
The ICD2 is a complete In-Circuit Debugging and Programming. That means the ICD2 provides ICSP (in-circuit serial programming) and at the same time can debug the target Microchip microcontrollers that support debug mode.

The VNB ICD2 always works with the latest version of MPLAB IDE because the firmware can be automatically updated with the new MPLAB IDE installation. MPLAB IDE is a free, integrated Development Environment for development of applications using Microchip's PIC and dsPIC microcontrollers. MPLAB IDE and supporting documents could be downloaded from [Microchip](#)

Features

- RS-232 interface to host PC
- Real time debugging
- Work with MPLAB IDE GUI (free from Microchip)
- Firmware upgrade from PC, always work with latest MPLAB IDE
- Power indicator LED
- Busy LED
- A push button to reset the board
- A push button for external trigger event
- Program configuration bits
- Erase program memory with verification
- Work the same way as MPLAB ICD2 at a much lower cost
- Reading/Writing memory space
- Reading/Writing EEDATA areas of the target MCU

Devices Supported

The VNB ICD2 supports most PIC and dsPIC Flash microcontrollers from Microchip. The latest firmware for the ICD2 can be updated to add more supported devices. New firmware is available for free download at [Microchip](#). For the most current list of the supported parts, please refer to the README file located in MPLAB IDE directory.

User's Guide

Since the VNB ICD2 works the same way as the MPLAB ICD 2 from Microchip. Documents related to the MPLAB ICD2, MPLAB ICD 2 in-Circuit Debugger User's Guide, MPLAB ICD 2 In-Circuit Debugger/Programmer and MPLAB ICD 2 Advisory can serve as good references for VNB ICD2 users. Those documents are available for download [here](#) .

ICD2 user's guide is also available from MPLAB IDE Help menu. To get there:
Help → *Topic...* → *Select MPLAB ICD2 under Debuggers* → *Click on OK.*

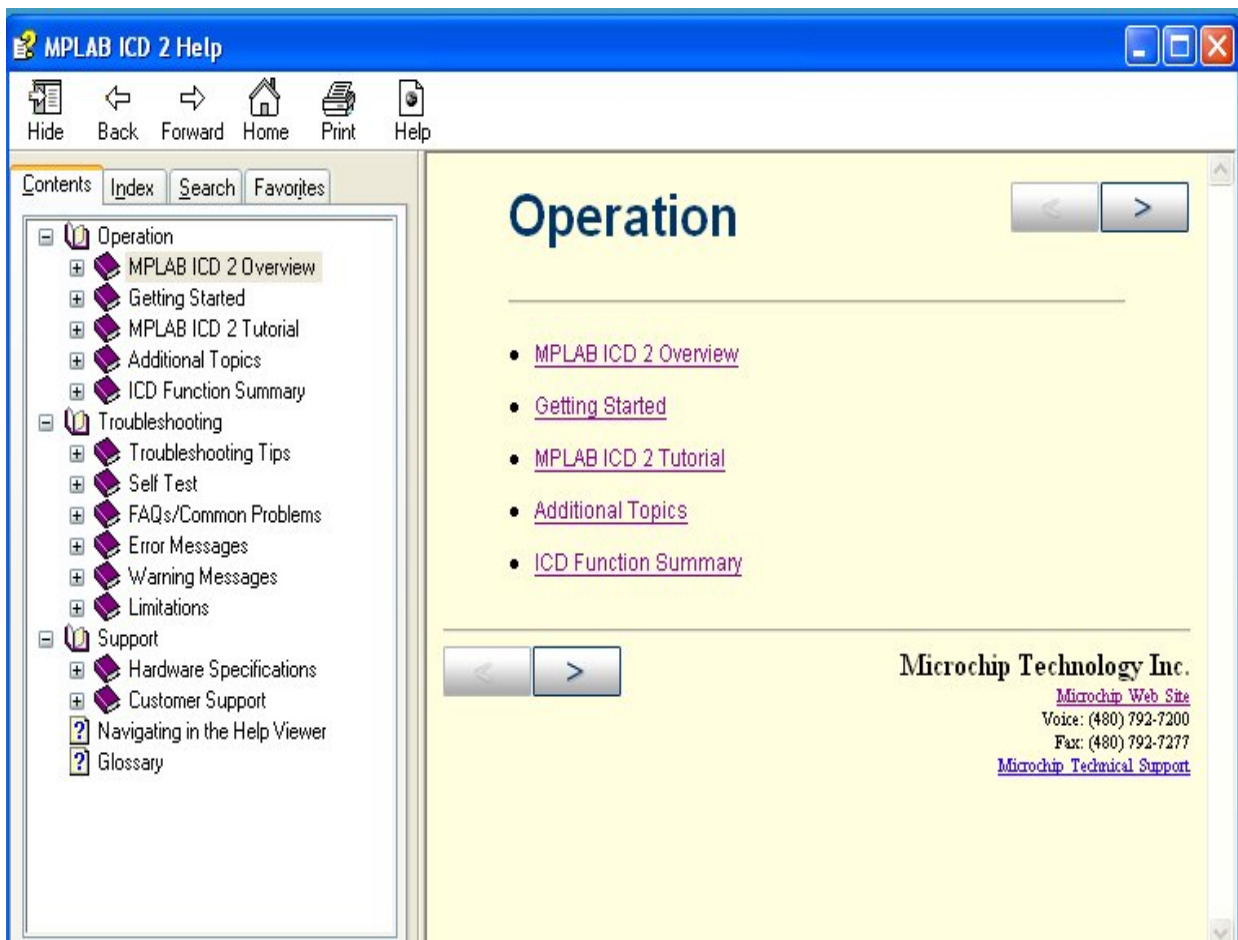


Figure 2: ICD 2 Help from MPLAB IDE

The following only serve as a quick guide in setting up and use the ICD 2. For more details on how to use the MPLAB ICD, please refer the documents mentioned above.

Communications port setup:

Make sure that the FIFO buffers are turned off and flow control is set for hardware in the COMM driver dialog.

- Go to windows device manager.
- Double click on the communication Port you want to use (We use COM1 in this guide) to bring up Communications Port (COM1) Properties

