At the “Templates” dialog, select **PIC18+CAN Evaluation Board**. Click on **OK**.
6. A series of smaller windows and dialog boxes is launched as part of the Evaluation Board template (Figure 2-4). Go to the CANKing for Windows menu at the top of the screen and select *Options > PIC18+CAN...* (you will need to close the Tip of the Day window at center screen first).

FIGURE 2-4: THE EVALUATION BOARD TEMPLATE AT LAUNCH (CANKing MAIN MENU BAR AT TOP LEFT)



PICDEM™ CAN-LIN 2 Development Kit User's Guide

- At the "Evaluation Board Options" dialog, select the following options from the appropriate drop-down menus:

- Clock Frequency: 25000 kHz (25 MHz)
- COM Baud Rate: 38400 bps
- COM Port: (the port that the board is connected to)

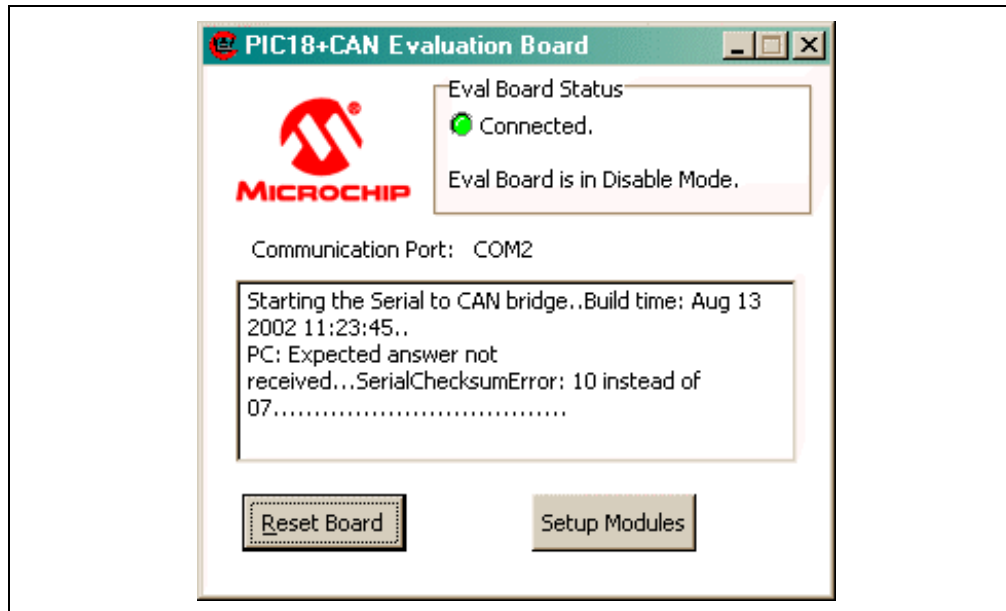
Under Options for the Current Configuration, check **Reset PIC18+CAN on Open**.

Click **OK**.

- In the Evaluation Board window (which launched along with the other windows of the Evaluation Board template), the "Connected" status indicator turns green, and a message indicating a successful serial connection appears.

Click on **Reset Board**. The green light stays on, and the message below it changes to "Eval Board is in Disable Mode" (Figure 2-5).

FIGURE 2-5: THE EVALUATION BOARD WINDOW, SHOWING A SUCCESSFUL CONNECTION



- In the CAN Controller window, click on **Go on Bus**. The On Bus light turns green. At the same time, the message in the Evaluation Board window changes to "Eval Board is in Normal Mode".

- In the Evaluation Board window, click on **Setup Modules**. Output information from the board appears in the Output window.

The PICDEM CAN-LIN 2 board is now ready to respond to control inputs from the host software.

Getting Started with the PICDEM CAN-LIN 2 Board

2.4 CHECKING THE BOARD IN EVALUATION MODE

While the board is connected to the host system and the host software is using the Evaluation template, it may be useful to verify its operation. This is also a good way to show off the board's capabilities.

After following the instructions in [Section 2.3 “Using the PICDEM CAN-LIN 2 Board for the First Time”](#), do the following:

1. Slowly turn the Node0 potentiometer clockwise and counterclockwise. The right most LED of Node1's LED bank should brighten and dim. At the same time, the **Pot Value** displayed in the Node0 Eval Board window should increase and decrease, while the **PWM Intensity** indicator in the Node1 Eval Board window should increase and decrease by the same amount.
2. Slowly turn the Node1 potentiometer clockwise and counterclockwise. The right most LED of Node0's LED bank should brighten and dim. At the same time, the **Pot Value** displayed in the Node1 Eval Board window should increase and decrease, while the **PWM Intensity** indicator in the Node0 Eval Board window should increase and decrease by the same amount.

Note: While this may seem anti-intuitive, using one node's potentiometer to affect the other's LED does prove a point. For this demonstration, we are showing that an analog input from one microcontroller can be communicated across the CAN bus to control the PWM output of the other microcontroller.

3. Click on any of the LED buttons in either of the CAN node's windows. The corresponding LED on the board should toggle on or off.
4. In the Node2 Eval Board window, select the **Count LEDs** check box. Both the LED buttons in the window, as well as the Node2 LEDs on the board, should start counting up in binary and in sync with each other.

If all of these tests worked, you are now ready to start working with the board.

PICDEM™ CAN-LIN 2 Development Kit User's Guide

NOTES:

Chapter 3. Getting Started with the CANKing Software

3.1 HIGHLIGHTS

The items discussed in this chapter are:

- Software Overview
- Starting the Program
- Introduction to the Templates
- The Main Menu
- The Output Window
- Customizing Projects

3.2 SOFTWARE OVERVIEW

The CANKing host software provides a comprehensive interface to control the board's operation. To make things easier, the program uses three distinct, predefined templates that perform specific functions.

Note: Using the CANKing host software requires that the PICDEM™ CAN-LIN 2 board's microcontrollers be programmed with the demo firmware. Since the CAN firmware is designed to run on PIC18F4680 microcontrollers only, using any configuration in Node0 and Node1 other than two PIC18F4680 microcontrollers precludes the use of CANKing host software. The board can still be used in other configurations for prototype development.

3.3 STARTING THE PROGRAM

To run CANKing, select *Programs > Microchip > CANKing* from the Start menu. Alternatively, double-click on the CANKing icon or shortcut.

If you have not disabled them on the first use of the software, you will see the initial CANKing Dialog and Warning window (see [Section 2.3.3 "Starting the Host Software for the First Time"](#) for details). If they appear, click **OK** at these dialogs to continue.

At the Open a Project or Template dialog (simply titled "CANKing for Windows"), select the **Template** option for creating a new project. (The other options listed are not available in this version of CANKing and should be dimmed.) Click **OK**.

At the "Templates" dialog, select the appropriate template and click **OK** to launch it. You can also directly launch the template by double-clicking on its icon.

If you have an alternate template or project you wish to use, select the **Open an Existing Project** option at the "Open a Project" dialog. A standard Windows dialog allows you to browse for the desired folder. Custom projects and templates are covered in more detail in [Section 3.7 "Customizing Projects"](#).

3.4 INTRODUCTION TO THE TEMPLATES

Much of the host software's versatility comes from its use of predefined templates. Because of the potential complexity of managing a microcontroller at the bit level – let alone a network protocol such as CAN – the problem of organizing all the information and controls that a user might need to evaluate and manage becomes a major challenge. CANKing simplifies matters by grouping all the necessary controls for a particular type of task into a template. Launching the template activates the necessary individual control or monitor windows that are required for the task. Users have the option to close or reopen particular windows as needed.

The individual templates and their controls are covered in detail in [Chapter 4. “Using the CANKing Templates”](#). A brief overview is given below.

3.4.1 PIC® MCU Register View Template

The PIC MCU Register template allows low-level control of Node0. It is typically used to evaluate and test the PIC18FXX8X at the register and bit level. All of the registers required for complete configuration of the CAN module are available in this template.

3.4.2 Basic Template

The Basic template is a high-level tool which focuses on CAN bus traffic. It is typically used to observe the PIC18FXX8X while on the bus. The development of a CAN node based on Node1 can be evaluated by using this template with Node0.

3.4.3 PIC18+CAN Evaluation Board Template

The Evaluation Board template provides real-time control of the entire board as a demonstration tool. It allows users to control the LEDs for each of the nodes and monitor in real time the status of the user push buttons and potentiometers.

3.5 THE MAIN MENU

Launching any of the templates, or opening any existing CANKing project, always places a common toolbar at the top of the screen. The overall operation of CANKing is controlled from here. The menu options available are, with a very few exceptions, universal across all of the templates.

The File menu implements a standard set of Windows options. Users can create a new project, save an existing project, open or reopen an existing saved project, close the existing project without exiting CANKing and exit CANKing entirely.

The View menu allows the user to selectively open and close any of the windows and dialogs available within the template. By default, each template opens only some of the windows available to it. All of the windows available within a template are listed in the View menu, allowing the user to select only those that are needed (or all windows, if required).

The Messages menu is context-sensitive. Depending on the template, it either opens (or shifts focus to) a specific configuration or message window, or selects the format for the next CAN message to be sent. This is covered in more detail in [Section 4.5 “Template-Specific Variations in the Main Menu”](#).

The Options menu sets program wide operational options for CANKing. The **PIC18+CAN...** selection configures hardware and communication options with the board (see [Figure 2-3](#)). The **Global...** selection configures software options for CANKing's operation, such as the displayed numeric base of data and auto-save on exit.

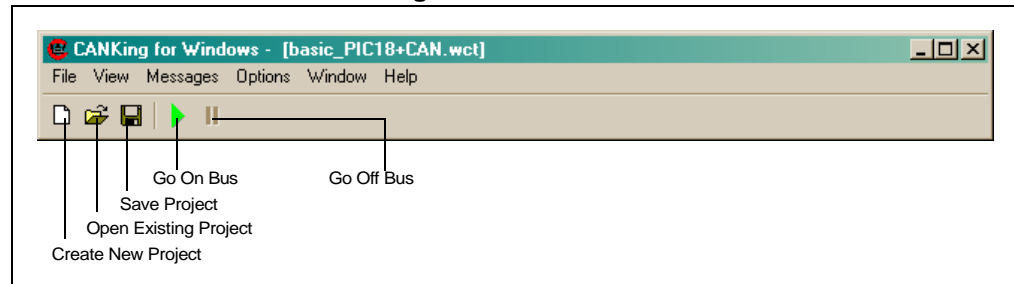
Getting Started with the CANKing Software

The Window menu lists the open windows and dialogs, and lets the user bring any one of the windows to the foreground. Unlike the View menu, this menu only shows those windows which are active.

The Help menu provides access to indexed and interactive on-line product help, as well as Internet links to Kvaser's CANKing web site. Context-sensitive help is also available by pressing F1.

The main menu toolbar (Figure 3-1) is the same for all templates. It provides standard Windows toolbar buttons for creating a new project, and opening and saving an existing project. Icons are also provided to go on and off the CAN bus; they are always present, but functional only in the Basic and Evaluation templates.

FIGURE 3-1: THE CANKing MAIN MENU



3.6 THE OUTPUT WINDOW

Common to both Basic and PIC18+CAN Evaluation templates is an Output window, which displays the messages that are received and transmitted by Node0. This window can be reconfigured to display messages in different formats. The formats are changed using a combination of the Message Formatter dialog box and the right mouse button.

The Message Formatter window (titled "Select Formatter") selects one or more of several predefined formats for the window. The format type may be specific to a particular usage (e.g., a CANKing's page interpreter or a LIN bus message interpreter) or a generic text format. More than one formatter may be selected, and their order of display may be arranged at will. Many of the formats can be fine-tuned with their own configuration options. For additional information, see [Section 4.3.3 "Select Formatters Window"](#).

Using the right mouse button in this window brings up a menu with several options:

- **Options** allows the user to set the font used in the window, as well as the maximum number of lines available in the window's buffer.
- **Fixed Positions** effectively assigns a slot for each message identifier. As messages with the same ID are received or transmitted, they overwrite the contents of the previous message with the same ID. Used in conjunction with the delta time feature, the frequency of each message type can be observed.
- **Copy to Clipboard** copies the contents of the window's buffer to the Windows clipboard.
- **Clear** empties the window and its buffer.

FIGURE 3-2: TYPICAL OUTPUT WINDOW (STANDARD TEXT FORMAT SHOWN)

Ident	Flg	Len	DO...1...	2...	3...	4...	5...	6...	D7	ASCII	Time	Dir
0000	8	FF	02	64	00	00	00	02	03	..d.....	194.993	T
0000	8	FF	10	02	00	F1	00	04	00	.....	194.993	T
0000	8	FF	02	65	00	00	00	03	03	..e.....	194.993	T
0000	8	FF	10	03	00	F0	00	02	00	.....	194.993	T
0000	8	FF	02	66	00	00	00	04	03	..f.....	194.993	T
0000	8	FF	10	04	00	F0	00	06	00	.....	194.993	T
0000	8	FF	02	67	00	00	00	05	03	..g.....	194.993	T
0000	8	FF	10	05	00	F1	00	08	00	.....	194.993	T
0000	8	FF	02	68	00	00	00	06	03	..h.....	194.993	T
0000	8	FF	10	06	00	F0	00	09	00	.....	194.993	T
0000	8	FF	02	96	00	00	00	09	03	.....	194.993	T
0000	8	FF	10	09	00	F0	00	05	00	.....	194.993	T
0000	8	FF	02	98	00	00	00	0A	03	.....	194.993	T
0000	8	FF	10	0A	00	F0	00	0A	00	.....	194.993	T
0000	8	FF	02	99	00	00	00	0B	03	.....	194.993	T
0000	8	FF	10	0B	00	F1	00	0B	00	.....	194.993	T
0096	8	03	01	00	00	00	00	00	00	.....	194.993	T

3.7 CUSTOMIZING PROJECTS

The templates furnished with the CANKing host software provide a quick way to connect to the PICDEM™ CAN-LIN 2 board and examine its operation. As you gain experience with the board and the software, however, you may want to customize your environment. For example, you may want to launch a different set of controls than those that a particular template uses as its default. Alternatively, you may want to use different communications settings. The host software accommodates these needs by allowing users to save CANKing projects with their particular settings, preserving both hardware and window configurations.

To save a configuration, use the *File > Save As* menu option. CANKing allows you to save either as a project (.wcc file extension), or a new template (.wct extension). A standard Windows dialog permits you to browse folders for the desired location.

