SK40C
40 PINS PIC
START-UP KIT

User's Manual

V2.0

JUNE 2015

INDEX

1. INTRODUCTION/OVERVIEW

SK40C is another 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 offers plug and use features. This kit is designed to offer:

- Industrial grade PCB
- Vin: 7 to 15VDC
- Every board is being fully tested before ship 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 I/O pins** are nicely labeled to avoid miss-connection by users
- **Connector for UIC00A/B** (low cost USB ICSP PIC Programmer) - simple and fast method to load program
- Fully compatible with SK40B
- No more frustration to plug PIC out and back for re-programming
- Perfectly fit for 40 pins **16F and PIC18F PIC, the 8-bit PIC.**
- With UIC00A/B, program can be loaded in less than 5 seconds
- More convenient to use and it is smaller than SK40B.
- Maximum current of 5V voltage regulator 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 mini B receptor on board.
- PICkit ICSP 6-pin port which can be used with UIC-A and PICkit 3
- And all the necessities to eliminate users difficulty in using PIC

Users are able to utilize the function of PIC by directly plug in the I/O components in whatever way that is convenient to user. With UIC00A/B 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.
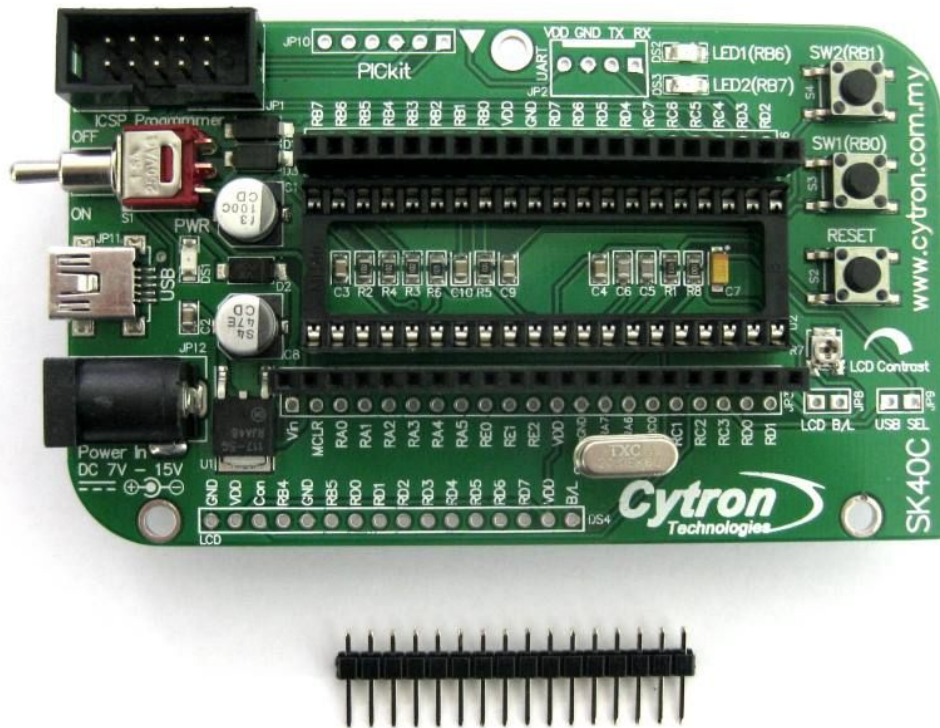
1. 1 x SK40C board with all components shown soldered
2. 1 x 16-way Header pin for LCD Display.
3. 1 x 20MHz Crystal
4. PIC MCU – **Not included**, please purchase separately from Cytron website
5. USB Mini-B Cable – **Not included**, please purchase separately from Cytron website

6. UIC00A/B – **Not included**, please purchase separately from Cytron website
7. User's Manual – **Not included**, please download from Cytron website

3. PRODUCT SPECIFICATION AND LIMITATIONS

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
Vin	Input voltage to DC jack	7	15	V
Imax	Maximum output current from 5V voltage regulator	-	0.5	A

SK40C comes with additional features of:
- 2 x Programmable push button (tactile)
- 2 x Programmable LED indicator
- Turn pin for crystal. User may use other crystal
- Parallel LCD pads (optional)
- 4-pin UART communication port
- USB Mini-B receptor on board
- And all the necessities to eliminate user difficulty in using PIC microcontroller

