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NOTES:

Preface

NOTICE TO CUSTOMERS

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

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

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

INTRODUCTION

This chapter contains general information that will be useful to know before using the Explorer 16 Development Board. Items discussed in this chapter include:

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

DOCUMENT LAYOUT

This document describes how to use the Explorer 16 Development Board as a development tool to emulate and debug firmware on a target board. The manual layout is as follows:

- **Chapter 1. “Introducing the Explorer 16 Development Board”** provides a brief overview of the Explorer 16 Development Board, its features and its uses.
- **Chapter 2. “Explorer 16 Programming Tutorial”** provides step-by-step instructions for using MBLAB® IDE to create a project and program the Explorer 16 board.
- **Chapter 3. “Explorer 16 Tutorial Programs”** describes the demonstration program created in **Chapter 2. “Explorer 16 Programming Tutorial”**.
- **Chapter 4. “Explorer 16 Development Hardware”** provides a more detailed description of the Explorer 16 board's hardware features.
- **Appendix A. “Explorer 16 Development Board Schematics”** provides a block diagram and detailed schematics of the Explorer 16 board.
- **Appendix B. “Updating the USB Connectivity Firmware”** describes how to upgrade the Explorer 16 board's USB connectivity subsystem.

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
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 (in source code)	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) { ... }

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.

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RECOMMENDED READING

This user's guide describes how to use the Explorer 16 Development Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

Readme for the Explorer 16 Development Board

For the latest information on using the Explorer 16 Development Board, read the `Readme for Explorer 16 Development Board.txt` file (an ASCII text file) at the root level of the Explorer 16 CD-ROM. The Readme file contains update information and known issues that may not be included in this user's guide.

Readme Files

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

PIC24FJ128GA010 PS Data Sheet (DS39756) and PIC24FJ128GA Family Data Sheet (DS39747)

Consult this document for detailed information on the PIC24F general purpose, 16-bit devices. Reference information found in this data sheet includes:

- Device memory map
- Device pinout and packaging details
- Device electrical specifications
- List of peripherals included on the device

Note that document, DS39756, is for use **only** with the initial prototype samples of the PIC24F family. These devices are all marked with a "PS" suffix at the end of the device number. For all other PIC24FJ128GA family devices, including those with an "ES" suffix, use DS39747.

dsPIC33F Family Data Sheet (DS70165)

Consult this document for detailed information on the dsPIC33F Digital Signal Controllers. Reference information found in this data sheet includes:

- Device memory map
- Device pinout and packaging details
- Device electrical specifications
- List of peripherals included on the device

dsPIC30F Programmer's Reference Manual (DS70030)

This manual is a software developer's reference for all of Microchip's 16-bit digital signal controllers. It describes the instruction set in detail and also provides general information to assist in developing software for PIC24 MCUs, dsPIC30F and dsPIC33F DSCs.

PIC24H Family Overview (DS70166)

This document provides an overview of the functionality of the new PIC24H product family. It helps determine how the PIC24H high-performance, 16-bit microcontrollers fit a specific product application.

MPLAB® C30 C Compiler User's Guide (DS51284)

This document details the use of Microchip's MPLAB C30 C Compiler for dsPIC® devices to develop an application. MPLAB C30 is a GNU-based language tool, based on source code from the Free Software Foundation (FSF). For more information about the FSF, see www.fsf.org.

Other GNU language tools available from Microchip are:

- MPLAB ASM30 Assembler
- MPLAB LINK30 Linker
- MPLAB LIB30 Librarian/Archiver

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

Consult this document for more information pertaining to the installation and implementation of the MPLAB Integrated Development Environment (IDE) software.

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

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DEVELOPMENT SYSTEMS CUSTOMER CHANGE NOTIFICATION SERVICE

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

The Development Systems product group categories are:

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

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

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

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

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

DOCUMENT REVISION HISTORY

Revision A (November 2005)

This is the initial release of this Document.

NOTES:

Chapter 1. Introducing the Explorer 16 Development Board

1.1 INTRODUCTION

Thank you for purchasing Microchip Technology's Explorer 16 Development Board Kit. The development board provides a low-cost, modular development system for Microchip's new line of 16-bit microcontroller families, including the PIC24, PIC24H and the 16-bit digital signal controller family, dsPIC33F.

As provided, the development board works as a demo board right from the box, and also has the ability to extend its functionality through modular expansion interfaces. The Explorer 16 board supports MPLAB ICD 2 for full emulation and debug capabilities, and also allows 3V controllers to interface with 5V peripheral devices.

1.2 HIGHLIGHTS

This chapter covers the following topics:

- What's in the Kit
- Explorer 16 Development Board Functionality and Features
- Using the Explorer 16 Out of the Box
- Explorer 16 Development Board Demonstration Programs
- Reference Documents

1.3 WHAT'S IN THE KIT

The Explorer 16 Development Board Kit contains the following:

- The Explorer 16 Development Board.
- A preprogrammed PIC24FJ128GA010 Processor Installation Module (PIM), already installed to the board
- A preprogrammed dsPIC33FJ256GP710 PIM
- An RS-232 cable
- The Explorer 16 Development CD ROM, containing:
 - This User's Guide
 - Data Sheets for the PIC24FJ128GA family and dsPIC33FJ256GP family
 - Schematics and PCB drawing files for the PIM modules
 - Example programs for use with the PIC24 and dsPIC33F devices
 - Files detailing general purpose expansion boards that can be used with the Explorer 16 board (provided in Gerber format)

If you are missing any part of the kit, please contact your nearest Microchip sales office, listed on the last page of this manual, for further assistance.

Note: The Explorer 16 Development Board has been designed to function primarily from a permanently mounted PIC24FJ128GA010 device at position U1. Initial units will be shipped with U1 unpopulated and a PIC24FJ PIM of equal functionality mounted on the U1A headers instead. When using the PIC24FJ PIM or any other PIM, it is critical to verify that switch S2 always remains in the "PIM" position. See **Section 4.2.1 "Processor Support"** for more information.