To open a previously saved project, either choose the "Open an Existing Project" from the dialog box, or use the *File > Open* menu option. A standard Windows dialog box permits you to browse folders for the desired file.

Chapter 4. Using the CANKing Templates

4.1 HIGHLIGHTS

The items discussed in this chapter are:

- PIC MCU Register View Template
- The Basic Template
- PIC18+CAN Evaluation Board Template
- Template-Specific Variations in the Main Menu

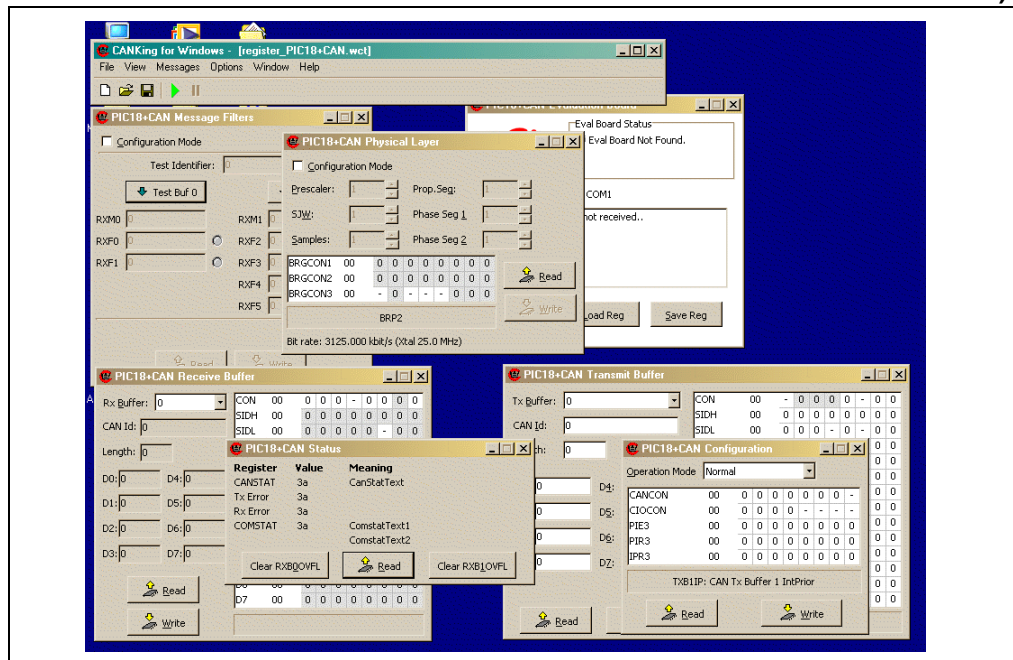
4.2 PIC MCU REGISTER VIEW TEMPLATE

This template allows low-level control of Node0. It is typically used to evaluate and test the PIC18FXX8X microcontroller at the bit level. All of the registers required for complete configuration are available in this template.

Values for buffer and control registers can be changed on both the byte and bit levels. To modify the register on a byte level, enter the value in the boxes next to the register names. Notice that the bit values will reflect the entered byte values.

To modify the registers at the bit level, double-click the desired bit. The bit will toggle for each double-click and the byte representation will be reflected next to the register name. The bit boxes are only modifiable when unshaded. Shaded bit boxes are read-only bits.

FIGURE 4-1: PIC® MCU REGISTER VIEW TEMPLATE (WHOLE SCREEN VIEW SHOWING THE AVAILABLE WINDOWS AT START-UP)

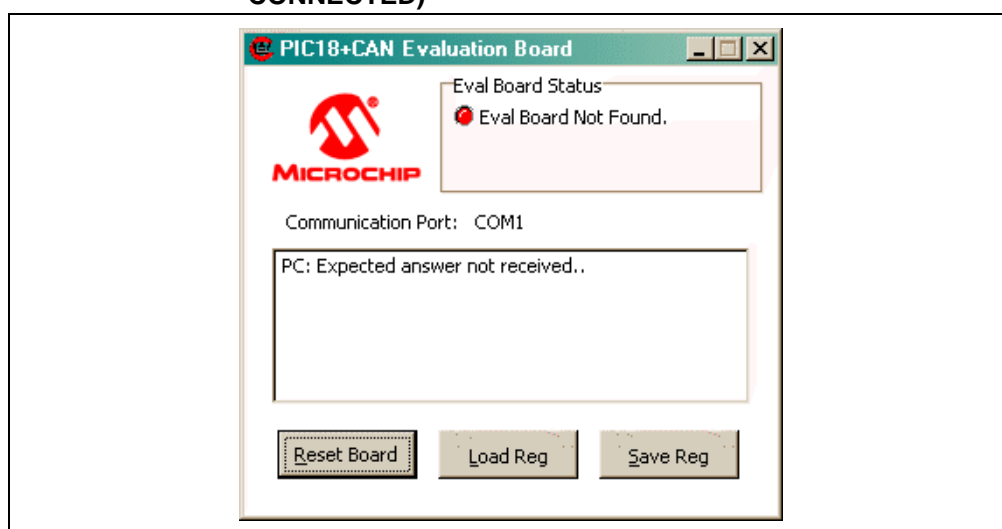


4.2.1 PIC18+CAN Evaluation Board

This window is functionally available in all three templates, but is named and configured in a slightly different manner for each. In each template, it displays the current communication status with the board. When a successful connection is detected, the “Eval Board Status” LED turns green and displays a “connected” message. The window also shows the current COM port setting and any log messages as the host software communicates with the board.

In the PIC MCU Register template, the window provides three control buttons. **Reset Board** causes a Reset of the board's firmware, and erases all previous settings. **Save Reg** saves the current register values as a HEX file; a standard Windows dialog allows the user to browse for the file location. **Load Reg** restores previously saved register values from a HEX file, and also uses a Windows dialog to search for the file's location.

FIGURE 4-2: PIC18+CAN EVALUATION BOARD WINDOW (REGISTER TEMPLATE VERSION, BOARD NOT CONNECTED)

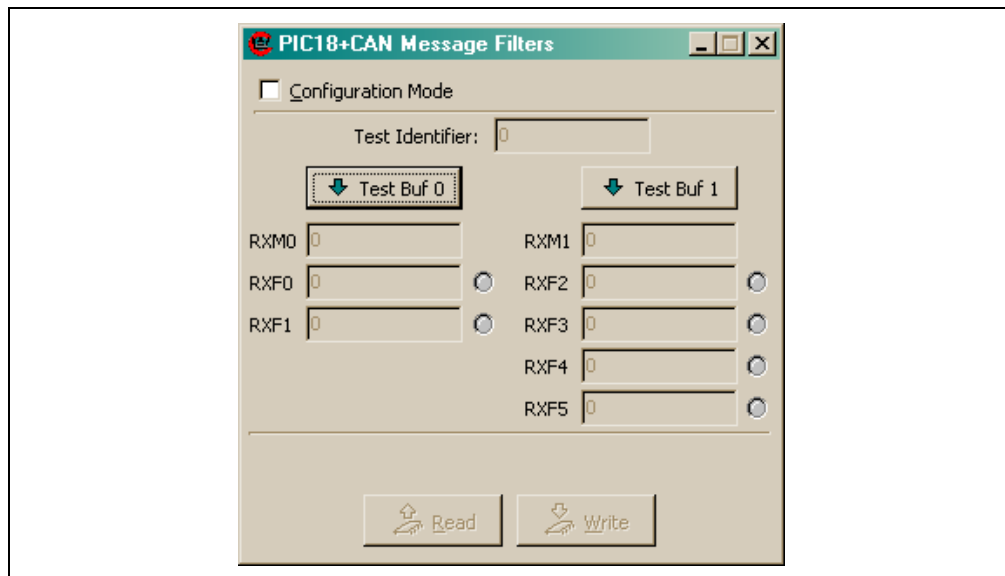


4.2.2 PIC18+CAN Message Filters

This window is used to set up and test mask and filter combinations with different message identifiers. Each mask and filter can be tested without actually writing the configuration to Node0. This is done to allow the user to test different configurations against message identifiers that would appear on the bus. When the desired mask and filter combinations are achieved, the values can be written to the Node0 by clicking the **Write** button.

Note: The masks and filters can be written only when the Node0 is in Configuration mode.

FIGURE 4-3: MESSAGE FILTER WINDOW



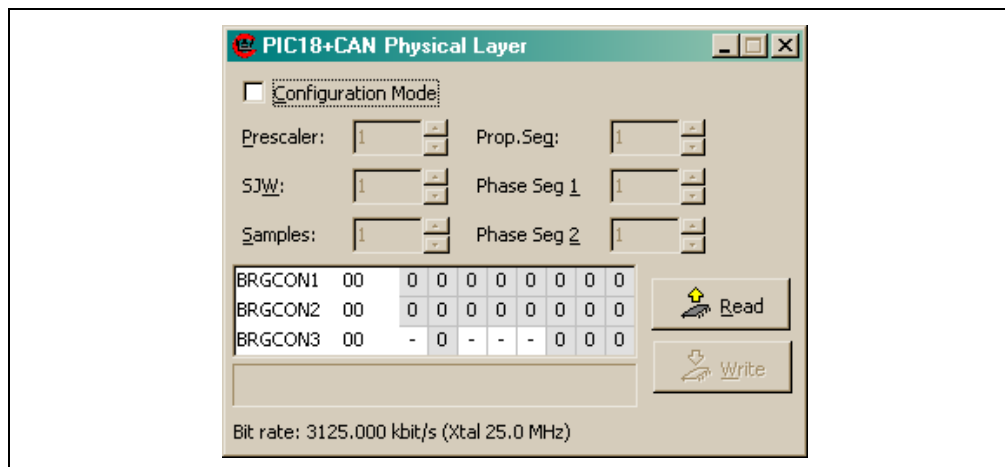
4.2.3 PIC18+CAN Physical Layer

The Physical Layer window is where the CAN bus rate is configured. The user has bit-level control of the three BRGCON registers (BRGCON1, BRGCON2 and BRGCON3), which sets up all items required for CAN bit timing including the time quanta (Tq), bit segments, the Synchronization Jump Width (SJW) and the Baud Rate Prescaler (BRP).

The calculated bit rate is shown at the bottom of the window. For this calculation to be valid, the oscillator value must be correct. To change the oscillator value, select *Options->PIC18+CAN...* from the main menu.

The BRGCON registers can be modified only when Node0 is in Configuration mode. The bit will be shaded and cannot be modified in other modes of operation.

FIGURE 4-4: PHYSICAL LAYER WINDOW



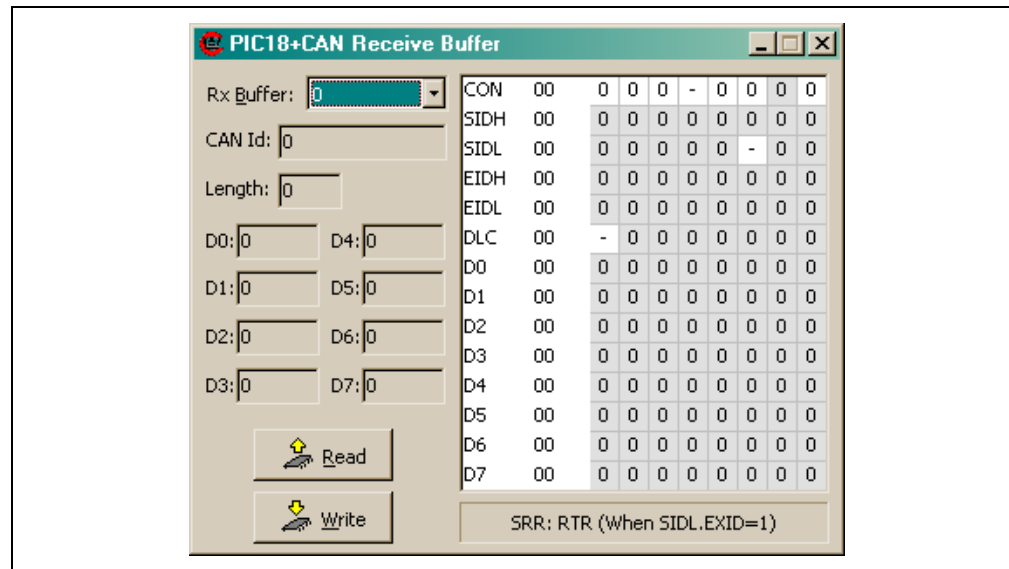
4.2.4 PIC18+CAN Receive Buffer

This window contains all of the buffer contents for the receive buffers including RXBnCON, the identifier registers and the data registers.

RXB0CON and RXB1CON are the only registers in this window that are not read-only, as indicated by the unshaded bit locations. These two registers set up the receive modes and enables or disables the hardware double-buffer function.

The Receive Buffer windows allows users to select one buffer to view at a time. Multiple Receive Buffer windows can be opened for simultaneous viewing by holding down the Shift key while selecting the Receive Buffer option from the Windows menu (*Messages > PIC18+CAN Eval Board > Receive Buffer*).

FIGURE 4-5: RECEIVE BUFFER WINDOW

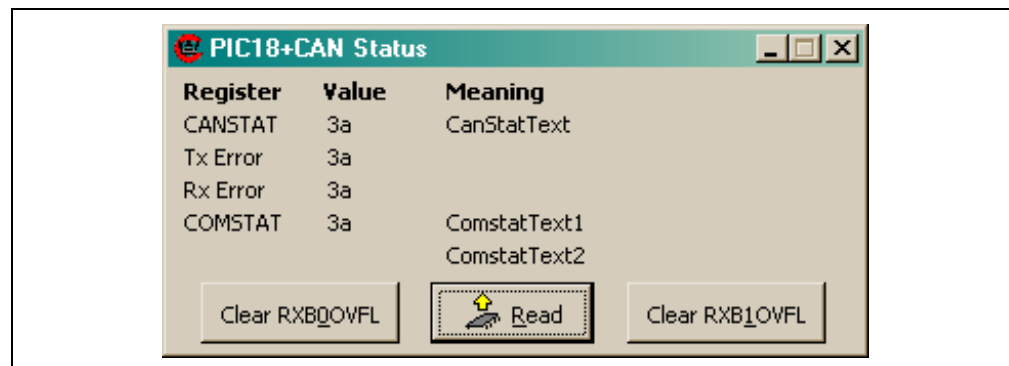


4.2.5 PIC18+CAN Status Window

The PIC18+SCAN Status window displays the contents of the CANSTAT register, the COMSTAT register and the counts for the receive and transmit error counters. The condition of the registers are also shown (for example, a CANSTAT value of 80h displays the condition as Configuration mode with no interrupts pending).

