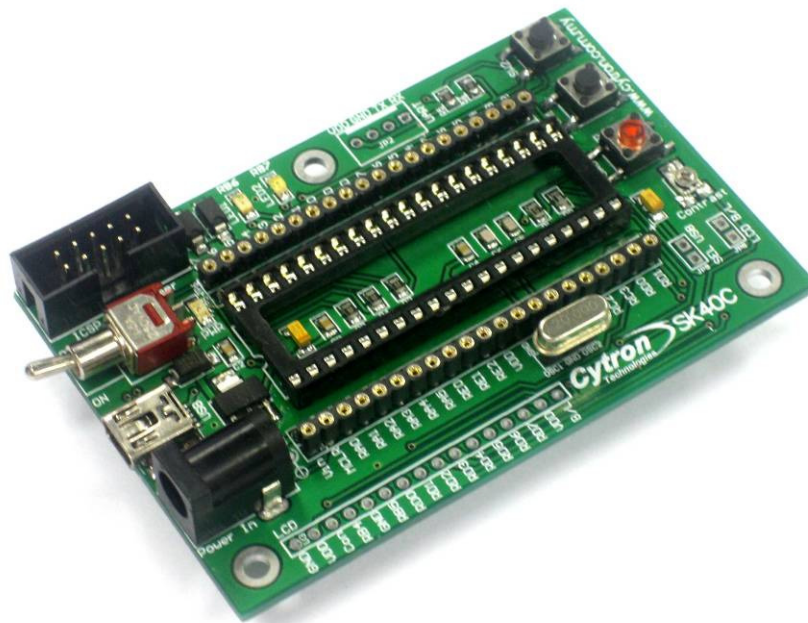




SK40C

ENHANCED 40 PINS PIC START-UP KIT



User's Manual

V1.2

Dec 2010

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1. INTRODUCTION AND OVERVIEW

SK40C is another enhanced version of 40 pins PIC microcontroller start up kit. It is designed to offer an easy to start board for PIC MCU user. However, all interface and program should be developed by user. This board comes with basic element for user to begin project development. It offer plug and use features. This kit is designed to offer:

- Industrial grade PCB
- Every board is being fully tested before shipped to customer
- Compact, powerful, flexible and robust start-up platform
- Suitable for hobbyists and experts
- Save development and soldering time
- No extra components required for the PIC to function
- **All 33 I/O pins** are nicely labeled to avoid miss-connection by users
- **Connector for UIC00A** (low cost USB ICSP PIC Programmer) - simple and fast method to load program
- Fully compatible with SK40B
- No more frustrated work plugging PIC out and back for re-programming
- Perfectly fit for 40 pins **16F and PIC18F PIC**
- With UIC00A, program can be loaded in less than 5 seconds
- More convenient to use and it is smaller than SK40B.
- Maximum current is 0.5A.
- **Dimension:** 85mm x 55mm

SK40C come with additional features:

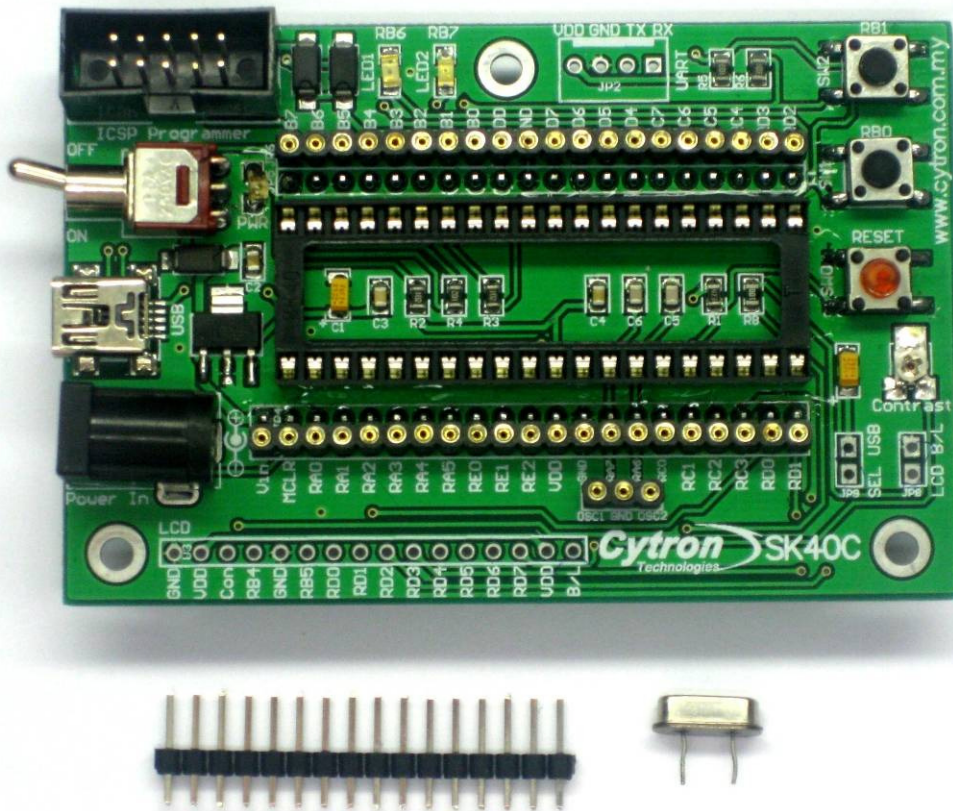
- 2 x Programmable switch
- 2 x LED indicator
- Turn pin for crystal. User may use others crystal provided.
- LCD display (optional)
- UART communication
- USB on board.
- And all the necessities to eliminate users difficulty in using PIC

Users are able to utilize the function of PIC by directly plugging in the I/O components in whatever way that is convenient to user. With UIC00A connector on board, user can start developing projects and have fun with this kit right away. This kit comes **WITHOUT** PIC microcontroller to provide the freedom for user to choose PIC type.

This document explains the method to use SK40C.

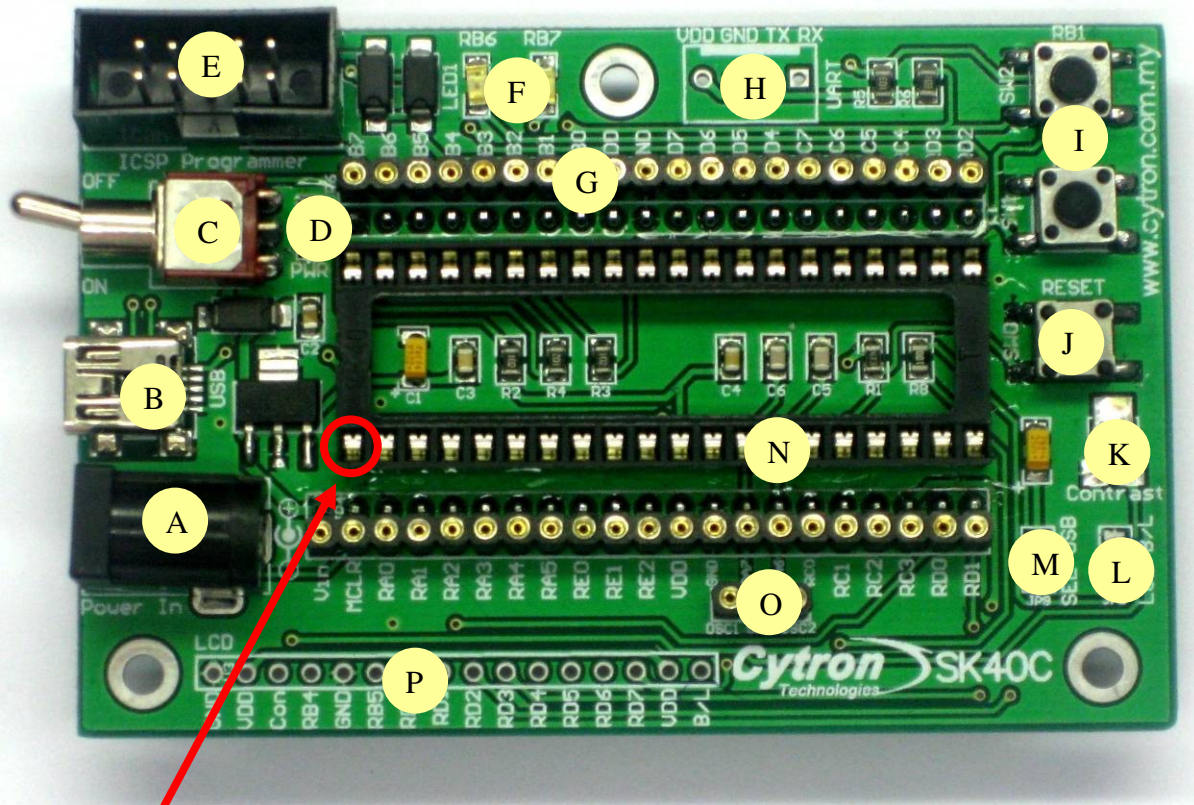
2. PACKING LIST

Please check the parts and components according to the packing list. If there are any parts missing, please contact us at sales@cytron.com.my immediately.



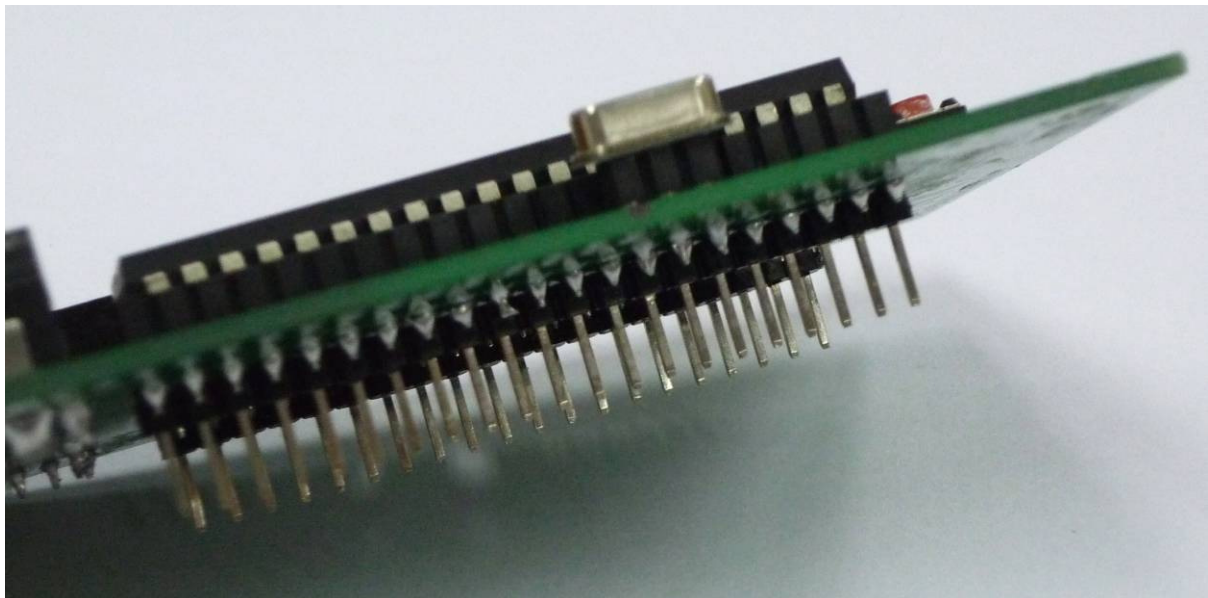
1. 1 x SK40C board with all components shown soldered
2. 1 x 16 Header pin for LCD Display.
3. 1 x 20M Hz Crystal
4. PIC MCU – Not included, please purchase separately from Cytron website
5. USB Cable – Not included, please purchase separately from Cytron website
6. UIC00A – Not included, please purchase separately from Cytron website
7. User Manual – Not included, please download from Cytron website

3. BOARD LAYOUT

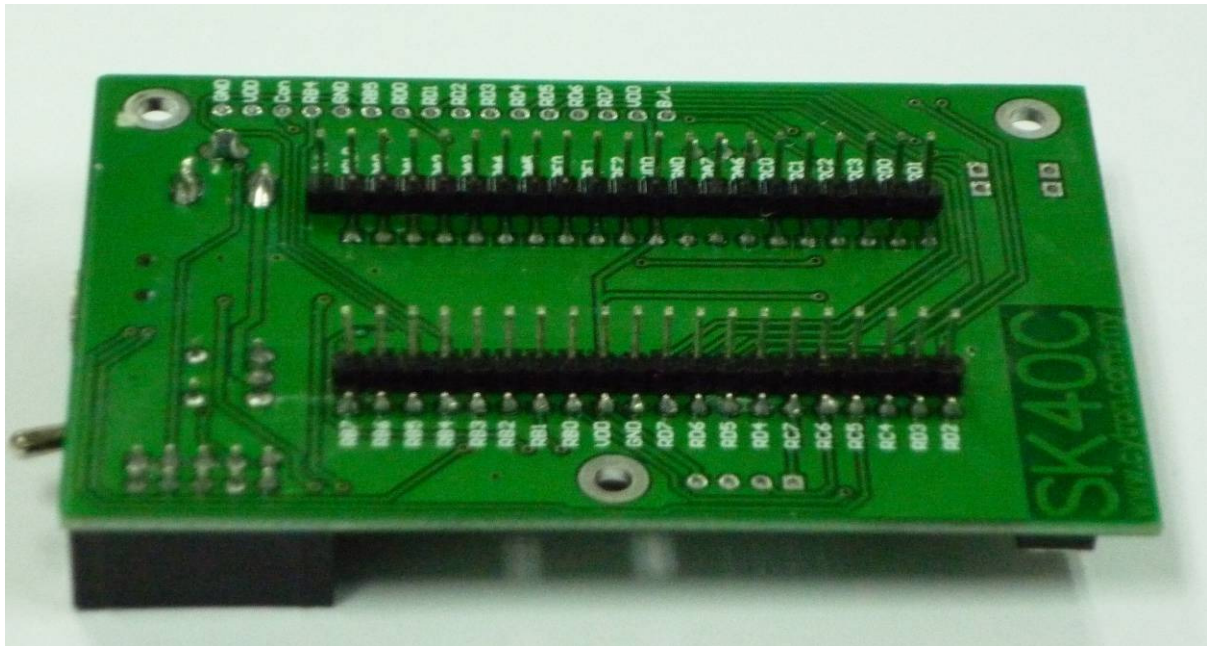


Pin 1
of PIC

a) Top View



b) Side view



c) Bottom view

Label	Function	Label	Function
A	DC power adaptor socket	I	Programmable Push Button
B	USB Connector	J	Reset button
C	Toggle Switch for power supply	K	LCD contrast
D	Power indicator LED	L	JP8 for LCD Backlight
E	Connector for UIC00A Programmer	M	JP9 for USB
F	LED Indicator	N	40 pin IC socket for PIC MCU
G	Header pin and turn pin	O	Turn pin for crystal
H	UART Connector	P	LCD Display

A – DC power adaptor socket for user to plug in DC adaptor. The input voltage should be ranged from 7 to 15V.