Introducing the Explorer 16 Development Board

1.4 EXPLORER 16 DEVELOPMENT BOARD FUNCTIONALITY AND FEATURES

A layout of the Explorer 16 Development Board is shown in Figure 1-1. The board includes these key features, as indicated in the diagram:

1. 100-pin PIM riser, compatible with the PIM versions of all Microchip PIC24F/24H/dsPIC33F devices
2. Direct 9 VDC power input that provides +3.3V and +5V (regulated) to the entire board
3. Power indicator LED
4. RS-232 serial port and associated hardware
5. On-board analog thermal sensor
6. USB connectivity for communications and device programming/debugging
7. Standard 6-wire In-Circuit Debugger (ICD) connector for connections to an MPLAB ICD 2 programmer/debugger module
8. Hardware selection of PIM or soldered on-board microcontroller (in future versions)
9. 2-line by 16-character LCD
10. Provisioning on PCB for add on graphic LCD
11. Push button switches for device Reset and user-defined inputs
12. Potentiometer for analog input
13. Eight indicator LEDs
14. 74HCT4053 multiplexers for selectable crossover configuration on serial communication lines
15. Serial EEPROM
16. Independent crystals for precision microcontroller clocking (8 MHz) and RTCC operation (32.768 kHz)
17. Prototype area for developing custom applications
18. Socket and edge connector for PICtail™ Plus card compatibility
19. Six-pin interface for PICkit 2 Programmer
20. JTAG connector pad for optional boundary scan functionality

For additional details on these features, refer to **Chapter 4. “Explorer 16 Development Hardware”**.

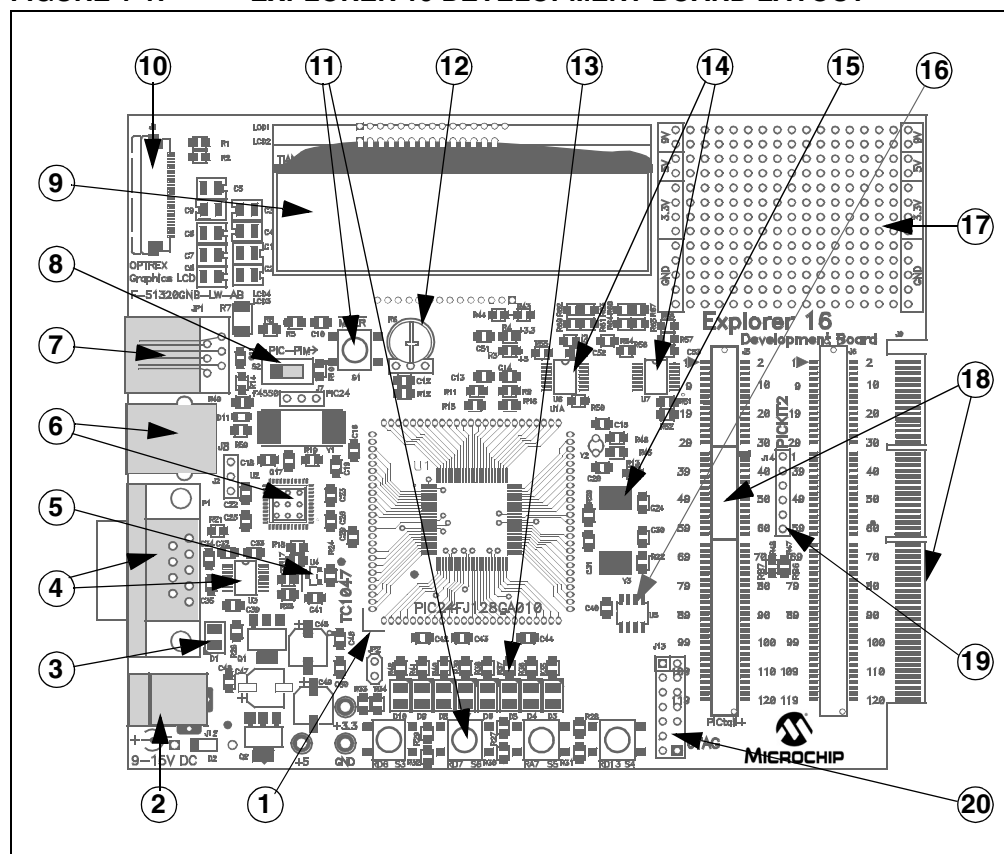
1.4.1 Sample Devices Included with the Development Kit

Each Explorer 16 Development Board Kit contains two preprogrammed 16-bit devices: a PIC24FJ128GA010 and a dsPIC33FJ256GP710. These are provided as 100-pin PIMs on riser sockets, which can be quickly installed on pin header U1A and exchanged as needed.

Note: As Microchip’s 16-bit portfolio develops, alternate devices may be included with the Explorer 16 Development Board Kit. It is anticipated that one device each of the PIC24 and dsPIC33F families will always be included. Also in the future, the included PIC24 device will be soldered onto the board and only the dsPIC33F device will be provided as a PIM.

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FIGURE 1-1: EXPLORER 16 DEVELOPMENT BOARD LAYOUT



1.5 USING THE EXPLORER 16 OUT OF THE BOX

Although intended as a development platform, the Explorer 16 board may also be used directly from the box as a demonstration board for PIC24 and dsPIC33F devices. The programs discussed in **Chapter 3. “Explorer 16 Tutorial Programs”** are preprogrammed into the sample device PIMs (i.e., PIC24ExplDemo.hex for the PIC24 device and dsPIC33ExplDemo.hex for the dsPIC33F device) and are ready for immediate use.

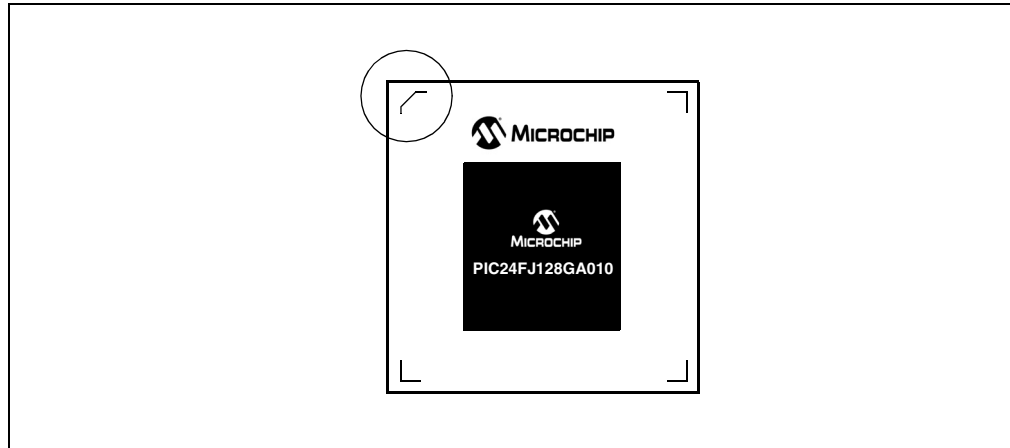
To get started with the board:

1. For Explorer 16 boards without a permanently mounted PIC24FJ device: verify that the PIC24FJ128GA010 PIM is correctly installed onto the board. If you want to use the dsPIC® device PIM, carefully remove the PIC24 PIM and install the dsPIC33F PIM in its place. For all PIMs, be certain to align the PIM so the notched corner marking is oriented in the upper left corner.
2. For Explorer 16 boards without a permanently mounted PIC24FJ device: verify that switch S2 is set in the “PIM” position.
For Explorer 16 boards with a permanently mounted PIC24FJ device: verify that switch S2 is set in the “PIC” position.
3. Verify that the jumper on JP2 is installed (to enable the LEDs).
4. Apply power to the board (9 VDC) at power input J2. For information on acceptable power sources, see **Appendix A. “Explorer 16 Development Board Schematics”**.

Refer to **Chapter 3. “Explorer 16 Tutorial Programs”** for details on the demonstration code operation.

Introducing the Explorer 16 Development Board

FIGURE 1-2: EXPLORER 16 PIM MODULE, SHOWING NOTCHED CORNER MARKING



1.6 EXPLORER 16 DEVELOPMENT BOARD DEMONSTRATION PROGRAMS

The preprogrammed example code on the PIMs has been included on the Explorer 16 CD-ROM for future reference. All project files have been included, so that the code may be used directly to restore a PIM to its original state (i.e., if the sample device has been reprogrammed with another program), or so the user may use the tutorial code as a platform for further experimentation.

In addition, the CD-ROM contains sample demonstration programs for both PIC24 and dsPIC33F family devices. Separate demo source code (as files in C) and compiled code files (in Hex) are provided for each family. These may be used with the included PIC24 and dsPIC33F PIMs by reprogramming the devices using MPLAB ICD 2.

1.7 REFERENCE DOCUMENTS

In addition to the documents listed in the “**Recommended Reading**” section, these documents are also available from Microchip to support the use of the Explorer 16 Development Board:

- *PIC18F2455/2550/4455/4550 Data Sheet* (DS39632)
- *TC1047/TC1047A Data Sheet* (DS21498)
- *25AA256/25LC256 Data Sheet* (DS21822)
- *PICkit™ 2 Microcontroller Programmer User's Guide* (DS51553)
- *MPLAB® ICD 2 In-Circuit Debugger Quick Start Guide* (DS51268)
- *PRO MATE® II User's Guide* (DS30082)

You can obtain these reference documents from your nearest Microchip sales office (listed in the back of this document) or by downloading them from the Microchip web site (www.microchip.com).

Chapter 2. Explorer 16 Programming Tutorial

2.1 INTRODUCTION

This chapter is a self-paced tutorial to get you started using the Explorer 16 Development Board.

2.2 HIGHLIGHTS

Items discussed in this chapter include:

- Tutorial Overview
- Creating the Project
- Building the Code
- Programming the Device

2.3 TUTORIAL OVERVIEW

The tutorial in this chapter demonstrates the main features of the MPLAB IDE and MPLAB ICD 2 as they are used with the Explorer 16 Development Board. As presented, it is designed for use with the PIC24FJ128GA010 specifically. However, the same procedures and toolsuites can also be used with PIC24H or dsPIC33F devices.

The PIC24 tutorial project demonstrated here, `PIC24ExplDemo.mcp`, is written in C for MPLAB C30. The program displays PIC24 features on the alphanumeric LCD, and also displays voltage, temperature and date/time as the various buttons are pressed. Described with the PIC24 project is the dsPIC device tutorial, `Example1_RTC_LED_ADC.mcp`. It is also written in C for MPLAB C30. The program displays voltage and current time, updating the display on command. Both programs are described in more detail in **Chapter 3. “Explorer 16 Tutorial Programs”**.

For either project, the source file (`PIC24ExplDemo.c` or `main_rtc.c` for PIC24 or dsPIC33F, respectively) is used with a linker script file (`p24fj128ga010.gld` or `p33fj256gp710ps.gld`) and header file (`p24fj128ga010.h` or `p33fj256gp710ps.h`) to form a complete project. While these simple projects use a single source code file, more complex projects might use multiple assembler and compiler source files, as well as library files and precompiled object files.

Upon completing this tutorial, you should be able to:

- Create a project using the Project Wizard
- Assemble and link the code and set the Configuration bits
- Set up MPLAB IDE to use the MPLAB ICD 2
- Program the chip with the MPLAB ICD 2

There are three steps to this tutorial:

1. Creating a project in MPLAB IDE.
2. Assembling and linking the code.
3. Programming the chip with the MPLAB ICD 2.

2.4 CREATING THE PROJECT

The first step is to create a project and a workspace in MPLAB IDE. Typically, there is one project in one workspace.

Note: These instructions presume the use of MPLAB IDE 7.22 or newer.

A project contains the files needed to build an application (source code, linker script files, etc.) along with their associations to various build tools and build options.

A workspace contains one or more projects and information on the selected device, debug tool and/or programmer, open windows and their location and other MPLAB IDE configuration settings.