The window also contains controls to clear overrun conditions for each of the receive buffers.

FIGURE 4-6: PIC18+CAN STATUS WINDOW



Using the CANKing Templates

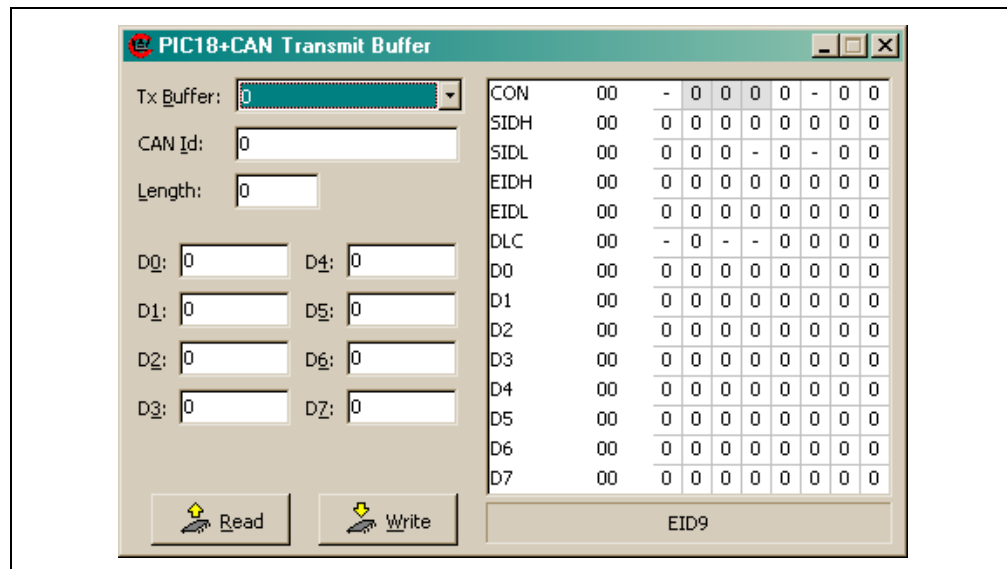
4.2.6 PIC18+CAN Transmit Buffer

This window controls the buffer contents for the three transmit registers, including TXBnCON, the identifier registers and the data registers.

Like the other register windows, the Transmit window maps the byte values to the bit boxes. Entering data into the “CAN ID:” box maps to multiple registers (SIDH, SIDL, EIDH and EIDL). For example, entering 1FFFFFFF in the “CAN ID:” box maps all ‘1’s to SIDH, SIDL, EIDH and EIDL.

Like the Receive Buffer window, the Transmit Buffer window allows users to select one buffer to view at a time. Multiple Transmit Buffer windows can be opened for simultaneous viewing by holding down the Shift key while selecting the Transmit Buffer option from the Windows menu (*Messages > PIC18+CAN Eval Board > PIC18+CAN Transmit Buffer*).

FIGURE 4-7: TRANSMIT BUFFER WINDOW

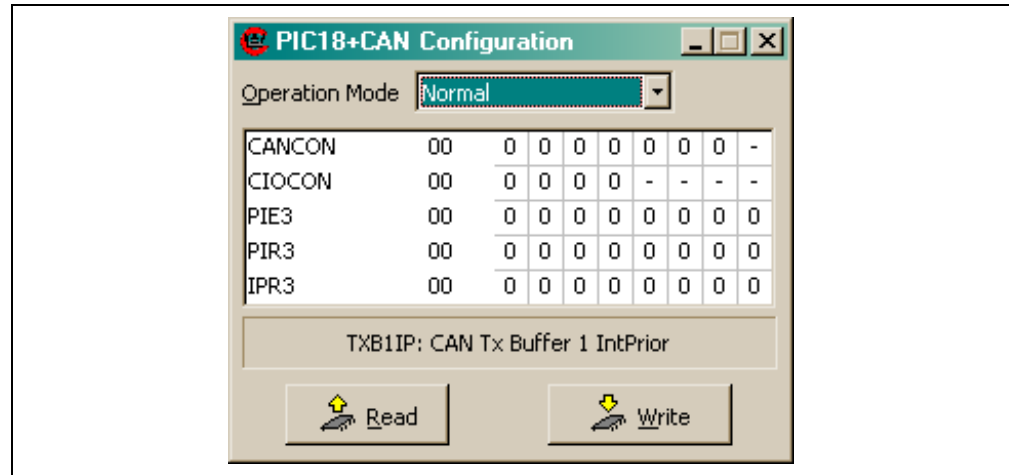


4.2.7 PIC18+CAN Configuration

This window displays and can directly control the contents of the CAN Control and Peripheral Interrupt registers (CANCON, CIOCON, PIE3, PIR3 and IPR3). These are the control and flag registers for the PIC18FXX8X microcontrollers.

A complete discussion of the function of these registers is beyond the scope of this manual. Interested readers are referred to the "PIC18F2585/2680/4585/4680 Data Sheet" (DS39625) for more information.

FIGURE 4-8: PIC18+CAN CONFIGURATION WINDOW



4.3 THE BASIC TEMPLATE

The Basic template is a high-level tool which focuses on CAN bus traffic. The user only has high-level control of Node0 (i.e., no direct register control) which includes:

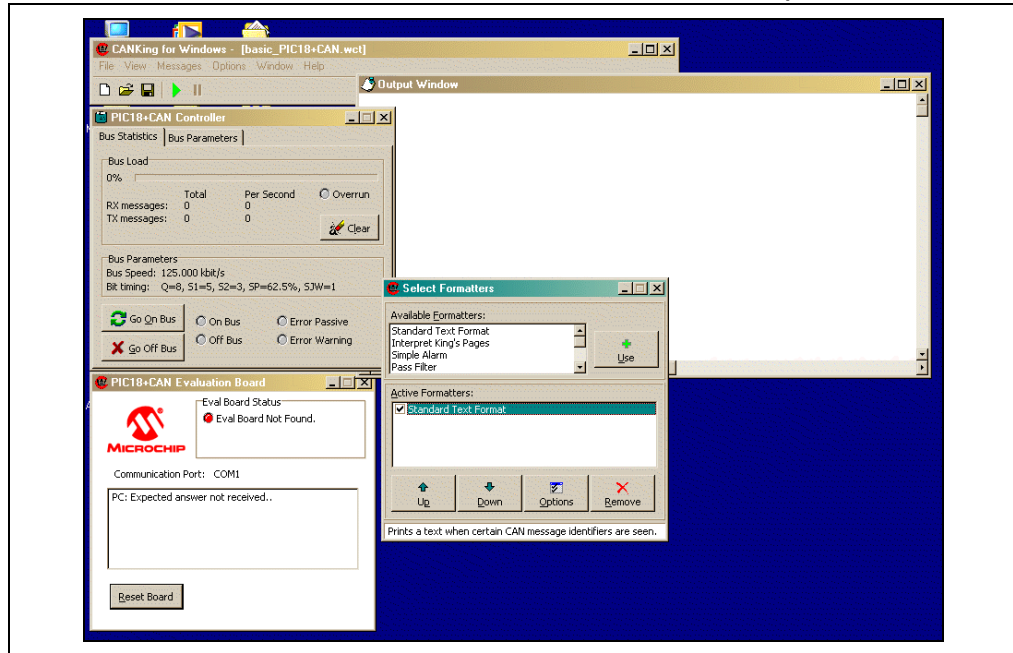
- Configuring the bus rate
- Changing modes of operation (Configuration and Normal)
- Configuring a Transmit register (the register number is predefined)
- Transmitting messages
- Resetting Node0

Other functions of the Basic template are receiving messages, saving transmitted messages, starting timed transmissions and observing the bus loading. Details of these functions can be found later in this section under the details of the individual windows.

This template would typically be used as a simple bus monitor that could be used to evaluate the PIC18FXX8X on a CAN bus, or assist in development by monitoring how Node1 is operating.

By default, the Basic template configures Node0 to receive ALL messages. The user has the option to maintain Node0 configurations when switching templates by selecting *Options > PIC18+CAN...* and deselecting the **Reset PIC18+CAN on Opening** check box. Keep in mind that deselecting this box may create unforeseen problems if the Node0 was not configured properly previously.

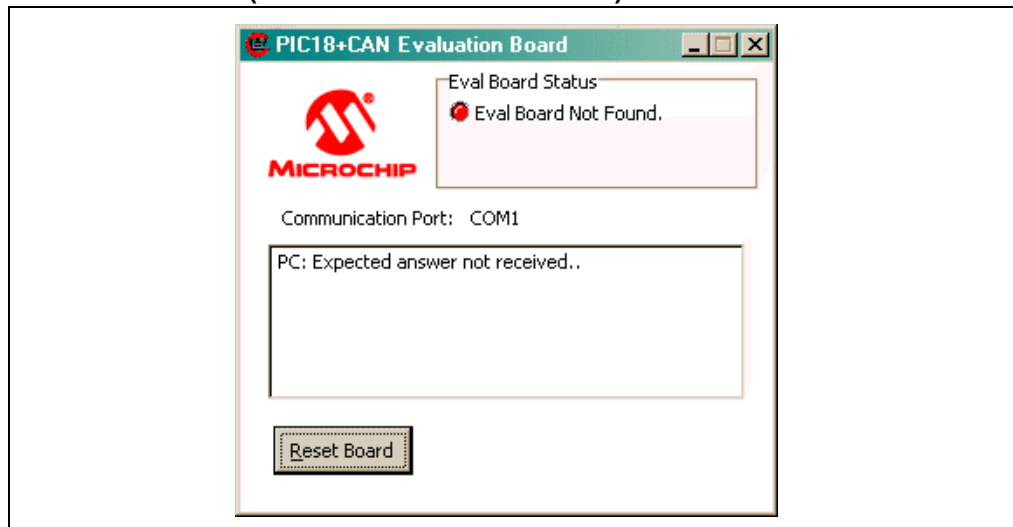
FIGURE 4-9: THE BASIC TEMPLATE (WHOLE SCREEN VIEW SHOWING THE AVAILABLE WINDOWS AT START-UP)



4.3.1 PIC18+CAN Evaluation Board

This window is similar in function to the Evaluation Board window in the PIC MCU Register template ([Section 4.2.1 “PIC18+CAN Evaluation Board”](#)) in displaying the current communication status of the board. For the Basic template, there is only one control, the **Reset Board** button. It resets the firmware and writes power-on default values to all of Node0's CAN registers.

FIGURE 4-10: PIC18+CAN EVALUATION BOARD WINDOW (BASIC TEMPLATE VERSION)



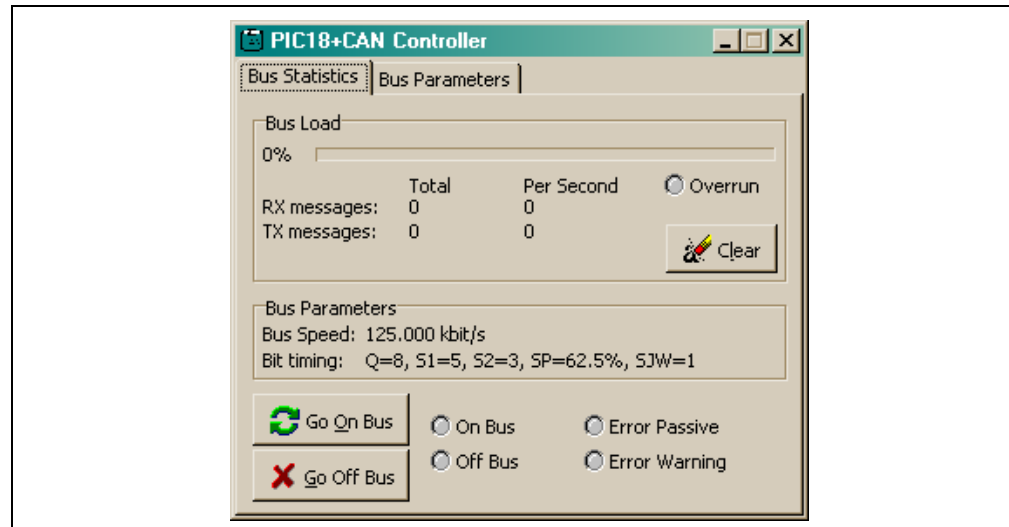
4.3.2 PIC18+CAN Controller

This window provides information about the status of the bus, including nominal bus loading, status of node (on or off the bus), and bus bit rate. The tabs at the top of the window select between **Bus Statistics** and **Bus Parameters** pages.

On the **Bus Statistics** page, the bus loading, bus parameters and bus status can be viewed. The bus loading shows the nominal load on the CAN bus as a percentage and as a number as well as the total number of messages sent and received. The bus parameters reflect the parameters set in the **Bus Parameters** view (i.e., bit rate, number of TQ, bit segment lengths and the location of the sample point). The **Bus Statistics** shows the mode of operation and error states; this is also where the controls to put the board **On Bus** (normal operation) or **Off Bus** (Configuration mode) are located.

Options on the **Bus Parameters** page allow the user to configure the bus rate, the sample point, the Synchronization Jump Width (SJW) and switching between Normal and Listen Only modes of operation.

FIGURE 4-11: PIC18+CAN CONTROLLER WINDOW



4.3.3 Select Formatters Window

This window determines the format of the displayed data in the Output window.

CANKing provides a number of predefined general and specialized format options for data display. Many of these formats can, in turn, be fine-tuned with specific configuration options. The default is “Standard Text Format” which displays the message data as normal data.