B – USB connector for communication between devices and a host controller (usually personal computers). This function is only valid for certain model of PIC microcontroller. Please refer to USB interface section. The power LED will light ON when the USB cable is connected.

C – Toggle switch to On/Off the power supply from DC adaptor.

D – Power indicator LED for on board. It will light ON as long as the input power is correctly connected.

E – 2x5 box header for UIC00A, USB ICSP PIC Programmer.

F – 2 LEDs (connected to RB6 and RB7) as active High output for PIC MCU. These LEDs are controllable from PIC MCU.

G – Consist of several line of header pin and turn pin. Header pin provide connector for user to solder SK40C to prototype board and use the I/O of PIC MCU. It is fully compatible between SK40B. Turn pin offer simple way to check voltage with multi-meter probe. 40 pins of PIC MCU except OSC (connected to crystal) are extended out to these pin. There is an extra pin on top of MCLR which is labeled as Vin, is connected to the input power.

H – Reserved for UART communication. Tx and Rx pin of SK40C are connect to RC6 and RC7 respectively. Ensure PIC use have the correct UART pin (RC6 and RC7).

I – 2 x Push button connected to RB0 and RB1 of PIC MCU. This is extra input button for user. It can be programmed as input switch.

J – Push button with the function of Reset for PIC MCU.

K – 5K of trimmer to set LCD contrast.

L – JP8 is provided for LCD Backlight. LCD Display will have backlight if this pin is shorted.

M – JP9 is provided for USB. Connect this pin if users use USB port

N – 40 pin IC socket for user to plug in any 40 pin PIC MCU (8 bit). It can either be 16F or 18F PIC. Of course the IC package should be PDIP. **Please ensure the first pin is at the top side.** Inside IC socket, there some electronics components, it include a 20MHz Crystal.

O – Turn pin is provided for crystal. 20M Hz is default crystal provided in SK40C. However, the 20M Hz crystal can be removed and replace with other crystal. Just remove the crystal and put other crystal on turn pin without soldering.

P – Reserved for 2 x 16 LCD Display. User may solder 2x16 LCD display at this space if want to use it.

Figure below shown pin connection for ‘**Label P**’ (2x16 LCD Display).

Pin	Name	Pin function	Connection
1	GND	Ground	GND
2	VDD	Positive supply for LCD	5V
3	Con	Brightness adjust	Connected to a preset to adjust brightness
4	RB4	Select register, select instruction or data register	Pin RS of LCD
5	GND	Ground	GND
6	RB5	Start data read or write	Pin E of LCD
7	RD0	LCD Data bus pin	Pin D0 of LCD
8	RD1	LCD Data bus pin	Pin D1 of LCD
9	RD2	LCD Data bus pin	Pin D2 of LCD
10	RD3	LCD Data bus pin	Pin D3 of LCD
11	RD4	LCD Data bus pin	Pin D4 of LCD
12	RD5	LCD Data bus pin	Pin D5 of LCD
13	RD6	LCD Data bus pin	Pin D6 of LCD
14	RD7	LCD Data bus pin	Pin D7 of LCD
15	VDD	Backlight positive input	VDD
16	B/L	Backlight negative input	Connect to JP8

Figure below shown pin connection for ‘**Label O**’ (Turn pin for crystal).

Pin	Name	Pin function	Connection
RA6	OSC2	Crystal	Turn pin (JP7)
RA7	OSC1	Crystal	Turn pin (JP7)

Figure below shown pin connection for ‘**Label I**’ (Push button).

Pin	Name	Pin function	Connection
RB0	SW1	Digital Input	‘SW1’ SWITCH
RB1	SW2	Digital Input	‘SW2’ SWITCH

Figure below shown pin connection for 'Label H' (UART).

Pin	Name	Pin function	Connection
RC6	TX	Transmit Data	TX pin of UART
RC7	RX	Receive Data	RX pin of UART

4. PRODUCT SPECIFICATION

SK40C is designed to offer starting up platform for development, the specification of PIC MCU used should be referred.

Absolute Maximum Rating

Symbol	Parameter	Min	Max	Unit
V _{CC}	Operating voltage	7	15	V
I _{max}	Maximum input current	-	0.5	A

SK40C come with additional features:

- 2 x Programmable switch
- 2 x LED indicator
- Turn pin for crystal. User may use others crystal.
- LCD display (optional)
- UART communication
- USB on board.
- And all the necessities to eliminate users difficulty in using PIC

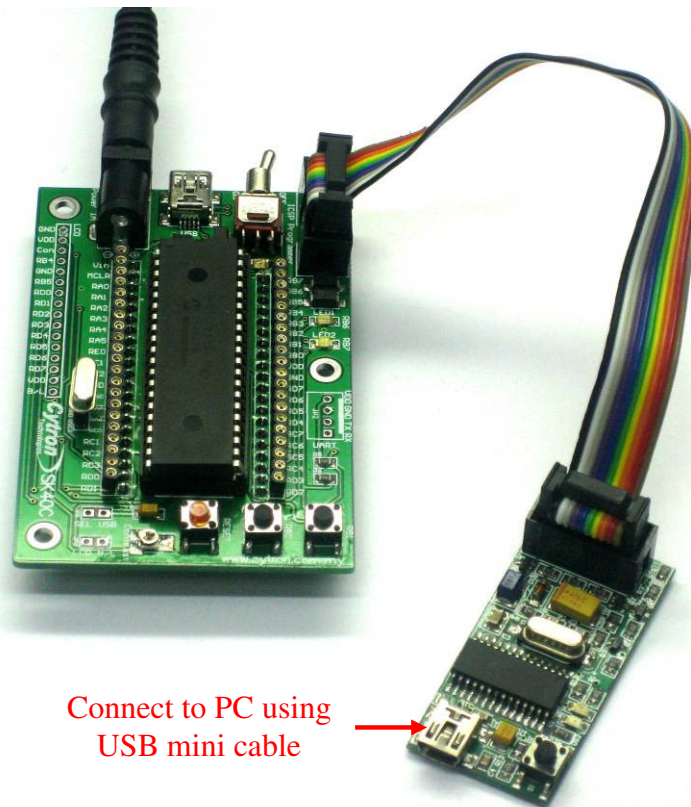
Note: Only 1 power supply should be provided to SK40C.

5. INSTALLATION (HARDWARE)

SK40C come with UIC00A ICSP USB programmer connector to offer simple way for downloading program. UIC00A ICSP programmer is very easy and save plenty of development time.

5.1 Loading Program Using UIC00A Programmer

Connect SK40C as shown in following figure.



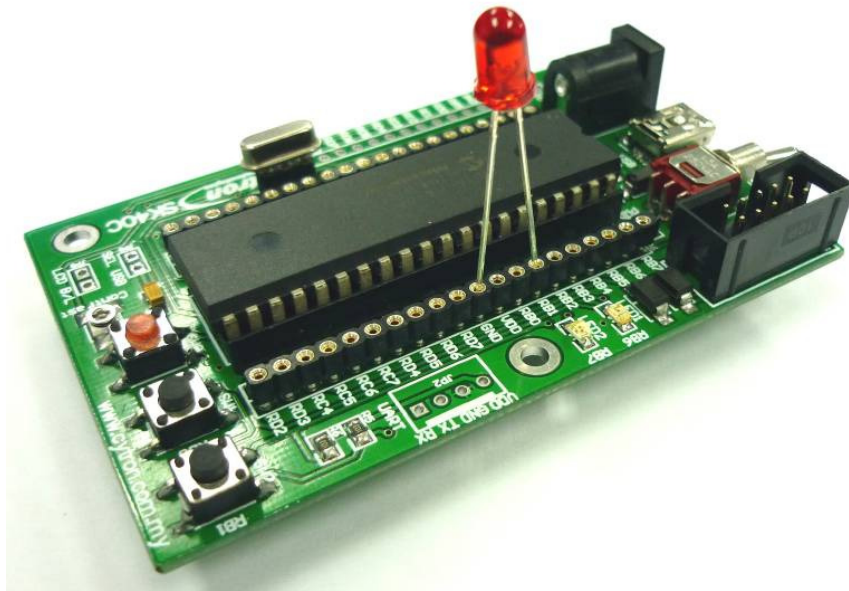
After plug in 40 pin PIC MCU (make sure the orientation is correct), SK40C should be powered by **DC adaptor**. Now, the hex code is ready to be loaded to SK40C. For the usage of UIC00A, please refer to UIC00A User's Manual.

RB7 and RB6 have been connected to UIC00A connector and 2 LED indicators. User is advice not to use these pin as input. Even when using as output, RB7 or RB6 pin are recommended to be used in controlling non critical device such as LED, LCD, 7 segments or buzzer. It is recommended to isolated ICSP signals from application circuit by using series resistor (range 220 ohm and above). Furthermore, **NO** capacitance component (capacitor) should be connected to these 2 pins. Please refer to UIC00A User's Manual for further details.

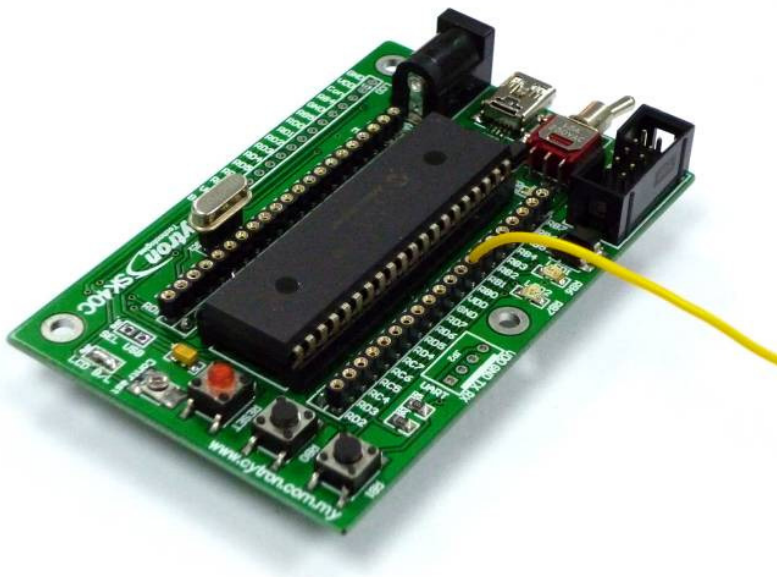
5.2 I/O Port (to electronic components)

Please refer “Getting Started” at Chapter 6.1 for LED Blinking and LCD example source code. I/O of the microcontroller can be access through few methods:

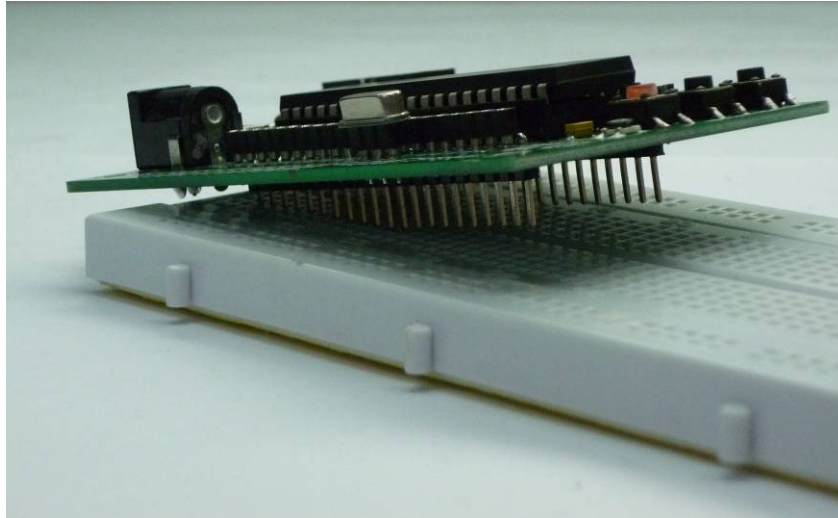
- a. Connect the components that needed onto the I/O port.



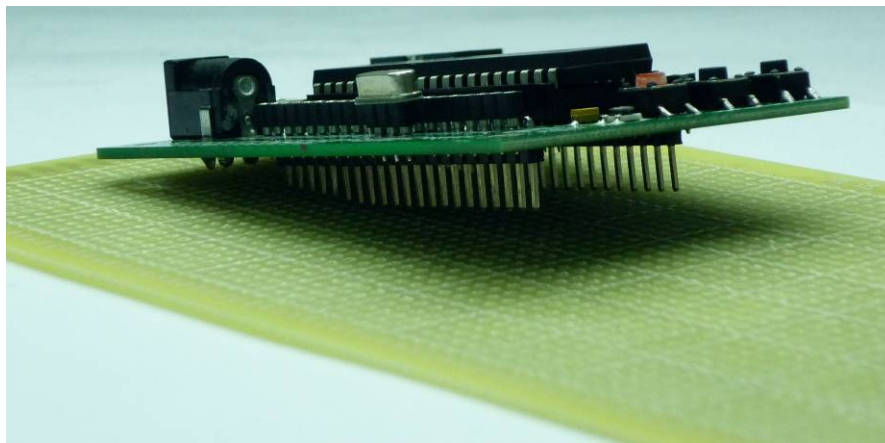
- b. Extend the I/O port to another board using jumper wire.



- c. Plug the I/O pins of the Start-up Kit onto a breadboard. Then, access I/O pin through the breadboard.

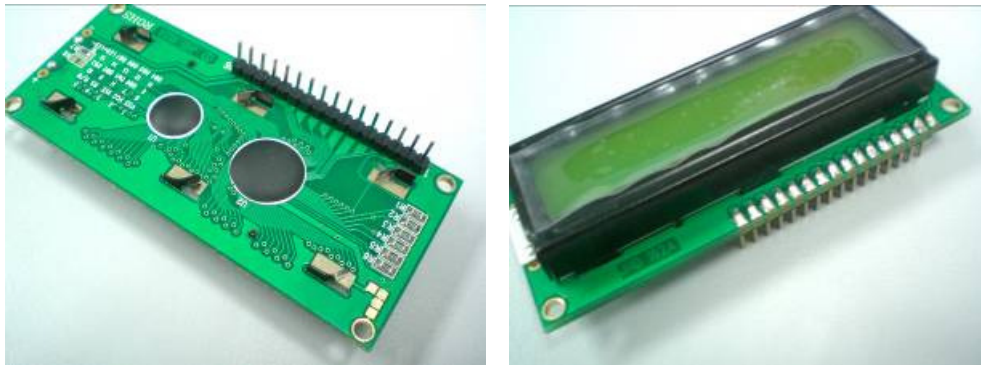


- d. Plug the I/O pins of the Start-up Kit onto a donut board. Solder the pins onto the board to access the I/O.