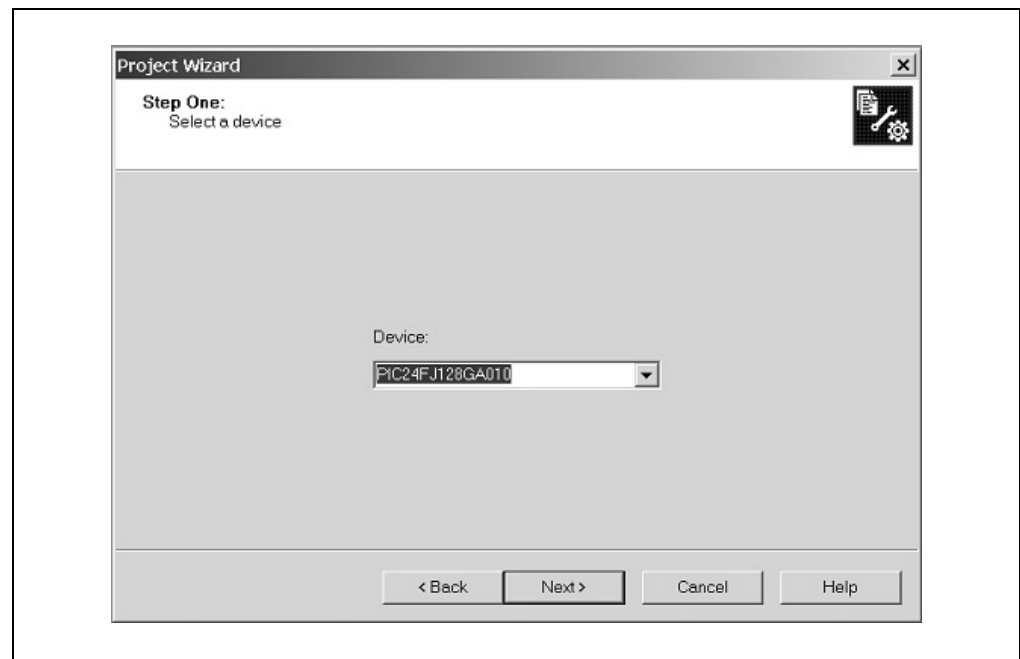
MPLAB IDE contains a Project Wizard to help create new projects. Before starting, create a folder named Tutorial for the project files for this tutorial (C:\Tutorial is assumed in the instructions that follow). From the `Example Code\Tutorial Code` directory on the Explorer 16 Development Kit Software CD-ROM, copy all of the source files into this folder.

Note: The screen shots in the following sections show the PIC24 tutorial. Except for displayed file names, the screens for the dsPIC33F tutorial will be identical.

2.4.1 Select a Device

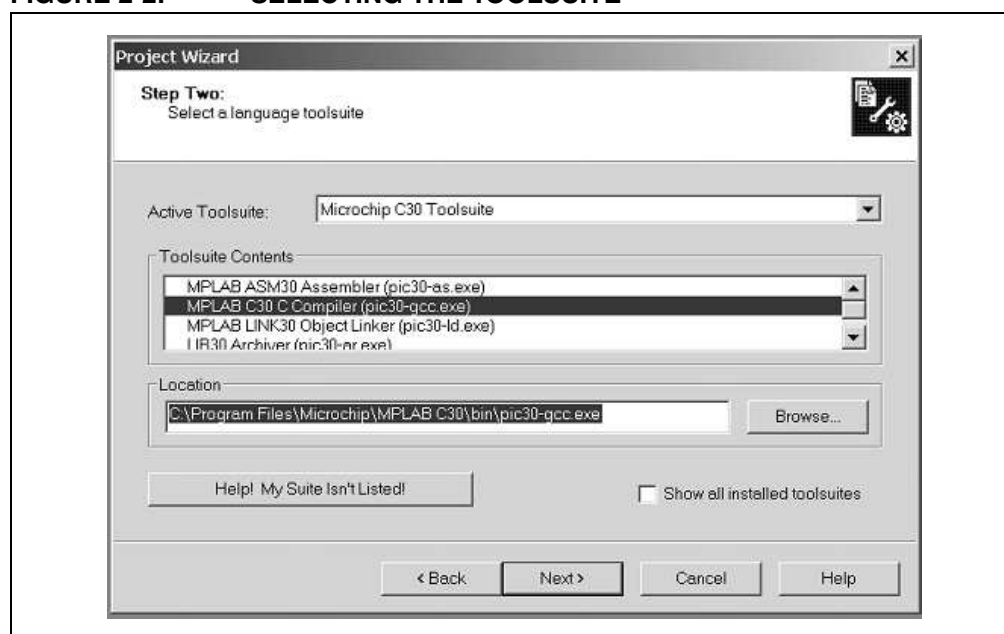
1. Start MPLAB IDE.
2. Close any workspace that might be open (*File > Close Workspace*).
3. From the *Project* menu, select *Project Wizard*.
4. From the Welcome screen, click **Next >** to display the Project Wizard Step One dialog (Figure 2-1).

FIGURE 2-1: SELECTING THE DEVICE



5. From the **Device** drop-down list, select "PIC24FJ128GA010" or "dsPIC33FJ256GP710PS", depending on the PIM being used. Click **Next >**. The Project Wizard Step Two dialog will be displayed (see Figure 2-2).