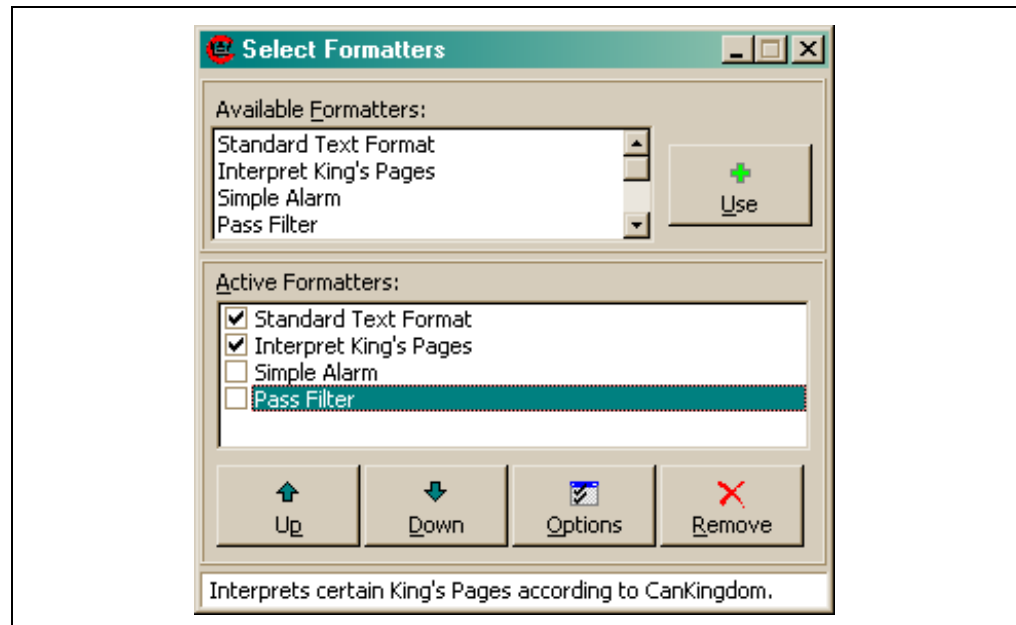
To add a formatter for the Output window, select an option from the “Available Formatters” spin box, and click on the **Use** button. Alternatively, you can double-click on the item. The formatter is successfully selected when it appears in the Active Formatters window and its check box is selected.

To deactivate a formatter, select the item from the “Active Formatters” window and click the **Remove** button. You can also temporarily deactivate an option by deselecting the check box next to it.

To change the order that formatters are applied to the Output window, select a formatter in the “Active Formatters” window and click on the **Up** or **Down** buttons.

The properties of the formatter can be changed by pressing the **Properties** button while the selection is highlighted in the “Active Formatters” list. The properties of the “Standard Text Format” are the numeric base of the display (octal, decimal or hexadecimal) and whether or not to display the message time-stamp as a running total or as delta time. Many of the other formatters have their own unique configuration properties (e.g., filter limits, message interpreters).

FIGURE 4-12: MESSAGE FORMATTERS WINDOW



4.3.4 Output Window

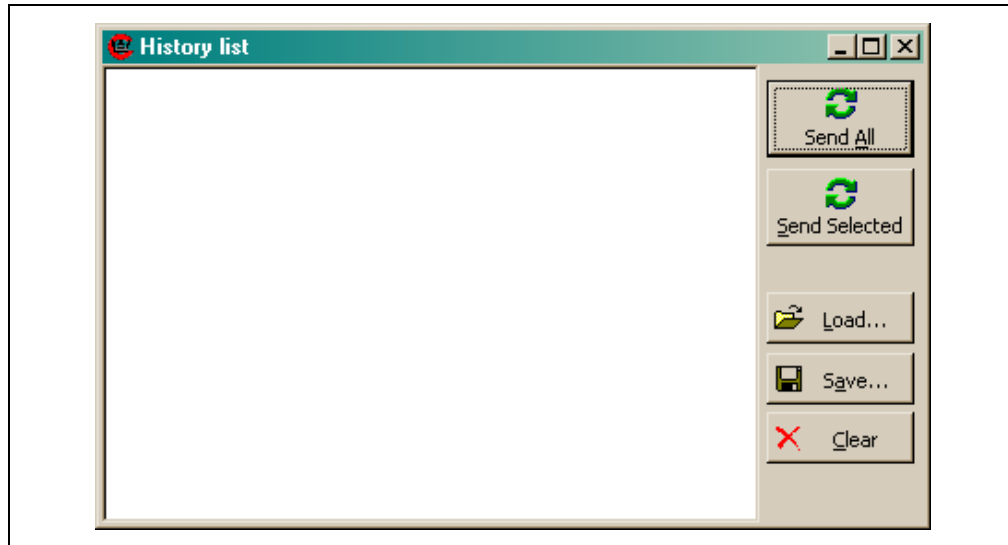
The Output window is discussed in detail in [Section 3.6 “The Output Window”](#).

4.3.5 History List

This window is used to collect transmitted messages for saving to a file. It is not opened by default when opening a new template, but by selecting *View > History List* from the main menu. Once opened, every transmitted message is captured in the History List window for saving to a file, if desired. Each line consists of Identifier, Data Len and Data Byte D0 through Data Byte D7. One or more messages can be selected for retransmission. There is also a button for sending all the captured messages.

The History List window works in conjunction with the Timed Transmission window. Messages can be retransmitted once, or continually at defined intervals. See the Timed Transmission window ([Section 4.3.6 “Timed Transmission”](#)) for more details.

FIGURE 4-13: HISTORY LIST WINDOW



4.3.6 Timed Transmission

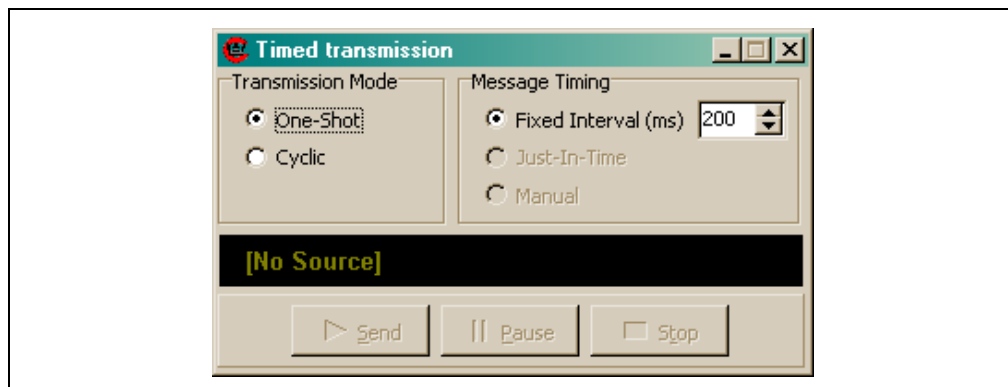
The Timed Transmissions window is used to send the messages in the History List, either once, or continually at timed intervals.

The **One-Shot** mode sends the selected (in the History List window) messages, one time, each time the send buttons are pressed in the History List window.

The **Cyclic** selection sends the selected messages at regular intervals (from 1 ms to 10 s). The interval is set with the fixed-interval spin box.

The other Message Timing selections (*Just-in-Time* and *Manual*) are not available in this version of the software.

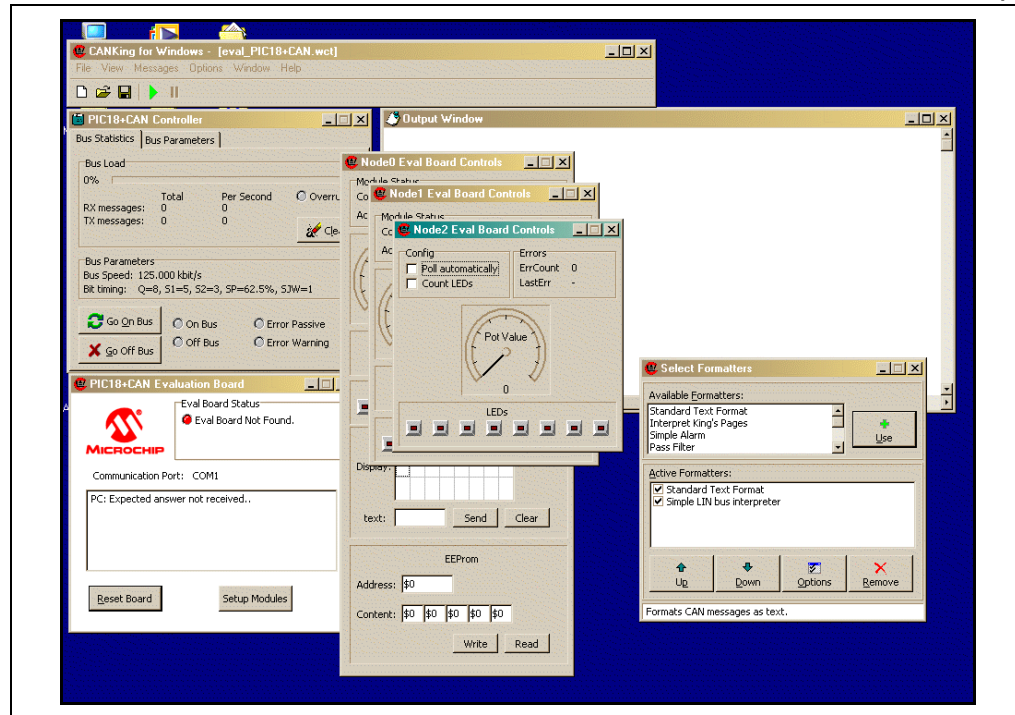
FIGURE 4-14: TIMED TRANSMISSION WINDOW



4.4 PIC18+CAN EVALUATION BOARD TEMPLATE

For most users, this is the very first template used when the PICDEM™ CAN-LIN 2 board is first set up and configured. It provides real-time control of the board's interactive features, and serves as the demo application for the on-board controls. The individual Board Evaluation windows allow users to, among other things, toggle the LEDs and monitor the real-time status of the push button switches and potentiometers.

FIGURE 4-15: THE EVALUATION BOARD TEMPLATE (WHOLE SCREEN VIEW SHOWING THE AVAILABLE WINDOWS AT START-UP)



4.4.1 Putting the Board in Evaluation Mode

Unlike the other templates, the PIC18+CAN Evaluation Board template requires additional action by the user beyond a firmware Reset. This involves initializing that section of the firmware which allows interactive control of the board's features which are not available when operating with the other templates. The initial setup described in [Section 2.3 "Using the PICDEM CAN-LIN 2 Board for the First Time"](#) describes the process in detail. If the board is already connected, however, it is only necessary to do the following:

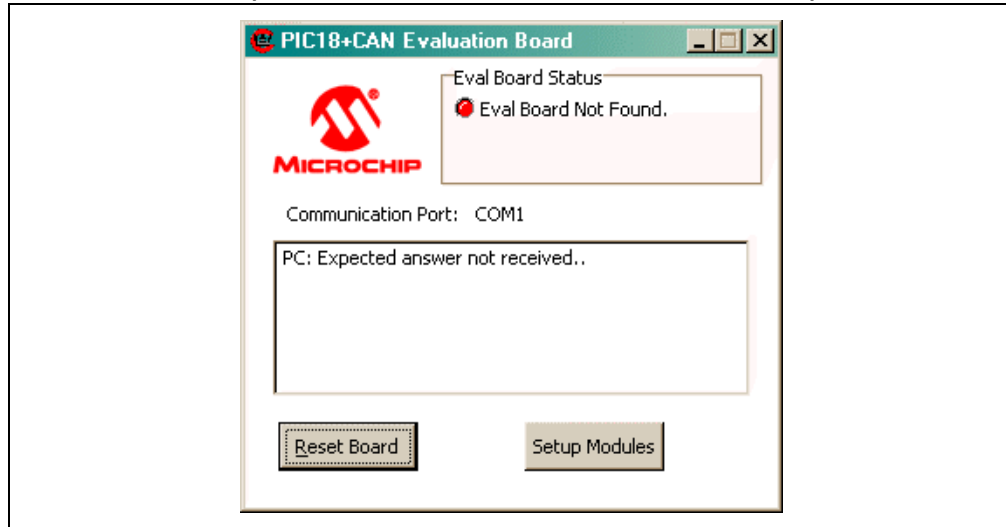
1. Open a new project using the Evaluation Board template.
2. In the PIC18+CAN Controller window, click **Go on Bus**.
3. In the PIC18+CAN Evaluation Board window, click **Setup Modules**. This command causes multiple CAN messages to be transmitted and initializes all nodes on the board.

The interactive features of the board are now available.

4.4.2 PIC18+CAN Evaluation Board Window

As with its counterparts in the other templates, this window displays the current communication status with the board. In this template, there are two control buttons. **Reset Board** resets the firmware and writes power-on default values to all CAN registers. **Setup Modules** initializes the firmware for the Interactive (Demonstration) mode.