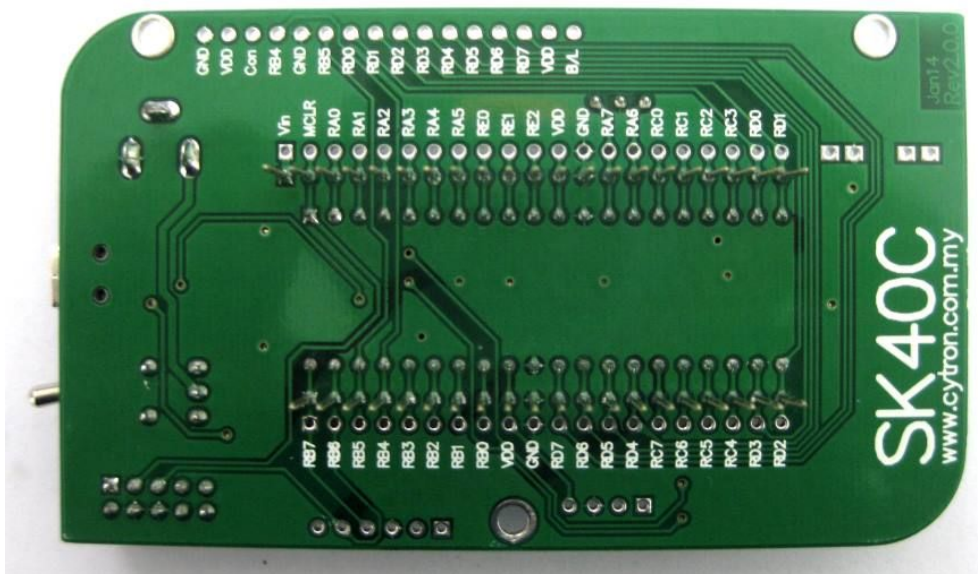**Note: Only 1 power source should be provided to SK40C. Either from DC adapter, USB port, external Vin or external 5V.**
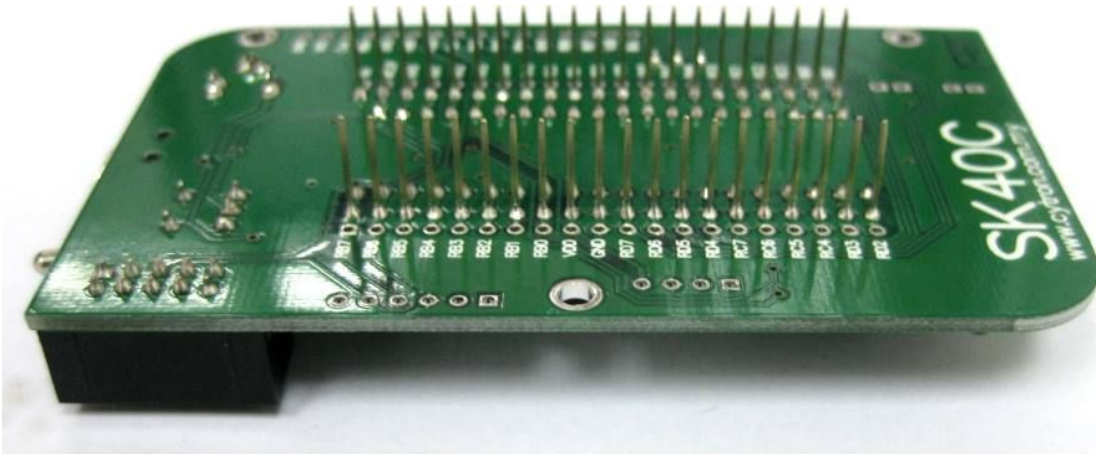
4. DIMENSION
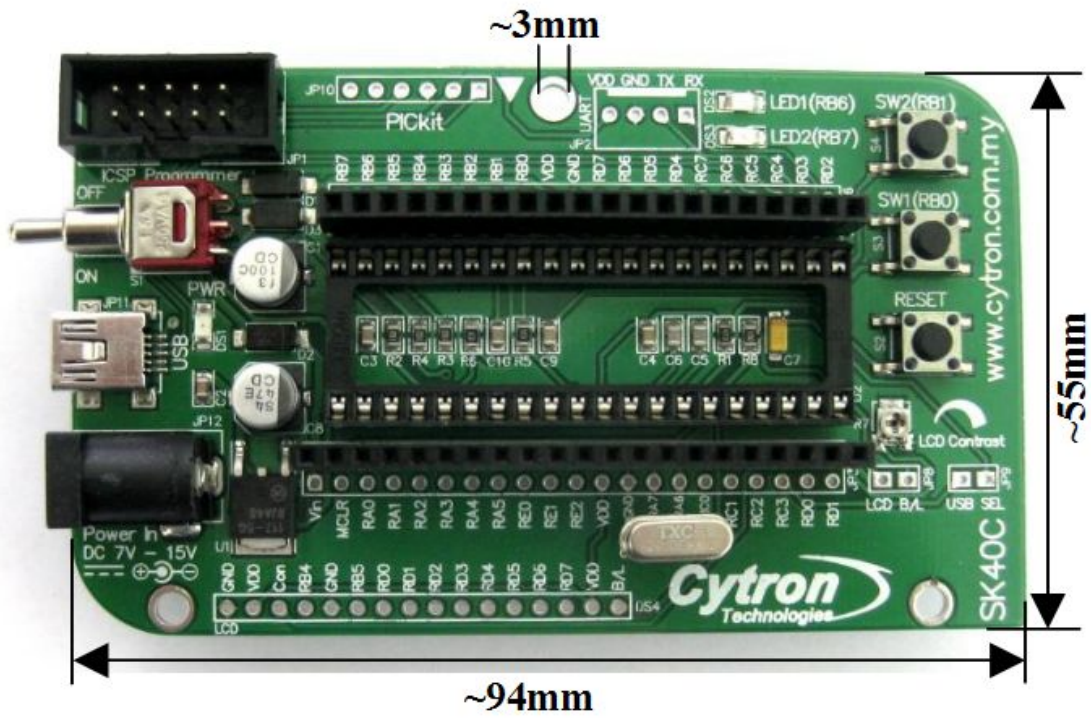
5. BOARD LAYOUT
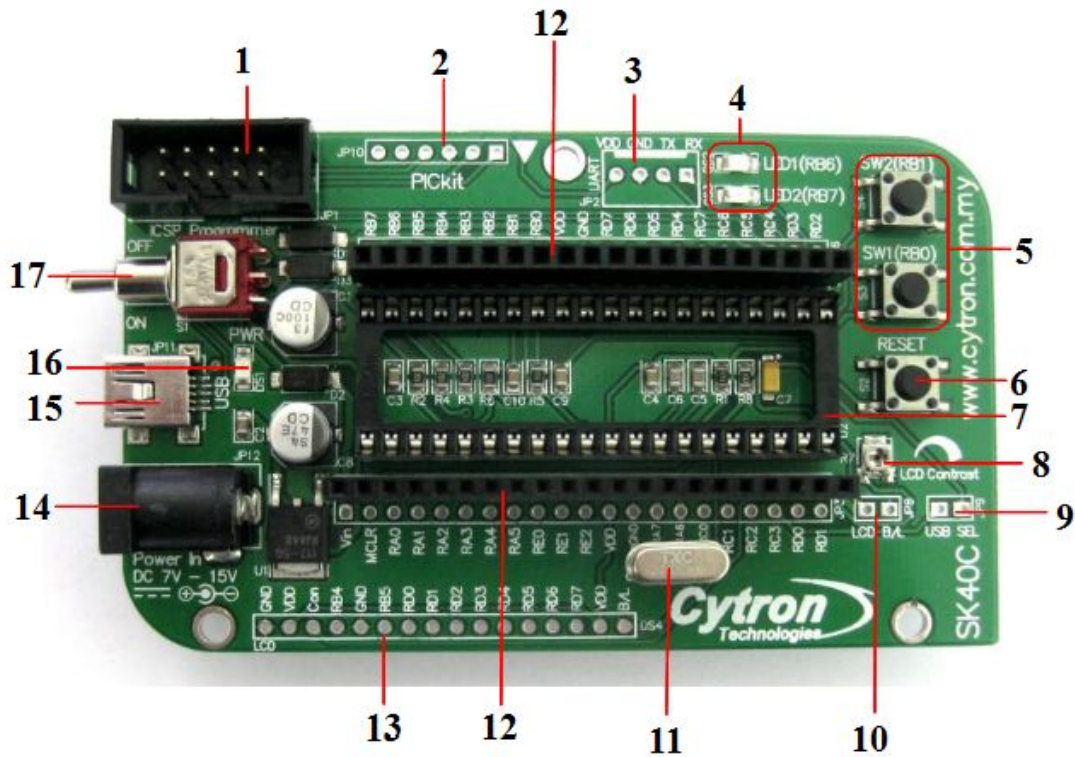
Top View

Bottom View

Side View

1. Connector for UIC00B Programmer
2x5 box header for UIC00A/B, USB ICSP PIC Programmer.

2. JP10 for PICkit
JP10 port reserved for PICkit programmer. User may use PICkit3 and plug to this port and utilize the ICSP pin to load program besides using UIC00B.

3. UART connector
Reserved for UART communication. Tx and Rx pin of SK40C are connect to RC6 and RC7 respectively. Ensure PIC Microcontroller chosen has the correct UART pin (RC6 and RC7).

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

5. Programmable Push Button
2 x Push button (Tactile switch) connected to RB0 and RB1 of PIC MCU. This is extra input button for user. It can be programmed as input switch.

6. Reset Button
 Push button with the function of Reset for PIC MCU.

7. 40-Pin IC socket for PIC MCU
40 pin IC socket for user to plug in any 40 pin PIC MCU (8-bit and 5V operated). 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.

8. LCD Contrast
5K of trimmer to set LCD contrast.

9. JP9 for USB
JP9 is provided for USB usage. Connect these pins if user uses USB communication. Shorting

both these pins will connect pin 18 of PIC (V_{USB} on PIC18F4550) to 1uF capacitor. This setting is necessary if USB peripheral is needed.

