Microchip Minutes: helloWorld Application Lab

Contents

Overview	
Equipment Needed	1
Hardware:	1
Software:	1
Procedure	2
Create a new project:	2
Setup MPLAB Code Configurator (MCC) to Generate Code	5
Enable Low-Voltage Programming Mode in Project Properties	12
How to install MPLAB Code Configurator (MCC)	13

Overview

The purpose of this lab is to introduce basic concepts of how to set up a project in MPLAB[®] X IDE while using the MPLAB Code configurator to light an LED connected to one of the pins of a PIC16F1619 microcontroller. This is commonly known as the helloWorld application.

Equipment Needed

This lab was developed using the following tools:

Hardware:

- Curiosity Development Board: <u>www.microchip.com/curiosity</u>
 - Page includes user's guide along with schematics and other helpful information.
- PIC16F1619 8-bit PIC[®] microcontroller: http://www.microchip.com/wwwproducts/Devices.aspx?product=PIC16F1619

Software:

- MPLAB X IDE : <u>www.microchip.com/mplabx</u>
- MPLAB XC8 C Compiler: <u>www.microchip.com/xc8</u>
- MPLAB Code Configurator (MCC): Please see How to install MPLAB Code Configurator (MCC) at the end of this lab.

Procedure

Create a new project:

- 1. Open MPLAB X IDE
- 2. Create a new project by clicking the New Project icon ¹ or by selecting <u>*File>New*</u> <u>*Project...*</u>
- 3. In the **New Project** window select **Microchip Embedded** in the **Categories:** frame and **Standalone Project** in the **Projects:** frame and click **Next**.

🔀 New Project	K New Project						
Steps	Choose Project						
1. Choose Project 2	Categories: Surocha Enbedded Other Enbedded B- Samples	Projects: Standalone Project Existing MPLAB IDE V8 Project Probult (Hex, Loadable Image) Project User Makefile Project Ubrary Project					
	Description: Creates a new standalone application proj project.	ect. It uses an IDE-generated makefile to build your					
	< Back	Next > Finish Cancel Help					

 Select the Mid-Range 8-bit MCUs (PIC10/12/16/MCP) in the Family dropdown in the Select Device window and then select PIC16F1619 in the Device dropdown. Click Next>.

Steps	Select Devic	ce
Choose Project Select Device Select Header Select Tool	Family:	id-Range 8-bit MCUs (PIC 10/12/16/MCP) 👻
 Select Plugin Board Select Compiler Select Project Name and Folder 	Device:	PIC16F1619 •
	S	
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		<pre><back next=""> Finish Cancel Help</back></pre>

K New Project	March 1 Second Concerns	23
Steps	Select Tool	
1. Choose Project 2. Select Device 3	Hardware Tools - oo ICD 3 - o PICM12 - o PICM2 - o PM3 - o Re - Microchip Starter Kits - o Starter Kits - o Starter Kits - of Starter	
	< Back Next > Finish	Cancel Help

5. Select the Curiosity Board in the Select Tool window and click Next>.

6. Next, select the XC8 compiler in the Select Compiler window and click Next>.

New Project	What's free & Salarian	×
Steps	Select Compiler	
Choose Project Select Device Select Header Select Header Select Yough Board Select Compiler Select Compiler Select Project Name and Folder	Compler Toolchains mpasm - onpasm (v5.62) [C:\Program Files (x86)\Microchip\MPLABX\v3.05\mpasmx] XC8 - o XC8 - o XC8 (v1.34) [C:\Program Files (x86)\Microchip\vc3\v1.34\br)	
	<back next=""> Finish Cancel Help</back>	

7. Select a project location and name the project to something meaningful such as **helloWorld.** Be sure that the check box next to **Set as main project** is selected and click **Finish.**

Ste	ew Project	Select Project Name	and Folder
1. 2. 3.	Choose Project Select Device Select Header		
4. 5.	Select Tool Select Plugin Board	Project Name:	helloWorld
5. 7.	Select Compiler Select Project Name and	Project Location:	C:\Users\c13137\MPLABXProjects Browse
7	Folder	Project Folder:	C:\Users\c13137\MPLABXProjects\helloWorld.X
		Overwrite existing	g project.
		Also delete source	25.
2		📝 Set as main proje	ct
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	PLABX	Encoding: 150-88	99-1 v
			<pre><back next=""> Finish Cancel Help</back></pre>

8. The MPLAB X IDE workspace should look similar to below. If not, common windows such as **Projects** can be opened through <u>*Windows>Projects*</u> etc...



Setup MPLAB Code Configurator (MCC) to Generate Code

- Open MPLAB Code Configurator (MCC) from <u>Tools>Embedded>MPLAB Code Configurator</u>. If the MCC is not listed or if the <u>Tools>Embedded</u> menu isn't listed, then MCC will need to be installed (<u>see How to install MPLAB Code Configurator at end of manual</u>)
- 2. Opening the MCC for the first time will display an overlay describing key sections of the workspace including Project Resources, Device Resources and Composer area. The reader is encouraged to take a moment to familiarize themselves with these sections. The overlay

can be closed by hitting the ESC key and reopened anytime by selecting the 🔨 button.