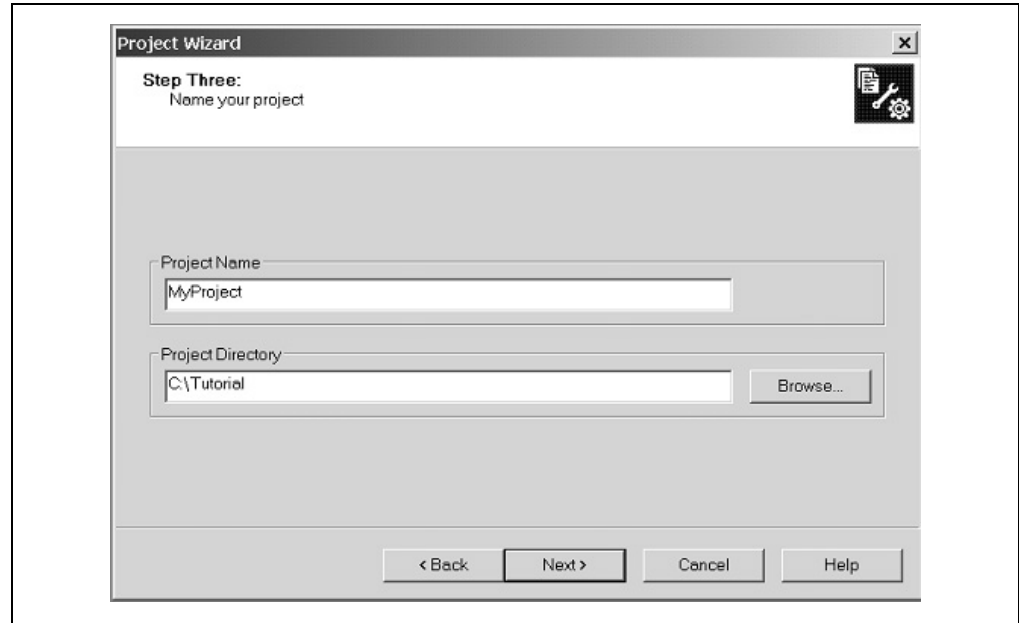
FIGURE 2-2: SELECTING THE TOOLSUITE



2.4.2 Select Language Toolsuite

1. From the **Active Toolsuite** drop-down list, select Microchip C30 Toolsuite. This toolsuite includes the assembler and linker that will be used.
2. In the **Toolsuite Contents** combo box, select MPLAB C30 Compiler (pic30-gcc.exe).
3. In the **Location** box, click **Browse...** and navigate to C:\Program Files\Microchip\MPLAB C30\bin\pic30-as.exe.
4. With MPLAB LINK 30 Object Linker (pic30-ld.exe) selected in **Toolsuite Contents**, click **Browse...** and navigate to C:\Program Files\Microchip\MPLAB C30\bin\pic30-ld.exe.
5. Click **Next >** to continue. The Project Wizard Step Three dialog displays (Figure 2-3).

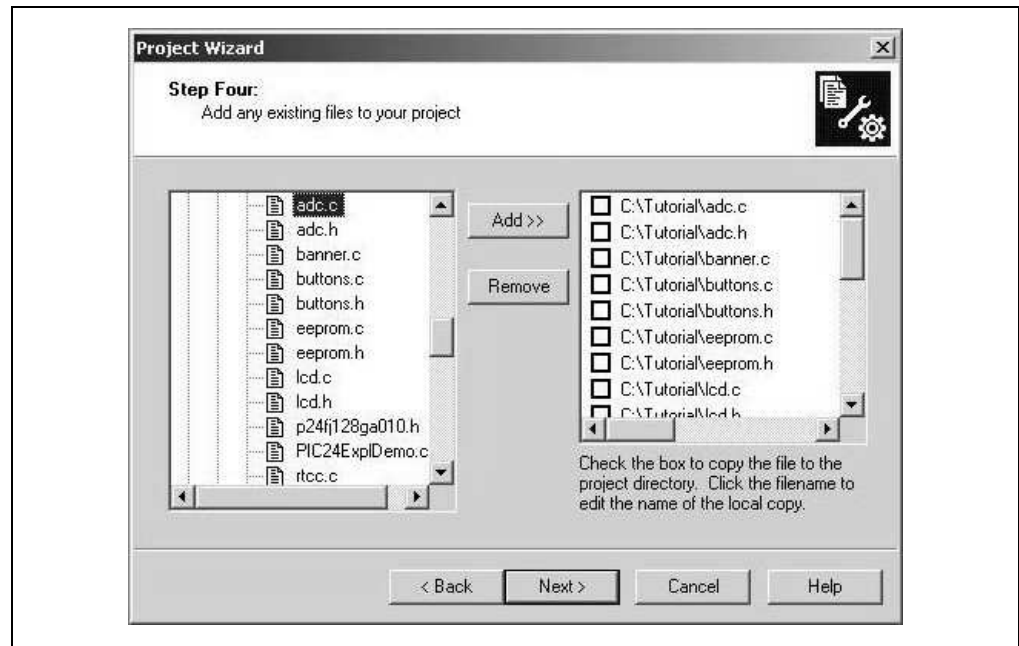
FIGURE 2-3: NAMING YOUR PROJECT



2.4.3 Name Your Project

1. In the **Project Name** text box, type "MyProject".
2. In the **Project Directory** box, click **Browse...** and navigate to C:\Tutorial to place your project in the Tutorial folder.
3. Click **Next >** to continue. The Project Wizard Step Four dialog displays (Figure 2-4).

FIGURE 2-4: ADDING FILES TO THE PROJECT



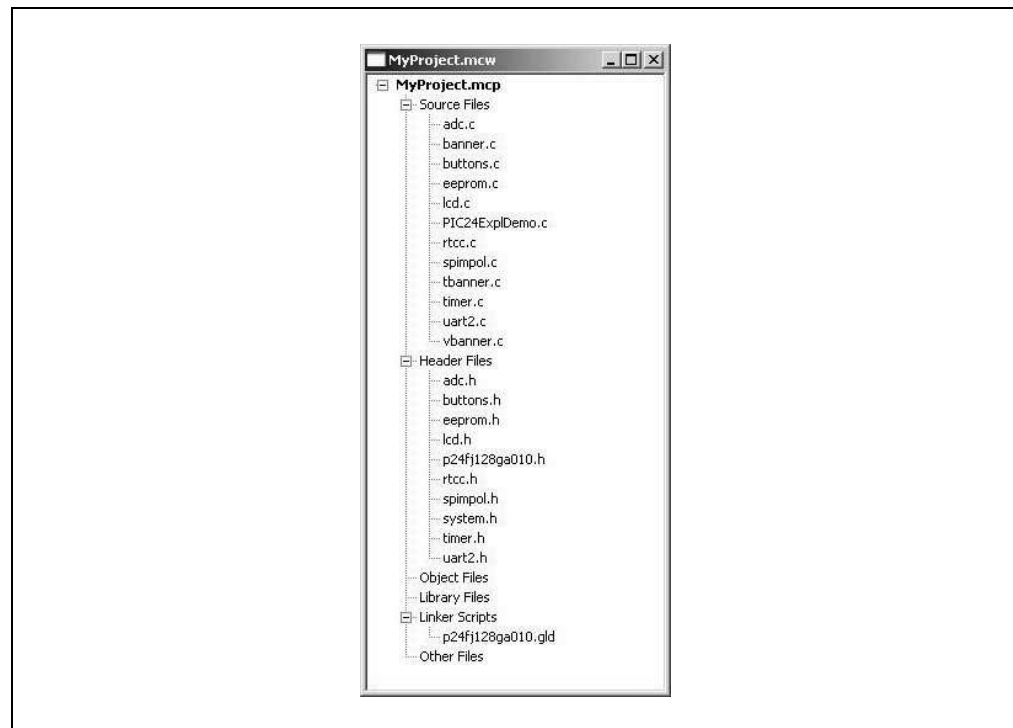
Explorer 16 Development Board User's Guide

2.4.4 Add Files to Project

1. From the list of folders on the PC, locate the C:\Tutorial folder.
2. Select the source (.c) and header (.h) files. Click **Add >>** to include the file in the project.
3. Expand the C:\Program Files\Microchip\MPLAB 30\support\gld folder and select the p24fj128ga010.gld or p33fj256gp710ps.gld file, as appropriate.
4. Click **Add >>** to include this file in the project. There should now be two files in the project.
5. Click **Next >** to continue.
6. When the summary screen displays, click **Finish**.