10. JP8 for LCD Backlight
JP8 is provided for LCD Backlight. LCD will have backlight if these pins are shorted.

11. Turn pin for crystal
Turn pin is provided for crystal. 20MHz is default crystal comes with SK40C. However, the 20MHz crystal can be removed and replace with other crystal. Just remove the crystal and put other crystal on turn pin without soldering.

12. Female Header
Female header provides connector for user to make connection between SK40C to prototype board and utilize the I/O of PIC MCU. It is fully compatible between SK40B. 40 pins of PIC MCU including 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.

13. Parallel LCD pads
Reserved for 2 x 16 character parallel LCD. User may solder 2x16 LCD at these pads if it is needed.

14. DC power adaptor socket
DC power adaptor socket for user to plug in DC adaptor. The input voltage should within 7 to 15VDC.

15. USB Connector
A USB Mini B receptor. USB connector for communication between devices and a host controller (usually personal computer or laptop). This function is only valid for certain model of PIC microcontroller. Please refer to USB interface section. The USB connection also provides 5V from USB port (computer or laptop or 5V charger) to the SK40C. The power LED will light ON when the USB cable is connected.

16. Power indicator LED
Power indicator LED for on board power. It will light ON when the 5V voltage regulator output power or it receives 5V from USB.

17. Toggle Switch for power supply
Toggle switch to On/Off the power supply from DC adaptor.

Table below shows pins connection for 2x16 LCD pads.

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

Table below shows pin connection for Turn pin of crystal oscillator

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

Table below shows pin connection for Programmable Push button.

Pin	Name	Pin Function	Connection
RB0	SW1	Digital Input	'SW1' SWITCH
RB1	SW2	Digital Input	'SW2' SWITCH

Table below shows pin connection for UART.

Pin	Name	Pin Function	Connection
RC6	TX	Transmit Data	TX pin of SK40C UART
RC7	RX	Received Data	RC pin of SK40C UART

* For detailed connection, please refer to SK40C Rev2.0 Schematic.

6. HARDWARE

SK40C comes with UIC00A/B ICSP USB programmer connector to offer simple way for downloading program.UIC00A/B ICSP programmer is very easy programming tool and helps to save development time.

6.1 Loading Program Using UIC00A/B Programmer

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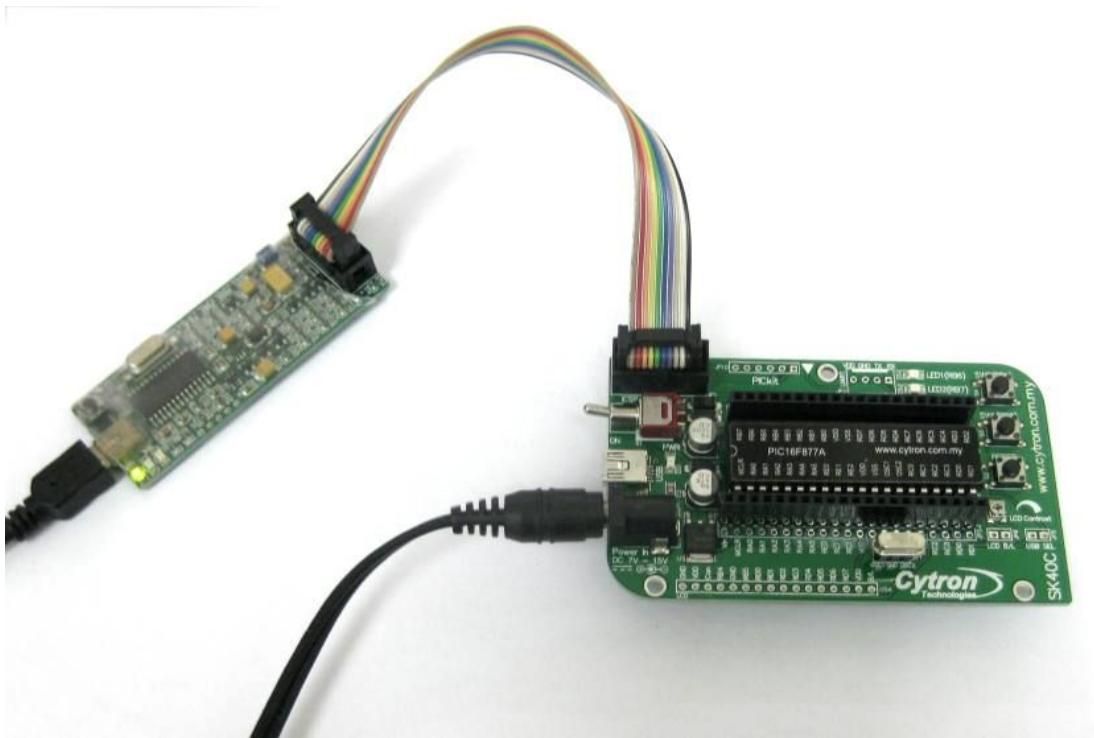
After plug in 40-pin PIC MCU (make sure the orientation is correct) of your choice, SK40C should be powered by **DC adaptor**. Now, the hex code is ready to be loaded to SK40C. For the usage of UIC00A/B, please refer to UIC00A/B User's Manual.

RB7/PGD and RB6/PGC are two pins that being used in ICSP program loading, and have been connected to UIC00A/B connector and 2 LED indicators. User is advised not to use these pins as input, because the input device may affect the ICSP process. Even when using as output, RB7 or RB6 pin is 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/B User's Manual for further details.

6.2 Loading program using PICkit (JP10)

JP10 (PICkit port) is reserved for user to load program using PICkit2/3. This is alternative way to load program besides using UIC00A/B. Below is some steps to load program using PICkit.

