# MPLAB X IDE TUTORIAL

The aim of this tutorial is to show how to use MPLAB X IDE.

## **Introduction to MPLAB X IDE**

MPLAB X IDE has three main components that work together to generate machine code to be loaded on a PIC microcontroller:

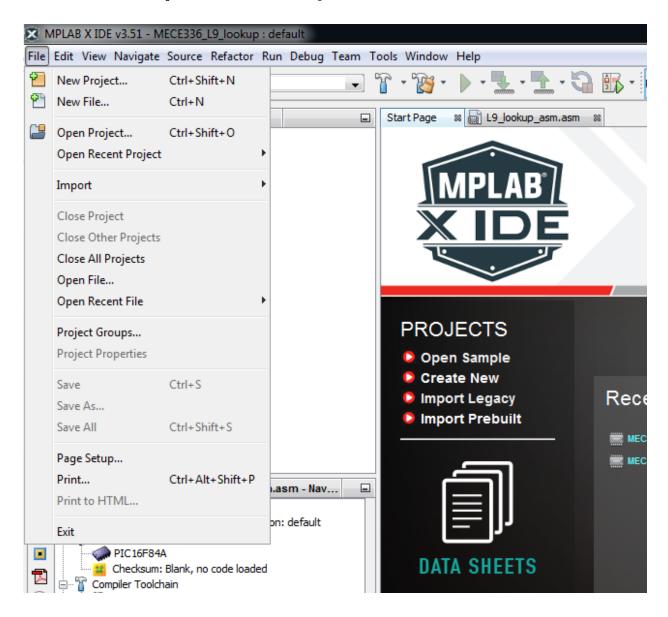
- **Project Manager**. The preferred way of developing programs in MPLAB is by creating a project. An MPLAB project groups all the files together that relate to the project and ensures that they interact with each other in an appropriate way and are updated as needed.
- **Text Editor**. This allows entry of the source code. It behaves to some extent like a simple text editor such as Notepad, but it can recognise the main elements of the programming language that is being used. Thus in Assembler it codes instructions in one colour, labels in another and comments in a third. In this way the programmer can immediately see if there is a misconception in his placing or use of text within the Assembler line.
- Assembler and Linker. The Assembler converts the Assembly language to machine language. In advanced projects, the code may be created from a number of different files. The role of the Linker is to put these together, give each its correct location in memory, and ensure that branches and calls from one file to the other are correctly established.

### **Creating a Project in MPLAB X IDE**

1) Open MPLAP IDE. Icon of the editor can be seen in Figure-1.



2) From the "Project" choose "New Project".



3) Select Microchip Embedded (Categories) and Standalone Project (Projects). Then click Next.

Steps	Choose Project	
1. Choose Project 2	Q, Filter:	
	Categories:	Projects:
	Microchip Embedded	Standalone Project
		Existing MPLAB IDE v8 Project Prebuilt (Hex, Loadable Image) Project
	🗄 🔁 Samples	User Makefile Project
		Library Project
	Description:	
	Creates a new standalone applicati project.	on project. It uses an IDE-generated makefile to build your
	projecti	

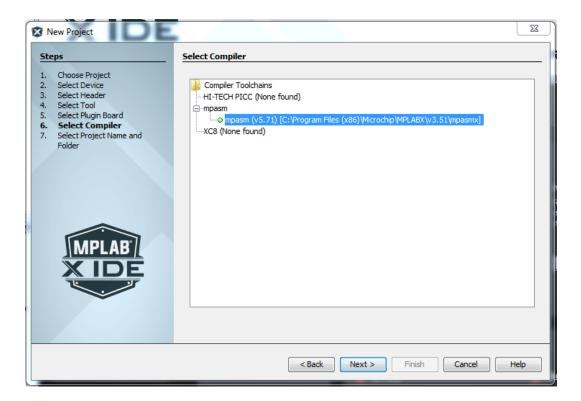
 Select the device. In our case choose the family Mid-Range 8-bit MCUs and the Device PIC16F84A. Click "Next".