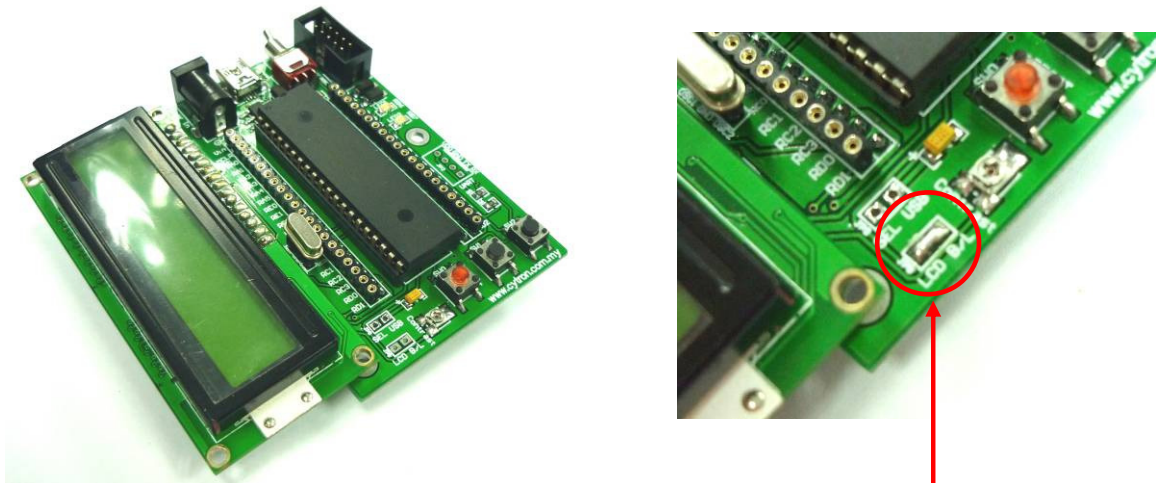


The 2x16 character LCD offer character display for a embedded system. It can be used to display numerical information, text message and also special symbol. 2 x 16 LCD Display is not included in SK40C packaging list. User may buy separately. Please refer chapter 6.1 “Getting Started for

- To use the LCD, user has to solder 16 header pin to the LCD.

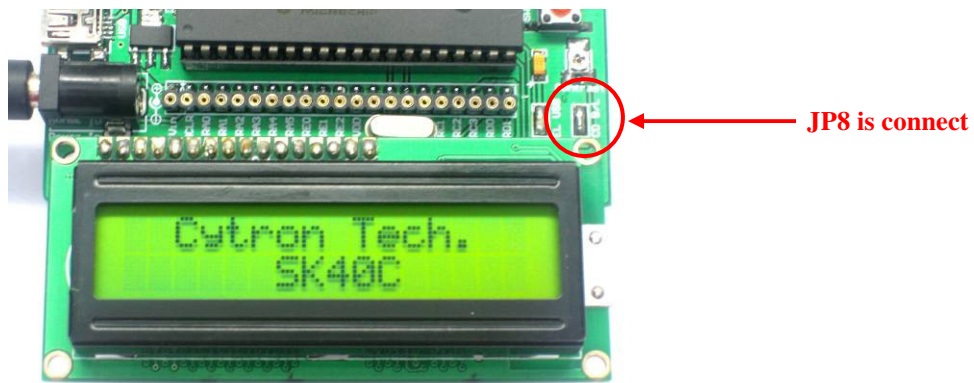


- Solder LCD display at the reserved place. To get the LCD backlight (optional), solder JP8 to connect the LCD B/L.

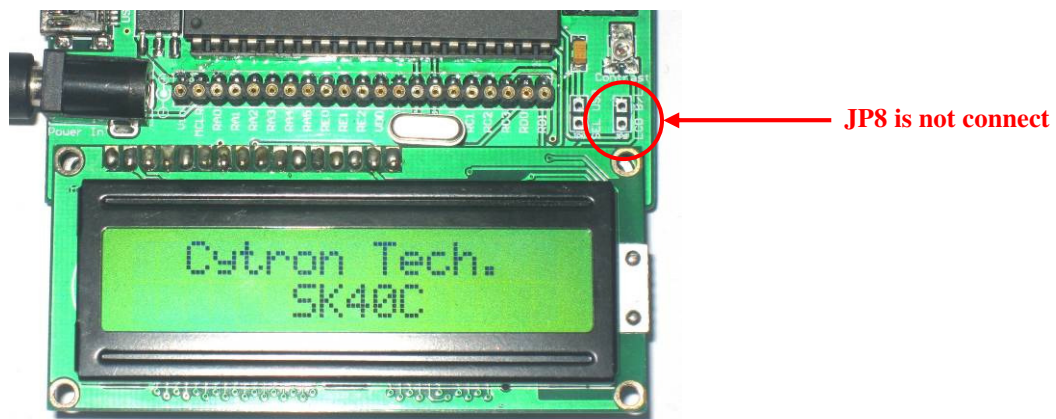


**LCD B/L is connected for
LCD backlight.**

Below shows the different between LCD with backlight and LCD without backlight.

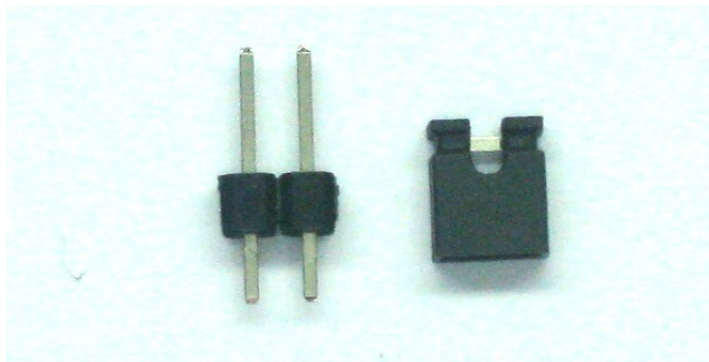


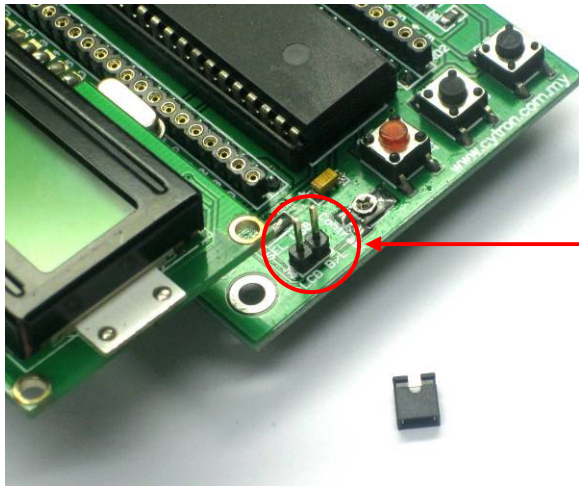
a) With backlight



b) Without backlight

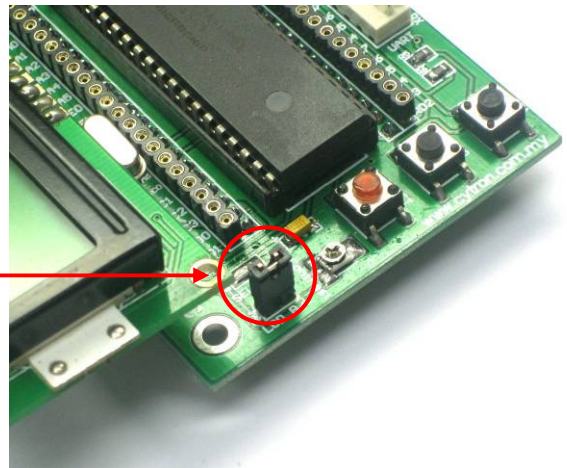
- Besides that may also use header pin and mini jumper to short LCD B/L. Header pin and mini jumper is **not provided** in SK40C packing list. Users need to buy separately.



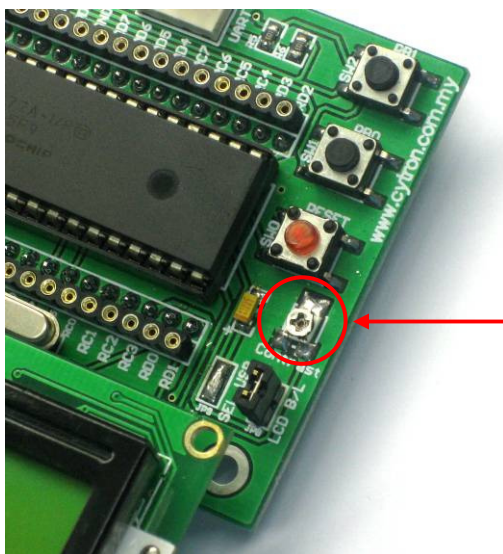


Solder header pin
at JP8

Put mini jumper to
short LCD B/L



- Potential meter is used to adjust the contrast of LCD Display. Turn left or right to adjust the contrast.

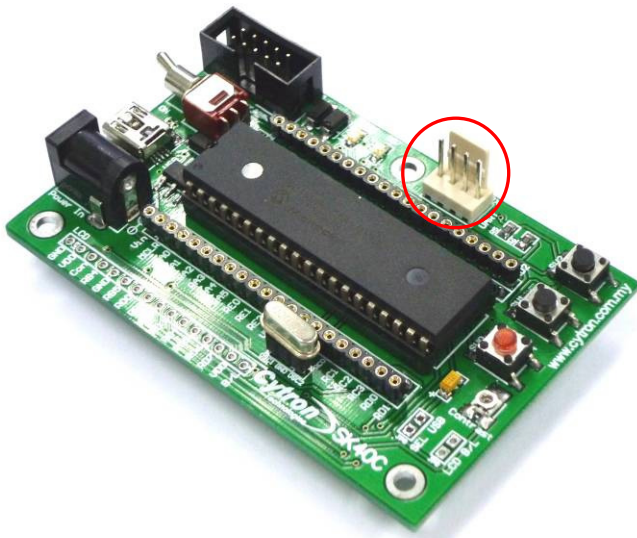


Adjust the potential meter for
different contrast of LCD.

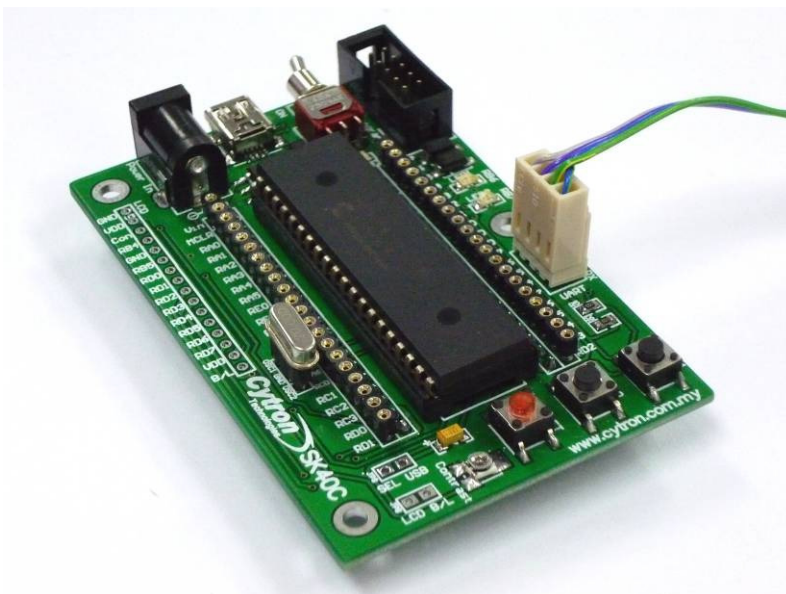
5.3 UART Interface

UART is provided in SK40C for communication to microcontroller or computer. Users need to solder 2510-04 connector by your own to use UART. 2510-04 connector is not included on SK40C packaging list. Please refer Chapter 6.2 “Getting Started for UART” for example source code.

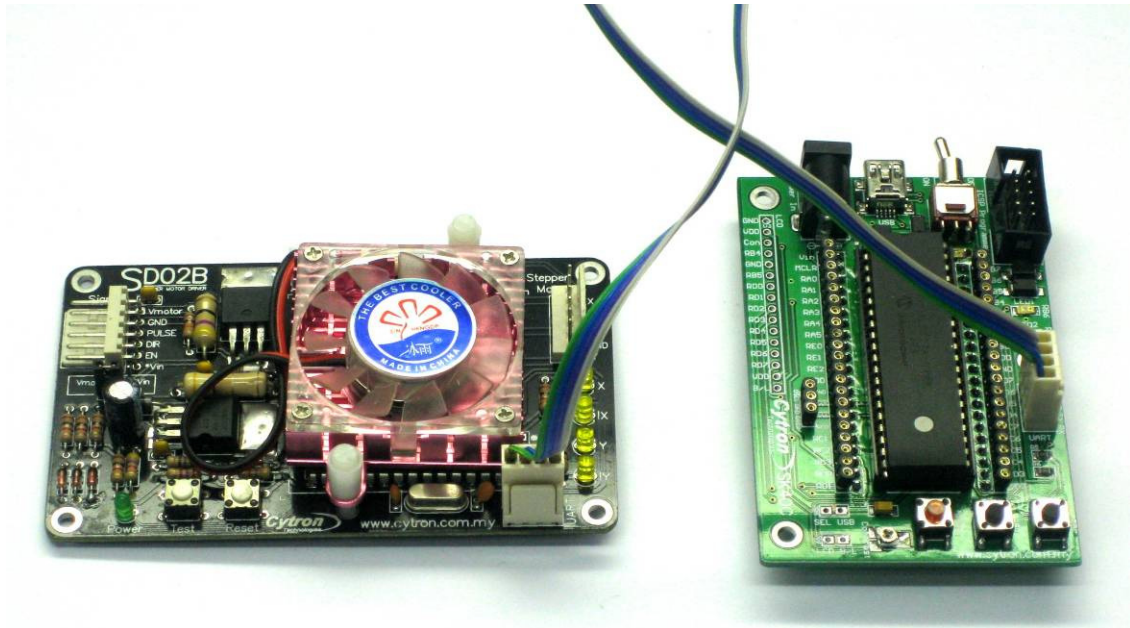
- Solder 2510-04 connector at UART reserved place.