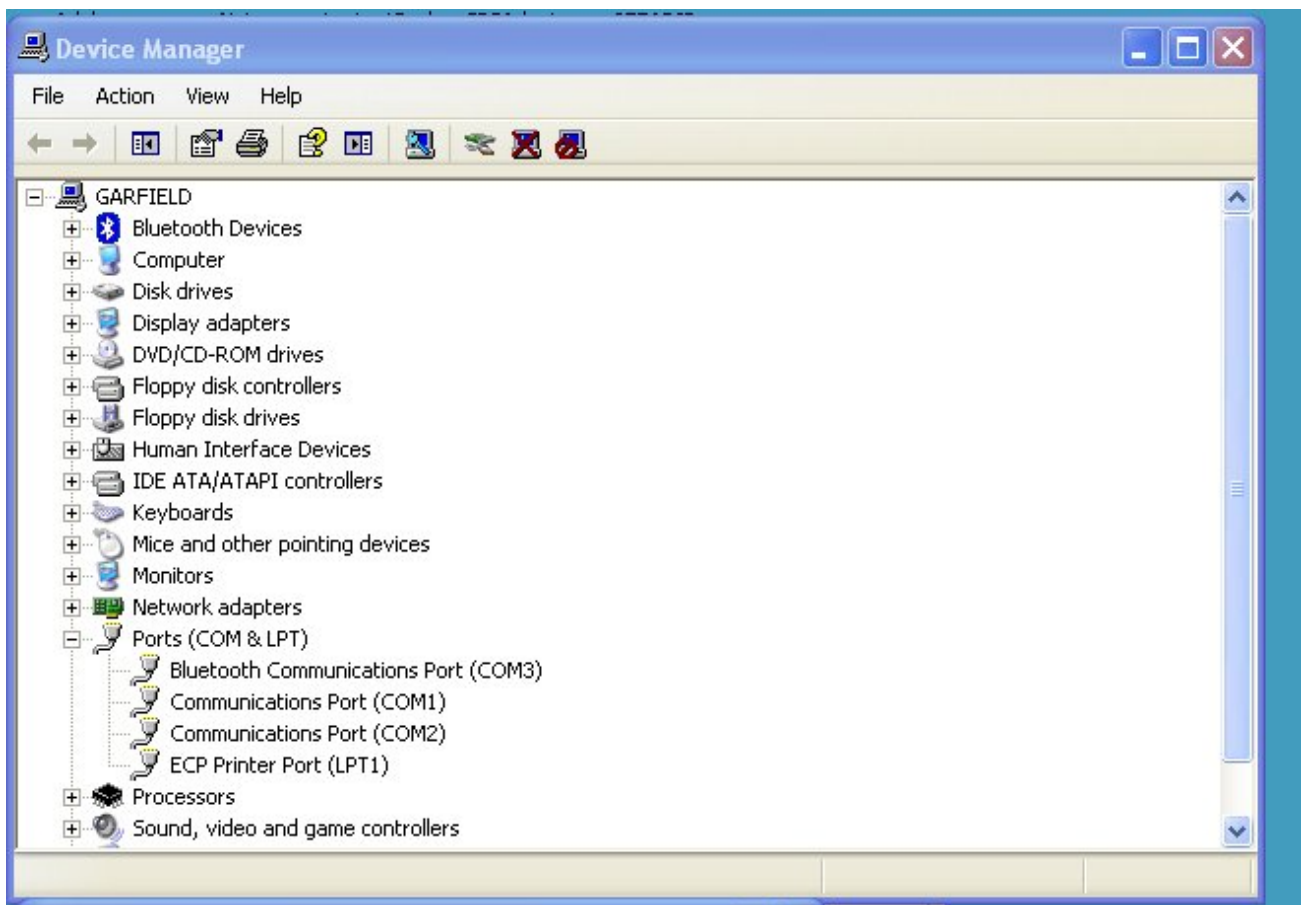


Figure 3 Windows Device Manager

- Click on Port Settings tab. Set Bits per second to 57600 or 19200

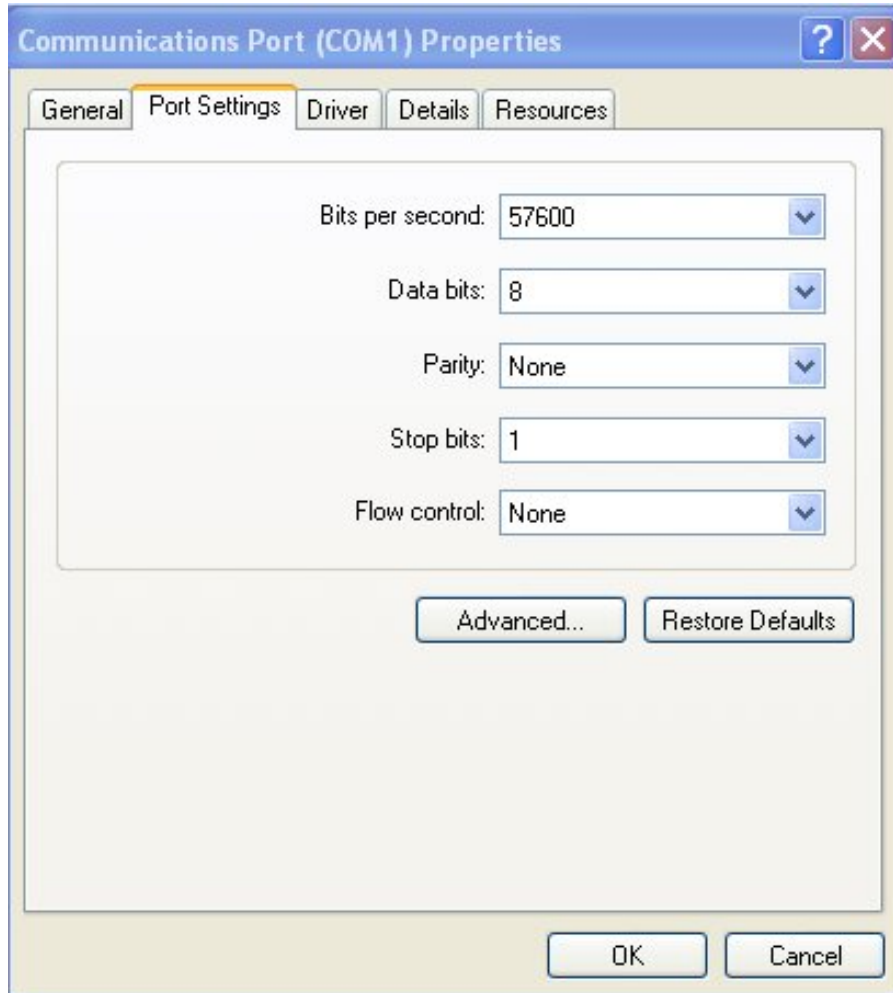


Figure 4 Communications Port Properties.

- Click on Advanced ... to bring up Advance Settings for COM1 and unselect “Use FIFO buffers” (Fig. 5)

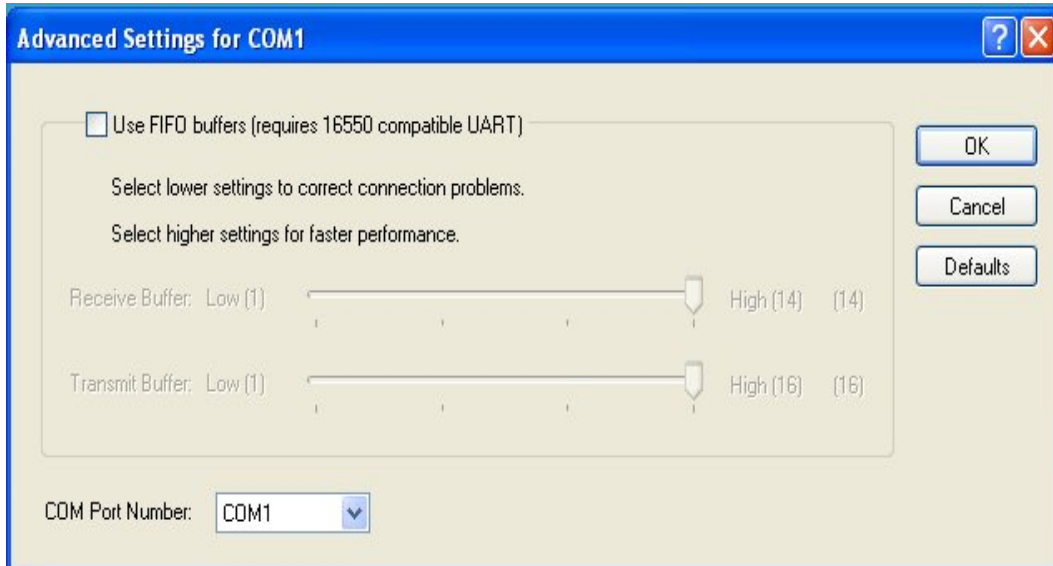


Figure 5 Unselect FIFO buffers

MPLAB IDE Setup:

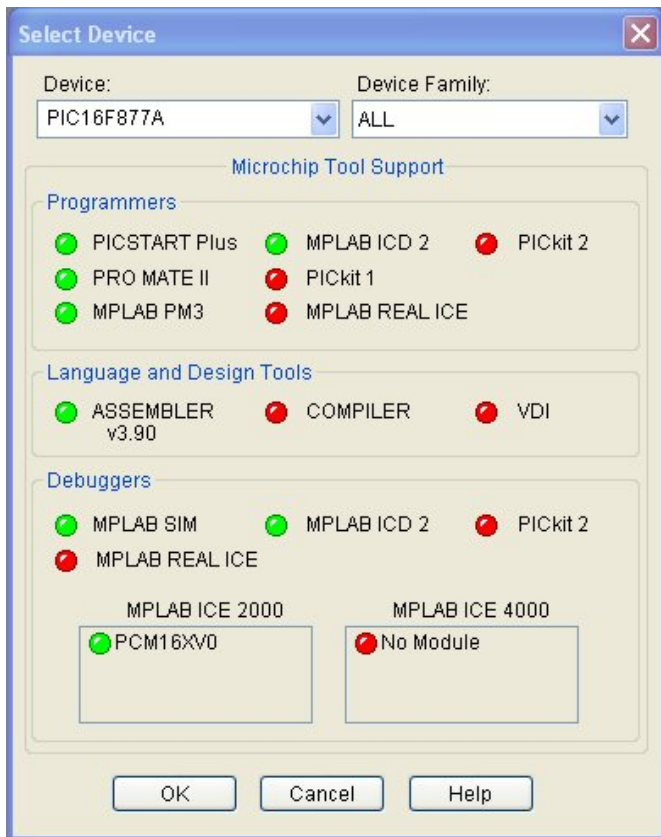


Figure 6: Select Device

Download and install the latest MPLAB IDE from [Microchip](#). Bring up MPLAB IDE by double clicking on the MPLAB IDE icon on the desktop or select MPLAB IDE from the Start button. If you want to use CCS as the compiler tool inside MPLAB, MPLAB IDE Plug-In is to be installed. The Plug-in can be downloaded from [CCS](#)

From the MPLAB IDE Tool Bar, click on *Configure* → *Select Device...*

To work with the VNB educational board please select PIC16F877A (Fig. 6)

Note that ICD2 is supported as both debugger and programmer.

Please refer to MPLAB IDE User's guide for more details. The user's guide can also be downloaded from [Microchip](#)

Project Wizard:

- Project → Project wizard
- Click Next on the welcome! Screen
- Select your target PIC MCU, in our case PIC16F877A
- Click Next to see a screen to select a language tool suite: we'll select CCS C Compiler for PIC12/14/16/18. Please note that there are other compilers that are supported by MPLAB IDE as seen in the pull down list on Fig. 7
- Click Next after select CCS Compiler and specify the location of the compiler by clicking on Browse... button.
- Specify project name and Directory then click Next
- Adding file to project or just skip and add later.
- Click Next, Finish and Done with project Wizard setup