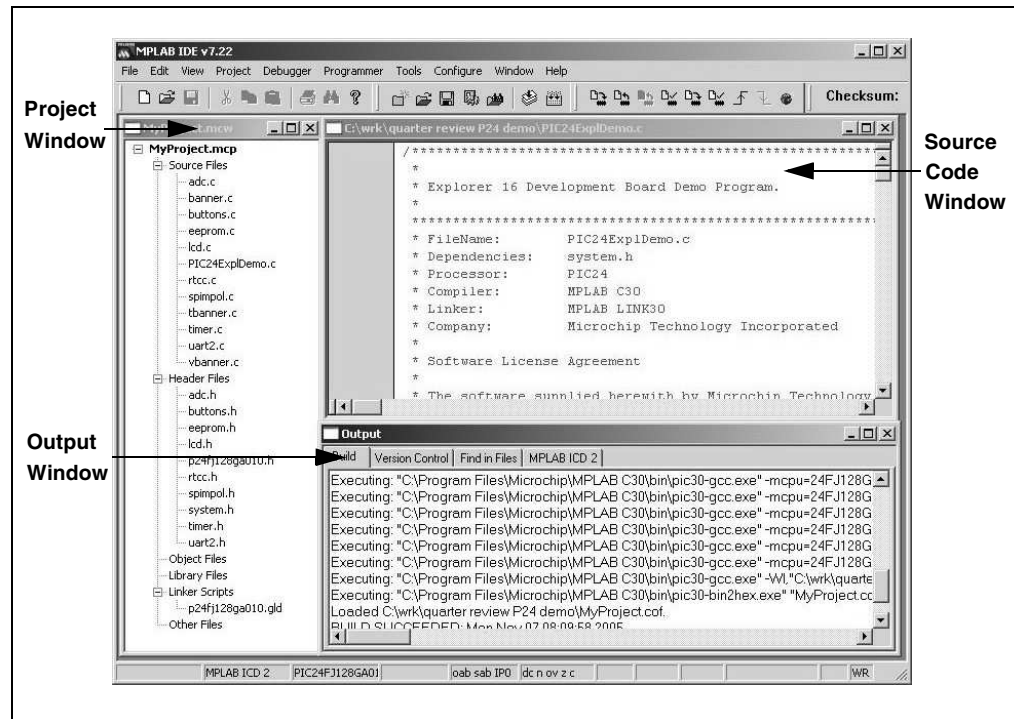
After the Project Wizard completes, the MPLAB Project window shows the source files in the Source Files folder and the appropriate linker script in the Linker Scripts folder (Figure 2-5).

FIGURE 2-5: PROJECT WINDOW



A project and workspace has now been created in MPLAB IDE. MyProject.mcp is the workspace file and MyProject.mcp is the project file. Double-click the PIC24ExlDemo.c file (for PIC24) or main_rtc.c file (for dsPIC33F) in the Project window to open the file. MPLAB IDE should now look similar to Figure 2-6.

FIGURE 2-6: MPLAB® IDE WORKSPACE



2.5 BUILDING THE CODE

In this project, building the code consists of compiling the source files to create an object file, `MyProject.o`, then linking the object file to create the `MyProject.hex` and `MyProject.cof` output files. (For dsPIC33F projects, the files would be `Example1_RTC_LED_ADC.o`, `Example1_RTC_LED_ADC.hex` and `Example1_RTC_LED_ADC.cof`.) The Hex file contains the data necessary to program the device, and the `.cof` file contains additional information that lets you debug the code at the source code level.

Before building, there are settings required to tell MPLAB IDE where to find the include files and to reserve space for the extra debug code when the MPLAB ICD 2 is used. For PIC24 projects, the following line in the `system.h` file is:

```
#include "p24fj128ga010.h"
```

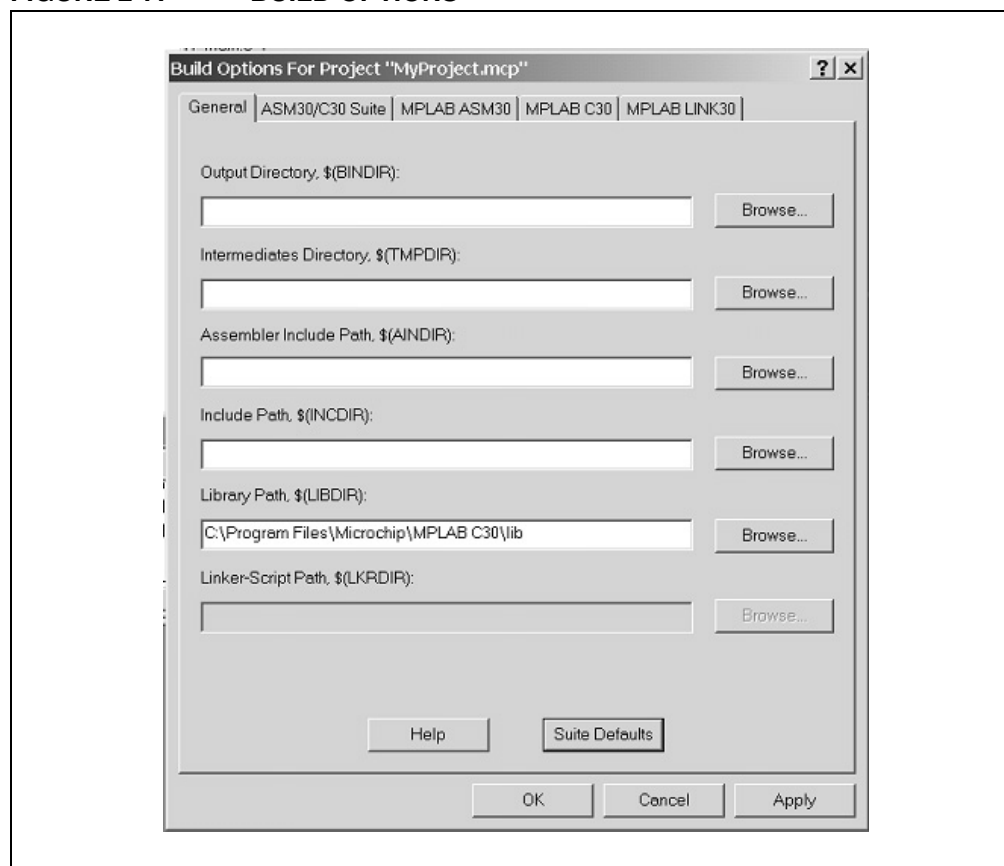
For dsPIC33 projects, the line is:

```
#include "p33fj256gp710ps.h"
```