FIGURE 4-16: PIC18+CAN EVALUATION BOARD WINDOW (EVALUATION BOARD TEMPLATE VERSION)



4.4.3 Node0 Eval Board (Control) Window

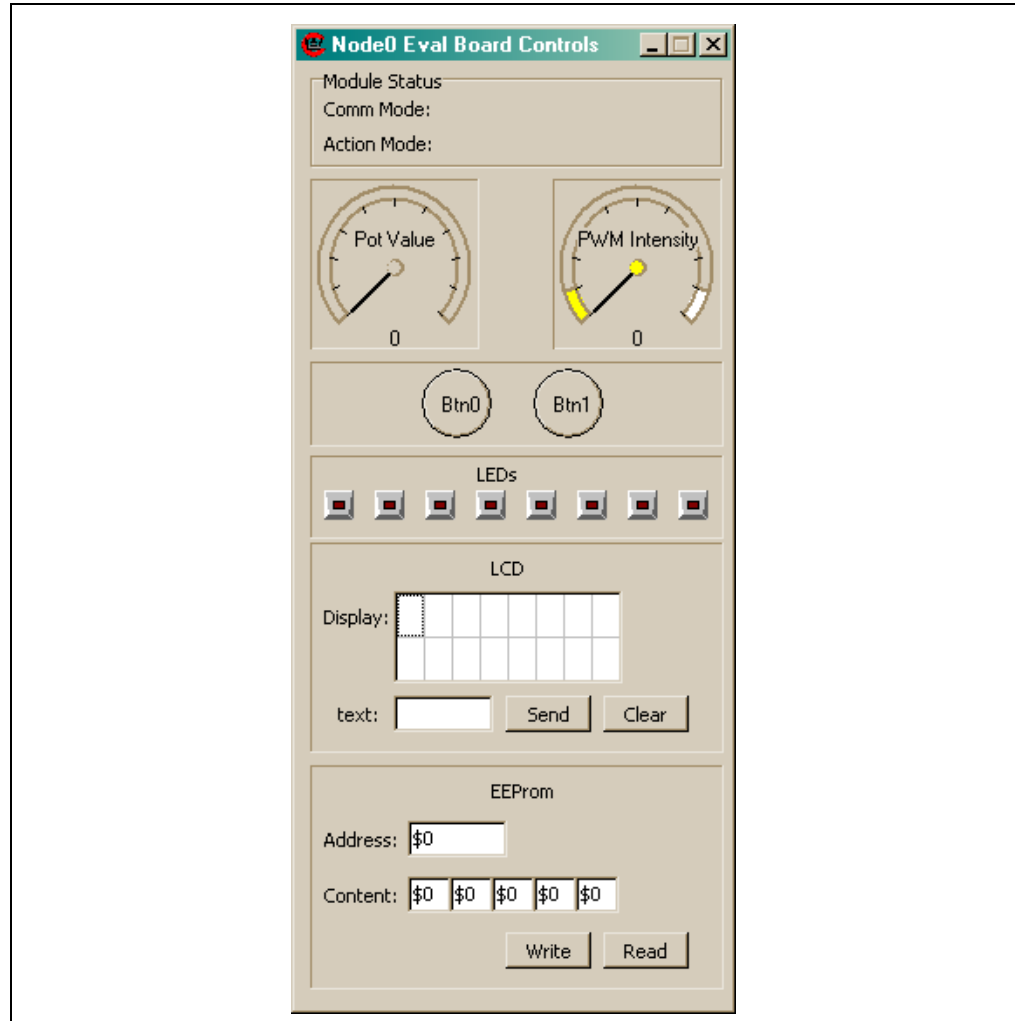
This window controls the interactive features on the Node0. Once initialized, this window displays the correct status for the user-defined devices connected to Node0. Node0 has the most interactive features, which means that this control window is the largest of the three. From top to bottom, the controls are:

- **Pot Value:** This indicator is updated in real time to display the approximate position of the Node0 potentiometer. The value is also displayed in numerical format, ranging from 0 to 1000 (approximately).
- **PWM Intensity:** This indicator shows the output of the PWM module in relative terms, from minimum to maximum. It also shows the value numerically, ranging from 0 to 1000 (approximately); this value is controlled by, and should match that of, the Node1 potentiometer in the Node1 Eval Board window. The relative value should also correspond to the brightness of the ninth LED, which is controlled by the PWM module's output.
- **Push Button Status:** The two indicators (btn0 and btn1) show the status of the node's user-defined push buttons. Pressing the buttons on the board will change the indicators.
- **LED Status:** These eight buttons control and indicate the status of the first 8 LEDs of the LED bank (the ninth LED is controlled by Node1's potentiometer). Clicking on any of the buttons will toggle the corresponding LED on or off. The LED enable jumper (JP3) must be installed for this feature to work.

Using the CANKing Templates

- **LCD:** If a compatible LCD display is attached at the header, a message can be written to it by using this area. To send a line of text, type into the “text:” text box (up to 7 characters), then click **Send**. To erase the display, click **Clear**.
- **EEPROM:** The on-board serial EEPROM can be read from, and written to, from this area. To write, enter a valid address in the “Address:” text box, enter data values into one or more of the “Content:” boxes, then click **Write**. To read, enter a valid address in “Address:”, then click **Read**.

FIGURE 4-17: Node0 EVAL BOARD CONTROL WINDOW



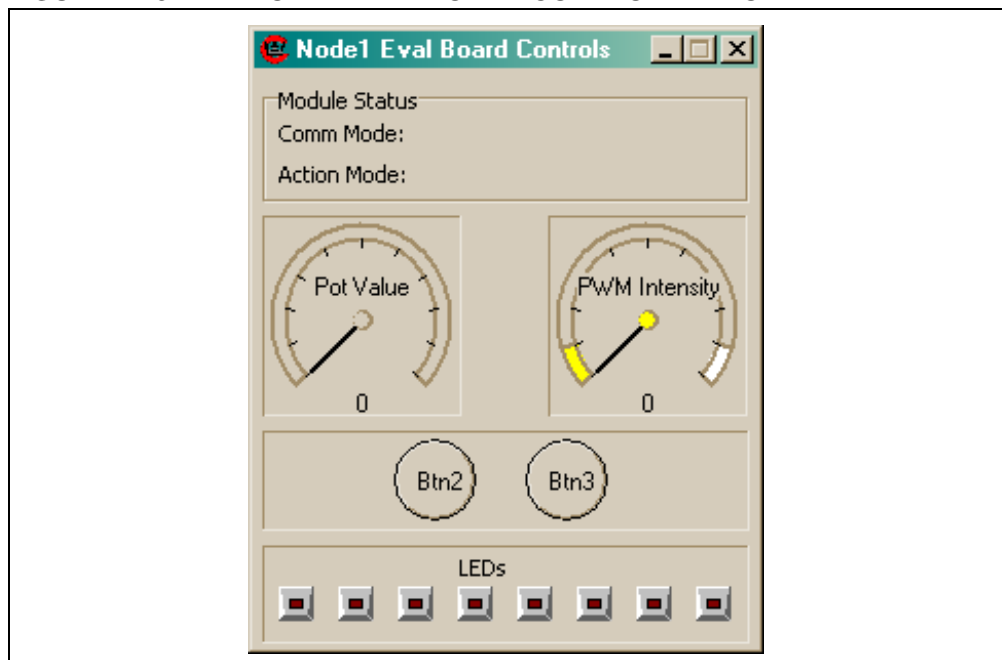
4.4.4 Node1 Eval Board (Control) Window

This window controls Node1, the second CAN and LIN master node. When the board is properly initialized, this window will also display the correct **Module Status**.

The interactive features are:

- **Pot Value and PWM Intensity:** These function identically to their counterparts for the Node0 Eval Board Control window, except these refer to Node1. The PWM intensity displayed and brightness of the ninth LED is controlled by the Node0 potentiometer, the value of which is displayed in the Node0 Eval Board window.
- **Push Button Status:** These are identical in function to Node0.
- **LED Status:** These are also identical to Node0. The LED enable jumper (JP4) must be installed for this feature to work.

FIGURE 4-18: NODE1 EVAL BOARD CONTROL WINDOW



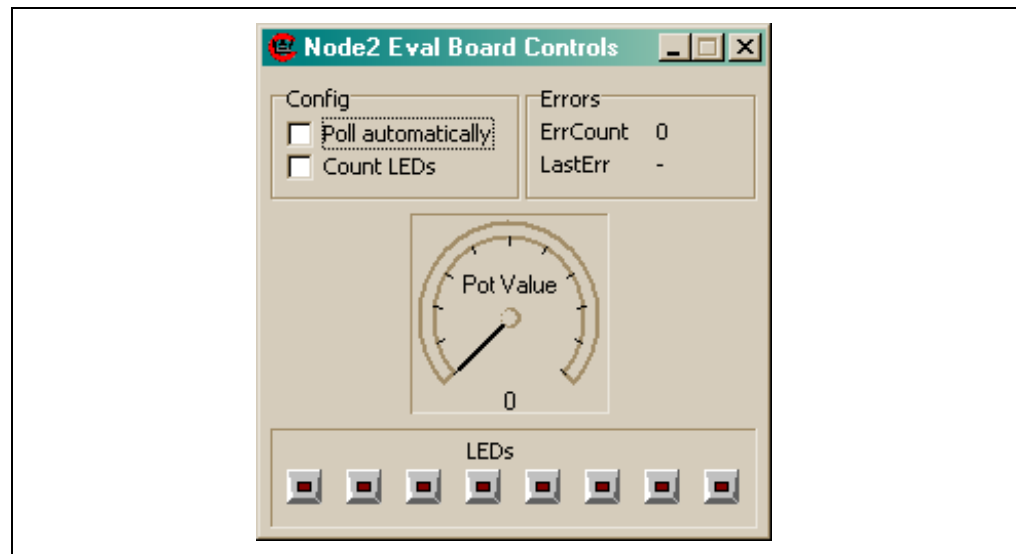
4.4.5 Node2 Eval Board (Control) Window

This window shows real-time status of Node2, the LIN slave node.

Its features are:

- **Poll automatically:** When this check box is selected, the status of the Node2 potentiometer is monitored in real time and shown on the **Pot Value** display. Like the other nodes, the value is also reported numerically.
- **Count LEDs:** Checking this box causes the Node2 LEDs to count up in binary sequence (least significant digit on the left). The LEDs on the board and the Eval window display count synchronously.
- **LED Status:** Like the other nodes, the LEDs for Node2 can also be individually toggled on and off. For this feature (and the **Count LEDs**) to work, the LED enable jumper (JP4) must be installed.

FIGURE 4-19: NODE2 EVAL BOARD CONTROL WINDOW



4.4.6 PIC18+CAN Controller

This window is identical to the PIC18+CAN Controller window in the Basic template ([Section 4.3.2 “PIC18+CAN Controller”](#)).

4.4.7 Select Formatters

This window is identical to the Message Formatters window in the Basic template ([Section 4.3.3 “Select Formatters Window”](#)).

4.4.8 History List

This window is identical to the History List window in the Basic template ([Section 4.3.5 “History List”](#)).

4.4.9 Timed Transmission

This is identical in form and function to the Timed Transmission window in the Basic template ([Section 4.3.6 “Timed Transmission”](#)).

4.4.10 Output Window

The Output window is discussed in [Section 3.6 “The Output Window”](#).

4.5 TEMPLATE-SPECIFIC VARIATIONS IN THE MAIN MENU

For the most part, the options available from the CANKing main menu are identical in all three template views. The few exceptions are described below. Only two menu items will be discussed in this section, as the others are self explanatory.

Messages Menu

In the Basic and PIC18+CAN Evaluation templates, the *Messages* menu selects the CAN message type to be transmitted. Each option opens a dialog box for configuring the message; the dialog is unique to the message type.

Two message options are available: Universal or CAN Kingdom. The *Universal* option allows the user to send standard generic-format messages using a normal (up to eight byte), integer, long integer, 32-bit floating point or string page format. The *CAN Kingdom* option lets the user transmit a message that adheres to the CAN Kingdom higher layer protocol in one of 20 pre-defined King's page formats, or a default letter format.

In the PIC Register template, the Messages menu provides alternate access to the various buffer and register configuration windows; these are available as submenu options from the single menu option (*PIC18+CAN Eval Board*).

Options Menu

All of the templates offer the *Global* and *PIC18+CAN...* options in the Options menu. These are used to configure communications with the board and global features of CANKing, and are discussed in [Section 3.5 "The Main Menu"](#).

The Basic and P Evaluation templates also include the *King's Pages* option. Selecting this allows the user to set a default King's envelope and city/group address.

<p>Note: The oscillator frequency must be set in software to match the hardware so the software can configure the bit timing registers correctly. The formulas for bit timing contain an oscillator frequency. Refer to the "PIC18F2585/2680/4585/4680 Data Sheet" for further details.</p>
--

The options menu contains the configurable properties of both the hardware and the software.

The default numeric base is selected by *Options > Global*. Auto-save switches are also contained here.

Options > PIC18+CAN... is where the COM port is selected, and where the oscillator frequency is set in software. This menu also contains a switch that determines whether or not the Node0 controller will be reset on file open. This feature is for those users who want to switch between templates without changing the PIC18FXX8X configuration (e.g., masks and filters are set to receive ALL messages in the Basic template unless this box is deselected).

Chapter 5. Reconfiguring the PICDEM CAN-LIN 2 Hardware

5.1 HIGHLIGHTS

This chapter covers the following:

- Node Configurations
- Oscillator Configurations
- Jumper Settings
- Restoring the PICDEM CAN-LIN 2 Firmware

5.2 NODE CONFIGURATIONS

The PICDEM CAN-LIN 2 board can be operated in many different configurations; only a few of the possibilities are listed here. Most of these can be implemented without any changes to the board; some may require the addition of some components or wiring. Access to the external LIN bus will require the addition of a LIN bus connector at the pads provided for J4 (item 16 in [Figure 1-1](#)).

5.2.1 Two CAN Nodes, One LIN Node, Embedded System

This is the default configuration. The two CAN nodes (Node0 and Node1) are connected via the on-board CAN bus, while Node1 and Node2 are connected via the on-board LIN bus. There are no external CAN or LIN bus connections.

This configuration can be used for evaluation or development. For design evaluation, use one of the three templates to monitor or control the board. For development, use Node1 for the development of applications; Node0 can then be used with the CANKing software to monitor the development node. If required, Node1 may also communicate with Node2.

5.2.2 Two CAN Nodes, One LIN Node, Distributed System

In this configuration, external CAN and LIN bus devices can be connected to the on-board bus.

This configuration can be used for evaluation or development, using a similar approach as an embedded system configuration (above).

5.2.3 Two CAN Nodes, Embedded System

In this configuration, Node2 is deactivated by removing the PIC16C432 controller from its socket (with the power off, of course). If required, the circuit traces between the Node1 USART pins and the stand-alone LIN bus transceiver may be cut, and an extra RS-232 line driver may be added.

In Development mode, Node0 can be used to monitor Node1.

5.2.4 Two CAN Nodes, Distributed System

This configuration connects both on-board CAN nodes to an external CAN bus.

In Evaluation mode, Node0 can be used to monitor the external bus. In Development mode, Node0 can be used to monitor both Node1 and the external bus.

PICDEM™ CAN-LIN 2 Development Kit User's Guide

5.3 OSCILLATOR CONFIGURATIONS

The PICDEM CAN-LIN 2 Board is designed to accommodate three different types of oscillators for the PIC18FXX8X device-based nodes:

- Crystal-controlled oscillator
- RC oscillator
- Self-contained oscillator module (“canned” oscillator)

There are two oscillator sections on the board, one for each of the CAN controllers. As shipped from the factory, the board is configured with two 25 MHz canned oscillators. If a different clock frequency is desired, it is only necessary to remove the existing oscillator modules and insert new ones.

To implement the other options, it will be necessary for users to make changes to the board.

5.3.1 Crystal Oscillator

The on-board oscillator module(s) (Y2 and/or Y3) must be removed from their sockets. Either one (or both) of the CAN controllers can be configured to use a crystal oscillator. Pads, Y1 and Y4 (for Node0 and Node1, respectively), have been provided to add a crystal. Depending on frequency and crystal used, capacitors may also need to be added at pads, C24/C25 (Node0) and C30/C31 (Node 1). It is the user's responsibility to select values for these components to obtain a frequency compatible with the controller. If the RC oscillator option has been previously used, it will be necessary to remove the RC network components.