- To use PICkit 3 as programmer, user has to solder 1x6 way right angle header pin to JP10.
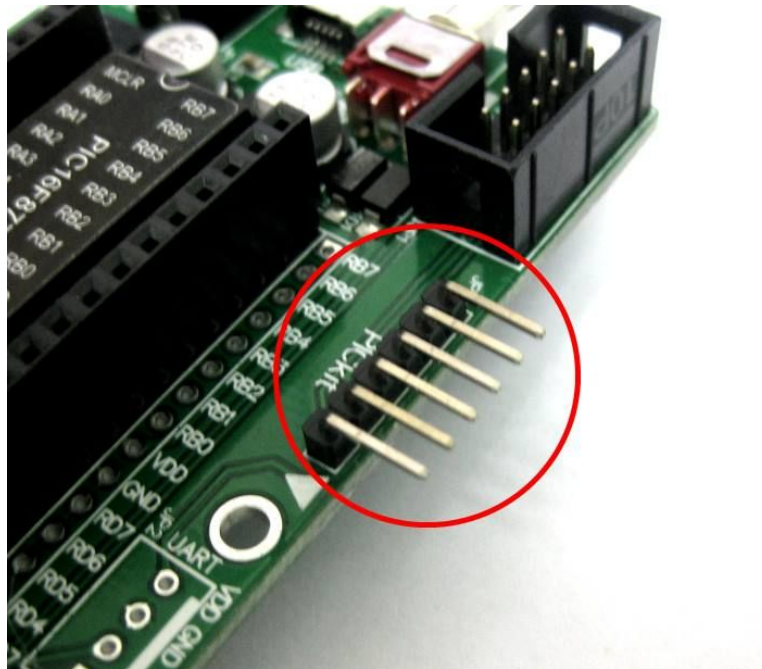
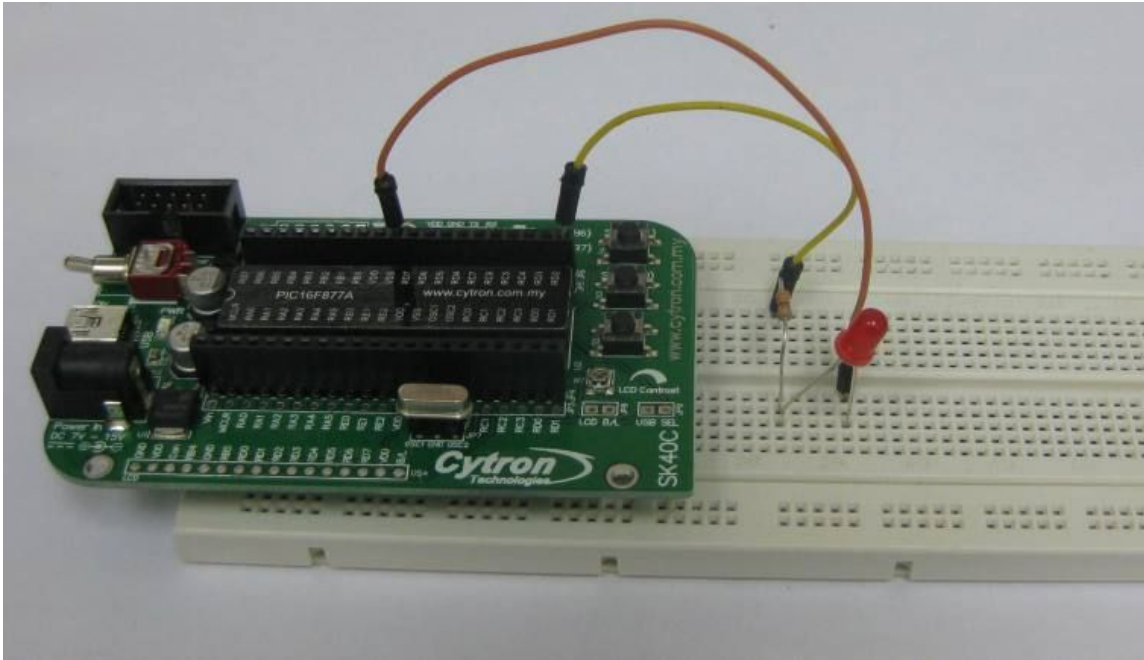- Connect PICkit 3 at JP10. Ensure the arrow on SK40C is same with arrow at PICkit 3.
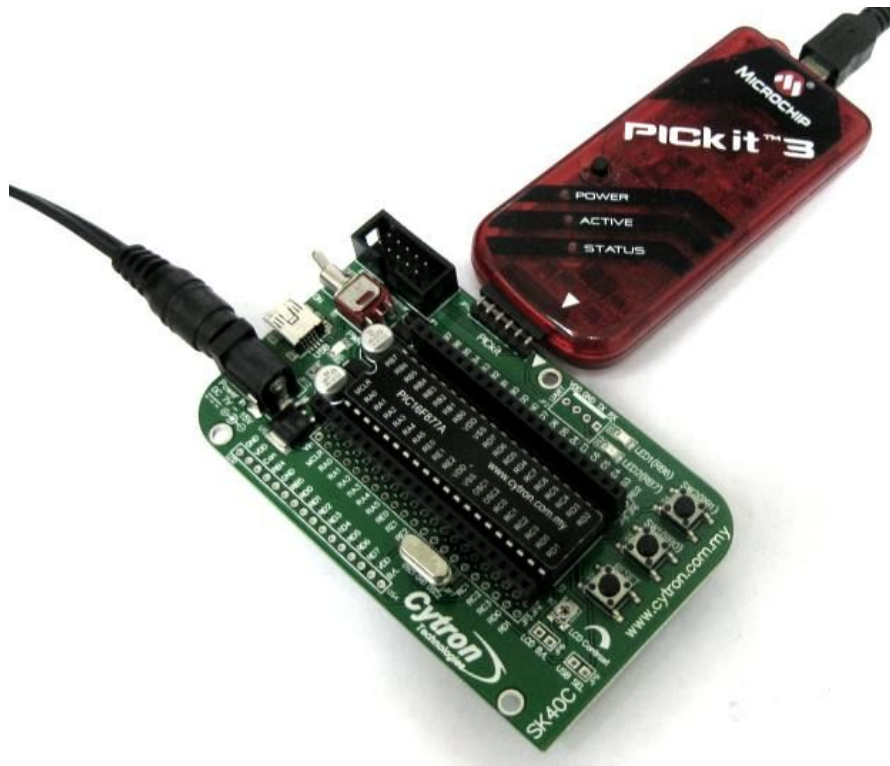
### 6.3 I/O Port (to electronic components)

I/O of the microcontroller can be access through few methods:

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

- Plug the I/O pins of the Start-up Kit onto a breadboard. Then, extend the I/O port to Input Output device using jumper wires.

- 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.
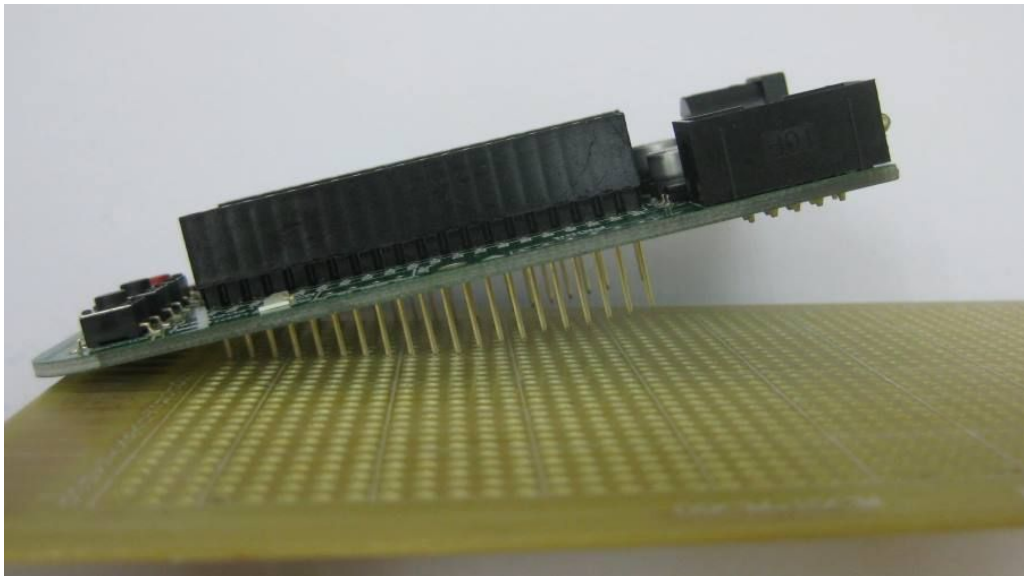
The 2x16 character LCD offers character display for embedded system. It can be used to display numerical information, text message and also special symbol. 2 x 16 LCD is not included in SK40C packaging list. User may purchase it separately.

- Solder 16-way header pin to the LCD.