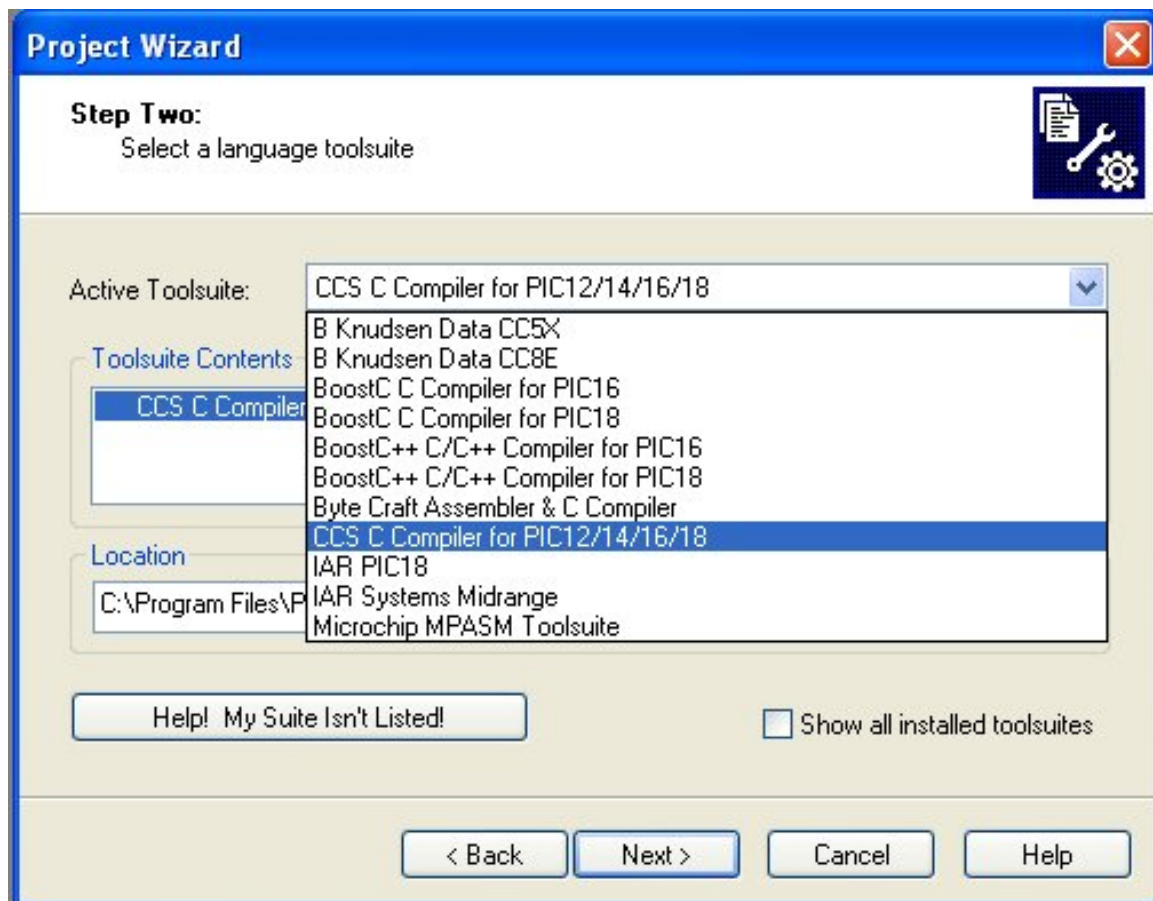


Figure 7: Project Compiler/language Tool Suite Selection

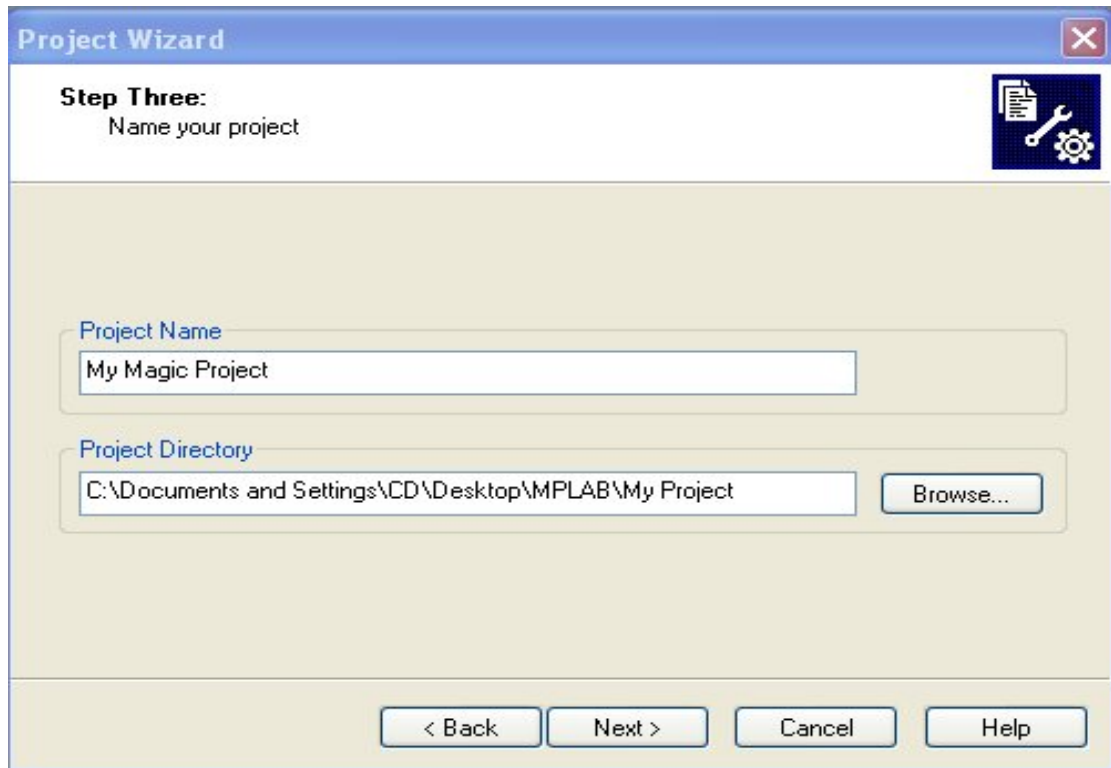


Figure 8: Project Name and Directory

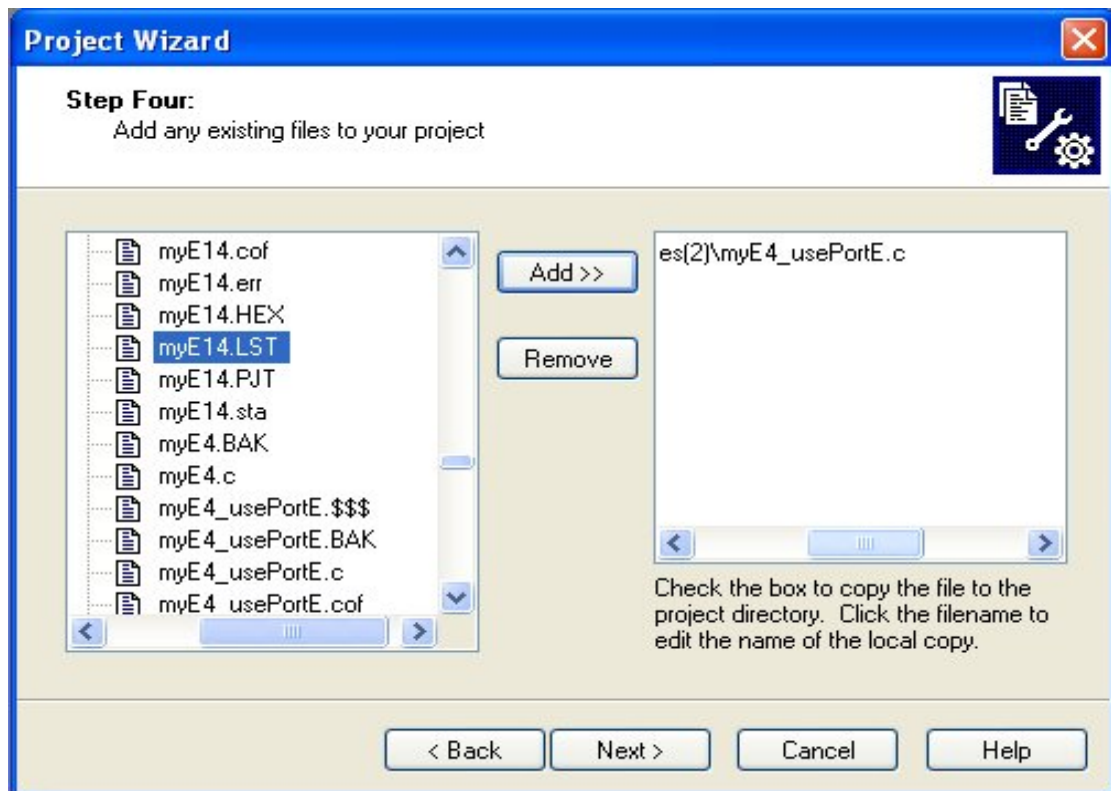


Figure 9: Add File to Project.

The proprietary information is and remains the property of VNB Technologies.
 The receiving Party does not receive any right or license under copyrights, patents, trade secrets without the agreement of VNB Technologies.

- After exiting the wizard, the MPLAB IDE desktop will again be visible. Close all other windows on the desktop to see the Project window.
- Double click on the source code file under Source Files to see the code. Note : for CCS compiler, the include files are not added to the project but they are being used.
- The project now can be compiled etc...
- ICD 2 setup now can be carried out before any programming or debugging can be done.

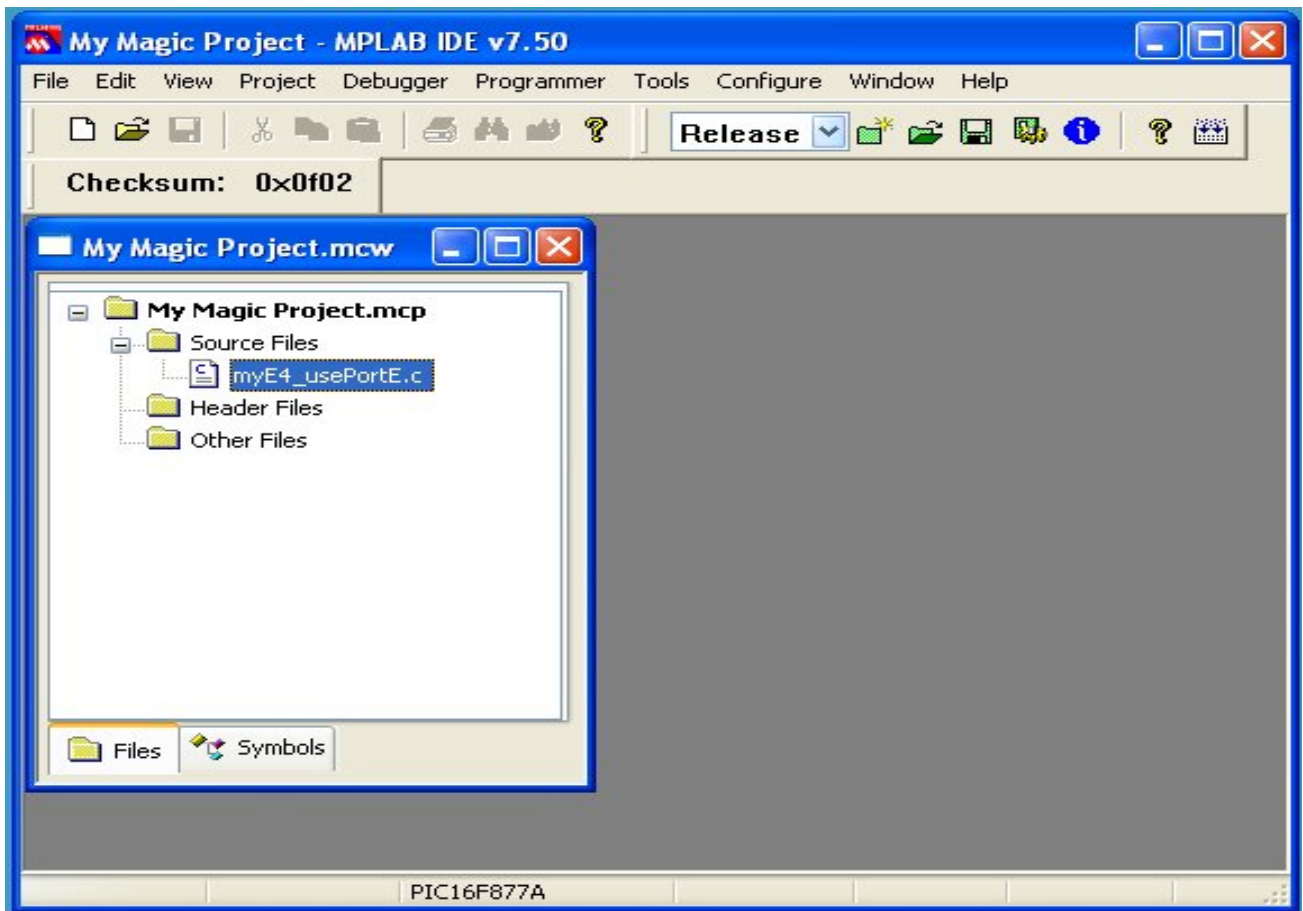


Figure 10: Project Window

Setup ICD2 as Programmer:

- Power up the ICD2
- Connect RS232 cable from PC to the ICD2
- Connect the ICD2 to the target (VNB Educational Board).
- Power up the target board (VNB Educational Board)
- The ICD2 could be connected as a programmer
 - From the tool bar, click on *Programmer* → *Select Programmer* → pull right to select *MPLAB ICD 2*.
 - *Programmer* → *MPLAB ICD2 Setup Wizard...*
 - Click Next on the Welcome! Screen
 - Select COM1 (in this guide), as Com. Port.
 - Select Baud Rate as 57600, then click Next

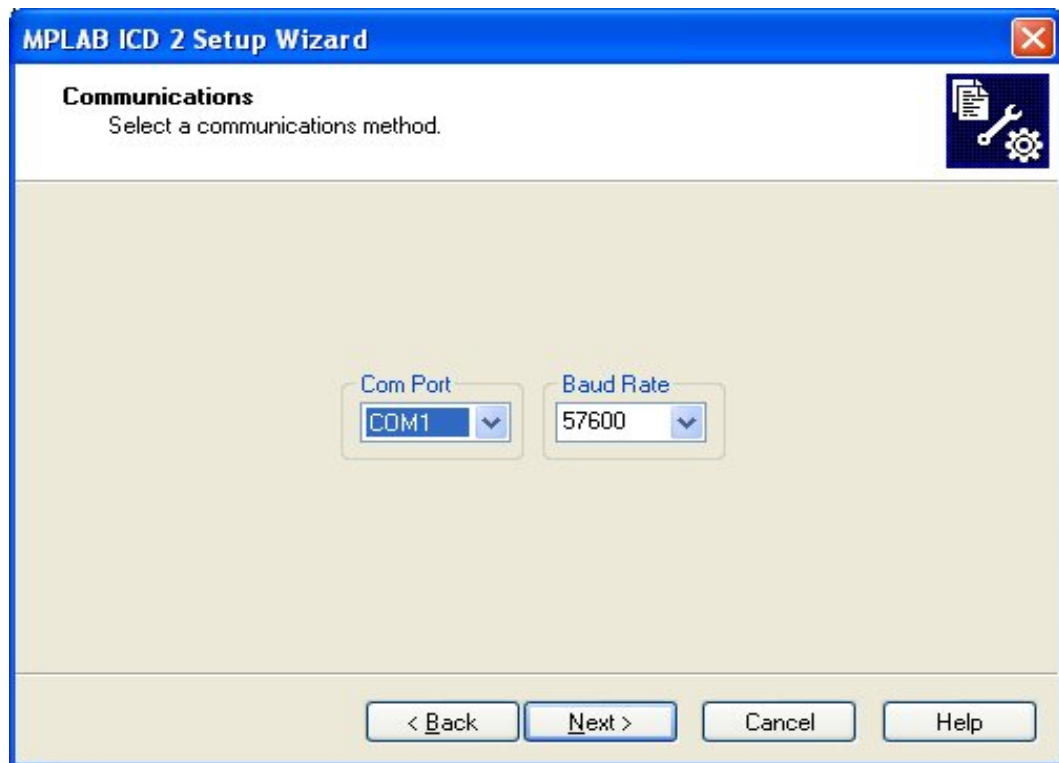


Figure 11: Communication Port and Baud Rate

- Select “Target has own power supply” then click Next

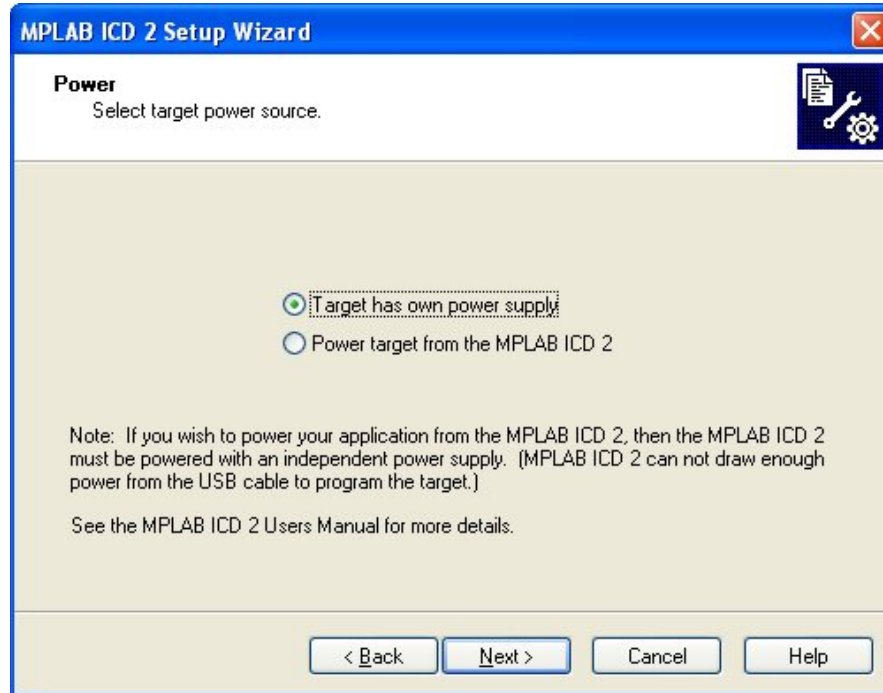


Figure 12 Target Power supply

- Make sure MPLAB automatically connects to MPLAB ICD2 is unselected.

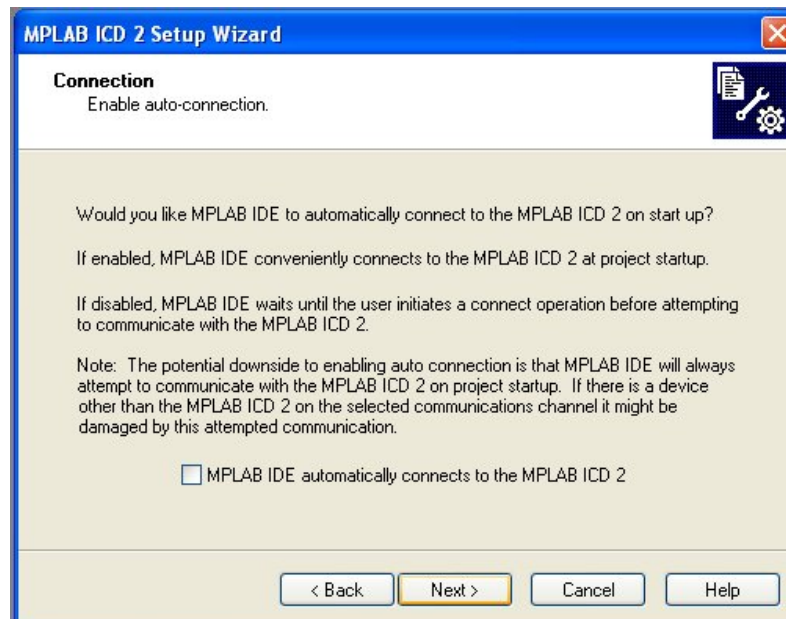


Figure 13: Auto Connection option

- Enable “*ICD2 automatically downloads the required operating system*” then click on *Finish* in the next screen to complete the ICD2 setup wizard.

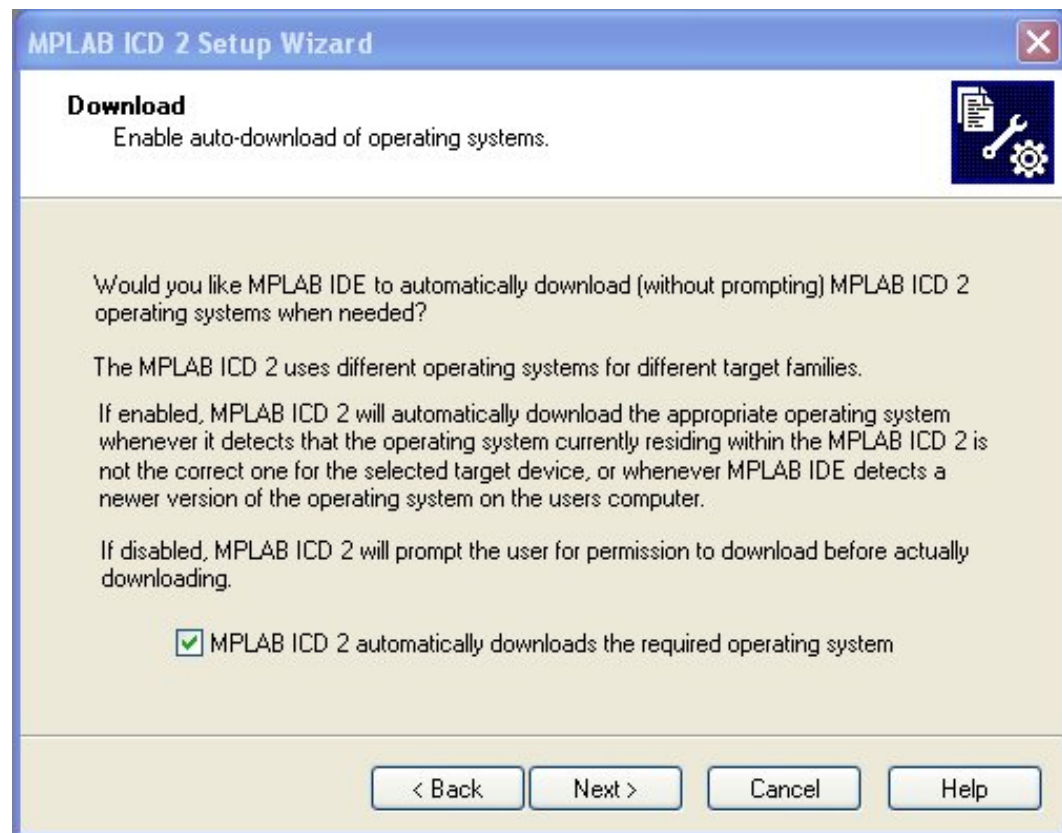


Figure 14: Auto download operating system

- Now it's time to connect the ICD2 as a Programmer: *Programmer* → *Connect* (Fig. 15)
- Compile project and program the target.
 - *Project* → *Compile* (Fig. 16)
 - *Programmer* → *Settings* → *Program Tab* (Fig 17): Select “*Manually select memories and ranges. Click on Full Range*” under Program Memory.
 - *Programmer* → *Program*