5.3.2 RC Oscillator

The on-board oscillator module(s) (Y2 and/or Y3) must be removed from their sockets. The RC network for the oscillator is not provided and must be added by the user. Each CAN controller has pads provided for an RC network. Pads, R21/C27 (for Node0) and R22/C29 (for Node1), are provided for the addition of these components. It is the user's responsibility to select values for these components to obtain a frequency compatible with the controller.

5.4 JUMPER SETTINGS

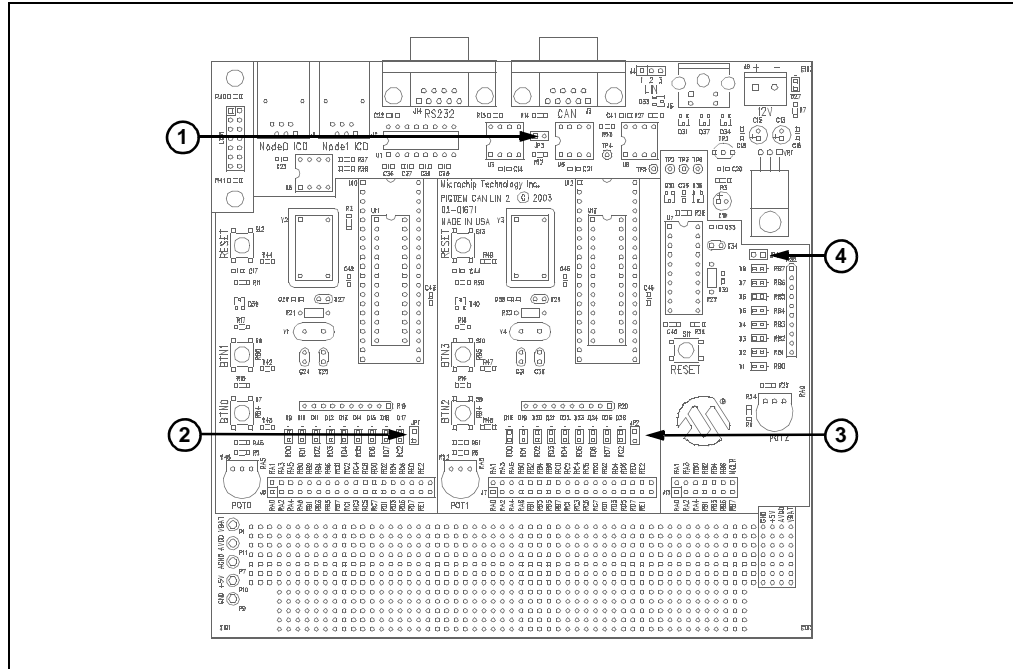
There are several jumpers provided for configuring the hardware operation of the PICDEM CAN-LIN 2 board. Their functions are listed in [Table 5-1](#) and locations are shown in [Figure 5-1](#).

TABLE 5-1: JUMPER DESCRIPTION

Number	Board ID	Function
1	JP3	Connects 120 ohm terminating resistor to the CAN bus
2	JP1	LED enable for Node0
3	JP2	LED enable for Node1
4	JP4	LED enable for Node2

Reconfiguring the PICDEM CAN-LIN 2 Hardware

FIGURE 5-1: JUMPER LOCATIONS



5.5 RESTORING THE PICDEM CAN-LIN 2 FIRMWARE

As shipped from the factory, the microcontrollers on the PICDEM CAN-LIN 2 board are preprogrammed with special firmware. This provides the code that makes the Interactive Evaluation mode possible and enables communication with the CANKing host software.

As users develop their own CAN applications, it is likely that the controllers will be reprogrammed with new firmware. Should it ever become necessary to return the board to its original state, it will be necessary to restore the original firmware.

To make this process easier, the required source and HEX files for the firmware have been included on the PICDEM CAN-LIN 2 Software CD. To reprogram the microcontrollers directly with the original firmware, use the following HEX files:

- 4680Node .hex: for Node0 and Node1 devices (PIC18F4680 only)
- LINSLAVE .hex: for the Node2 device (PIC16C432)

Users should follow the procedure appropriate for their device programmer and development environment.

PICDEM™ CAN-LIN 2 Development Kit User's Guide

NOTES:

Chapter 6. Troubleshooting

6.1 HIGHLIGHTS

This chapter discusses the following:

- Common Problems

6.2 COMMON PROBLEMS

1. The Power LED is not lit.

Check the PICDEM CAN-LIN 2 board for power:

- Verify that the power supply is plugged in and the wall outlet has power. If battery connection is used, verify that the correct polarity is used.
- Check that voltage is available (12 VDC) at the plug. If the original power supply is not being used, check for appropriate voltage (12 VDC).
- Check that the regulated voltage (5 VDC) is available at the connectors at the prototype area of the board.

2. The host software cannot communicate with the board.

Check that the board is receiving power (see issue 1 above).

Check the serial cable for proper connections to the board and the computer. Verify that the cable is connected to the correct serial port on the computer. If necessary, verify the serial cable by swapping in another cable that is known to be good.

Verify through Windows Device Manager (accessed through the System applet in the Control Panel) that the selected COM port is recognized by the operating system and is working.

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 Node0 LEDs flash briefly on Reset or power-up of the board.

If you are using the optional LCD module, verify that the text "PIC CAN" is briefly displayed on Reset or power-up, and an underscore cursor is displayed.

3. The board is operational, but neither of the CAN nodes are recognized on an external network.

See [Appendix B. "FAQs on Configuring the PIC18FXX8X"](#) for the most common CAN troubleshooting hints.

PICDEM™ CAN-LIN 2 Development Kit User's Guide

NOTES:

Appendix A. PICDEM CAN-LIN 2 Board Technical Information

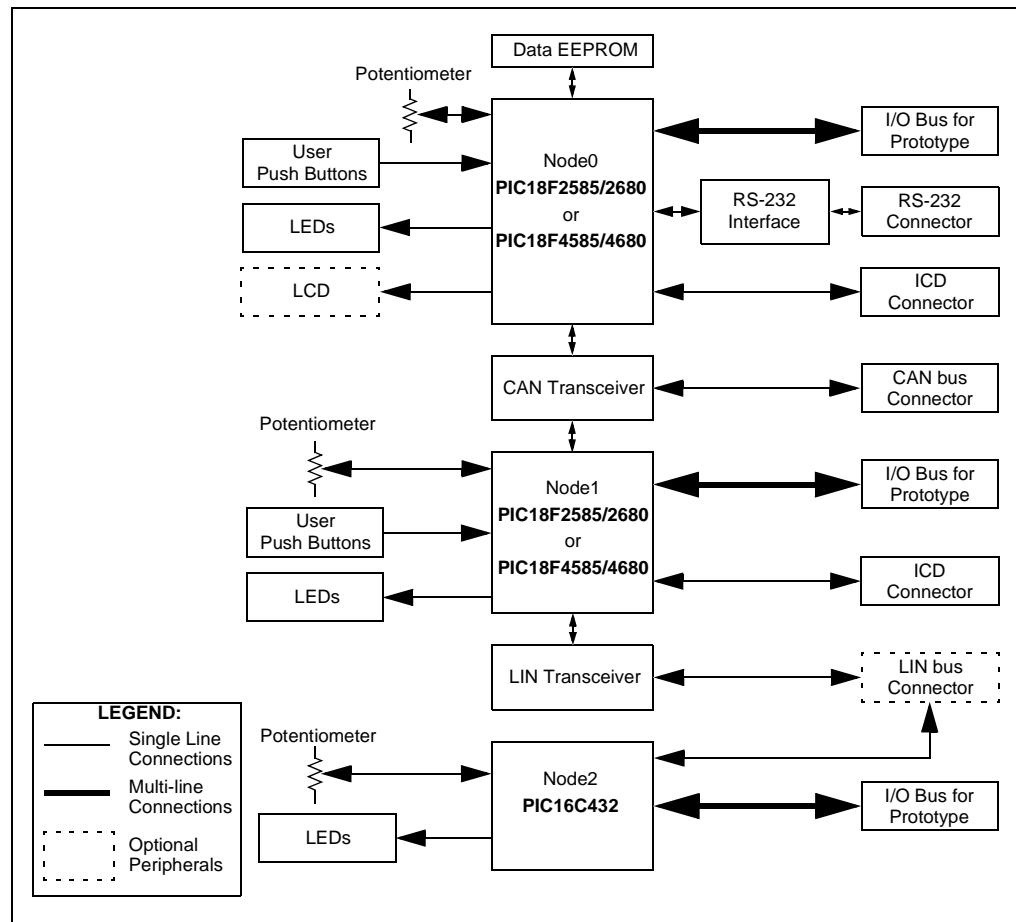
A.1 HIGHLIGHTS

This chapter will cover the following topics:

- PICDEM CAN-LIN 2 Block Diagram
- PICDEM CAN-LIN 2 Board Schematics

A.2 PICDEM CAN-LIN 2 BLOCK DIAGRAM

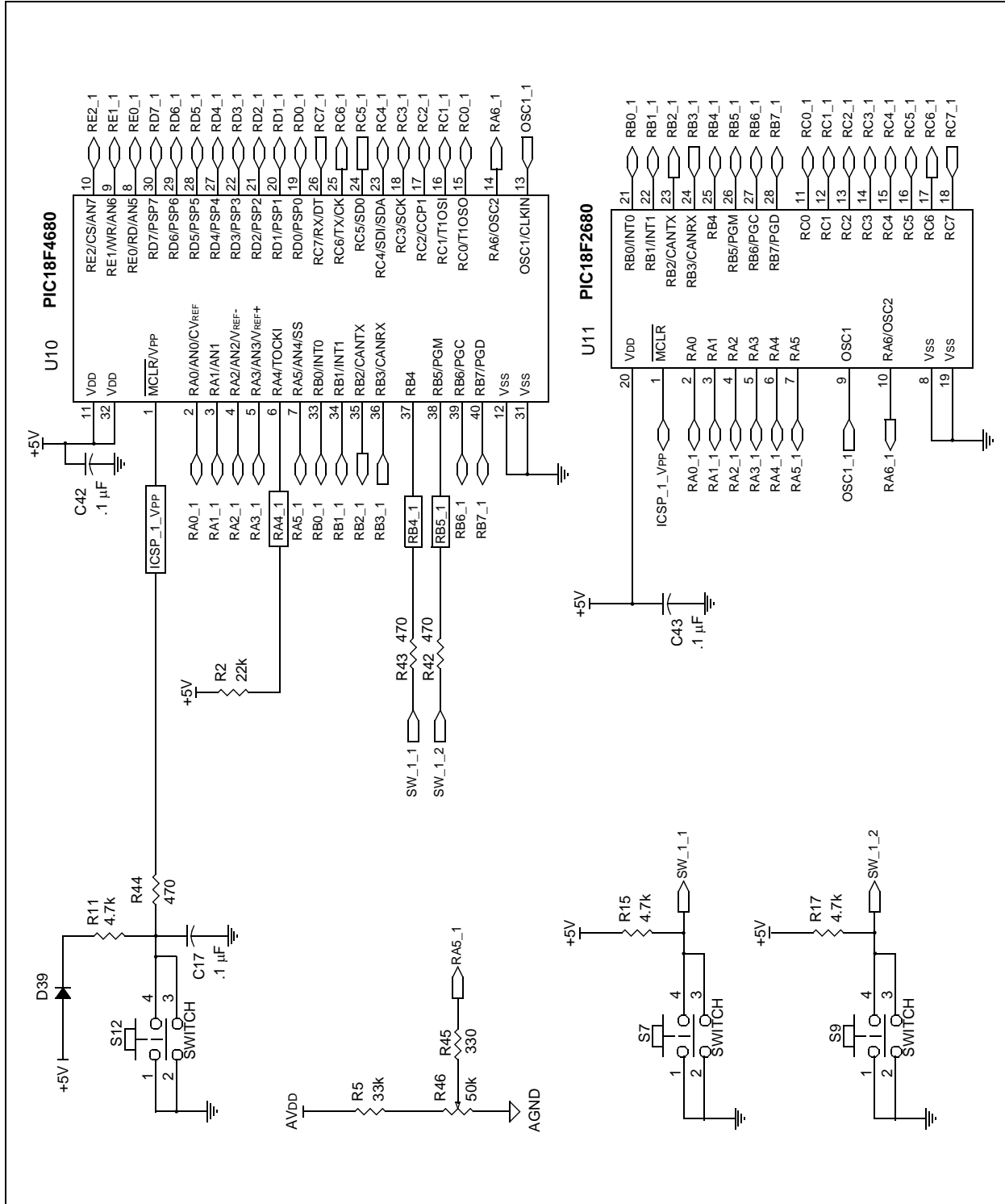
FIGURE A-1: PICDEM™ CAN-LIN 2 DEVELOPMENT BOARD FUNCTIONAL BLOCK DIAGRAM



PICDEM™ CAN-LIN 2 Development Kit User's Guide

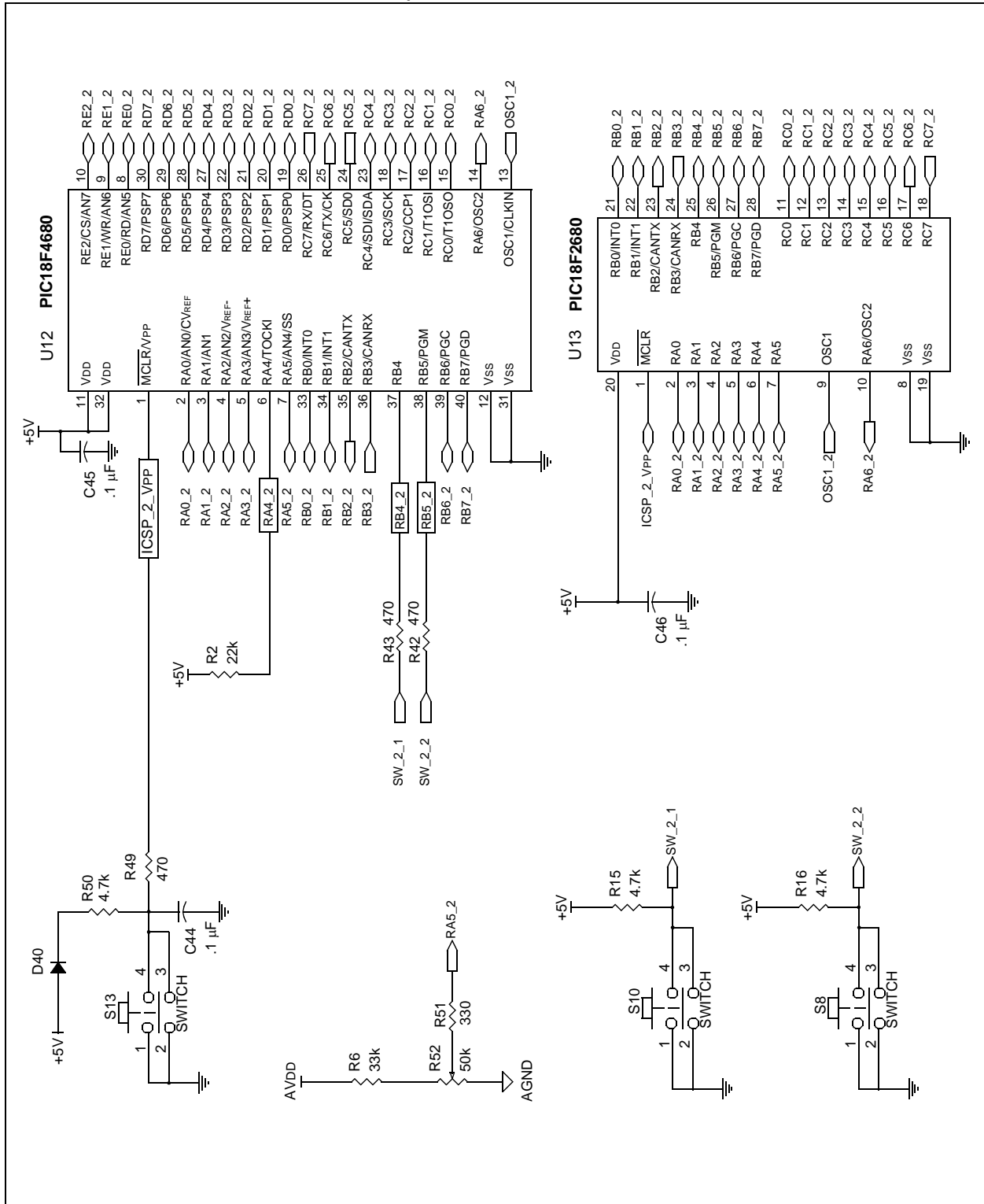
A.3 PICDEM CAN-LIN 2 BOARD SCHEMATICS

FIGURE A-2: BOARD SCHEMATIC, PART 1 (Node0 MICROCONTROLLERS AND ASSOCIATED PARTS)



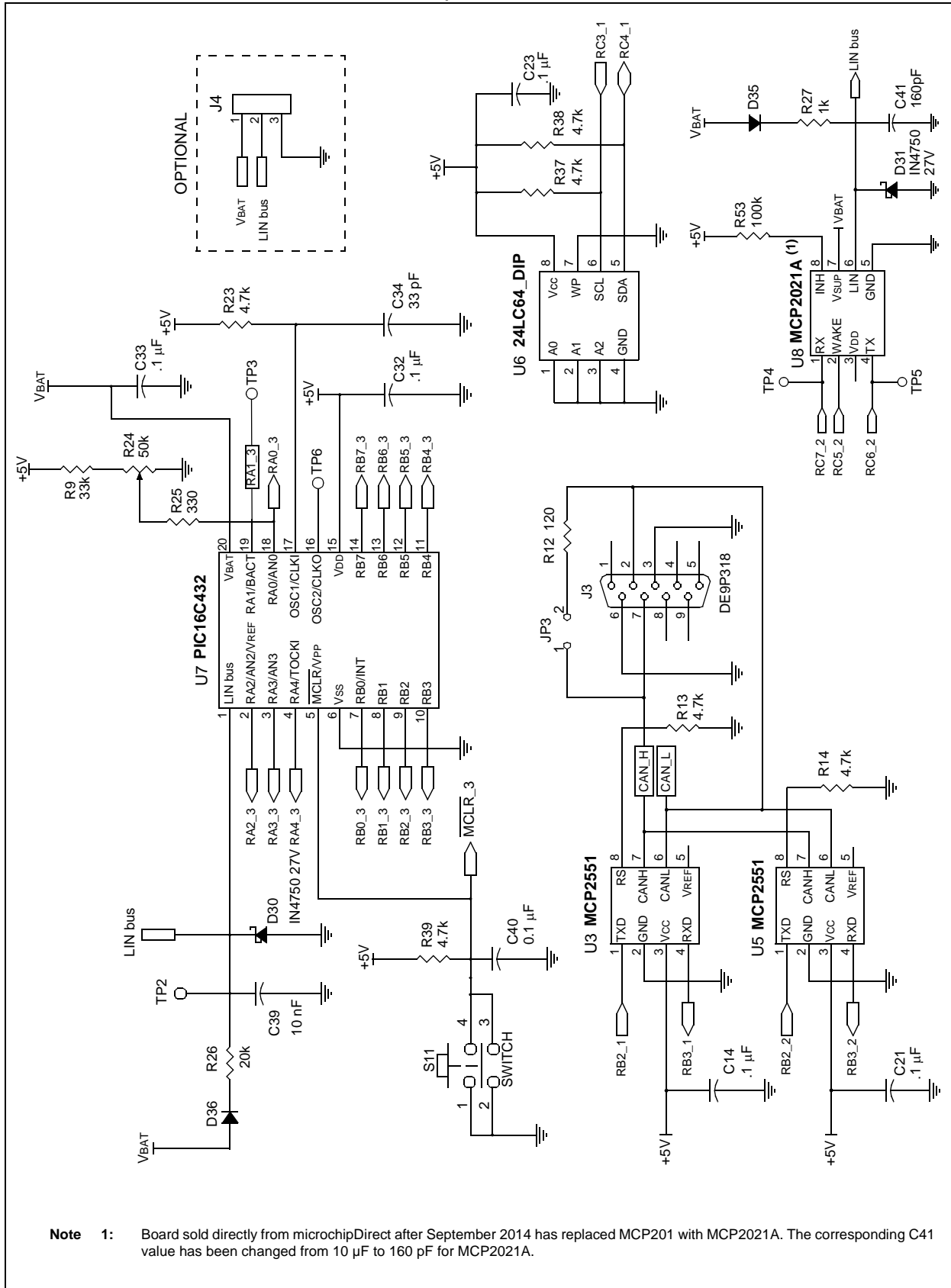
PICDEM CAN-LIN 2 Board Technical Information

FIGURE A-3: BOARD SCHEMATIC, PART 2 (Node1 MICROCONTROLLERS AND ASSOCIATED PARTS)



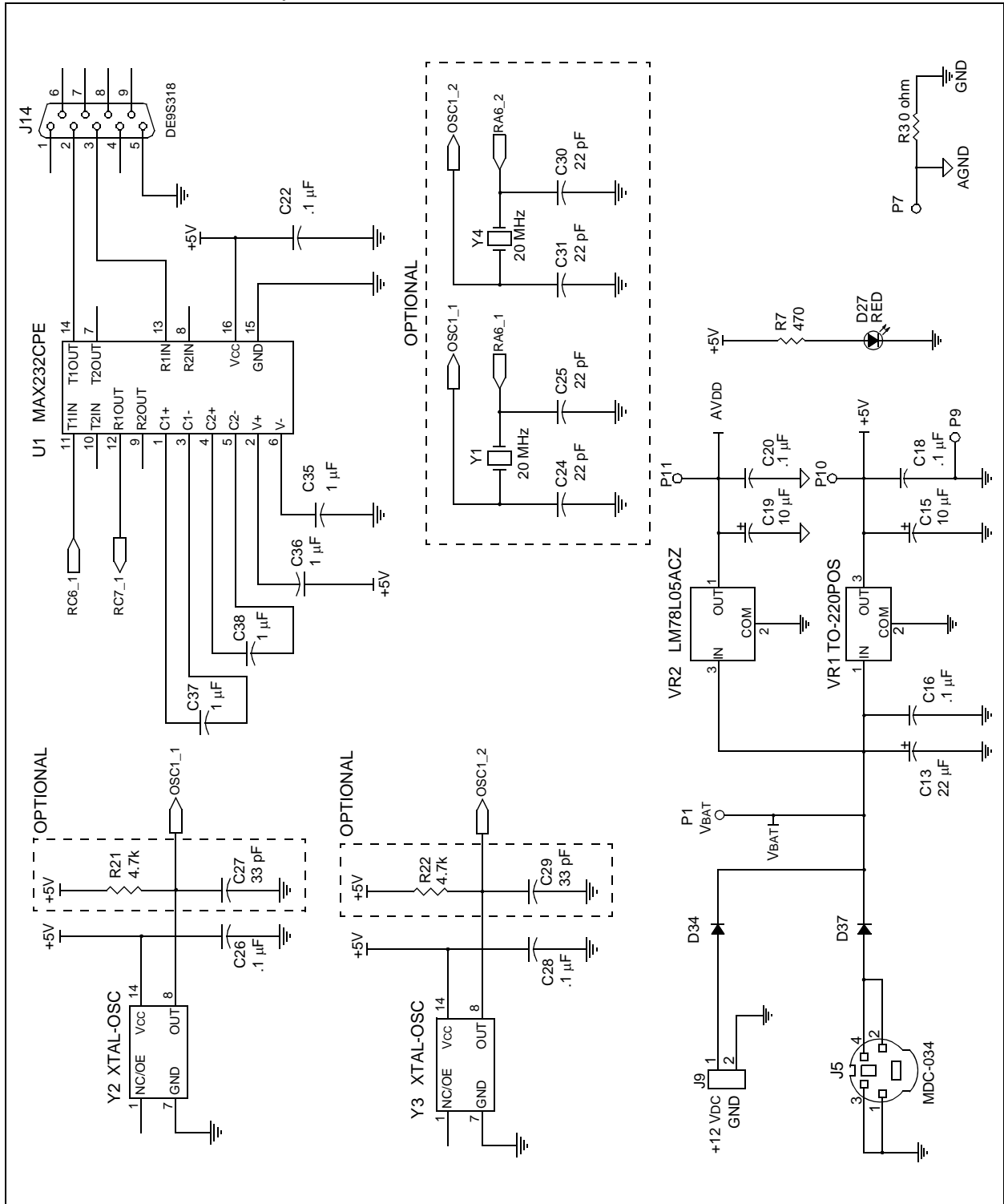
PICDEM™ CAN-LIN 2 Development Kit User's Guide

FIGURE A-4: BOARD SCHEMATIC, PART 3 (Node2 MICROCONTROLLER, LIN AND CAN TRANSCEIVERS, EEPROM)



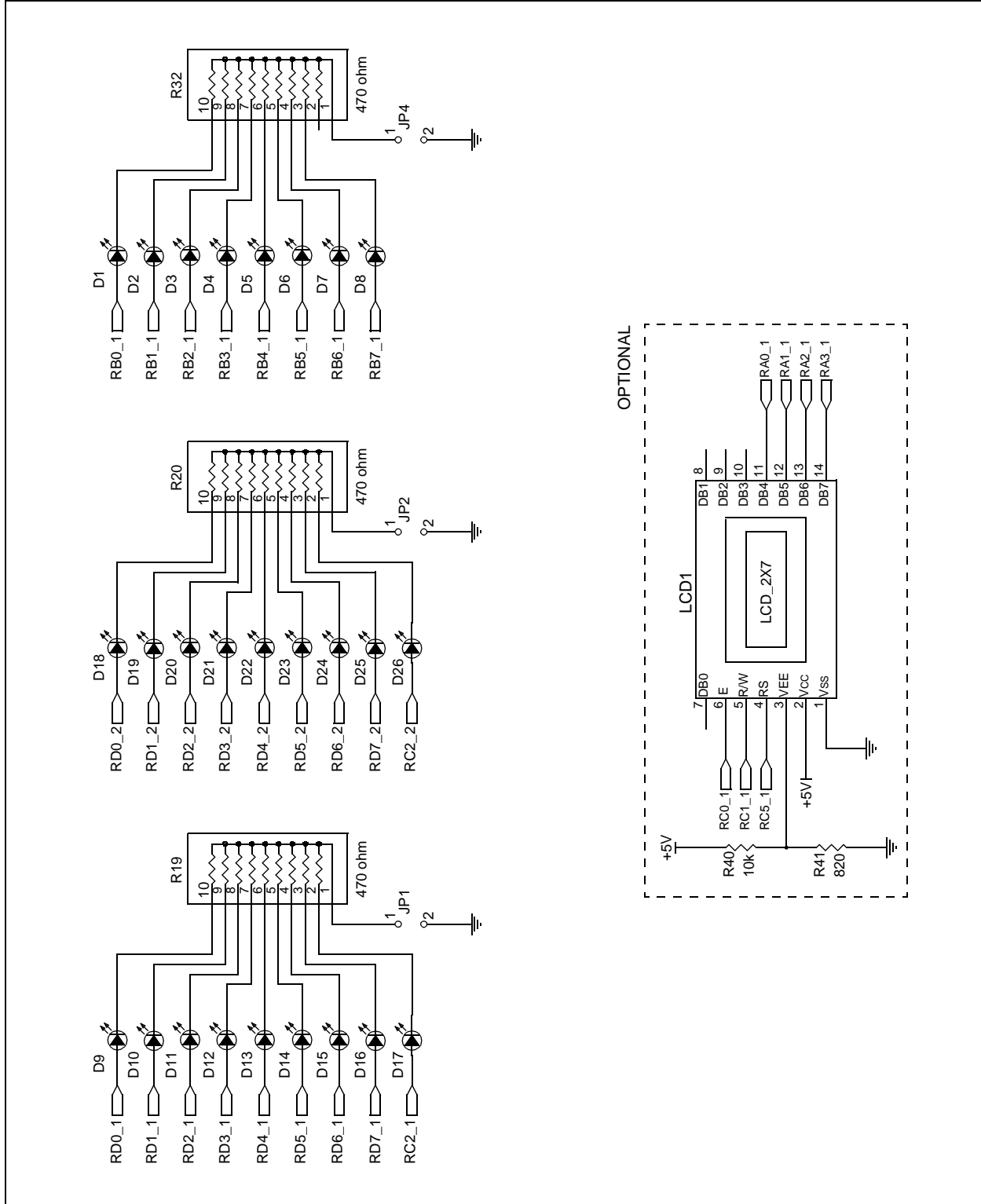
PICDEM CAN-LIN 2 Board Technical Information