This line causes a standard include file to be used. Microchip provides these files with all the Special Function Register (SFR) labels already defined for convenience.

To build the code, select **Build Options > Project** from the **Project** menu. The Build Options dialog displays (Figure 2-7).

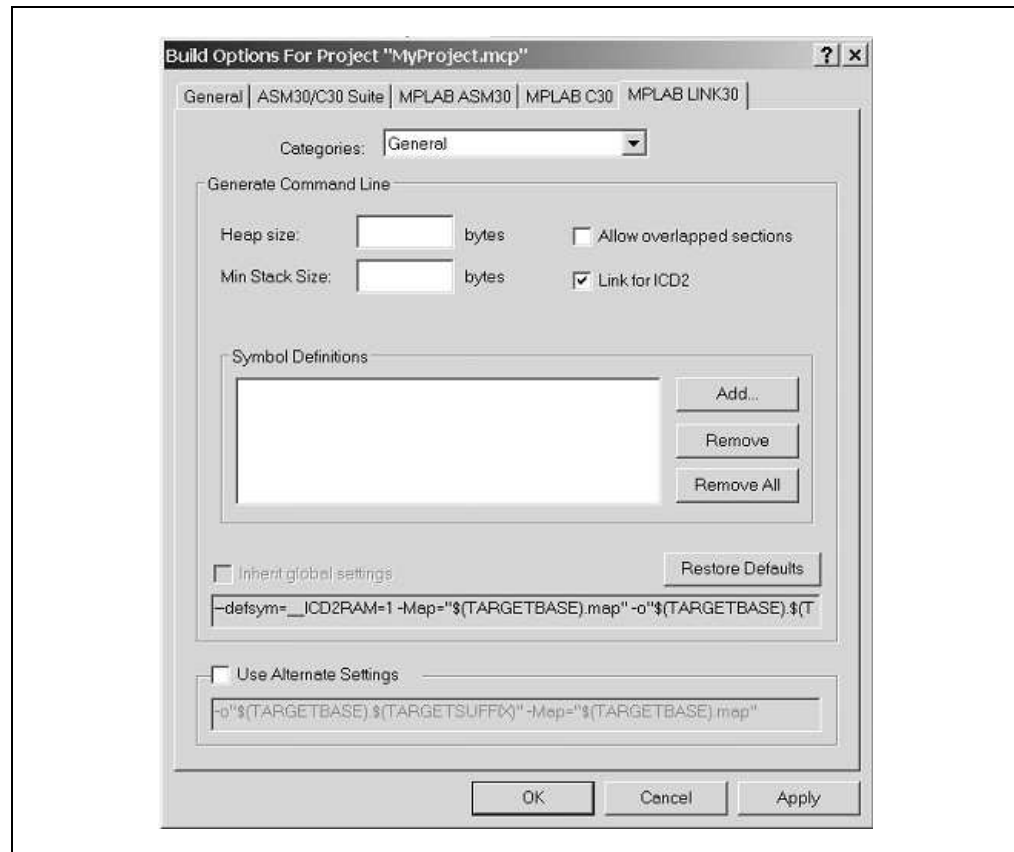
FIGURE 2-7: BUILD OPTIONS



2.5.1 Identify Assembler Include Path

1. Select the **General** tab.
2. Click **Suite Default**. This tells the environment where to find the library files.
3. Select the **MPLAB LINK30** tab to view the linker settings (Figure 2-8).
4. Check **Link for ICD2**.
5. Click **OK**. The text box closes while the linker reserves space for the debug code used by the MPLAB ICD 2.
6. Click **OK** again to save these changes. The project is now ready to build.

FIGURE 2-8: MPLAB® LINK30 BUILD OPTIONS

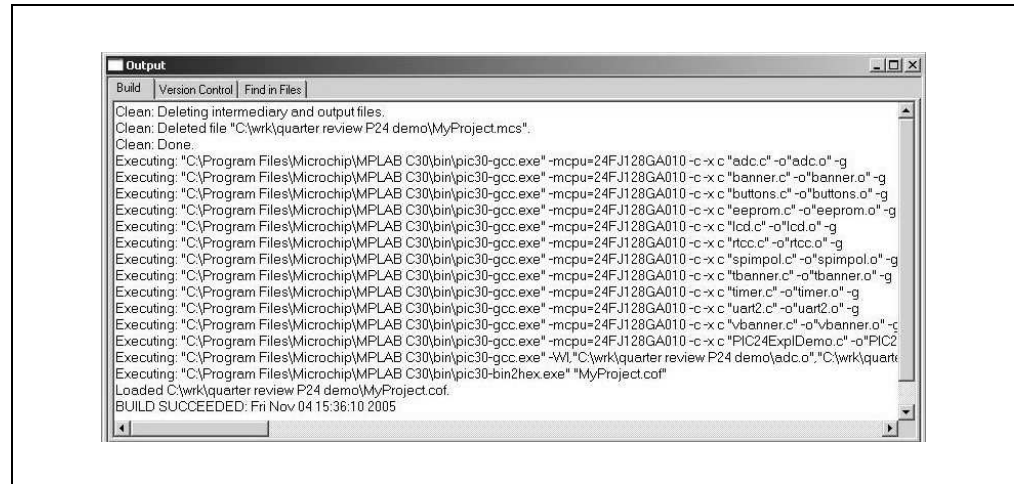


2.5.2 Build the Project

From the menu bar of the main MPLAB IDE window, select **Project > Make**. The Build Output window displays (Figure 2-9).