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File Edit View Navigate Source Refactor Run Debug Team Tools	*tindow Help - 溜・ト・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・
Projects Firs Classes MPLAB9 Code Config	Start Page = N ₩ MPLAB X Store x MPLAB & Code Configurator x Compare Code (2) Compare Code (2) Code (2)
All the peripherals which were selected and configured are displayed here. Clicking on one of the entries will display the UI in the "Composer Area ->"	<- Select which driver you want to configure from here
Device Resources Area	In this area you will see the UI for the peripheral you have selected in the "<- Project Resources Area". Here you will find all settings which you can configure for the selected peripheral

Other buttons in the MCC include:

Accesses the MCC Homepage and Forums

Accesses Options to customize how the MCC behaves. These labs will use the default configuration

3. In the **Project Resources** area, select the **System** resource to open the user interface in the composer area.



The system user interface is where core device operational parameters are setup such as oscillator selection and enabling or disabling features such as brown-out reset, windowed-watchdog use and so on.

4. Configure the system to use the INTOSC (Internal Oscillator) from the **System Clock Select** drop-down menu. The **Internal Clock** set to **500KHz_HF** default can be left as is.



5. In the bottom section of the **Composer Area** is where fuses or configuration bits are set. Here the Microcontroller will need to be configured to use **Low Voltage Programming**. This is the programming mode used by the integrated programmer/debugger on the Curiosity Board.

Expand the CONFIG2 drop down and select the radio button next to the Low-voltage

programming enabled selection under the Low-Voltage Programming Enable [LVP ON] sub category.



6. A General Purpose I/O pin will be driven HIGH to light an LED connected to it. In the **Device Resource Area**, locate and expand the **GPIO** drop-down and double-click on the **GPIO::GPIO** selection to add to the **Project Resources Area**.



Select **GPIO::GPIO** in the **Project Resources Area** to open the GPIO peripheral user interface in the **Composer Area**.

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Projects Files Classes MPL 4	Start Page 🕫 MPLAB® Code Configurator 🕫		: MPLAB® Code Configurator Pin Manager	Ð
Project Resources	Selected pins: 0 Pin No. Output Start High WPUE IOCP IOCN Custom Name	< <resources manager="" pn="">></resources>	VDD 1 1 RA5 2 RA4 3 MCLR 4 RC5 0 MCCCCHP RC5 0 MCCCCHP	20 VSS 19 RA0 18 RA1 17 RA2 16 RC0 15 RC1 14 RC2
			Rec 9 Rec 9 Re7 10 Package (FOIP20) Reverse Pin Order 19 18 17 4 3	13 0 R84 12 R85 11 R86 2 13 12 11 10 16 15 14
Viel Berlin P Point Resurverse P			PORTA * PORTA * PORTA * PORTA * PORTA *	PORTE

Note that an additional area appears called the **MPLAB Code Configurator Pin Manager.** This area provides a graphical representation of the selected device along with available pins for the selected peripheral in blue. Pins are assigned by selecting the desired pin in the lower section of the area.

7. Ensure that the appropriate package is selected in the Pin Manager using the Package drop-down menu. This lab utilizes the Curiosity board populated with a PIC16F1619 in 20-pin PDIP package.



Referring to the Curiosity Board schematic, LEDs are connected to RC5 (PORTC bit 5), RA2 (PORTA bit 2), RA1 (PORTA bit 1) and RA5 (PORTA bit 5) I/O pins. Select one of these by clicking on the appropriate pin in the lower **Pin Manager** window. Here RC5 connected to LED D7 is selected. Note the changes in the **Pin Manager** with the pin selected now appearing green with a lock icon a.



9. Pin names can be changed by the user so that they are easier to identify. In the **Composer Area**, configure the I/O pin as an output by checking the appropriate box and change the name to something meaningful such as **Ied**.



Next, click on the **Generate Code** button in the **Composer Area** to generate the necessary C code that corresponds to the configuration setup in the MCC.

Gen	Generate Code (2)							
OId	r ^{Select}	ed pin:	s: 1—					
ö	Pin	No.	Output	Start High	۷			
GPI	RC5	5	V	V				

Note that the MCC will ask if the user would like to generate a **main.c** file if one doesn't already exist. In this instance, click **Yes**.



10. The **Output – MPLAB Code Configurator** window at the bottom of MPLAB X IDE should indicate that code has been generated successfully. If the **Output** window is not visible it can be opened by selecting <u>Window>Output>Output</u>.



11. Compile the project and download to the PIC16F1619 by clicking the Make and Program

Device Main Project button **I** in the MPLAB X IDE Workspace.



Result

If configured correctly, the LED D7 on the Curiosity Board should light.

Note: If MPLAB X IDE displays a window indicating the target device is not recognized, <u>low-voltage programming may need to be enabled in the project properties</u>.