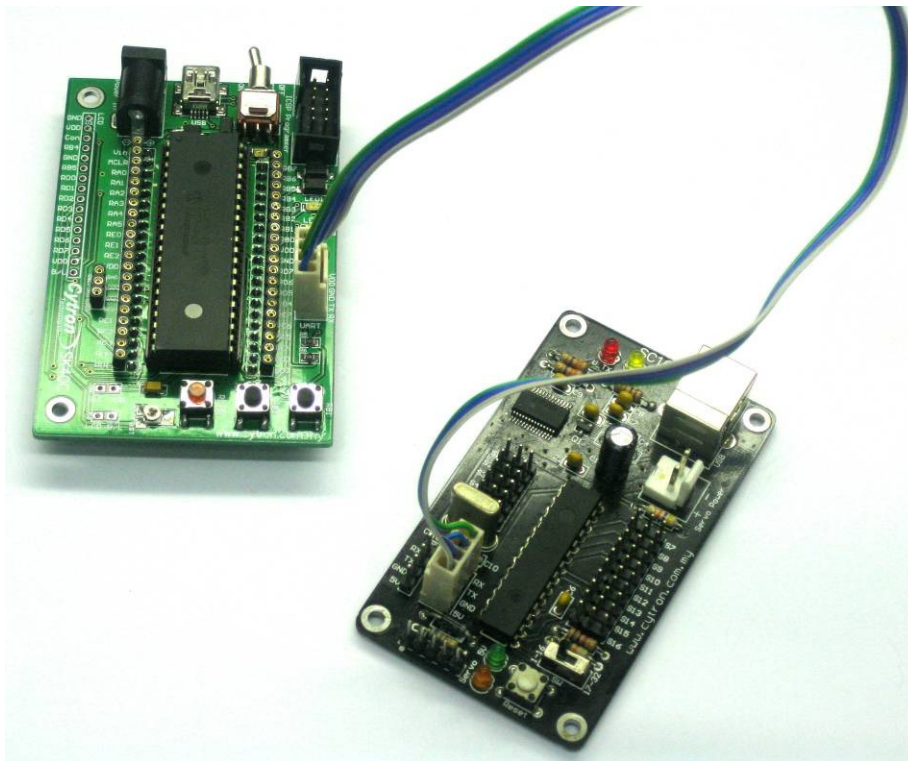
- Connect to other microcontroller using cable connector.



Below is shown some examples connection of SK40C to microcontroller using UART.

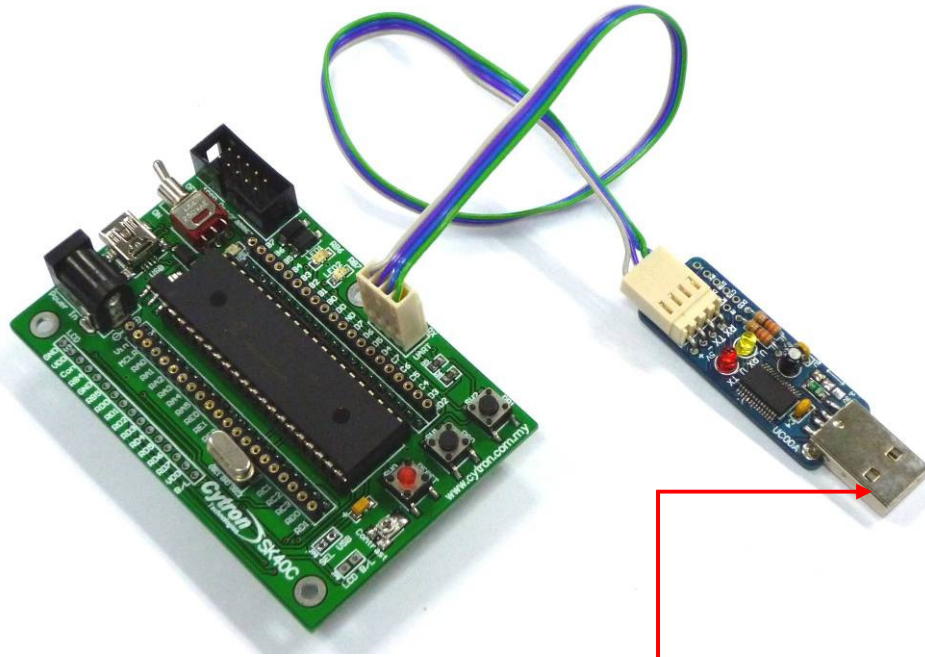


(a) SK40C to SD02B using UART



(b) SK40C to SC16A using UART

- Connect to computer/laptop using UC00A (communication between SK40C and PC)



**Connect to
computer or
laptop.**

5.4 USB Interface

USB is serial communication between microcontroller and computer. Previous Starter Kit (SK40B) use RS232 Serial port for serial communication. RS232 is conventional way of interfacing microcontroller to PC via serial port. Now USB is replace RS232 in serial communication.

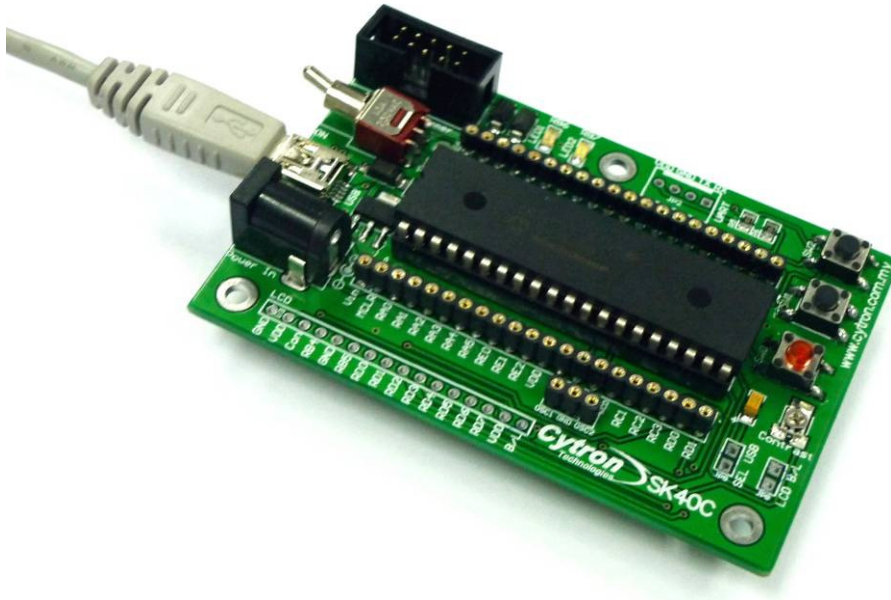
5.4.1 SK40C USB

USB data pins (pin 23, D- and pin 24, D+) were connected to a mini USB port on SK40C board for USB development use. So far, Microchip has only 5 USB 8-bit microcontrollers in 40-pin PDIP package such as PIC18F4450, PIC18F4455, PIC18F4550, PIC18F4458 and PIC18F4553. Microchip has USB software to support USB on 8-bit, 16-bit and 32-bit MCUs. This software is royalty free source code which called MCHPFSUSB Framework and also includes example projects. Download the appropriate USB stack for the target processor. Each includes USB firmware for the microcontroller as well as a USB device driver for the PC which allows the PC to treat the microcontroller as a USB device. Classes supported include HID, CDC, MSD and generic.

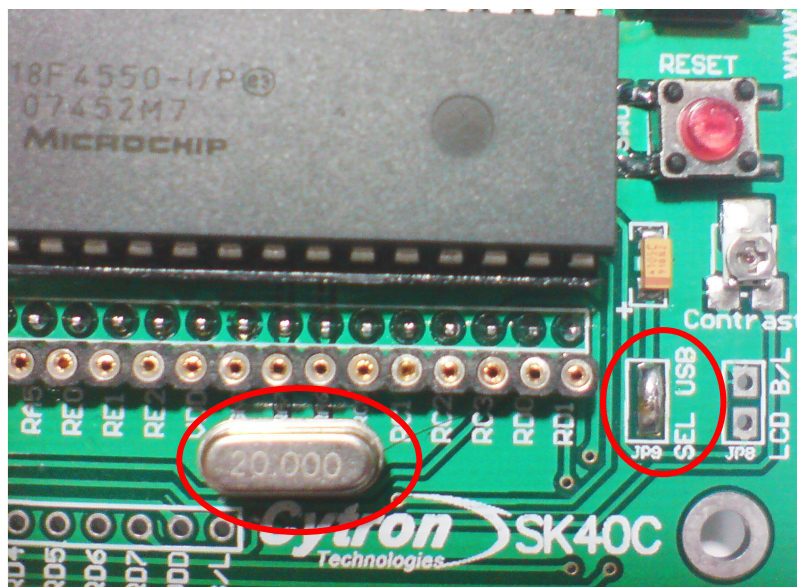
User can download MCHPFSUSB Framework (Microchip Application Libraries) from Cytron website under “Useful Document” of SK40C. Unzip it and install it after finish download. “Microchip Solutions” folder will be created at your C Drive. All free framework and example projects are inside the folder. For SK40C user, only the project with this name “PICDEM FSUSB.mcp” is suitable for your project but you need do some modification on “HardwareProfile – PICDEM FSUSB.h” because the SK40C’s switches and LEDs are connected to different I/O pin if compare to the PICDEM FSUSB Demo Board. User can download the PICDEM FSUSB Demo Board User’s Guide at Cytron website under “Useful Document” of SK40C which has the schematic diagram for your reference.

This section will show hardware installation for USB.

- Connect USB mini cable to SK40C USB connector. Connect the other end of USB mini cable to PC USB port. Make sure PIC used is support USB program.

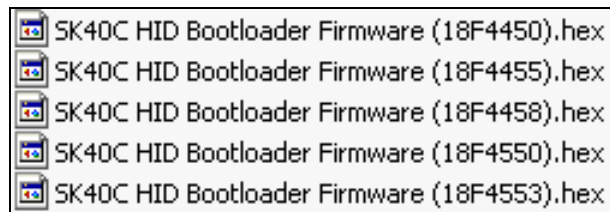


- Make sure your crystal frequency is 20MHz (unless you change the configuration of the MCHPFSUSB Framework) and jumper SEL USB is connected (soldering) as shown below.



5.4.2 SK40C HID USB Bootloader

Cytron Technologies has provided the SK40C HID USB Bootloader firmware (edited form MCHPFSUSB Framework). This firmware is currently configured to work with the PIC18F4550 using the CYTRON SK40C. However, user still can use this code for other USB microcontroller after doing some project modification. User just loads the given appropriate hex file to PIC by using the programmer (UIC00A). Please do remind that 8-bit USB microcontrollers in 40-pin PDIP only PIC18F4450, PIC18F4455, PIC18F4550, PIC18F4458 and PIC18F4553. So, Cytron Technologies has provided all of the hex files for each PIC inside the “SK40C HID Bootloader Firmware (Hex file)” folder as shown as below. Other than that are not support this USB bootloader on SK40C board.



6. GETTING STARTED

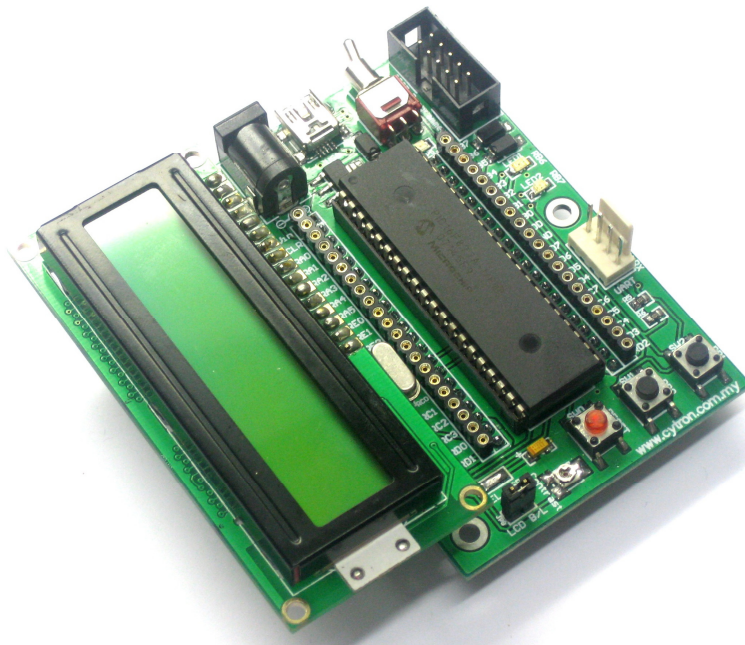
SK40C is ready to be plug and use, no extra driver or software is necessary. It is a hardware platform, please install the necessary driver or configure the correct setting in window. SK40C is ready be used to start the electronics interface.

6.1 LED Blinking and LCD Display

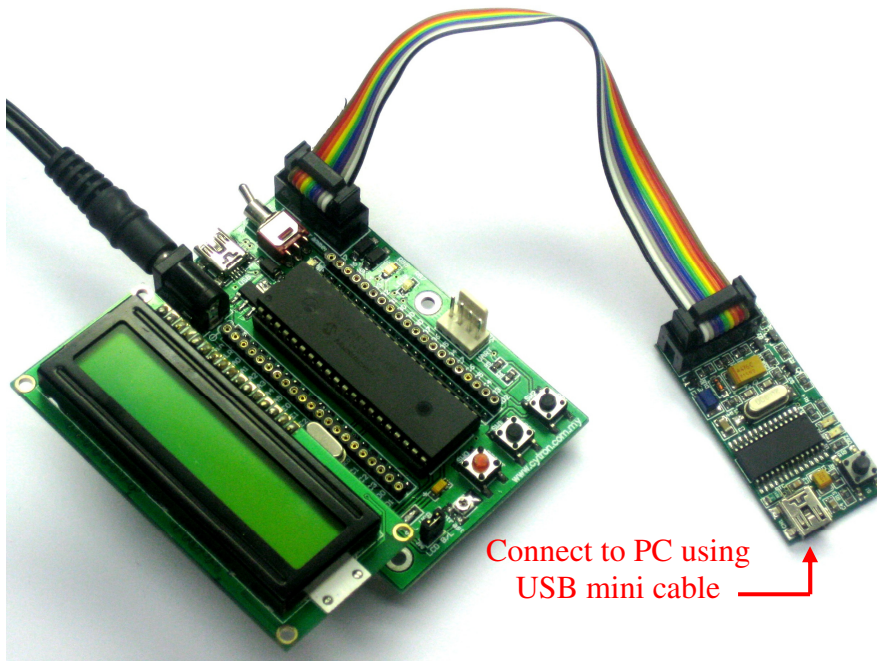
Sample Source Code is provided to test the functionality of SK40C. Sample source code will show LED blinking and Start up message on LCD Display. Sample source code can be downloaded from SK40C product page. This sample source is provided for PIC 16F. Please refer UIC00A User's Manual to load hex code into PIC of SK40C.