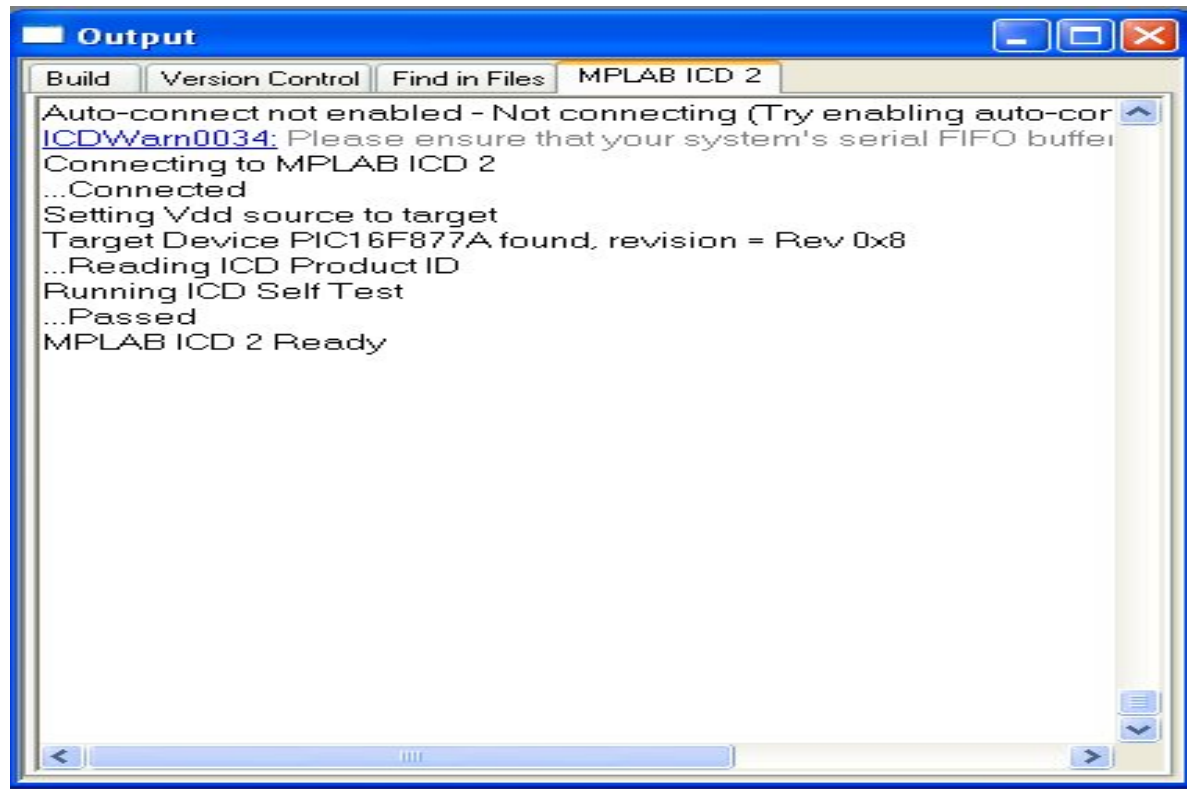


Figure 15: Connect ICD2 as programmer

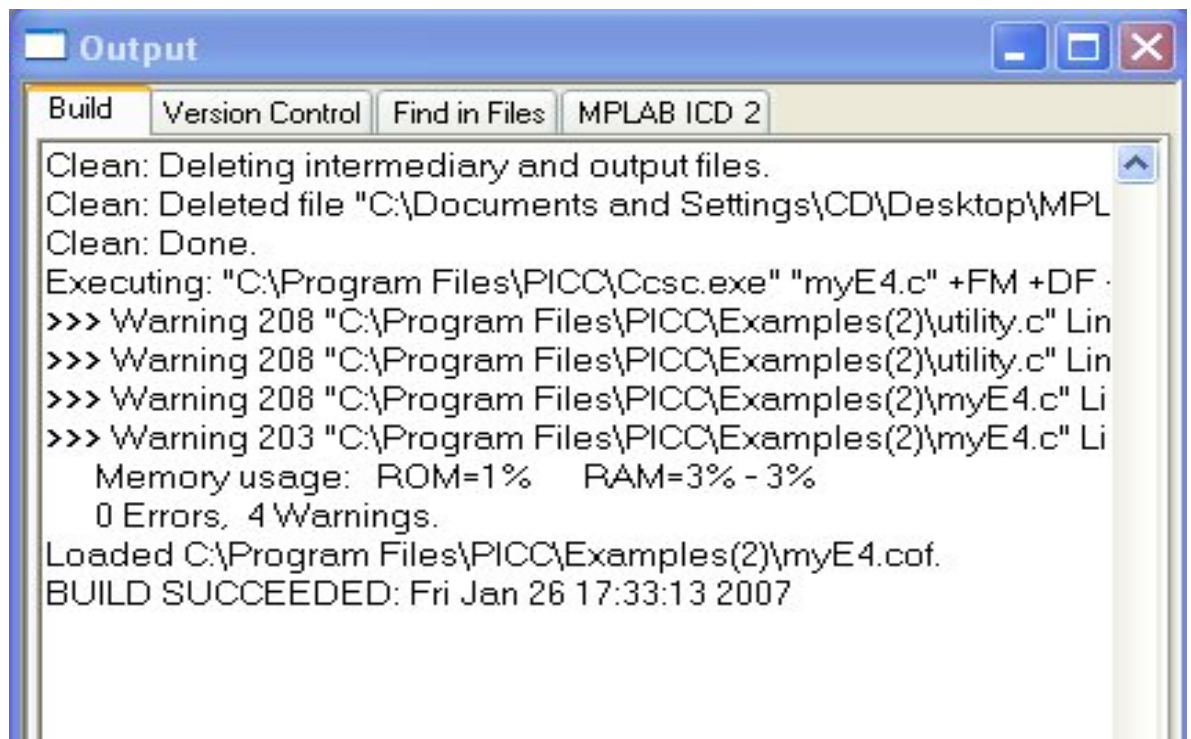


Figure 16: Compile Project

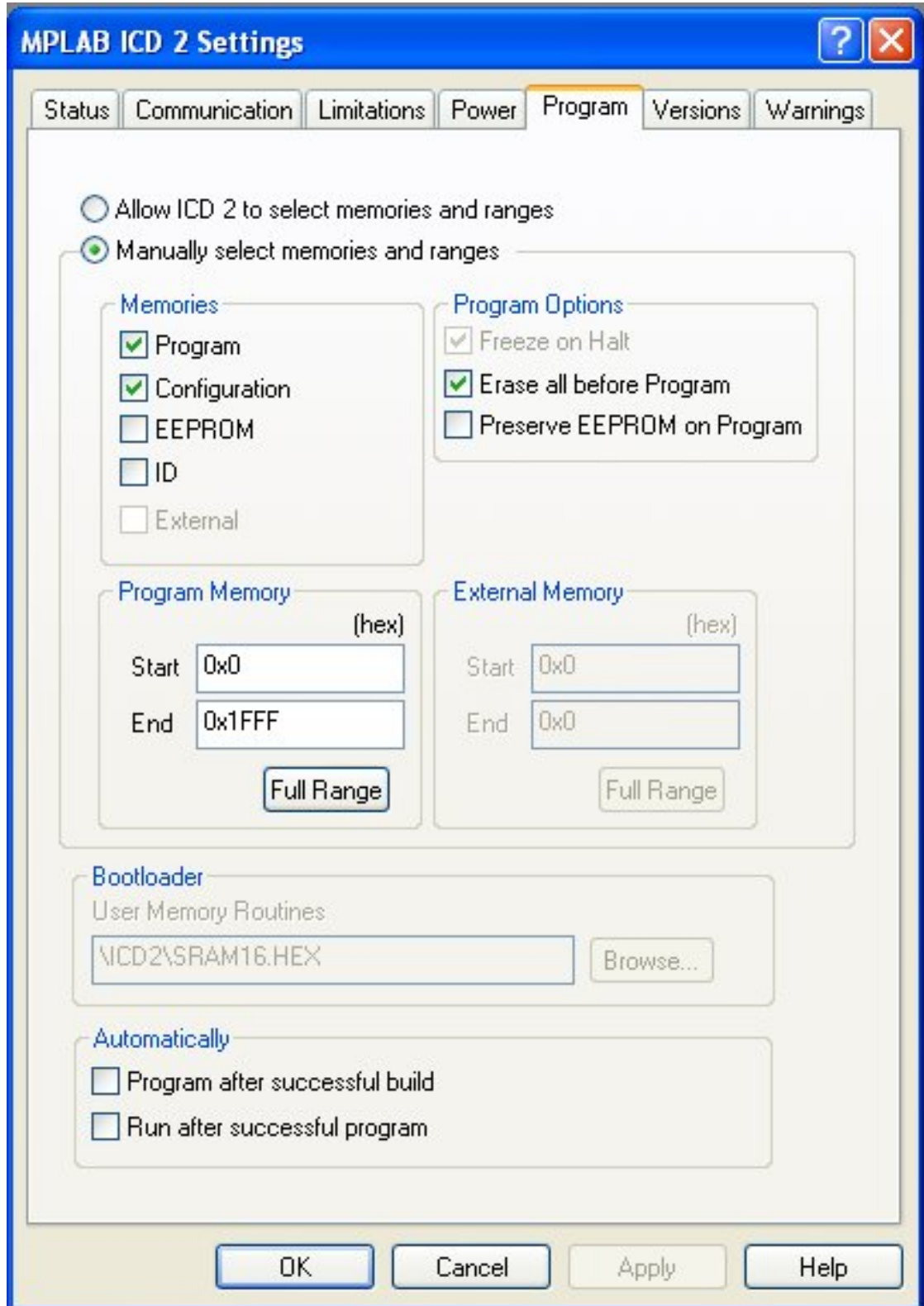


Figure 17: Program Settings

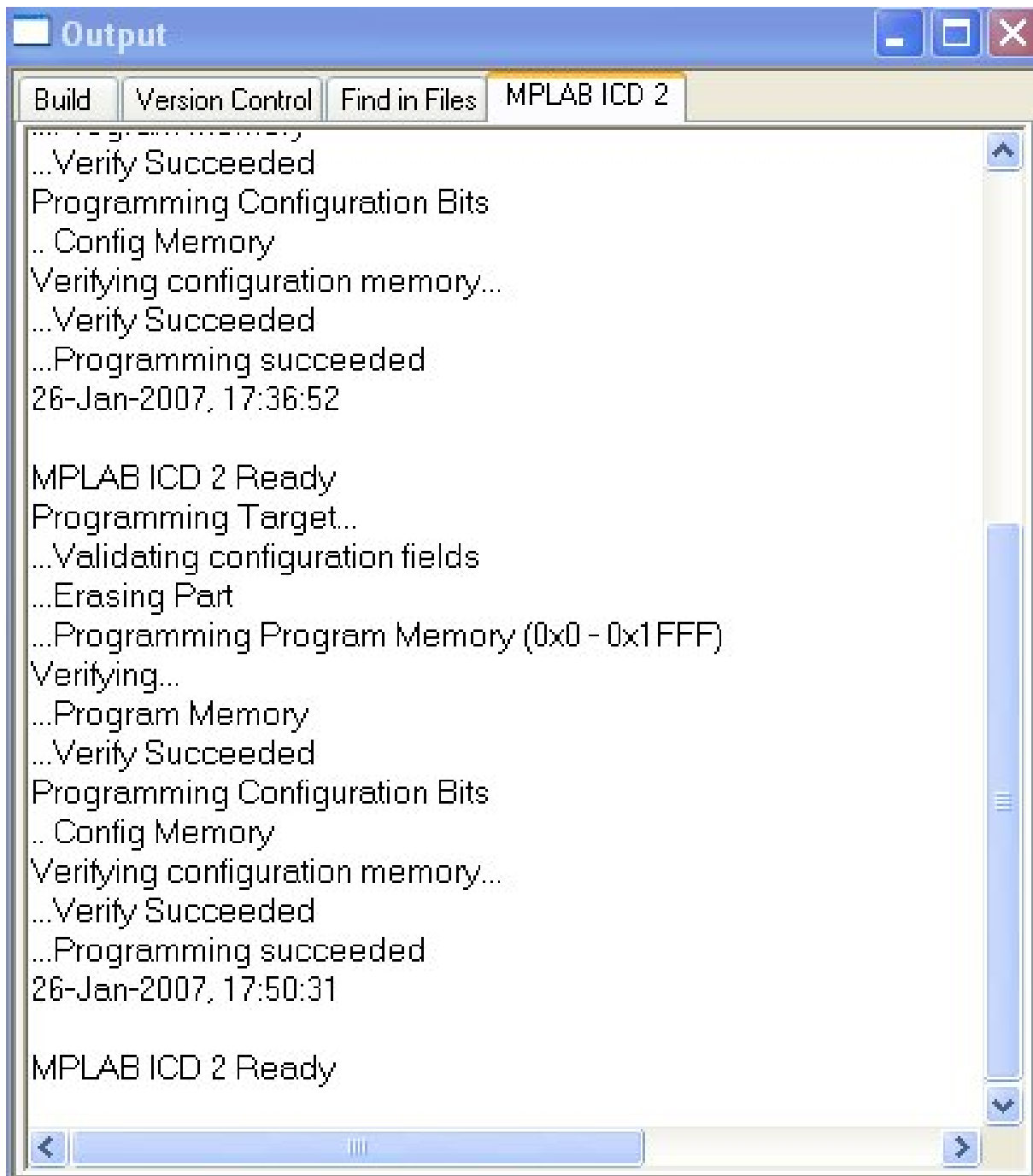


Figure 18: Programming the target

Setup ICD2 as Debugger:

Step to setup the ICD 2 as a debugger is very similar to those of the programmer: Instead of start out with Programmer from the Tool Bar, start out with Debugger in the tool bar:

- The ICD2 could be connected as a debugger:
 - From the tool bar, click on *Debugger* → *Select Tool* → pull right to select *MPLAB ICD2*
 - *Debugger* → *ICD2 Setup Wizard...*
 - *Debugger* → *Connect*
- Debugger → Settings
 - Select “manually select memories and ranges”
 - Click on “Full Range”