- Solder LCD on to SK40C as shown. To enable LCD backlight (optional), solder JP8 to connect the LCD B/L.
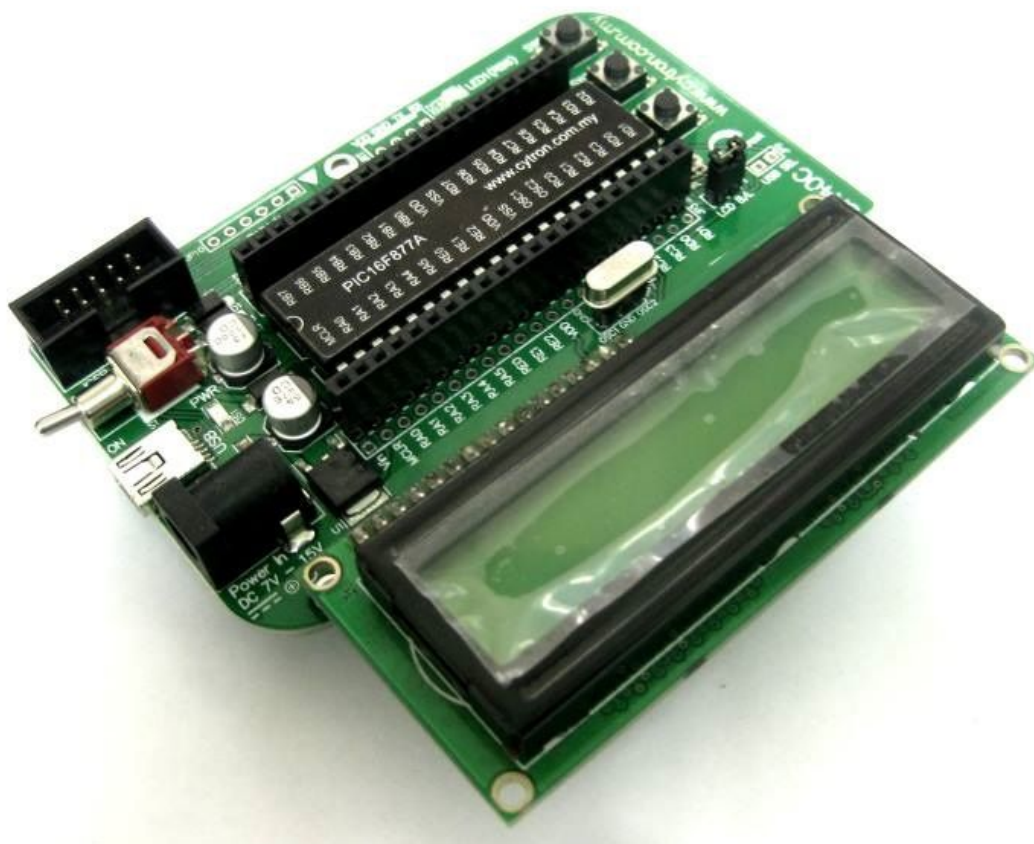
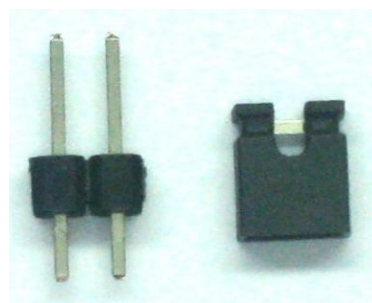Below shows the difference between LCD with backlight and LCD without backlight.
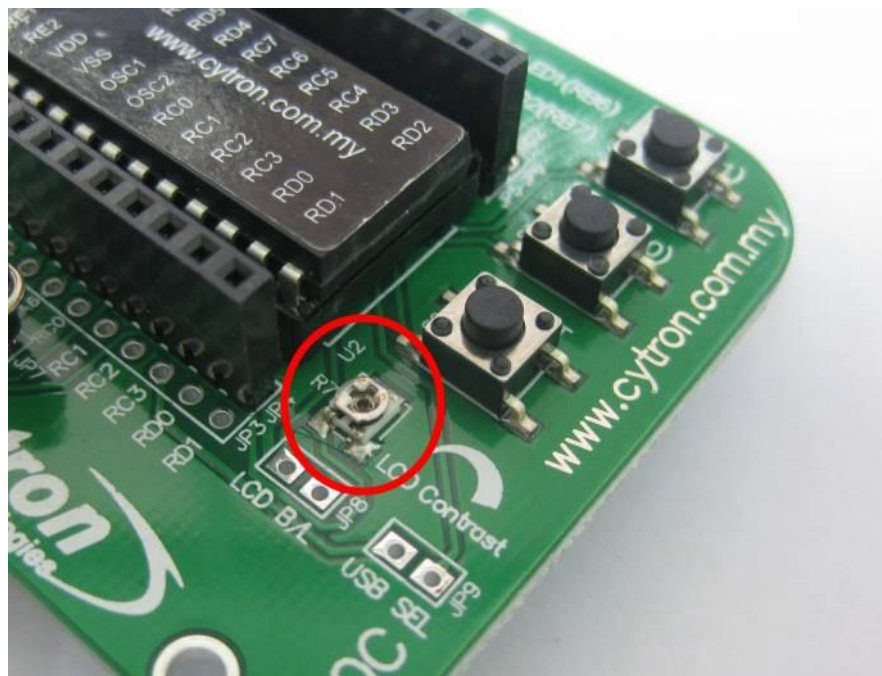

a) With backlight

b) Without backlight

- Beside, user may also use header pin and mini jumper to connect LCD B/L. Solder header pin at JP8 and use mini jumper to connect LCD B/L. Header pin and mini jumper is **not included** in SK40C packing list. Users need to buy separately.
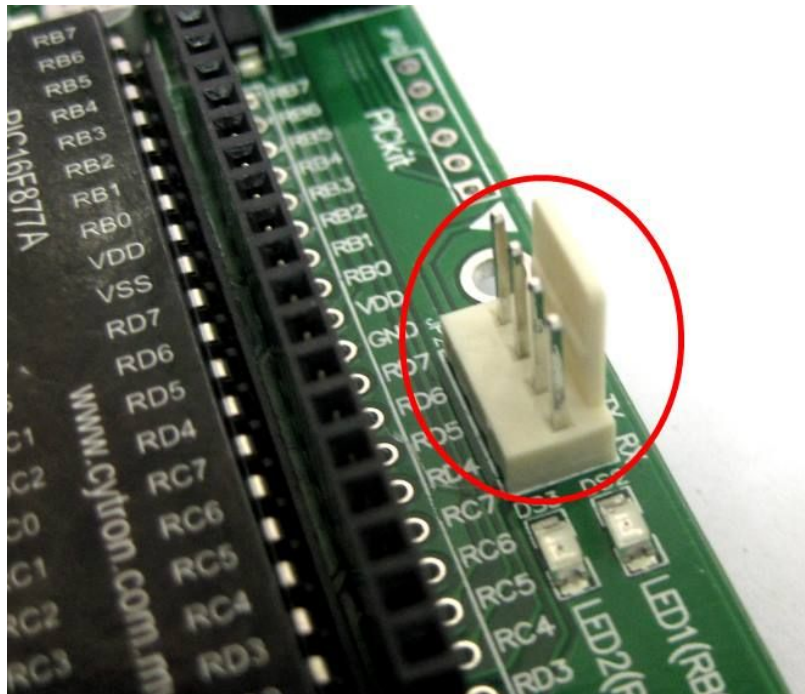
- Potentiometer is used to adjust the contrast of LCD. Turn left or right to adjust the contrast.