New Project		x
Steps	Select Device	
<ol> <li>Choose Project</li> <li>Select Device</li> <li>Select Header</li> <li>Select Tool</li> <li>Select Plugin Board</li> <li>Select Compiler</li> <li>Select Project Name and Folder</li> </ol>	Family: Mid-Range 8-bit MCUs (PIC 10/12/16/MCF ↓ Device: PIC 16F84A ↓	
MPLAB X IDE		
	< Back Next > Finish Cancel Help	

5) Choose the Hardware Tool. If we want to use the MPLAB Simulator, select **Simulator**.

X New Project	
Steps	Select Tool
<ol> <li>Choose Project</li> <li>Select Device</li> <li></li> </ol>	Hardware Tools I hardware Tools I CD 3 PICkit2 PM3 Real ICE Simulator Difference Other Tools I Policies Debugger
XIDE	<back next=""> Finish Cancel Help</back>

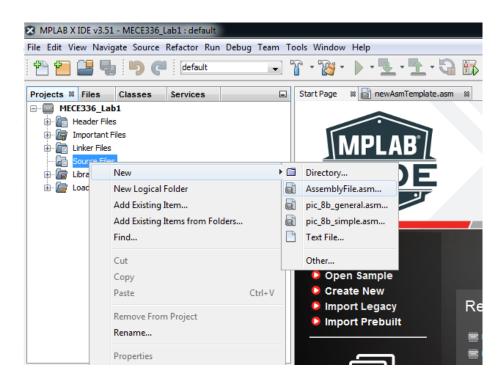
Choose the programming language. If you want to use Assembly choose "mpasm", then click "Next".



7) Choose a directory and a name for the project. Click "Finish".

🗴 New Project			
Steps	Select Project Name and	l Folder	
1. Choose Project 2. Select Device 3. Select Header	Project Name:	MECE336_Lab 1	
<ol> <li>Select Tool</li> <li>Select Plugin Board</li> </ol>	Project Location:	C: \Users \klaus \Desktop	Browse
<ol> <li>Select Compiler</li> <li>Select Project Name and</li> </ol>	Project Folder:	C:\Users\klaus\Desktop\MECE336_Lab1.X	
Folder			
	Overwrite existing pro	oject.	
	Also delete sources.		
	👽 Set as main project		
	Use project location a	s the project folder	
	Encoding: ISO-88	59-1	
		<back next=""> Finish</back>	Cancel Help

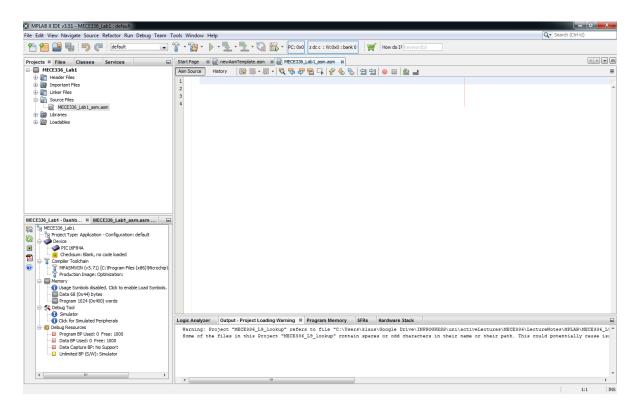
8) A new project is created. Your window should look like in the next figure. The next step is to write our assembly code. Expand the tree under Projects and select Source Files -> New -> AssemblyFile.asm.



9) Write a file name and click **Finish**.

X New AssemblyFile.asm	×
Steps	Name and Location
<ol> <li>Choose File Type</li> <li>Name and Location</li> </ol>	File Name: MECE336_Lab1_asm
	Project: MECE336_Lab1
	Folder: Browse
	Created File: C:\Users\klaus\Desktop\MECE336_Lab1.X\MECE336_Lab1_asm.asm
	< Back Next > Finish Cancel Help

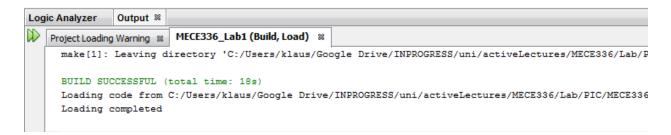
**10)** Your project window should now look as in the following figure. You can start writing assembly code.