LCD Display is not included in SK40C packing list. Buy it separately if want display message on LCD Display. Please refer section 5.2 for interface SK40C with LCD Display.

1. Plug in 40 pin PIC MCU. No restriction to what type of 40 pin PIC MCU can be used for SK40C.



2. Connect Adaptor to DC Power Adaptor Socket. Connect UIC00A/B to ICSP programmer. Switch on toggle switch.



3. Load hex code (LED_Blink.hex) into 40 pin PIC MCU using UIC00A/B.
4. LED1 and LED2 are blinking.
5. LCD Display will display “Cytron Tech.” at 1st line and “SK40C” at 2nd line.

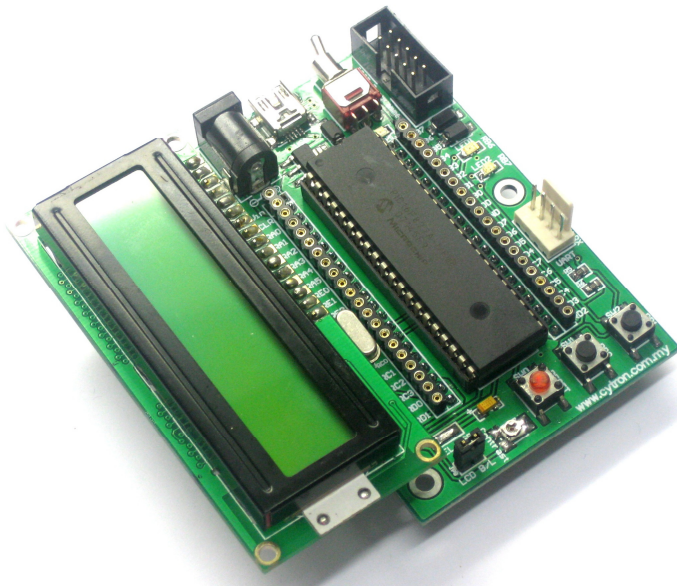
6.2 UART

UART (Universal Asynchronous Receiver Transmitter) can be used to communicate between:

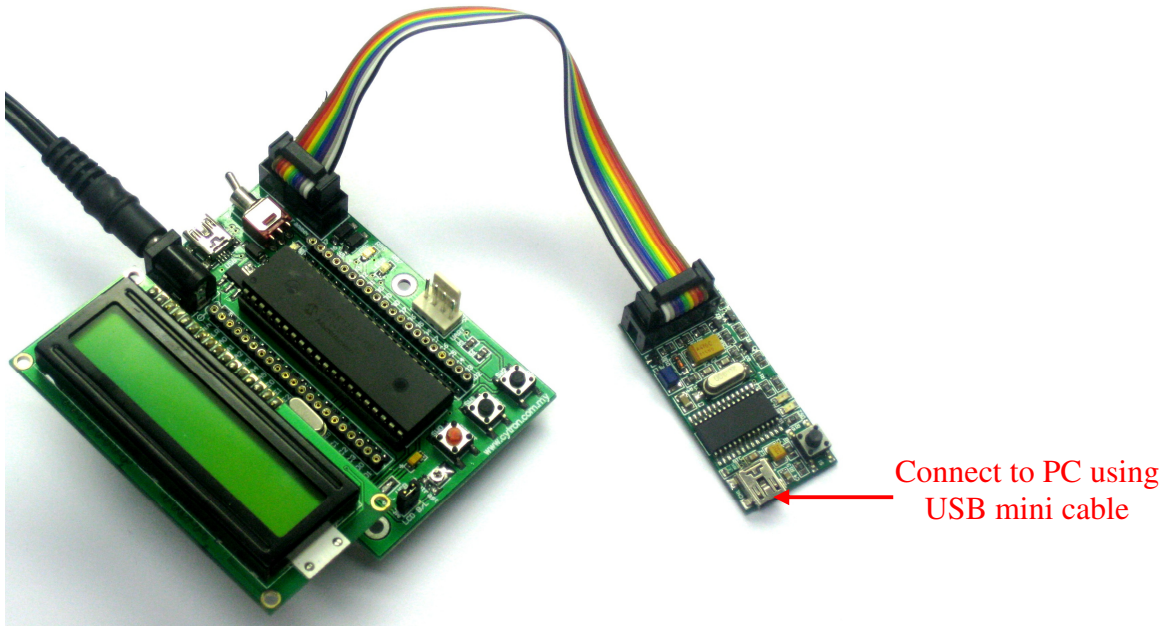
- i. SK40C – Computer/Laptop
 - ii. SK40C – Microcontroller
- UART to Computer/Laptop

UC00A is a USB to UART converter which can be used for UART communication between SK40B and Computer/Laptop. Please refer UC00A User's Manual for details. We have provided a sample source for UART communication between SK40C and Computer. This sample source is provided for PIC 16F.

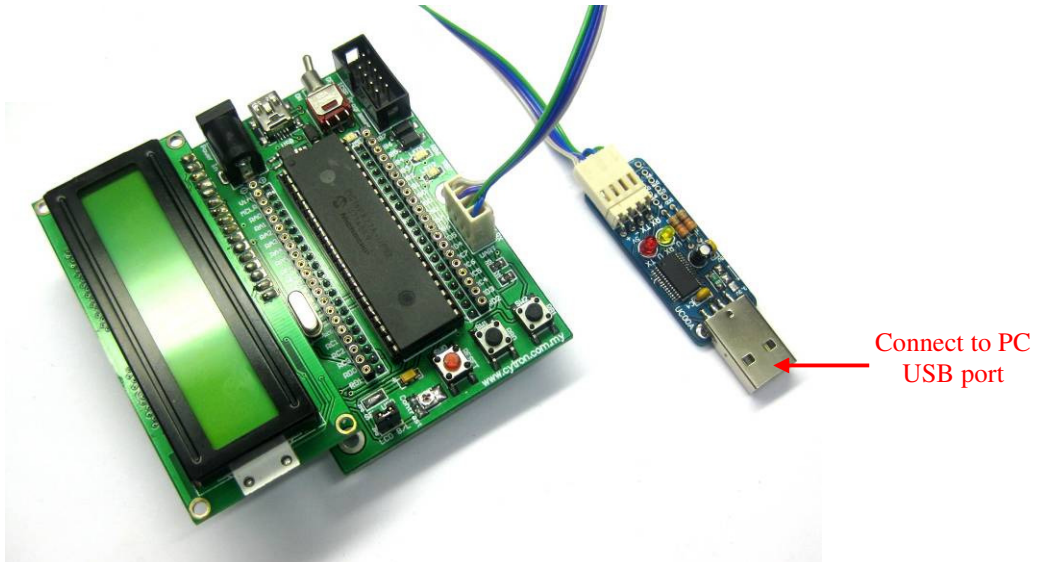
1. Plug in 40 pin PIC MCU. No restriction to what type of 40 pin PIC MCU can be used for SK40C, as long as it has UART peripheral.



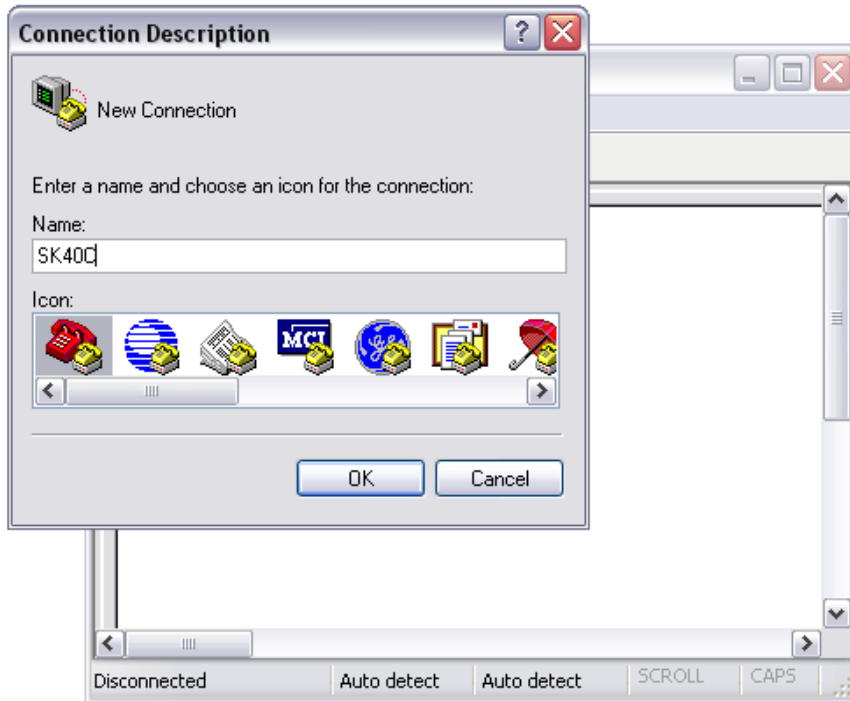
2. Connect Adaptor to DC Power Adaptor Socket. Connect UIC00A/B to ICSP programmer. Switch on the power.



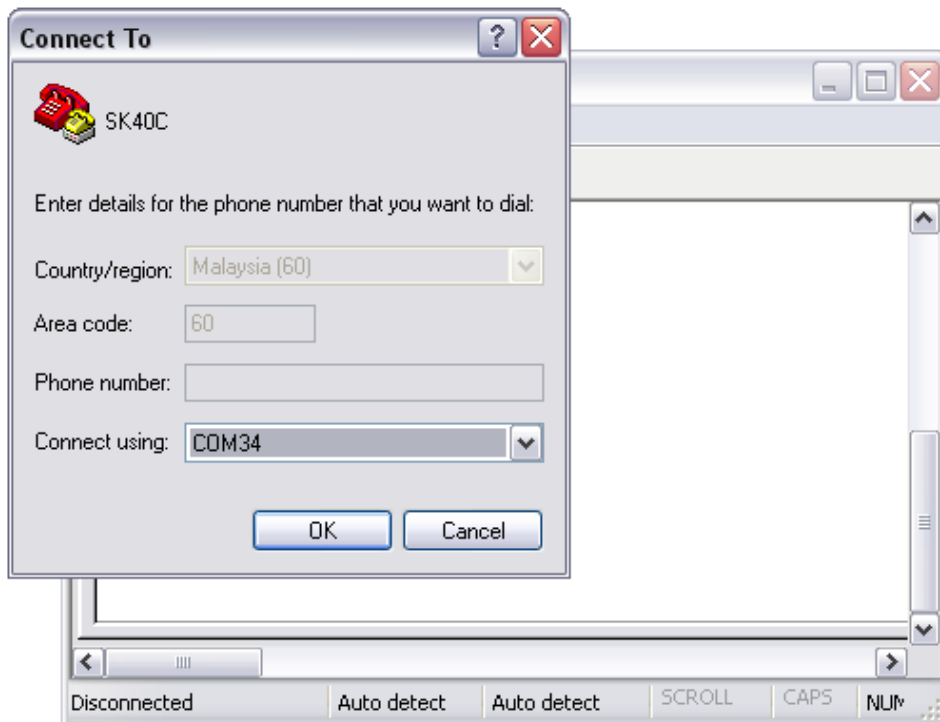
3. Load hex code (UART_PC.hex) into 40 pin PIC MCU using UIC00A/B.
4. Connect UC00A to SK40C and Computer.



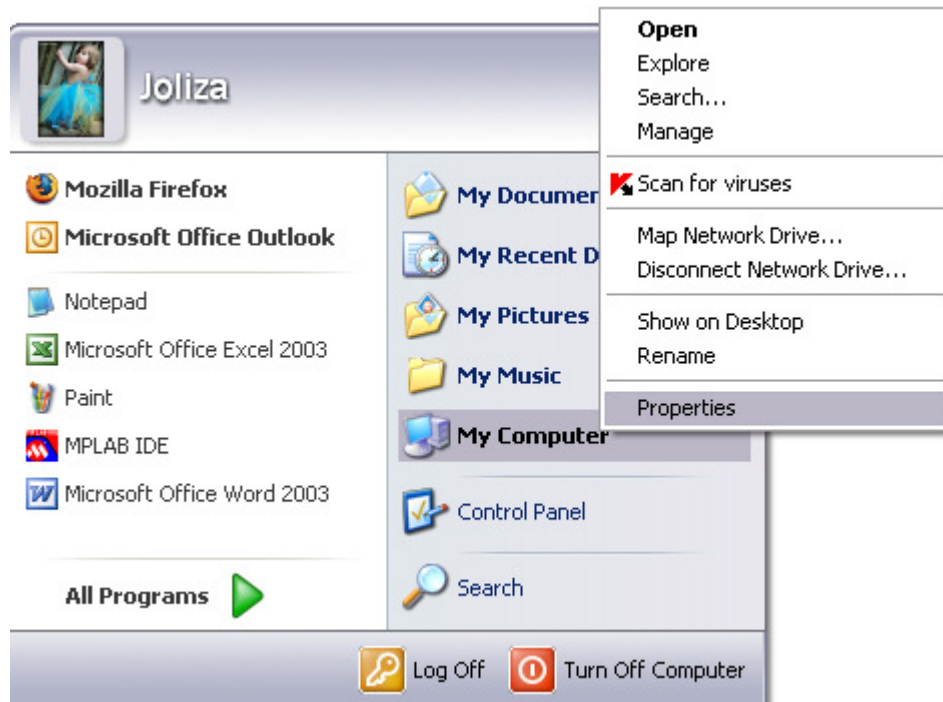
5. Setup HyperTerminal. This setup only valid for UART communication with computer using UC00A. It's not valid for USB at SK40C. Open HyperTerminal. Enter a name and choose an icon for connection as picture below then click OK.



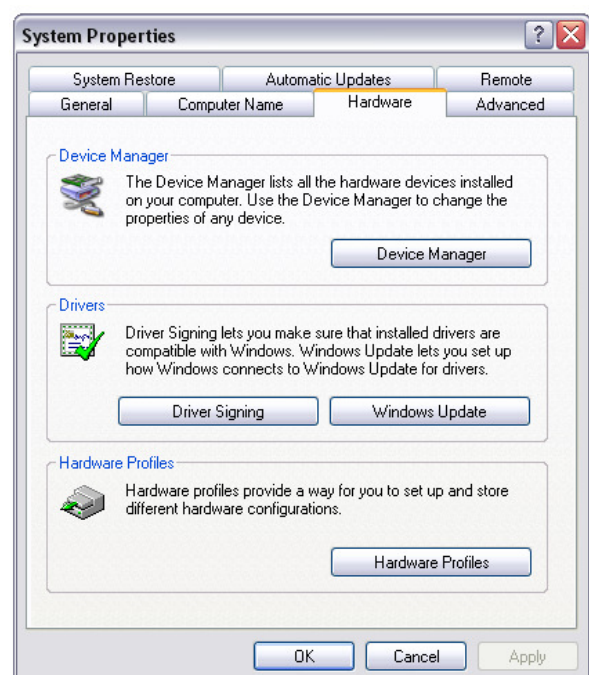
6. Select COM port.