6.4 UART Interface

UART port is provided on SK40C for communication to microcontroller or computer. Users need to solder 2510-04 connector to utilize the UART. 2510-04 connector is not included on SK40C packaging list.

● Solder 2510-04 connector at UART as shown.

● Connect to other microcontroller using cable connector.

● Figure below shows an example connection of SK40C to external device via UART port. This example connection shows UART pins of SK40C (PIC16F877A) is connected to UART pins 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.
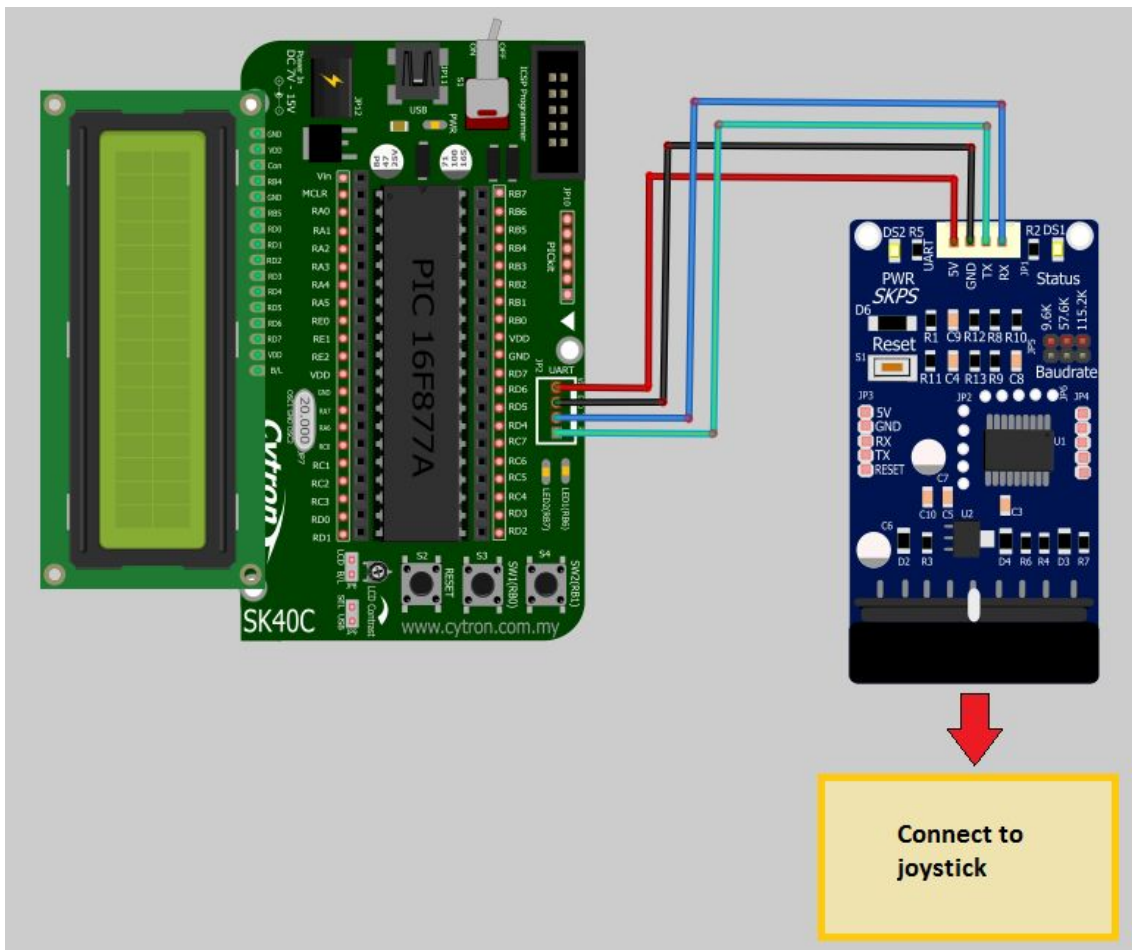
● Connect to computer/laptop using UC00A (communication between SK40C and PC). This sample schematic shows UART pins of SK40C (PIC16F877A) is connected to UART pins of UC00A. Tx and Rx pin of SK40C should be cross connected to Tx and Rx pin of UC00A. In other words, Tx pin of SK40C should be connected to Rx pin of UC00A, while Rx pin of SK40C should be connected to Tx pin of UC00A. No extra component is necessary between these connections. For details connection, please refer to sample schematic.
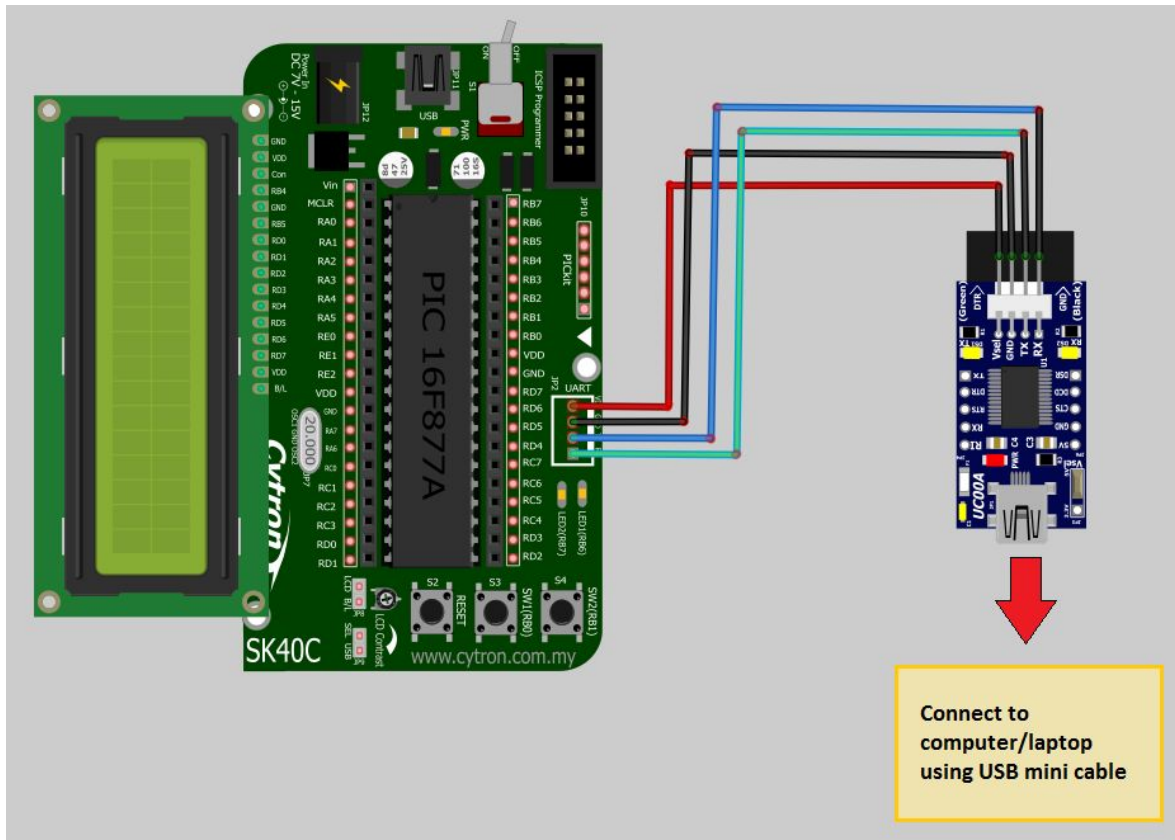
6.5 USB Interface

USB is another type of 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 has replaced RS232 in serial communication.