Enable Low-Voltage Programming Mode in Project Properties

- 1. Open *File>Project Properties (helloWorld)*
- 2. In the Project Properties window, highlight Starter Kit (PKOB) in the Categories pane.
- 3. On the right side of the **Project Properties** window, select **Program Options** from the **Option categories:** drop-down menu

X Project Properties - helloWorld	I 0 Di	
Categories:	Options for Starter Kit (PKOB)	
⊟- ● <u>Conf: [default]</u>	Option categories: Memories to Program	•
Starter Kit (PKOB) O Loading	Memories to Program Auto select memories Program Options	Allow PICkit 3 to Select Memo
• Libraries	Configuration Memor	V
O Building XC8 clobal options	ID	\checkmark
·····	Program Memory	V
····· ◇ XC8 linker	Program Memory Start (hex)	0x0
	Program Memory End (hex)	0×1fff
	Preserve Program Memory	
	Preserve Program Memory Start (hex)	0x0

4. Make sure that the checkbox next to **Enable Low Voltage Programming** is selected. Even if the checkbox is selected click **Apply** and then **OK** to close the window.

How to install MPLAB Code Configurator (MCC)

- 1. Select <u>Tools>Plugins</u>
- 2. In the **Plugins** window select the **Available Plugins** tab, locate the **MPLAB Code Configurator** and ensure the checkbox under **Install** is selected. Click **Install** to install the plugin.

	a catalog				Jear G N
Install	Name	Category ₹	Source		MDI AB® Code Configurator
	DMCI	MPLAB Plugin	<u>66</u>		MPLAB® Code Configurator
	PCLint	MPLAB Plugin	88 C		AA Community Contributed Plunin
	MPLAB® Harmony Configurator	MPLAB Plugin	88		gg community contributed Plagm
	Power Monitor	MPLAB Plugin	<u>88</u>		Version: 2.10.3
	ELFViewer	MPLAB Plugin	66		Author: Microchip Technology Inc.
	MPLABX KeeLog Plugin	MPLAB Plugin	88		Date: 3/12/15
	Code Profiling (Trial Version)	MPLAB Plugin	<u>66</u>		Source: Microchip Plugins
	ECAN Bit Rate Calculator	MPLAB Plugin	88 C		Homepage: http://www.microchip.com/mcc
7	MPLAB® Code Configurator	MPLAB Plugin	66		
	Graphics Display Designer X	MPLAB Plugin	<u>66</u>		Plugin Description
	MemoryStarterkit	MPLAB Plugin	66		
	dsPICWorks	MPLAB Plugin	66	Ε	The MPLAB® Code Configurator (MCC) generates seamless easy to understand C code
	Plugin Update Services	MPLAB Plugin	<u>66</u>		that's inserted into your project. It enables, configures and utilizes a rich set of
	RTOS Viewer (FreeRTOS)	MPLAB Plugin	88		peripherals across a select list of devices. It's integrated into MPLAB X (IDE) to provide
	Path Tools	Netbeans Plugin			a very power or and extremely easy to use development platform.
1000	Format Many	Netbeans Plugin	66		System requirements
	PBP Tool Chain	Tools	66		
	PicBasic Language Syntax	Tools	88 C		 MPLAB X: v2.26
	CCS C Compiler	Tools	88		• XC8: V1.34
	SDCC Toolchain	Tools	<u>88</u>		• AC10: V1:24
	Proteus VSM Viewer	Tools	-	-	

3. Click **Next>**in the **Plugin Installer** window

🔀 Plugin Installer	23
Welcome to the Plugin Installer The installer will download, verify and then install the selected plugins.	
The following plugins will be installed:	
MPLAB® Code Configurator [2.10.3]	
< Back Next > Cancel Her	

4. Check next to I accept the terms in all of the license agreements and then click the Install button to install MCC.

🗙 Plugin Installer	23
License Agreement Please read all of the following license agreements carefully.	
In order to continue with the installation, you need to agree with all of the license agreements asso with the particular plugins.	ociated
MPLAB® Code Configurator License Agreement Copyright (C) [2012-2015] Microchip Technology Inc. and its subsidiaries (Microchip).	
All rights reserved.	E
You are permitted to use the accompanying software and its derivatives with Microchip products. See the Microchip license agreement accompanying this software for additional info regarding your rights and obligations.	
MICROCHIP SOFTWARE AND DOCUMENTATION ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTY O MERCHANTABILITY, TITLE, NON-INFRINGEMENT AND FITNESS FOR A PARTICULAR PURPOSE. IN ANO EVENT WILL MICROCHID ON THE LICENSORS BELIABLE ON OPLICATED LINDED. CONTRACT	÷ F
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5. MPLAB X IDE will need to be restarted in order to complete plugin installation. Click **Finish** to restart the IDE

X Plugin Installer	x
Restart application to complete installation Restart application to finish plugin installation.	
The Plugin Installer has successfully installed the following plugins: MPLAB® Code Configurator	
Restart Now	
🔘 Restart Later	
Finish Cancel	lelp

Restarting the IDE may take a minute or two.

6. Once restarted, MCC should now appear in the <u>Tools>Embedded</u> menu.