- Enter Debug Executive mode: program code must be programmed into the target PIC micro MCU to use the in-circuit debugging capabilities of the ICD 2.
 - *Debugger* → *Program*
 - If the program code is not loaded, you would get error message like the one seen here, ICD0083 (Fig. 19)

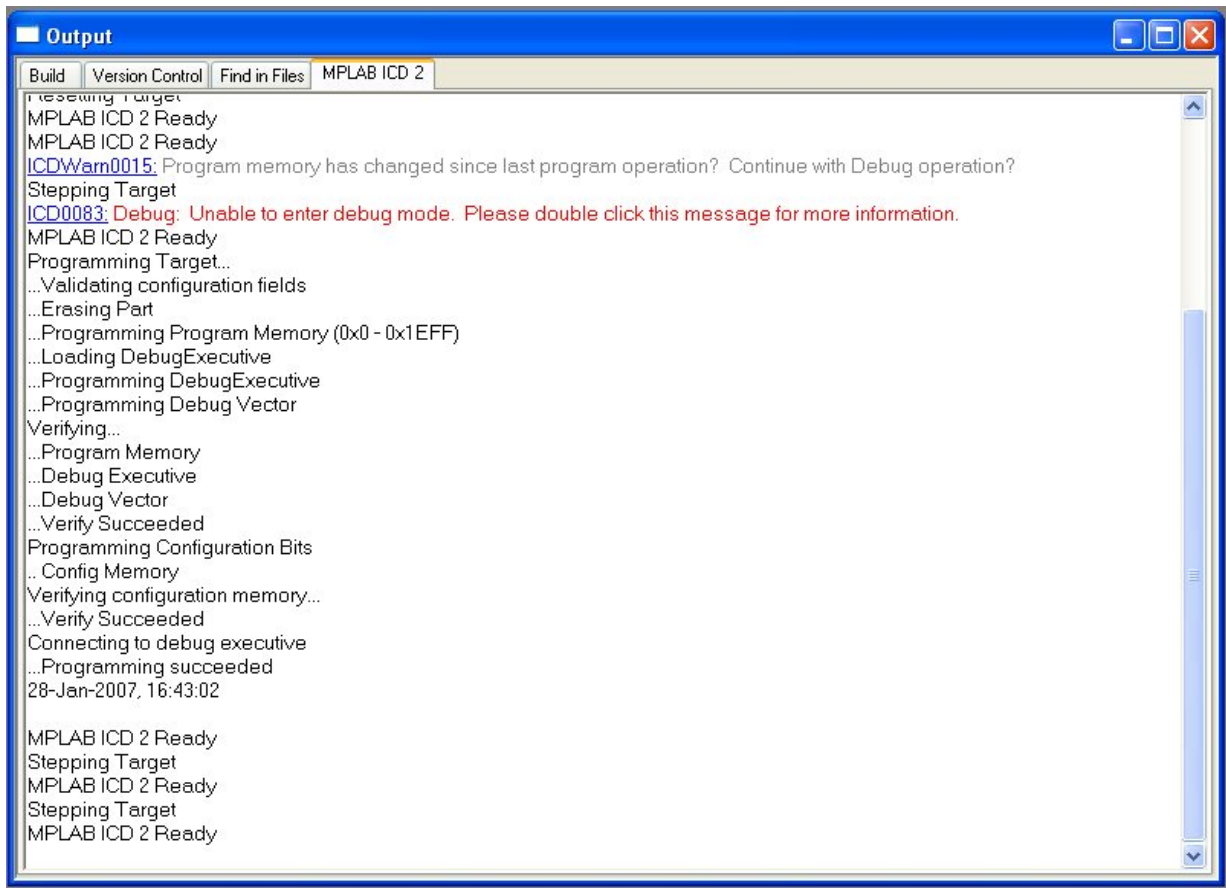


Figure 19: MPLAB ICD2 program loading for entering debug mode

The ICD 2 executes in Real-Time or in Step mode (Fig. 20):

- Real time execution occurs when the target PIC MCU (PIC16F877A in the VNB Educational board in our case) is put in the MPLAB IDE Run mode.
- Step mode execution can be accessed after the processor is halted.

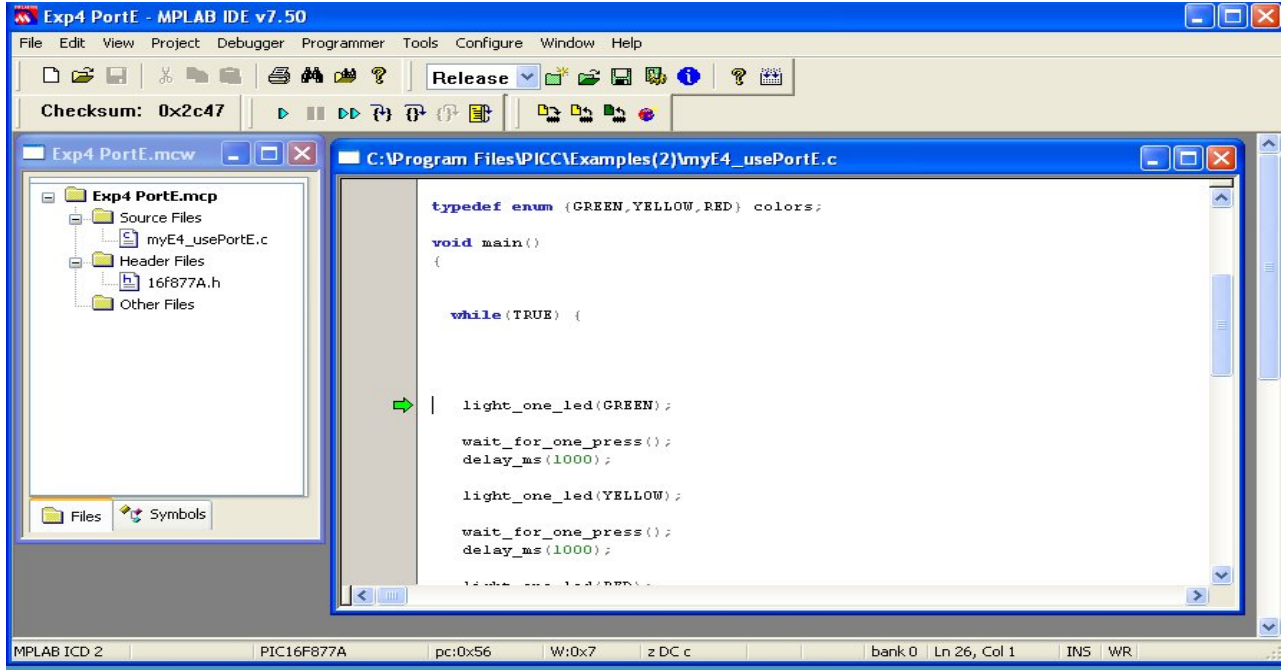


Figure 20: Debug Mode

- Here is a table of commonly used debug operations from the toolbar. Please refer to MPLAB IDE Help for more details.