6.5.1 SK40C USB

USB data pins (pin 23, D- and pin 24, D+) are connected to a mini-B USB port on SK40C board for USB development. 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 framework/library to support USB on 8-bit, 16-bit and 32-bit MCUs. This framework/library is royalty free. Source code which called MCHPFSUSB Framework is also includes example projects. Download the appropriate USB stack for the target processor. It 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-B cable to SK40C USB connector. Connect the other end of USB mini-B cable to PC USB port. Make sure PIC used comes with USB peripheral.

● 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.
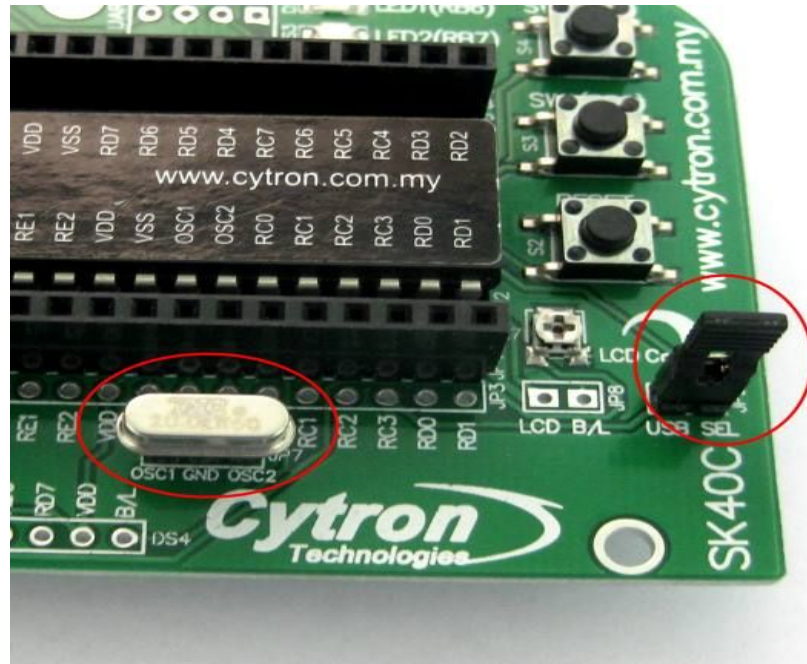
7. SOFTWARE

7.1 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 can always use this code for other USB microcontroller after doing some project modification. Loads the appropriate hex file to PIC by using the programmer (UIC00A/B). Please be reminded that 8-bit PIC USB microcontrollers in 40-pin PDIP package include: (By the time we develop the example hex)

- PIC18F4450
- PIC18F4455
- PIC18F4550
- PIC18F4458
- PIC18F4553

Cytron Technologies has provided all of PIC model USB Bootloader hex files inside the "SK40C HID Bootloader Firmware (Hex file)" folder as shown as below.
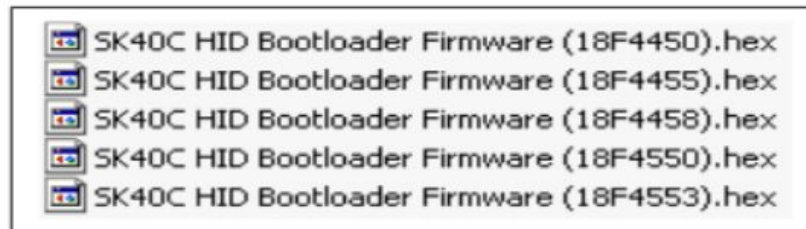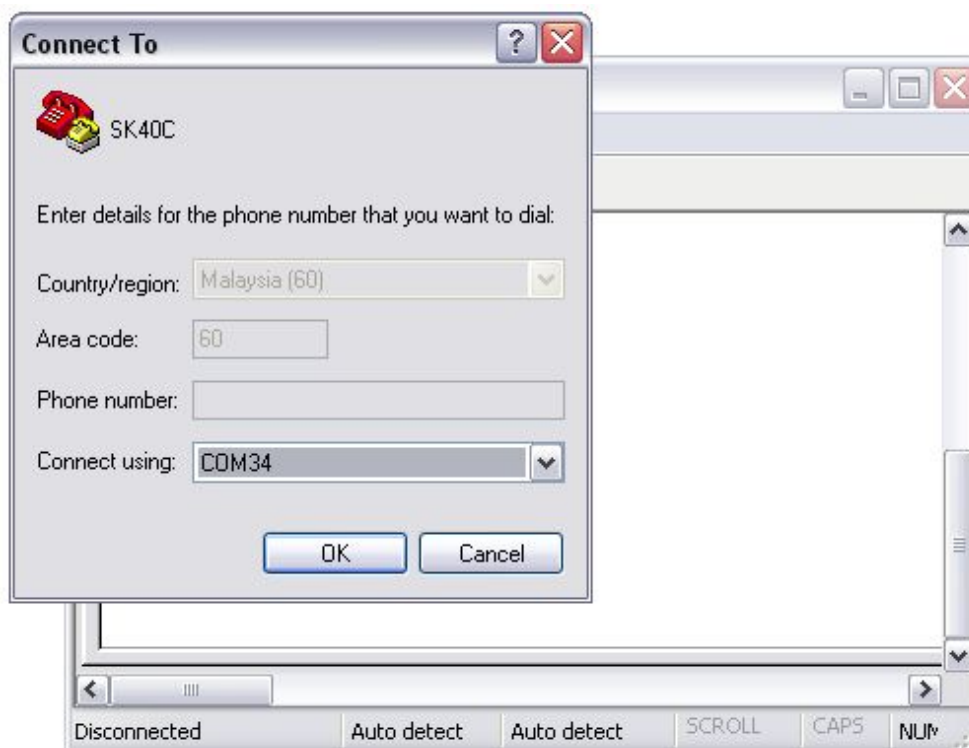
7.2 Setup for hyperterminal

This setup only valid for UART communication with computer using UC00A. It's not valid for USB at SK40C.