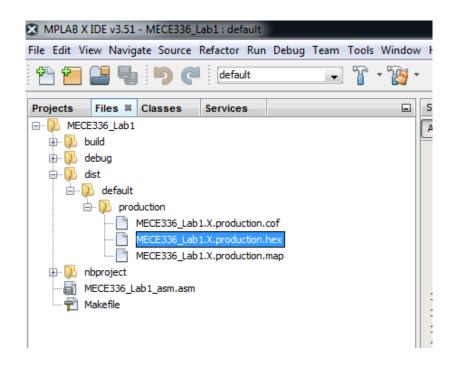
 Special commands in the written code are colored as blue and keywords are colored as magenta. You can now compile your code by clicking **Build Project**.

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ECE336_Lab1	Asm Source History 🔀 💀 🗸 🔩 🗸	<u>,</u>
	1 list p=16F84A	-
Important Files     Important Files	2 include "p16f84A.inc"	
Linker Files     Source Files	3	
	4 org 0;	
E- Loadables	5	
_	6 main	
	7 clrf 0Ch; 8 clrf 10h;	
	9 movlw 07h;	
	10 movwf 0Ch;	
	11 clrw ;	
	12 movf 0Ch,0;	
	13 movwf 10h;	
	14 clrf 0Ch;	
	15 goto main;	
	16 end	
	17	

12) If your code is correct in terms of assembly syntax rules then the output window shows"BUILD SUCCESSFUL". The ".hex" file is created and we are ready for the simulation.



13) If you want to look at the .hex file, you can find it under Files->ProjectName->dist->default->production.



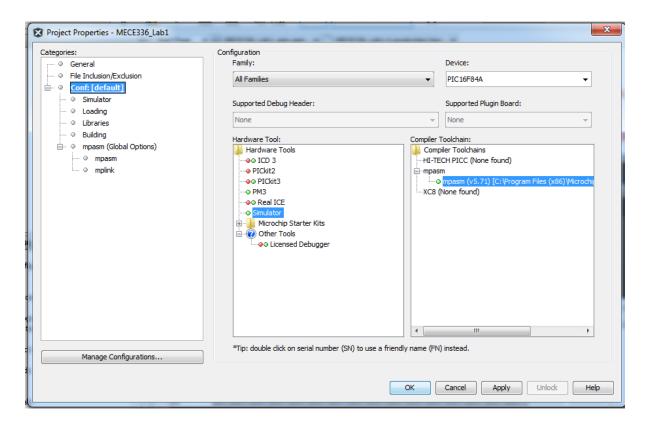
## **B** Simulate your assembly code in MPLAB X IDE

MPLAB X IDE contains a **Software Simulator and Debugger**. A software simulator allows a program to be tested by running it on a simulated CPU in the host computer. Inputs can also be simulated and outputs and memory values can be observed. The debugger contains the tools which allow program execution to be fully examined, for example by single stepping through the program, running at slow speed, or halting at a particular location.

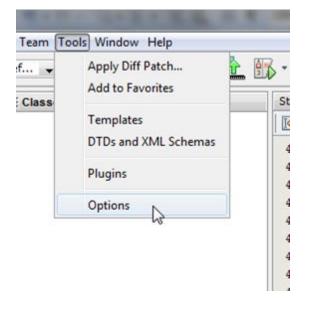
#### 1. Open a Project as described above

#### 2. Select Simulator as the Hardware Tool

- Select MECE336\_Lab1 from the project list
- Right click
- Select "Properties"
- Click Conf:[default]
- Under "Hardware Tools", verify that Simulator is selected



3. Setting the Simulator to start at the beginning of main() function



- From the "Tools" pull down menu select "Options"
- Select the Embedded icon
- Select the "Generic Settings" tab
- Ensure the "Debug startup" is set to 'Halt at Main'