Debugger Menu	Toolbar Buttons
Run	
Halt	
Animate	
Step Into	
Step Over	
Step Out	
Reset	

Figure 21: Commonly used debug operations

The proprietary information is and remains the property of VNB Technologies.
The receiving Party does not receive any right or license under copyrights, patents, trade secrets without the agreement of VNB Technologies.

Connector/Jack Description:

CN1: 9V DC Jack

CN2: RS232 Connector

CN3: ICD Connector.

Pin Number	1	2	3	4	5	6
ICD 2 Board	VPP	VDD	GND	PGM CLK	PGM Data	N/C
Target Board	MACLR	VDD +5V	GND	B7	B6	B3

Part List

To make it easier for those who chose to assemble the board themselves, the part list is included here

Description	Designator	Quantity	Notes
Capacitor 0805 15pF	C1,C2	2	
CAP POL Electrolytic CAP 47uF	C3,C12,C13	3	
Cap 0805 0.1uF	C4,C5,C6	3	
CAP POL 1206 TANT 10uF	C7, C8,C9,C10,C11	5	
DC Jack	CN1	1	
DB9 Female Connector	CN2	1	
Header, 3-Pin, Dual row	CN3	1	
Diode 1N4148	D1,D2,D3,D4,D5,D6,D7	7	
LED	LED1, LED2	2	LED1 is Red, LED2 is YELLOW for power indicator and busy indicator
NPN General Purpose Amplifier 2N3904	Q1,Q2	2	
PNP General Purpose Amplifier 2N3906	Q3,Q4	2	
Resistor 0805 330 Ohms	R1,R2,R3,R4,R5,R6	6	
Resistor 0805 1K	R7	1	
Resistor 0805 4.7K 1%	R8,R9	2	
Resistor 100K 0805	R10	1	
Resistor 0805 47K	R11	1	
Resistor 6.8K 0805	R12,R13	2	
Resistor 2.2K 0805	R14,R15	2	

The proprietary information is and remains the property of VNB Technologies.

The receiving Party does not receive any right or license under copyrights, patents, trade secrets without the agreement of VNB Technologies.

Resistor 0805 22K	R16,R17	2	
Resistor 0805 10K	R18,R19	2	
Voltage Regulator (Convert 12V To 5.0V), 3-pin LM7805	U1	1	
PIC16F877A-40PDIP	U2	1	
MAX232	U3	1	
Oscillator 20MHz	Y1	1	

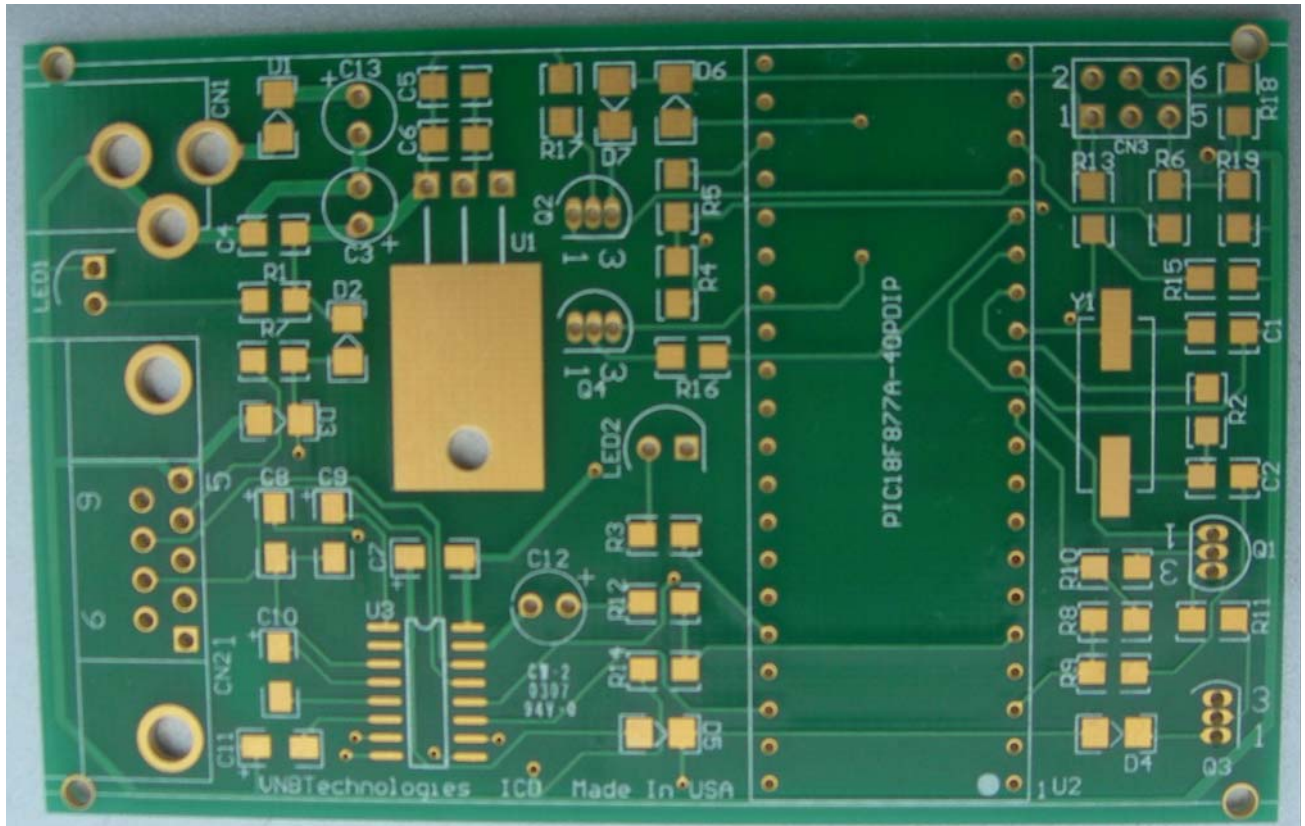


Figure 22: ICD 2 PCB

ICD2 boot-loader and downloading OS system

(This only applies to those who chose to assemble their own ICD2 board)

The PIC16F877A needs to be first flashed with the ICD2 bootloader file which can be downloaded from www.vnbtech.com. You might not have to worry about this step because the PIC is shipped with the bootloader preloaded.

Before the ICD 2 could be used, you need to update it with the latest Operating System.

- Programmer/Debugger → Download ICD2 Operating System.
- Select the latest OS which is the hex file in *C:/Program Files/Microchip/MPLAB ICD2/*

The proprietary information is and remains the property of VNB Technologies.

The receiving Party does not receive any right or license under copyrights, patents, trade secrets without the agreement of VNB Technologies.

VNB Technologies Inc. www.vnbtech.com

You would not be able to connect the ICD2 if the PIC16F877A is flashed with the bootloader and the OS is not downloaded:

- An attempt to connect the ICD 2 before downloading the OS will result in error messages ICD0286 and ICD0021.
- After the OS downloading, ICD2 connection is a success.

If you bought a fully assembled version, you would not have to worry about these steps.

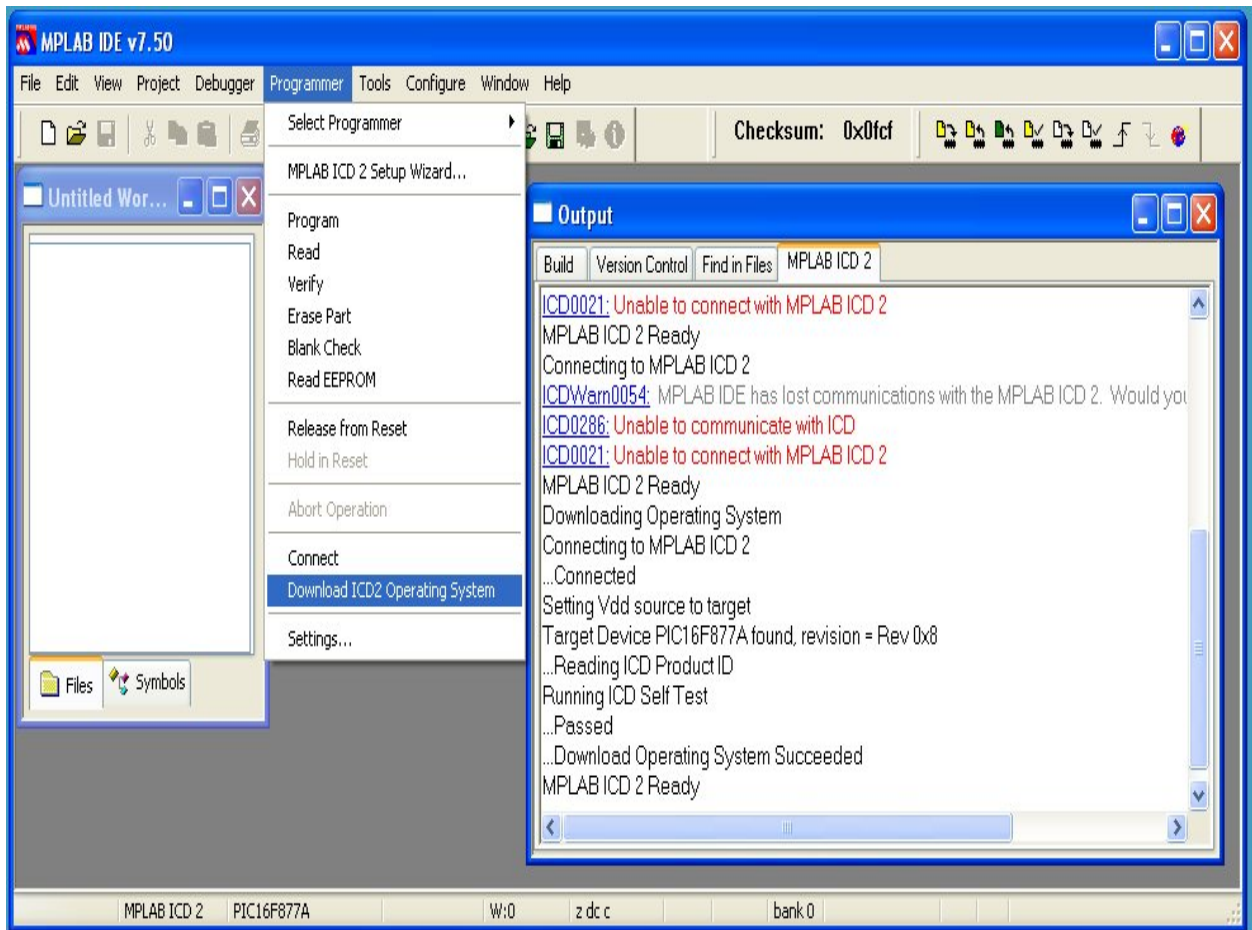


Figure 23: Before First Connection, Need to Download OS

Requirements:

Power Supply

Require a 5-12V DC power supply adapter.