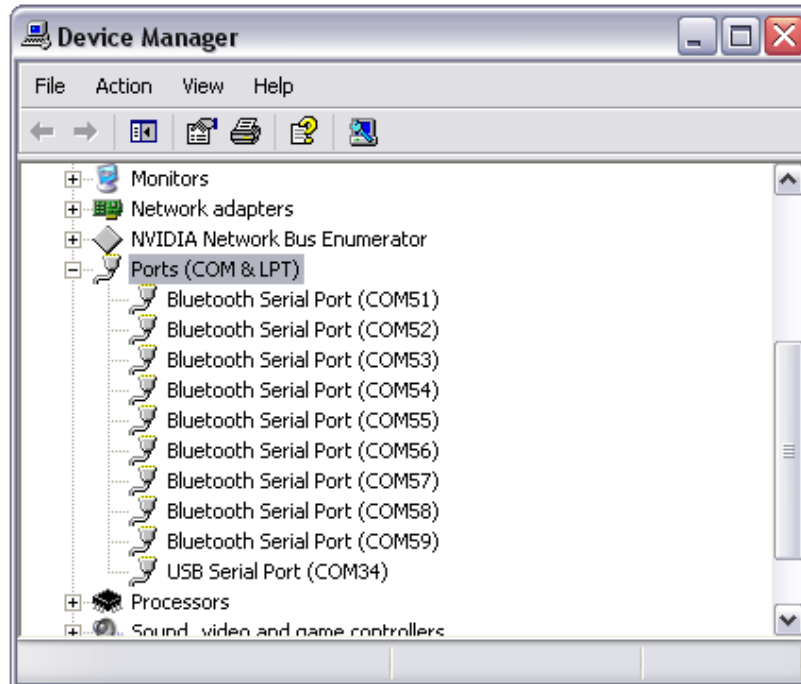
7. Please follow step (8) to (10) if the COM port number is not confirm.
8. Go to Start, right click on My Computer and choose Properties.



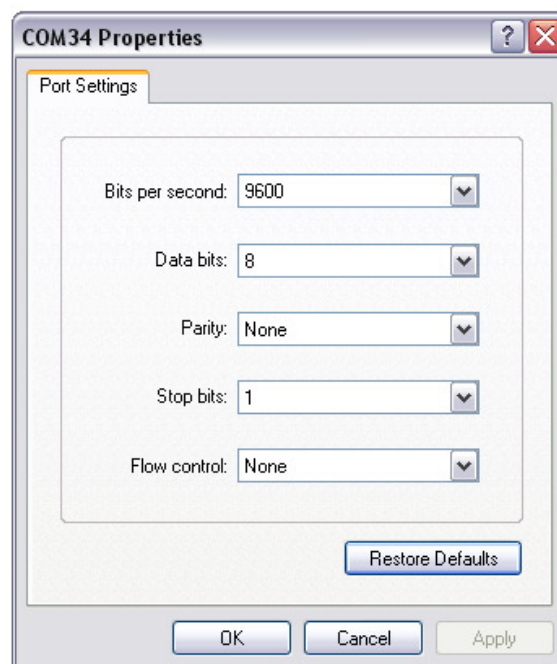
9. At System Properties, choose Hardware and click on Device Manager. Device Manager will pop up.



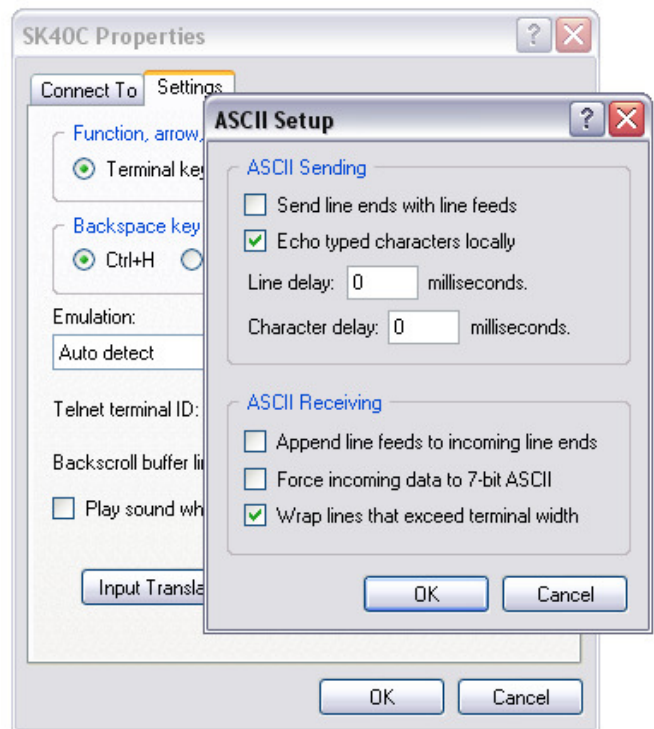
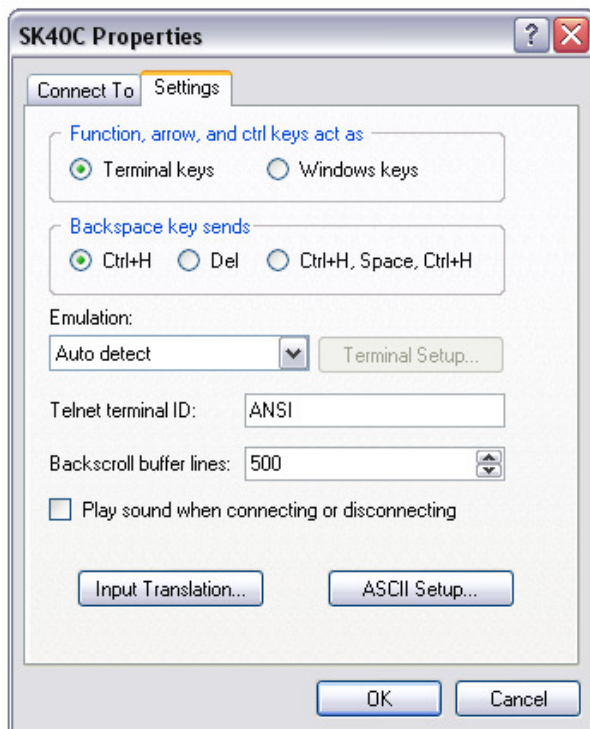
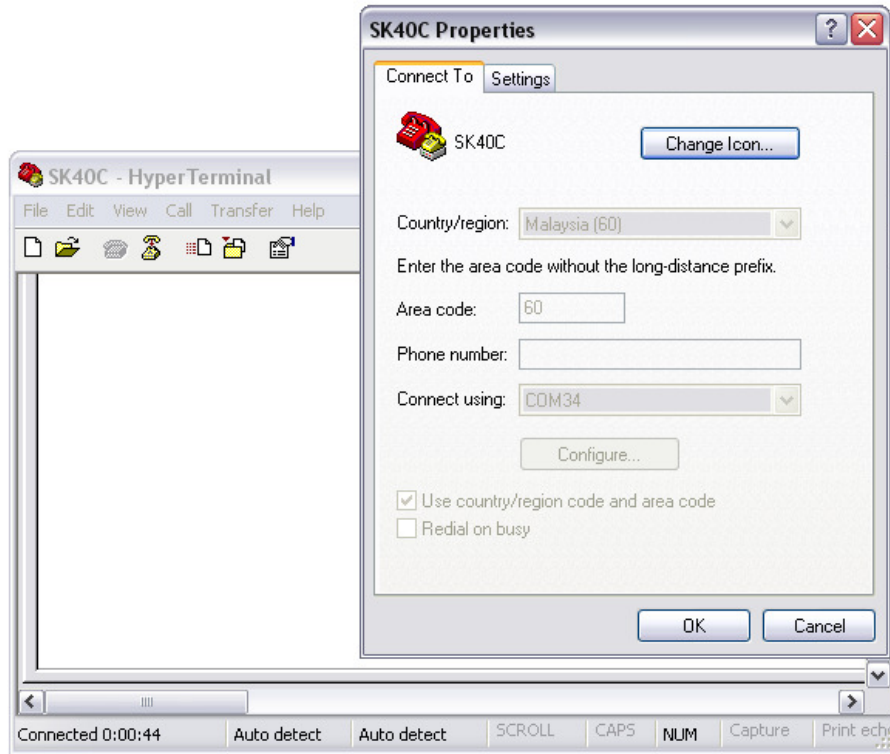
10. At Device Manager, choose (COM & LPT) and USB Serial Port COM will be visible. As an example below, COM Port for SK40C is **COM34**. The COM Port is not definitely same for each computer. Usually, the COM port is the largest USB Serial Port show in (COM & LPT). To make sure it, unplug UC00A and plug in back. The COM port for UC00A disappears when we unplug UC00A and appear when we plug in.



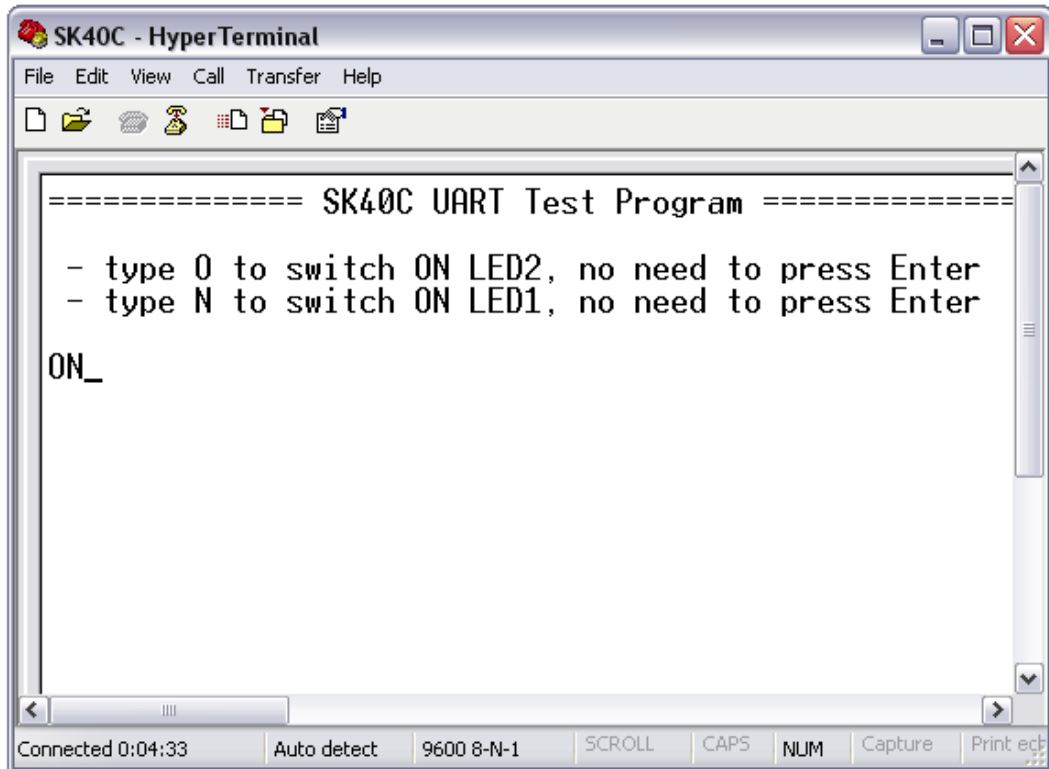
11. Set the “Port Setting” as picture below. Bits per seconds must be same with SK40C Baud Rate in programming. After finish setting, click Apply and then click OK.



- Click Properties button. 'SK40C' Properties will show. Choose Setting tab and click ASCII Setup. Click on *Echo typed characters* locally and then click OK. *Echo typed characters* is to display on HyperTerminal what is pressed on keyboard. User may click or unclick *Echo typed characters*.



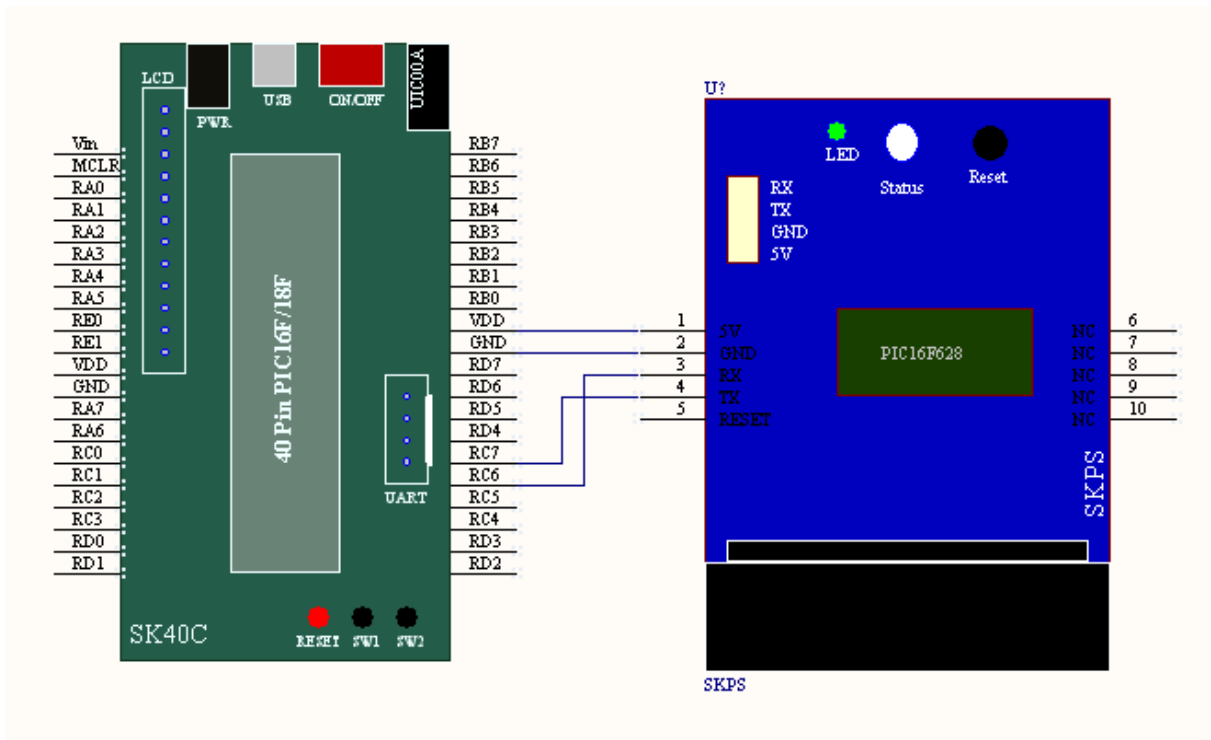
13. After all settings are complete, user may now check the functionality of SK40C UART. Below show message displayed in HyperTerminal if our sample source code used.