Options					
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General	Editor	Fonts & Colors	Keymap	c/c+-	+ Embedded Miscellaneous
uild Tools Pr	oject Optio	Generic Settings	kuppressible M	lessages	Diagnostics Other
Projects Fo	lder: C:\User	s\m91186\MPLABX	Projects		
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Halt build o	n first failure				
Maintain ac	tive connection	on to hardware tool			V
Read Devic	e Memory To	File: Export only me	emory used		
Silent build					
Enable alte	rnate watch li	st views during deb	ug sessions		
Disable aut	o refresh for	call stack view durin	g debug session	s.	
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5 mm	Turnet				
Export	Import				OK Cancel Help

#### 4. Select Memory Locations to Observe

- Select Window->PIC Memory Views from the Menu bar
- You can for example observe the file registers, special function registers (SFRs) or the program memory
- The figure below shows the file register starting from address 0x00.

Wat	ches	Vari	ables	Call	Stack	Bre	akp	. Οι	rtput		File	e	88	SFRs		_
Q	Addr	ess	00	01	02	03	04	05	06	0	7	08	09	9 0A	0B	
-	00		00	00	00	18	00	00	00			00	00	00	00	
	10		00	00	00	00	00	00	00	00		00	00	00	00	
	20		00	00	00	00	00	00	00	00		00	00	00	00	=
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		PIC Memory Views		•	Program	n Memo	ory
		Simulator		•	File Reg	gisters	
		Configure Window Reset Windows			-	uration f	
MECE336_Lab1 - Dashboard * MECE336_Lab1_asm.asm		Close Window Close All Documents Close Other Documents Document Groups Documents	Ctrl+W Ctrl+Shift+W Shift+F4			are Stack Memor	
Debug Image: COFF: Optimization:     Memory     Data 68 (0x44) bytes							

## 5. Starting the Debug Session

Build a debug version of the open project by clicking on the Debug Project icon



You will notice that clicking the "Debug Project" icon will build the project, download it to the simulator, start the simulator session, and run until the program reaches "main".

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Observe the green code highlight on the first line after main. The simulation has started but stopped at this place in the code. The green line indicates the current position of the PC during a debug session.

Notice the addition of the Debug Toolbar



## 6. Step Into

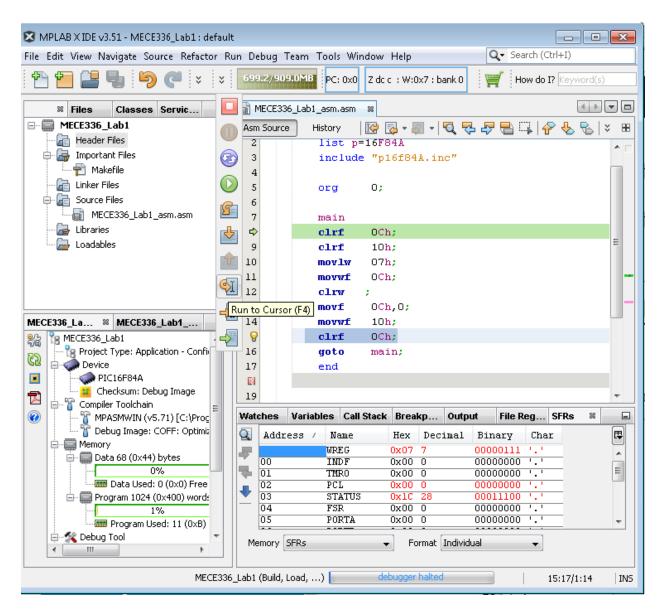
Click "Step Into" icon to execute one line of source code. Notice the PC increment as the green line goes to the next line in code

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MECE336_	Lab1 (	Build, I	Load,	)	d	ebugger	halted				11:1		INS

#### 7. Run to Cursor

We could continue to step through the program one line at a time to get to a place of interest but this may be time consuming.

Place the cursor on the line of code containing the desired instruction, for example "clrf 0Ch";. Then, right click and select Run to Cursor



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