FIGURE A-5: BOARD SCHEMATIC, PART 4 (USART, OSCILLATOR OPTIONS AND POWER SUPPLY)



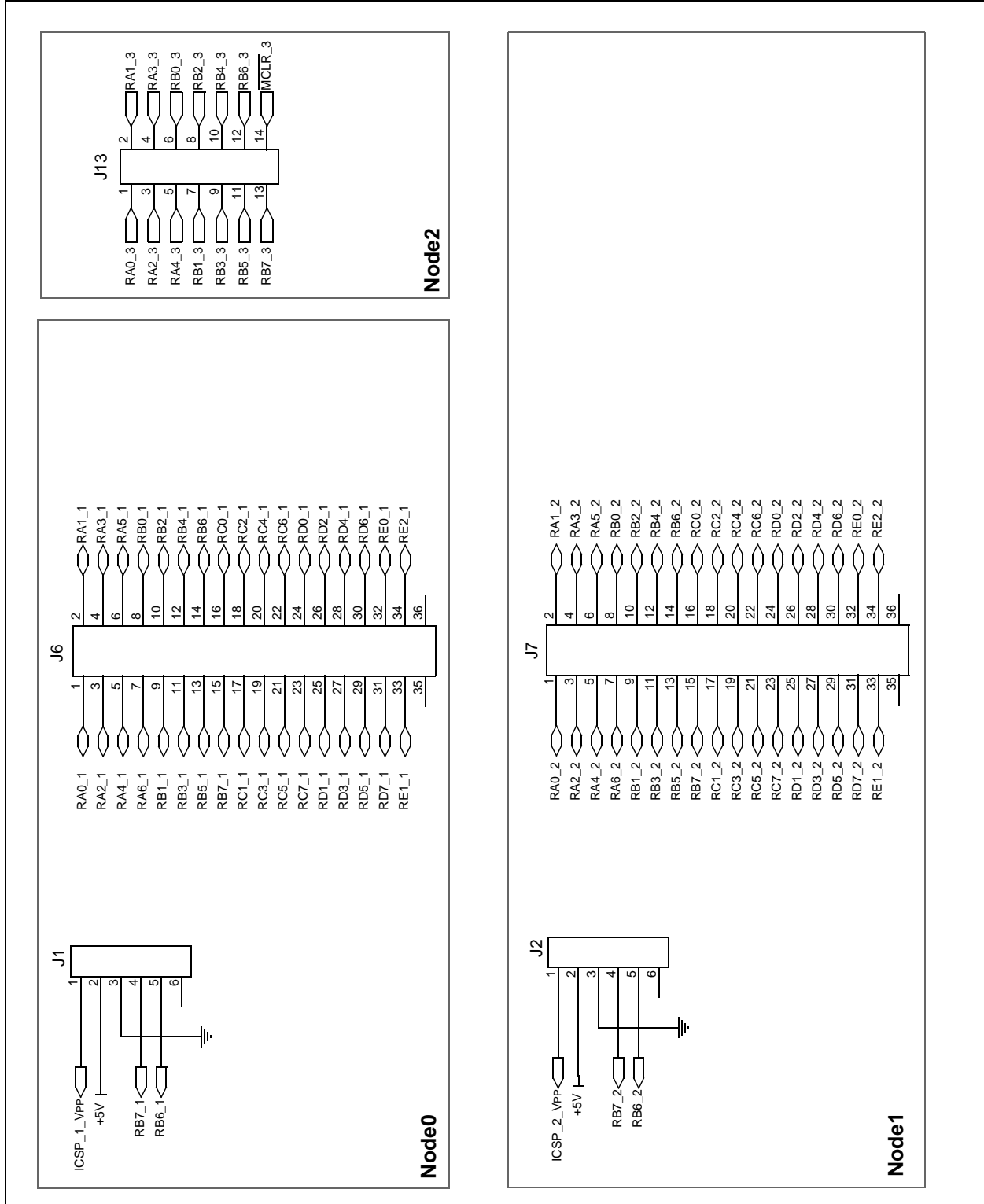
PICDEM™ CAN-LIN 2 Development Kit User's Guide

FIGURE A-6: BOARD SCHEMATIC, PART 5 (LEDS AND LCD DISPLAY OPTION)



PICDEM CAN-LIN 2 Board Technical Information

FIGURE A-7: BOARD SCHEMATIC, PART 6 (PROTOTYPE HEADERS AND CONNECTORS)



PICDEM™ CAN-LIN 2 Development Kit User's Guide

TABLE A-1: SIGNALS USED IN THE PICDEM™ CAN LIN 1 SCHEMATIC

Signal Name	Function
CAN_H, CAN_L	Differential high and low CAN bus signals
ICSP_1_VPP or ICSP_2_VPP	ICSP™ programming voltage and Reset for the designated controller: 1 – CAN Node0 2 – CAN Node1
LIN bus	Differential LIN bus signal
MCLR_3	Reset signal for LIN node (PIC16C432)
SW_1_n or SW_2_n	Push button input from switch n for the designated controller: 1 – CAN Node0 2 – CAN Node1
RXn_1, RXn_2 or RXn_3	Bit n of PORTx for the designated controller: 1 – CAN Node0 2 – CAN Node1 3 – LIN Node (PIC16C432)
VBAT	LIN bus battery voltage (+9 to +12 VDC)

TABLE A-2: LCD CONTROLLER HEADER

Pin	Signal	Pin	Signal
1	GND	2	+5V
3	VEE	4	RS
5	R/W	6	E
7	NC	8	NC
9	NC	10	NC
11	DB4	12	DB5
13	DB6	14	DB7

Appendix B. FAQs on Configuring the PIC18FXX8X

B.1 HIGHLIGHTS

This chapter will cover the following topics:

- FAQs

B.2 FAQs

Q: Why doesn't the development tool successfully communicate on an external bus?

A: There are several possible reasons why this happens. The following are the most common problems:

Condition	Fix
The PIC18FXX8X is off the bus (not in Normal mode).	Basic template – Go on Bus button in the Bus Status window.
The COM port is not configured correctly.	Make sure COM port selection is correct (<i>Options > PIC18+CAN...</i>).
The bus rate is not set to match the bus.	Basic template – Set the bus rate in the Bus Status window. Register template – change BRGCON registers.
The oscillator frequency not set to match hardware (FOSC is required in bit rate formula).	Set the oscillator frequency (<i>Options > PIC18+CAN...</i>).
Board is not connected to the external bus.	Connect to the external bus using the DB9 labeled CAN. Pinouts: CANH – pin 7, CANL – pin 2.

Q: Why does the node Acknowledge messages in the Basic template, but not display them?

A: The PIC18FXX8X filters are not matching the incoming messages. This can be caused because the **Reset PIC18+CAN on Open** is deselected causing the old register contents (masks and filters) to remain unchanged when switching templates.

Press Reset or select the **Reset PIC18+CAN on Open** box and reopen the template.

Q: Why can't I enter values in the Physical Layer window?

A: The PIC18FXX8X is not in Configuration mode. The three BRGCON registers are only modifiable while in Configuration mode. Change modes.

PICDEM™ CAN-LIN 2 Development Kit User's Guide

Q: Why don't the mask and filter registers change after pressing the Write button?

A: The PIC18FXX8X is not in Configuration mode. Masks and filters are changeable only in Configuration mode.

Q: How do I enter extended IDs into a field?

A: Lead off the number with an 'x', which indicates an extended frame (e.g., x12345).

Appendix C. PICDEM CAN-LIN 2 Software CD

C.1 HIGHLIGHTS

This chapter will cover the following topics:

- What's on the CD

Note: The CD no longer comes in the form of physical copy and its content is now available at <http://www.microchip.com/DM163011>.

C.2 WHAT'S ON THE CD

The PICDEM CAN-LIN 2 CD includes the following software tools and support documentation.

CANKing Host Software

The entire utility is contained in the self-extracting installer file, `wc32mchip_pic.exe`. Executing this file will install the CANKing software described in [Chapter 3. "Getting Started with the CANKing Software"](#), and the predefined templates covered in [Chapter 4. "Using the CANKing Templates"](#).

PICDEM CAN-LIN 2 Firmware

The firmware for the Demonstration Board's microcontrollers is located in the Firmware folder. The device-specific files are located in the subfolders, CAN node (for PIC18F4680 devices) and LIN node (for PIC16C432). In addition to the HEX files for device programming, assembler and C language source files are provided for creating custom projects.

All necessary project, header and linker files are also included, so that users with MPLAB® IDE may begin to create custom projects immediately.

Note: The MPLAB Integrated Development Environment software is not included with the PICDEM™ CAN-LIN 2 Kit. Users who do not have MPLAB IDE may download it without charge from the Microchip web site (www.microchip.com).

Support Files for Microchip PIC Microcontrollers with CAN

Also provided is a complete library of support information for Microchip's line of microcontrollers with CAN functionality. This includes:

- The latest *"PIC18F2585/2680/4585/4680 Data Sheet"*
- The In-Circuit Serial Programming™ specification for the PIC18FXX8X family
- AN738, *"PIC18C CAN Routines in 'C'"*, which presents a library of CAN functions
- AN853, *"PIC18XXX8 CAN Driver with Prioritized Transmit Buffer"*, which provides an assembler-based firmware driver for a CAN node
- Sales and support literature for the PIC18FXX8X family

The application notes are provided with a complete set of the source code files discussed in each document, allowing the user to begin working with the CAN utilities immediately.

PICDEM™ CAN-LIN 2 User's Guide

This single file is the electronic version of this Development Kit manual, provided in Adobe® Acrobat® format.

PICDEM™ CAN-LIN 2 Development Kit User's Guide

NOTES:



MICROCHIP

Worldwide Sales and Service

AMERICAS

Corporate Office
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support:
<http://www.microchip.com/support>
Web Address:
www.microchip.com

Atlanta
Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

Austin, TX
Tel: 512-257-3370

Boston
Westborough, MA
Tel: 774-760-0087
Fax: 774-760-0088

Chicago
Itasca, IL
Tel: 630-285-0071
Fax: 630-285-0075

Cleveland
Independence, OH
Tel: 216-447-0464
Fax: 216-447-0643

Dallas
Addison, TX
Tel: 972-818-7423
Fax: 972-818-2924

Detroit
Novi, MI
Tel: 248-848-4000

Houston, TX
Tel: 281-894-5983
Indianapolis

Noblesville, IN
Tel: 317-773-8323
Fax: 317-773-5453

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608

New York, NY
Tel: 631-435-6000

San Jose, CA
Tel: 408-735-9110

Canada - Toronto
Tel: 905-673-0699
Fax: 905-673-6509

ASIA/PACIFIC

Asia Pacific Office
Suites 3707-14, 37th Floor
Tower 6, The Gateway
Harbour City, Kowloon

Hong Kong
Tel: 852-2943-5100
Fax: 852-2401-3431

Australia - Sydney
Tel: 61-2-9868-6733
Fax: 61-2-9868-6755

China - Beijing
Tel: 86-10-8569-7000
Fax: 86-10-8528-2104

China - Chengdu
Tel: 86-28-8665-5511
Fax: 86-28-8665-7889

China - Chongqing
Tel: 86-23-8980-9588
Fax: 86-23-8980-9500

China - Dongguan
Tel: 86-769-8702-9880

China - Hangzhou
Tel: 86-571-8792-8115
Fax: 86-571-8792-8116

China - Hong Kong SAR
Tel: 852-2943-5100
Fax: 852-2401-3431

China - Nanjing
Tel: 86-25-8473-2460
Fax: 86-25-8473-2470

China - Qingdao
Tel: 86-532-8502-7355
Fax: 86-532-8502-7205

China - Shanghai
Tel: 86-21-5407-5533
Fax: 86-21-5407-5066

China - Shenyang
Tel: 86-24-2334-2829
Fax: 86-24-2334-2393

China - Shenzhen
Tel: 86-755-8864-2200
Fax: 86-755-8203-1760

China - Wuhan
Tel: 86-27-5980-5300
Fax: 86-27-5980-5118

China - Xian
Tel: 86-29-8833-7252
Fax: 86-29-8833-7256

ASIA/PACIFIC

China - Xiamen
Tel: 86-592-2388138
Fax: 86-592-2388130

China - Zhuhai
Tel: 86-756-3210040
Fax: 86-756-3210049

India - Bangalore
Tel: 91-80-3090-4444
Fax: 91-80-3090-4123

India - New Delhi
Tel: 91-11-4160-8631
Fax: 91-11-4160-8632

India - Pune
Tel: 91-20-3019-1500

Japan - Osaka
Tel: 81-6-6152-7160
Fax: 81-6-6152-9310

Japan - Tokyo
Tel: 81-3-6880-3770
Fax: 81-3-6880-3771

Korea - Daegu
Tel: 82-53-744-4301
Fax: 82-53-744-4302

Korea - Seoul
Tel: 82-2-554-7200
Fax: 82-2-558-5932 or
82-2-558-5934

Malaysia - Kuala Lumpur
Tel: 60-3-6201-9857
Fax: 60-3-6201-9859

Malaysia - Penang
Tel: 60-4-227-8870
Fax: 60-4-227-4068

Philippines - Manila
Tel: 63-2-634-9065
Fax: 63-2-634-9069

Singapore
Tel: 65-6334-8870
Fax: 65-6334-8850

Taiwan - Hsin Chu
Tel: 886-3-5778-366
Fax: 886-3-5770-955

Taiwan - Kaohsiung
Tel: 886-7-213-7828

Taiwan - Taipei
Tel: 886-2-2508-8600
Fax: 886-2-2508-0102

Thailand - Bangkok
Tel: 66-2-694-1351
Fax: 66-2-694-1350

EUROPE

Austria - Wels
Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen
Tel: 45-4450-2828
Fax: 45-4485-2829

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

Germany - Dusseldorf
Tel: 49-2129-3766400

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Germany - Pforzheim
Tel: 49-7231-424750

Italy - Milan
Tel: 39-0331-742611
Fax: 39-0331-466781

Italy - Venice
Tel: 39-049-7625286

Netherlands - Drunen
Tel: 31-416-690399
Fax: 31-416-690340

Poland - Warsaw
Tel: 48-22-3325737

Spain - Madrid
Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

Sweden - Stockholm
Tel: 46-8-5090-4654

UK - Wokingham
Tel: 44-118-921-5800
Fax: 44-118-921-5820

01/27/15