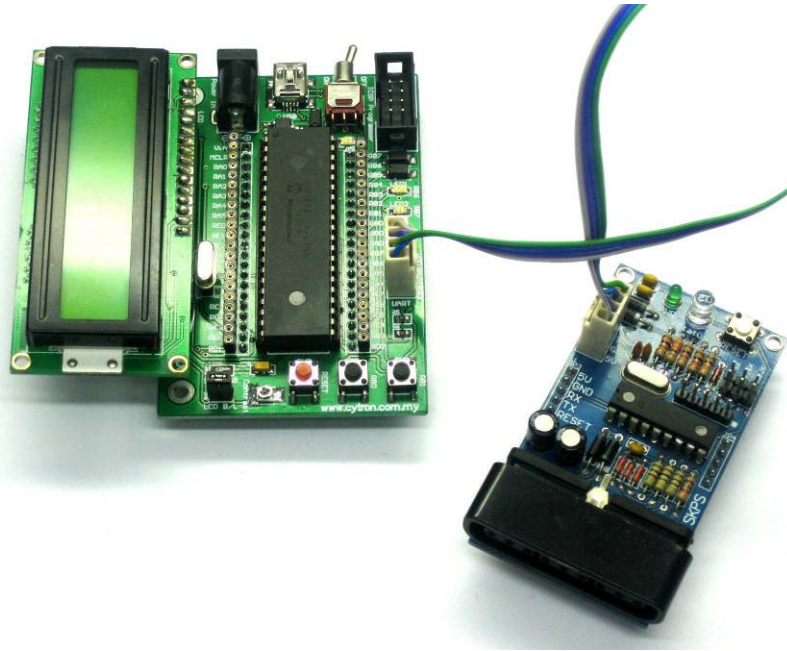


- UART to Microcontroller

Another possible usage of UART is to communicate with another embedded system or microcontroller. For microcontroller to interface with SK40C, the minimum requirement will be TTL UART (Universal Asynchronous Receiver and Transmitter) and 5V supply. As for UART, a minimum of Receiver pin is required to receive command from SK40C.

1. Following sample schematic show SK40C is interface to SKPS. This sample schematic show UART pin of SK40C (PIC16F877A) is connecting to UART pin of SKPS. Tx and Rx pin of SK40C should be cross connected to Tx and Rx pin of SKPS. In other words, Tx pin of SK40C should be connected to Rx pin of SKPS, while Rx pin of SK40C should be connected to Tx pin of SKPS. No extra component is necessary between these connections. For details connection, please refer to sample schematic.



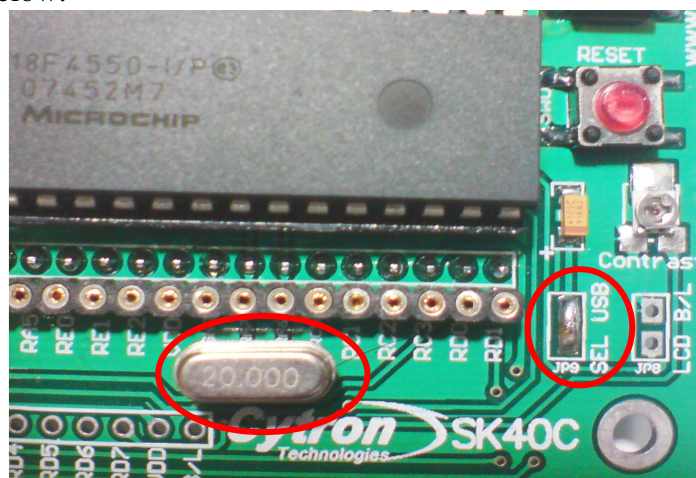


2. Sample source code is provided to show UART communication between SK40C and microcontroller (SKPS). User may download the source the source code in Cytron website under product page.
3. Load the hex code (UART_SKPS) into PIC MCU.
4. LCD will display “LEFT, RIGHT, UP and DOWN” if that button on PS2 Joystick is pressed.

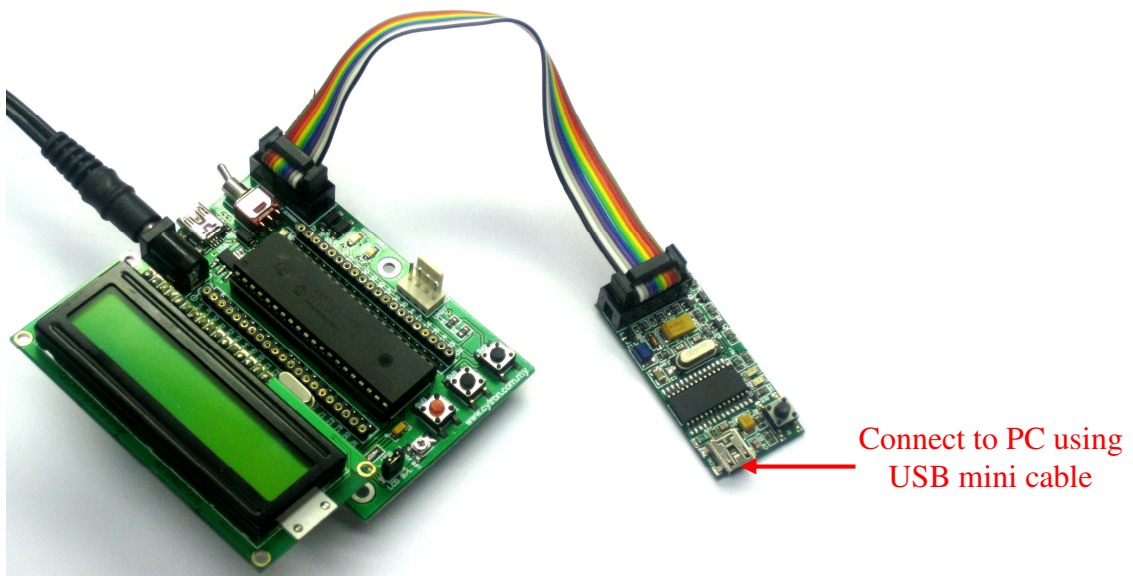
6.3 USB

This section is shown example source code for LED Blinking using USB bootloader. User may download the sample source code in Cytron website. The sample hex file is valid for PIC18F4550 only. For non- PIC18F4550, user need to change the device and rebuild the project to regenerate the new hex file.

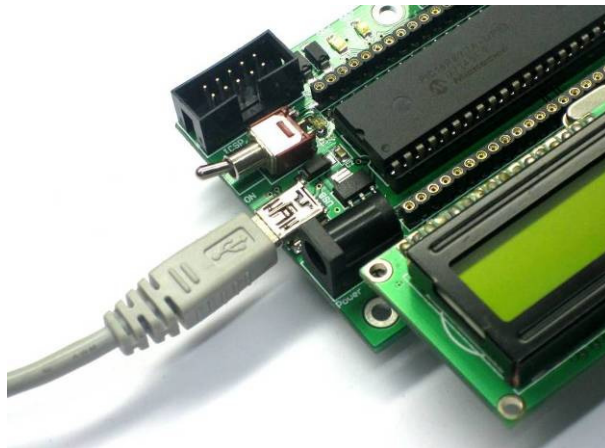
1. Make sure your crystal frequency is 20MHz (unless you change the configuration of the MCHPFSUSB Framework) and jumper SEL USB is connected (soldering) as shown below.



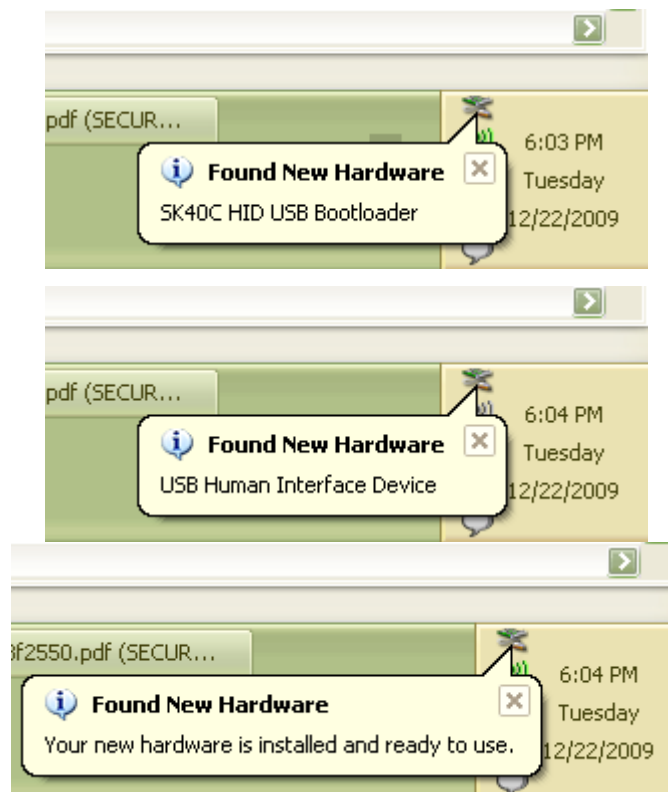
2. Plug in 40 pin PIC MCU. Ensure that the PIC can support USB bootloader.
3. Connect Adaptor to DC Power Adaptor Socket. Connect UIC00A/B to ICSP programmer. Switch on the power.



4. Load the hex file of SK40C HID Bootloader Firmware as mentioned in Section 5.4.2.
5. After USB bootloader firm was loaded into PIC, unplug the UIC00A/B programmer. For boot mode, press and hold the SW2 then connect the mini USB port on SK40C board to your PC then release the SW2. Another way to activate the boot mode is pressing and holds the SW2 then press RESET button without unplug the USB cable.



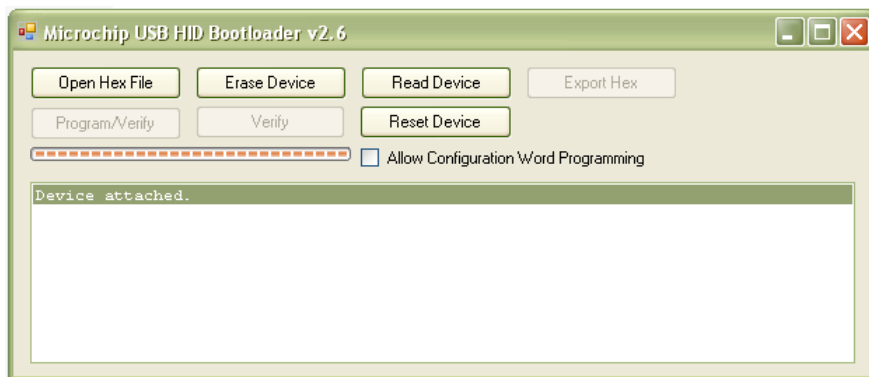
6. SK40C has secondary power supplied by USB port, so external power may not needed for USB application. LED1 and LED2 will alternate blink at the time when in boot mode. These messages will pop out one by one on your PC for first time plug in only.



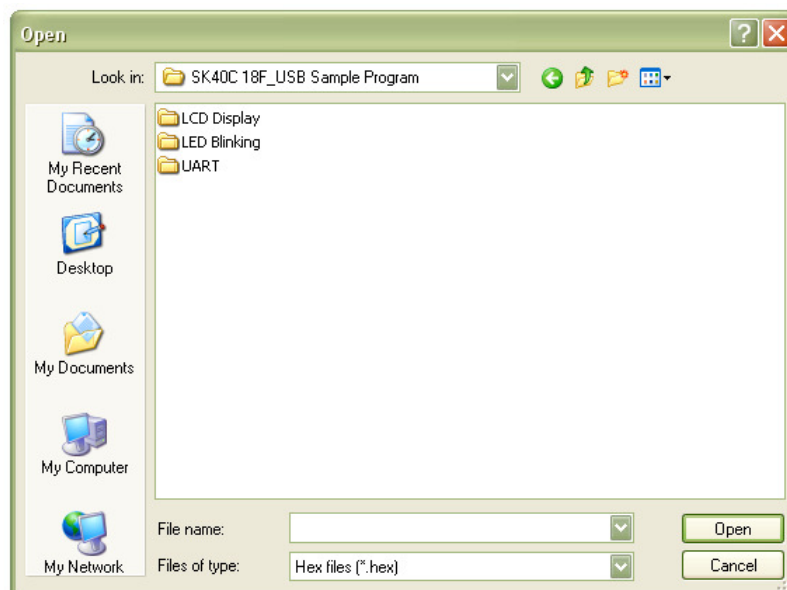
- Open this exe file inside the folder. You may already have the .NET framework installed on your PC, especially if you have already installed other applications which were built with one of the Visual Studio 2005 .NET languages. If you do not yet have it, the .NET framework can be freely downloaded from Microsoft's website. Users of Windows Vista do not need to install the .NET framework, as it comes pre-installed as part of the OS. The redistributables are currently (22 May 2008) available at Cytron website under "Useful Document" of SK40C.