Observe the progress of the build. When the “BUILD SUCCEEDED” message displays, you are ready to program the device.

FIGURE 2-9: BUILD OUTPUT



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2.6 PROGRAMMING THE DEVICE

The MPLAB ICD 2 In-Circuit Debugger is used to program and debug the microcontroller in-circuit on the Explorer 16 Development Board.

Note: Before proceeding, make sure that the USB driver for the MPLAB ICD 2 has been installed on the PC (see the *MPLAB® ICD 2 In-Circuit Debugger User's Guide* (DS51331) for more details regarding the installation of the MPLAB ICD 2).

2.6.1 Set Up the Device Configuration

The device configuration for the target microcontroller can be set by two methods: using configuration macros in the source code, or using the Configuration Bits window in MPLAB IDE.

The PIC24 Explorer 16 tutorial code already includes configuration macros in the source code itself. It is only necessary to confirm that the following macros are in place near the top of the `PIC24ExplDemo.c` file:

```
_CONFIG1(JTAGEN_OFF & GSS0_OFF & GWRP_OFF & BKBUG_OFF & COE_OFF  
& FWDTEN_OFF & FNOSC_PRI)  
_CONFIG2(FCKSM_CSDCMD & OSCIOFNC_ON & POSCMOD_HS)
```

For the dsPIC33F tutorial code, confirm that the following macros are in place near the top of the `main_rtc.c` file:

```
_FGS(CODE_WRITE_PROT_OFF);  
_FOSCSEL(FRC_PLL);  
_FOSC(CSW_FSCM_OFF & OSC2_IO & XT);  
_FWDT(WDT_OFF);
```

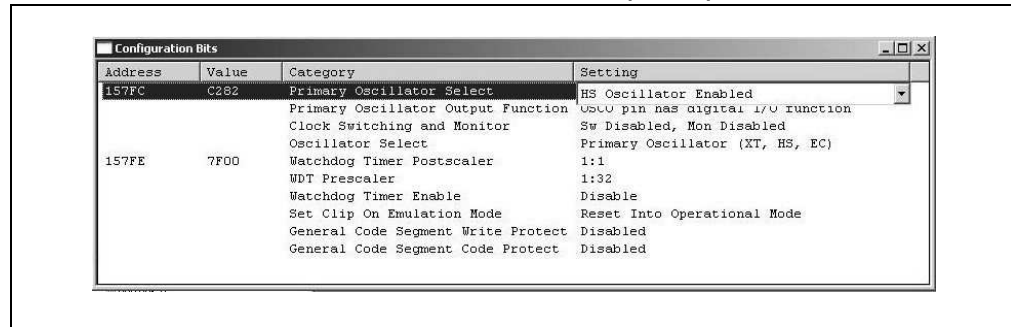
If configuration macros are not used in the source code, it is also possible to set device configuration with the Configuration Bits window. For the PIC24 code, the process is as follows:

1. From the main window's menu bar, select Configure > Configuration Bits to display the configuration settings (Figure 2-10).
2. Set the Configuration bits by clicking on a particular line item and selecting an option from the drop-down menu that appears. The Configuration bits should be set as shown in Figure 2-10.

The settings that will most likely need to change are:

- a) Primary Oscillator Select: HS Oscillator Enabled
- b) Oscillator Select: Primary Oscillator (XT, HS, ES)
- c) Clock Switching and Monitor: SW Disabled, Mon Disabled
- d) Watchdog Timer Enable: Disable

FIGURE 2-10: CONFIGURATION SETTINGS (PIC24)



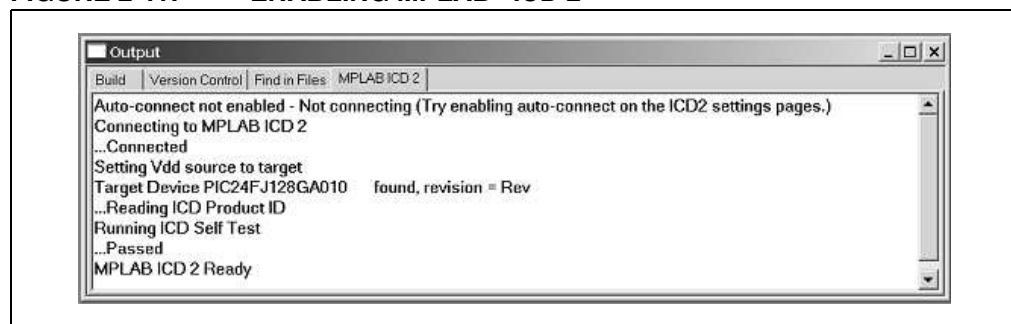
Note: Do not use the Configuration Bits window to set device configuration if configuration macros are already used in the source code. In cases where both methods are used, configuration macros may override settings from the Configuration Bits window. Refer to the *MPLAB IDE Simulator, Editor User's Guide* (DS51025) for additional information.

2.6.2 Connect and Enable MPLAB ICD 2

1. Connect the MPLAB ICD 2 module to the PC with the USB cable.
2. Connect the MPLAB ICD 2 to the Explorer 16 Development Board with the short RJ-11 cable.
3. Apply power to the Explorer 16 board.
4. From the Debugger menu, click Select Tool > MPLAB ICD 2 to set the MPLAB ICD 2 as the debug tool in MPLAB IDE.
5. From the Debugger menu, select Connect to connect the debugger to the device. MPLAB IDE should report that it found the PIC24FJ128GA010 device, as shown in Figure 2-11.

Note: MPLAB IDE may need to download new firmware if this is the first time the MPLAB ICD 2 is being used with a PIC24FJ device. Allow it to do so. If any errors are shown, double-click the error message to get more information.

FIGURE 2-11: ENABLING MPLAB® ICD 2



2.6.3 Program the Device

1. From the *Debugger* menu, select *Program* to program the part. The Output window (Figure 2-12) displays the program steps as they occur.
2. Observe the results of the programming. When “MPLAB ICD 2 Ready” displays, the device is programmed and ready to run.

FIGURE 2-12: PROGRAMMING THE DEVICE