System Requirements:

- Windows 95, 98, ME, NT, 2000 or XP
- RS232 port and USB port.

Quick Tips:

To avoid any potential complications/errors when using the ICD2, please follow the Power Up and Power Down Sequences below:

- Power Up Sequence:
 - Power up The ICD first → Connect ICD2 to the Target Board using the ICD 2 cable
 - Launch MPLAB IDE
 - Open Saved Workspace or Create New project
 - If ICD 2 was not setup, set it up as programmer/debugger
 - Power up the target board (Educational board in our case)
 - Connect RS232 cable
 - Debugger/Programmer→Connect

- Power Down Sequence:
 - DO NOT disconnect the ICD cable first.
 - Disconnect the target board power
 - Disconnect the RS232 cable
 - Disconnect the Power Supply of the ICD2
 - Disconnect the ICD2 cable

- After loading the program code, if you don't see the green arrow, click Reset Icon.

- When you Step Over a line like `while(input(PUSH_BUTTON))`, the debug cursor (Green Cursor) might seem to stuck here forever, make the condition of the while statement a FALSE one (press the event push button on the educational board) so that the cursor will go to the next line when click on the Step Over Icon in debug. (Fig.24)

- To save time in setting up the ICD2 and other settings when you resume your work next time, before leaving current working session, save working space: *File → Save Workspace or File → Save Workspace as*. This saved work spaces can be opened next time you launch MPLAB IDE: *File → Open Work Space* (Fig. 25)

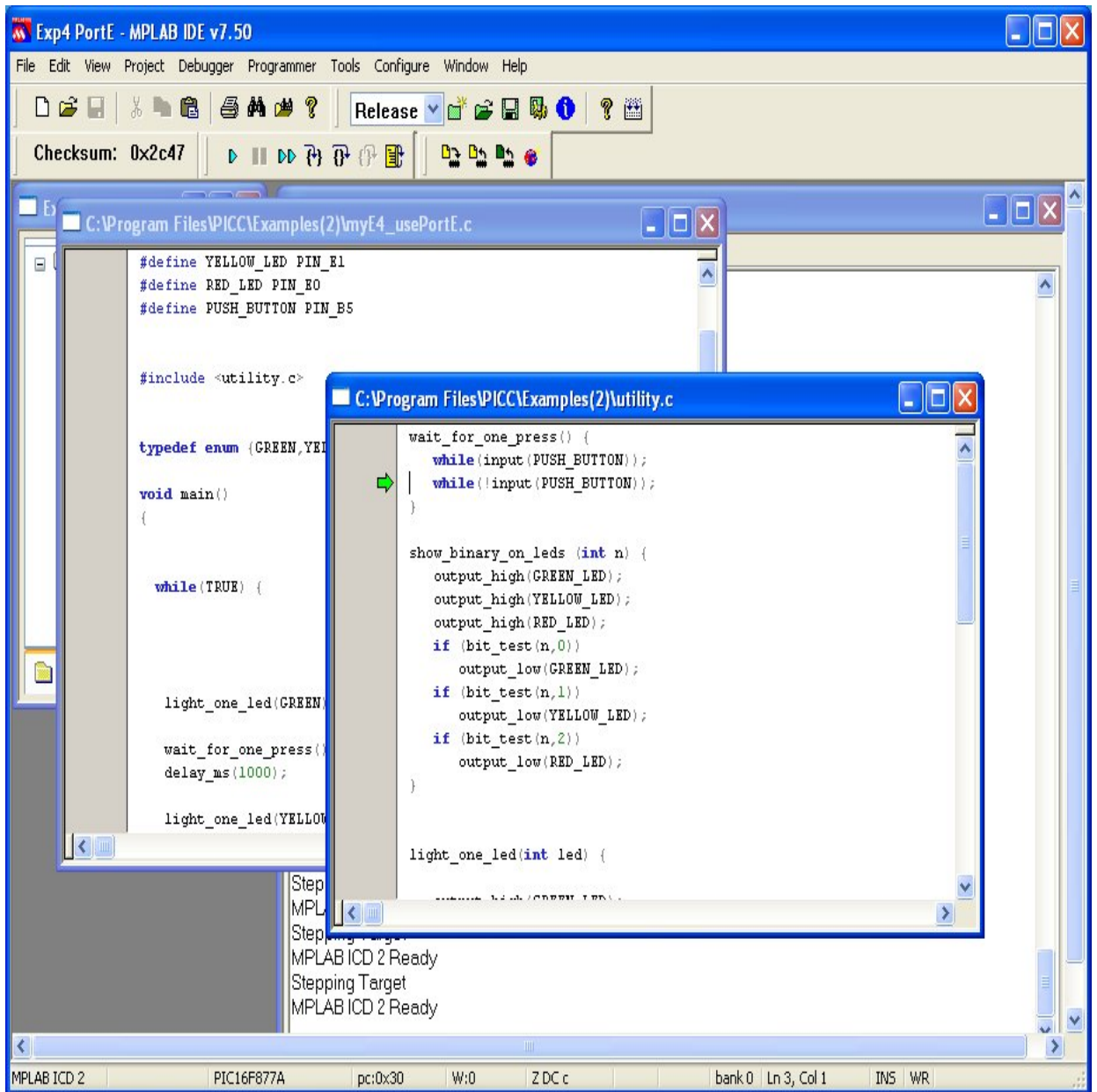


Figure 24: While Loop Line: Debug Step Over

- Step Over a line like `delay_ms(10)` would seem to take forever, click on the Pause icon to get over to the next line.

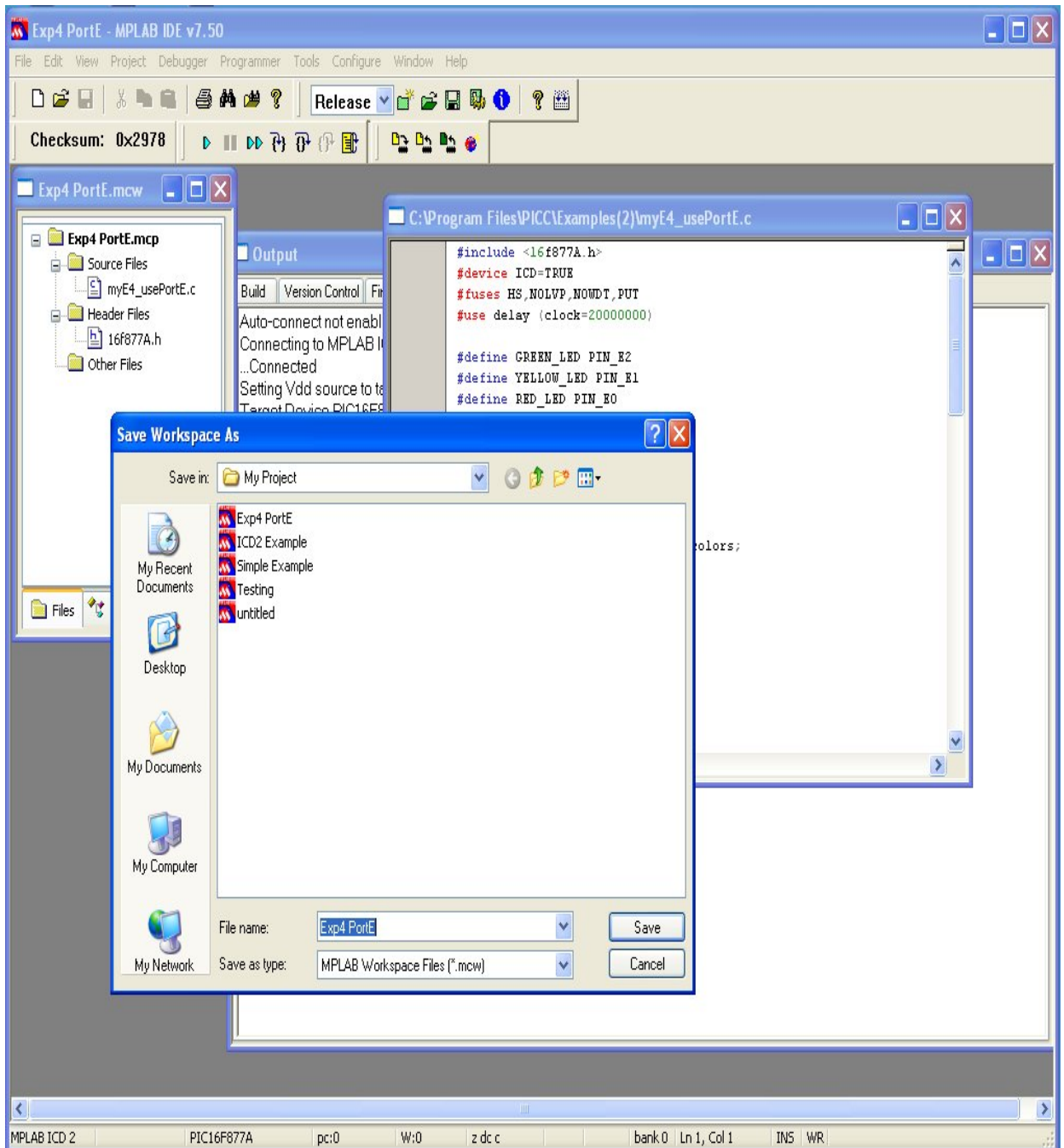


Figure 25: Save work space

Contact information:

Visit our company website <http://www.vnbtech.com>

In Vietnam, please contact our local VNBTECH members:

- Mr. Nguyen Vinh Truong @ 0908444793
- Mr. Phan Tan Dat @ 0903151886

Revision History

Date	Version	Description of change	Author
2007-1-30	1.0	Initial Release	CD