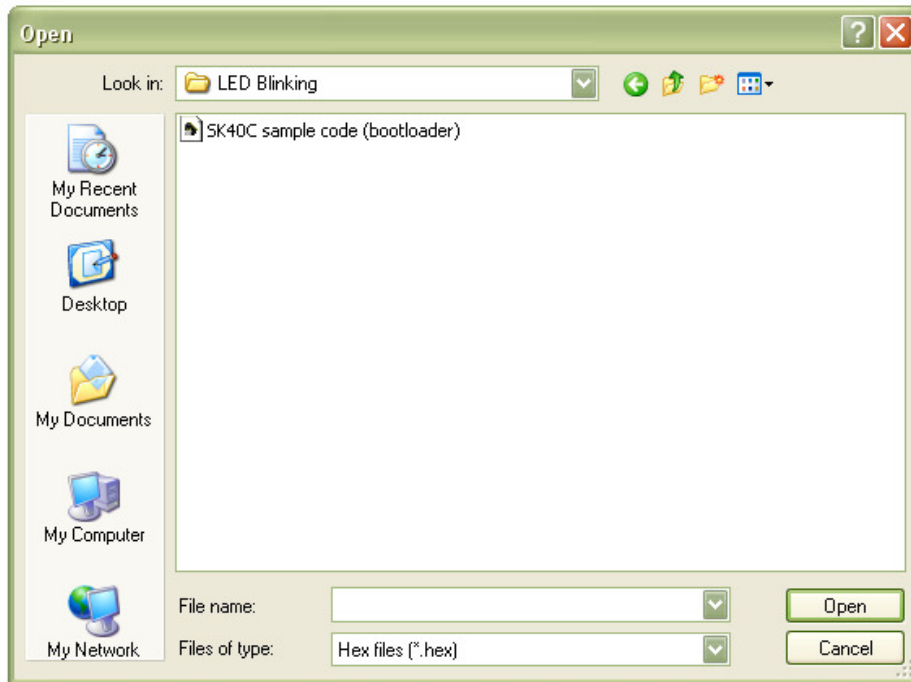
- And this window will pop out and click "Open Hex File"



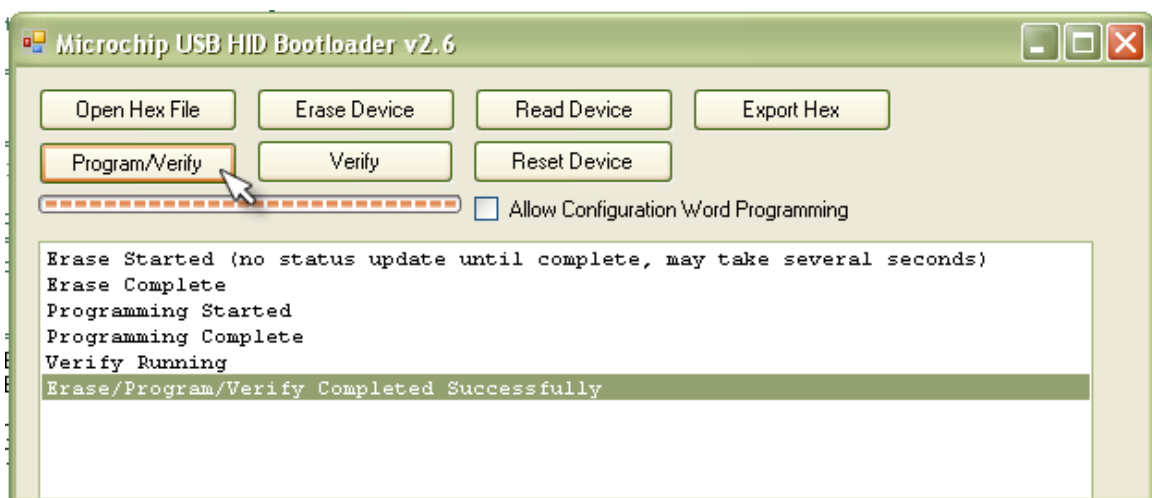
- Search "SK40C 18F_USB Sample Program" folder which users have download from website. They are 3 sample programs which are LCD Display, LED Blinking and UART. Click on LED Blinking folder.



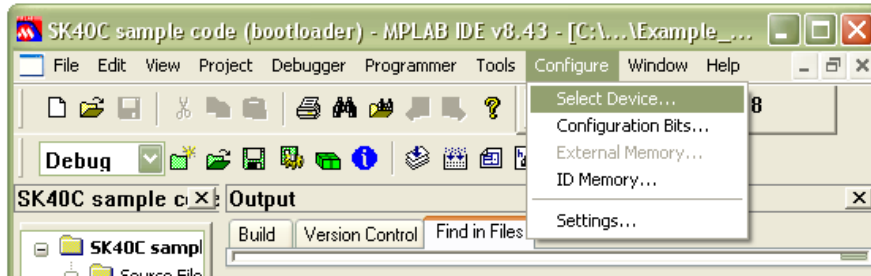
- Select the given hex file “SK40C sample code (bootloader).hex” folder and click open. Note that the original sample hex file, “SK40C sample code (bootloader).hex” is for PIC18F4550.



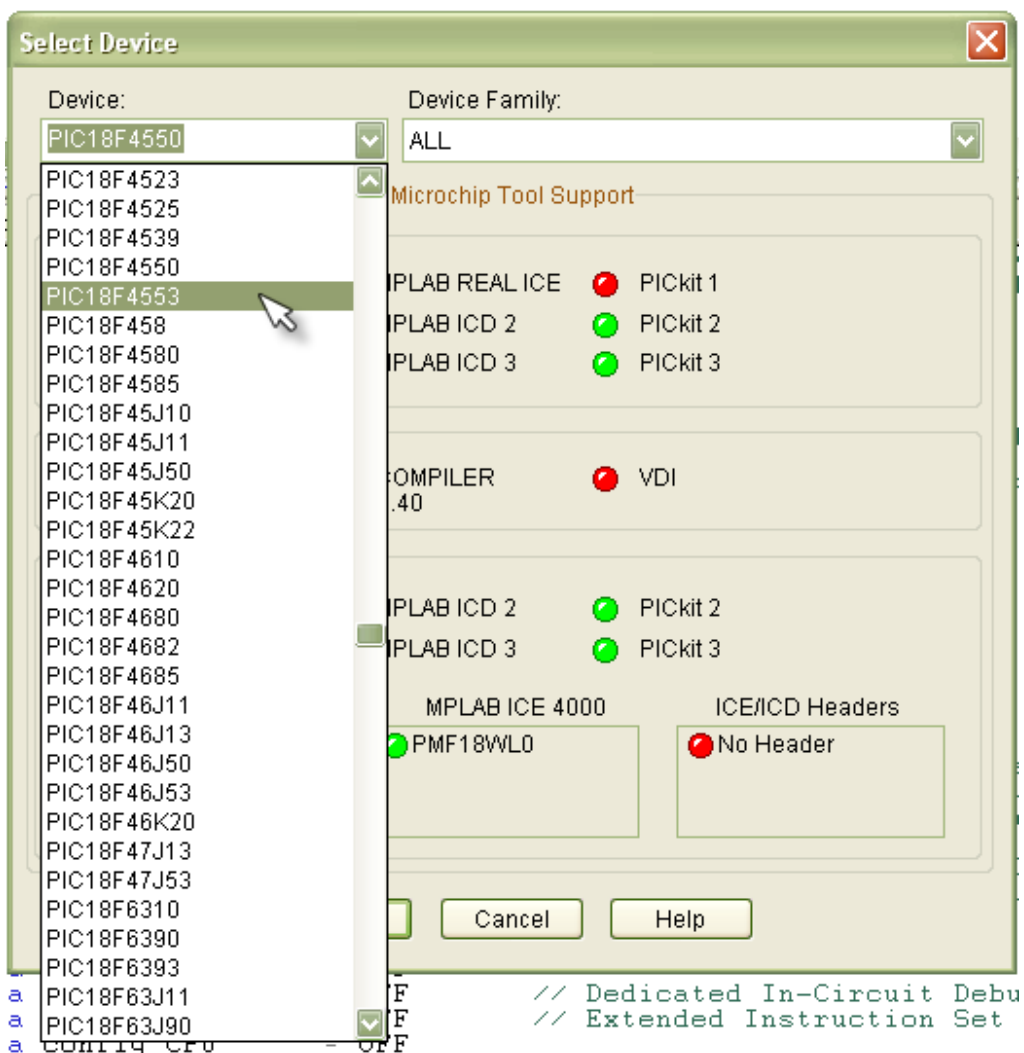
- Click “Program/Verify” to load hex file to your PIC and programming status will be shown as below. Next, click “Reset Device” to run your program. LED1 and LED2 will blink like strobe on police car if “SK40C sample code (bootloader).hex” is loaded. LEDs will stop blinking if either SW1 or SW2 button is being pressed.



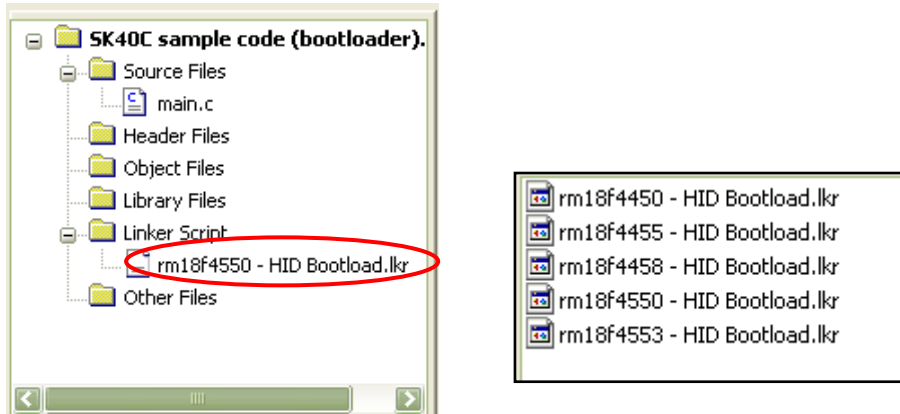
12. User need to do some modification for other USB PIC. Change the device by clicking Configuration>>Select Device as shown below.



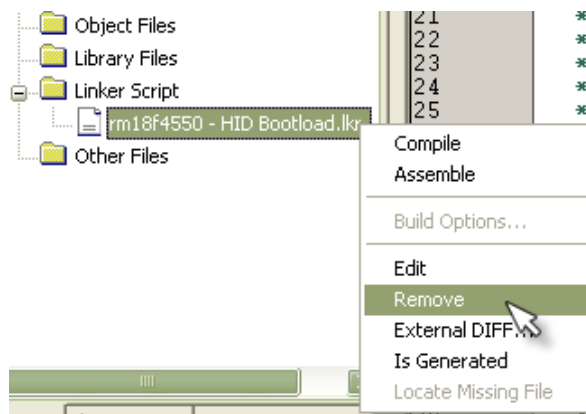
13. Choose decided PIC let say PIC18F4553 then click “OK”.



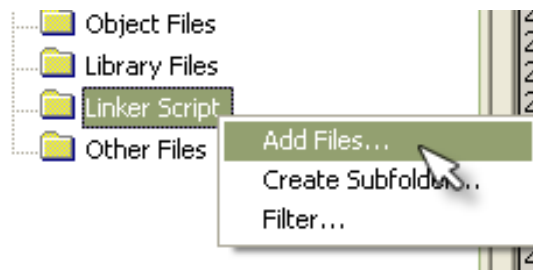
14. Edit the appropriate linker file. User MUST use the given remapped linker files for the application if bootloader is used.



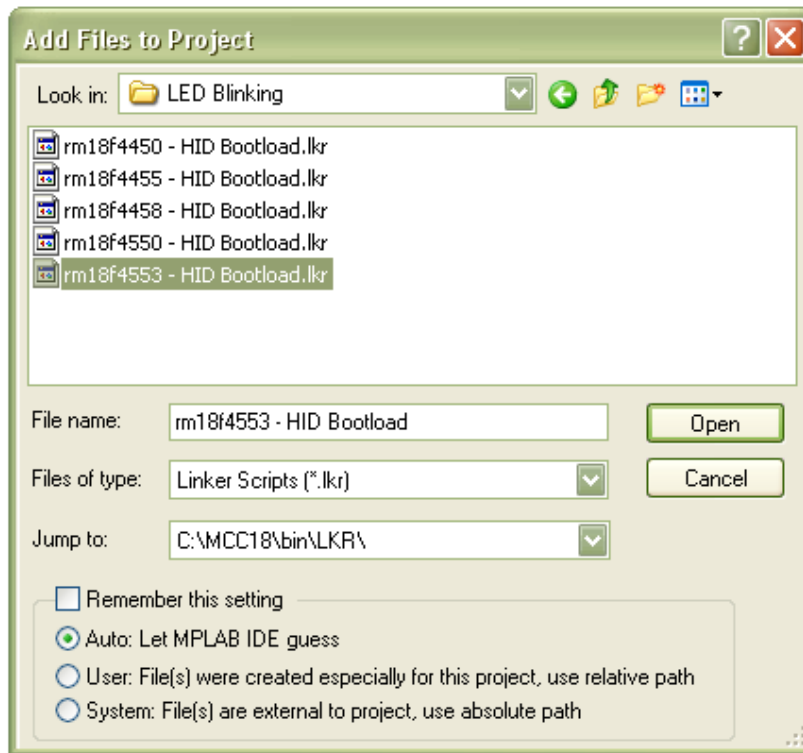
15. Right click the linker file under Linker Script folder and remove it.



16. Right click the Linker Script folder then click “Add Files”



17. This window will pop out and search your file directory and select the appropriate linker file. All these linkers are special modified for USB bootloader use.



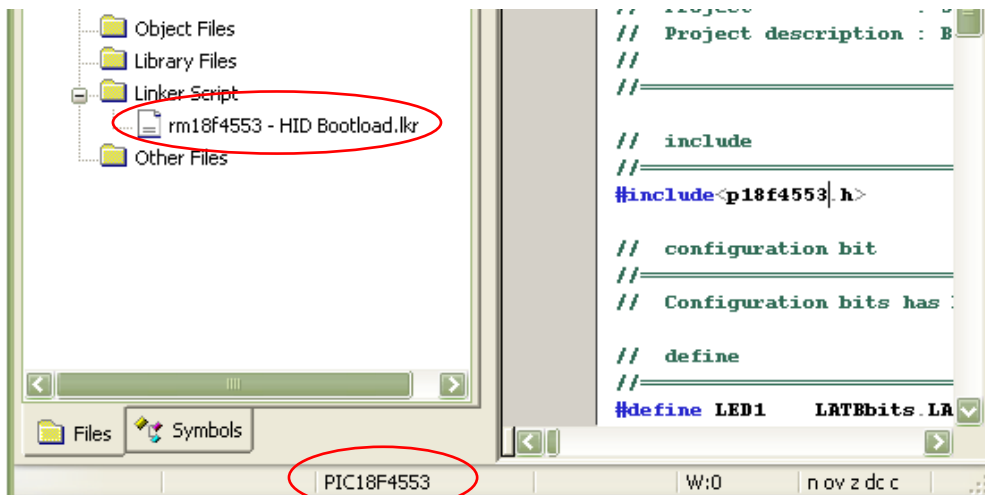
18. Lastly, do not forget to change the include file before rebuild it. User is free to edit the sample program.

```

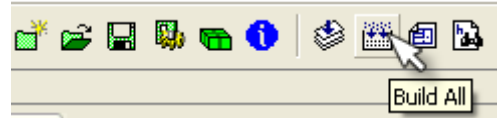
8 // include
9 //=====
10 #include<p18f4550.h>
11

```

19. Make sure the linker file and the selected device is correct.



20. Click the “Build All” icon to rebuild the project and a new hex file will be generated and it will replace the old hex file in folder directory then load it into your PIC by using the Microchip USB HID Bootloader as mentioned from step 7 to step 10 in this section. Make sure compiler used is C18 Compiler V3.32 or above.



7. WARRANTY

- Product warranty is valid for 6 months.
- Warranty only applies to manufacturing defect.
- Damage caused by mis-use is not covered under warranty.
- Warranty does not cover freight cost for both ways.

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APPENDIX