1. Open HyperTerminal. Enter a name and choose an icon for connection as picture below then click OK.
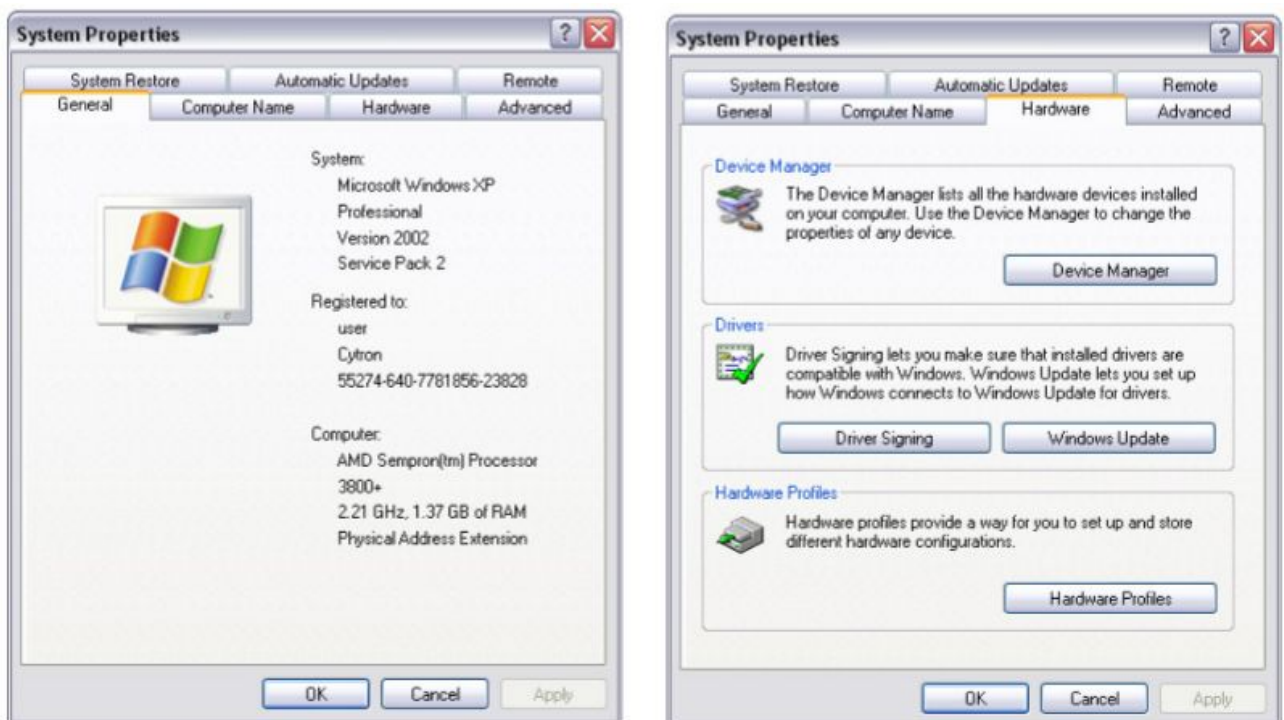

2. Select COM port

3. Please follow step (4) to (6) if the COM port number is not confirm.

4. Go to Start, right click on My Computer and choose Properties.

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


6. At Device Manager, choose (COM & LPT) and USB Serial Port COM will   be visible. As an example (shown in following figure), COM Port for UC00A 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.
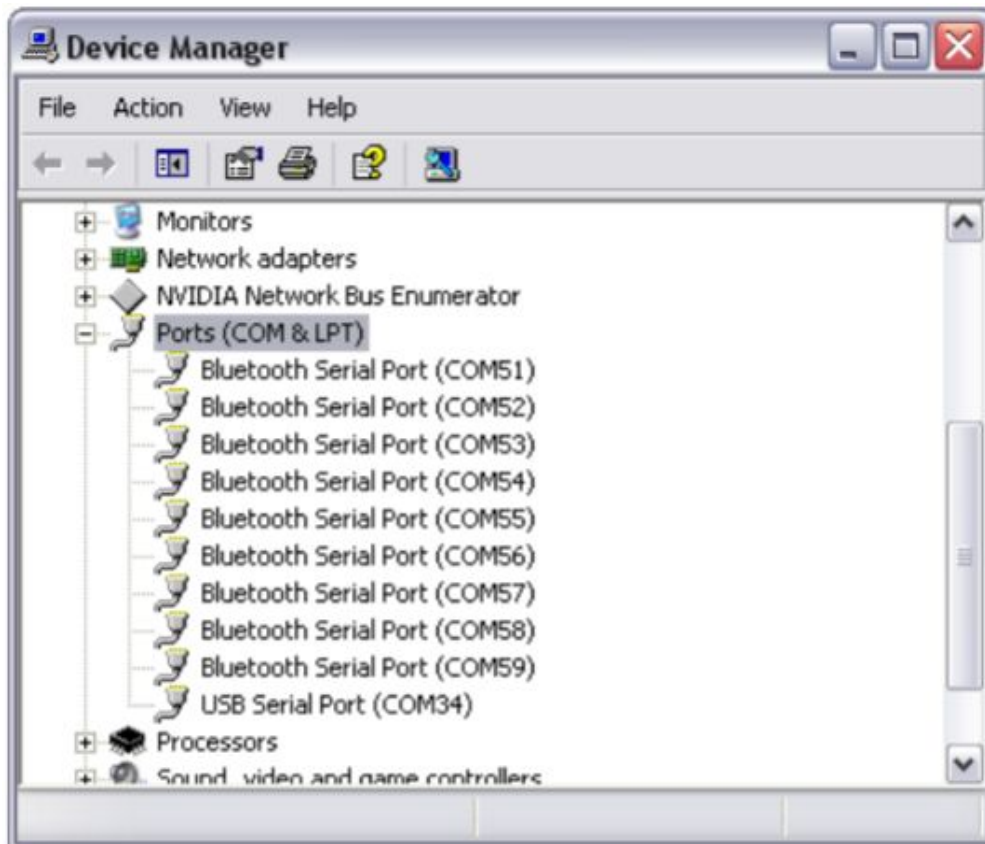
7. Set the "Port Setting" as picture below. Bits per seconds must be same with SK40C Baud Rate in programming. After finish setting, click Apply and then click OK.
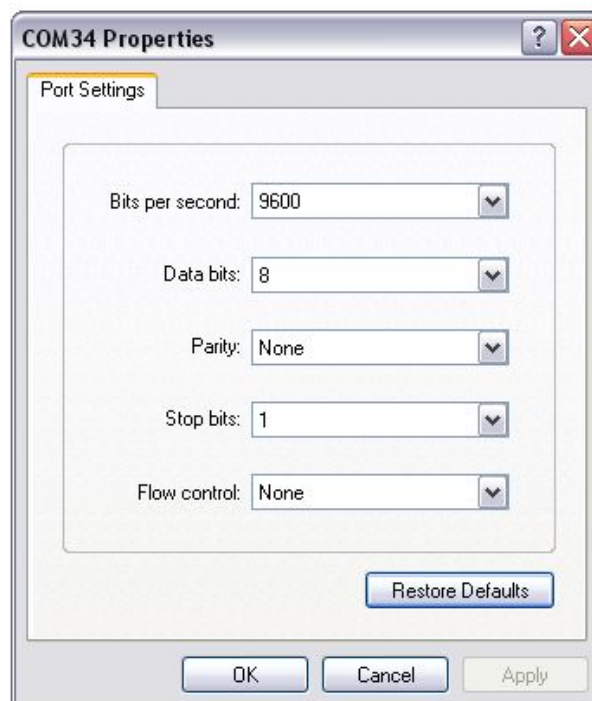
8. Click Properties button. 'SK40C' Properties will show. Choose Setting tab and click ASCII Setup. Click on *Echo typed characters locally* and then click OK. *Echo typed characters locally* is to display what is being typed on keyboard. User may click or unclick *Echo typed characters locally*.
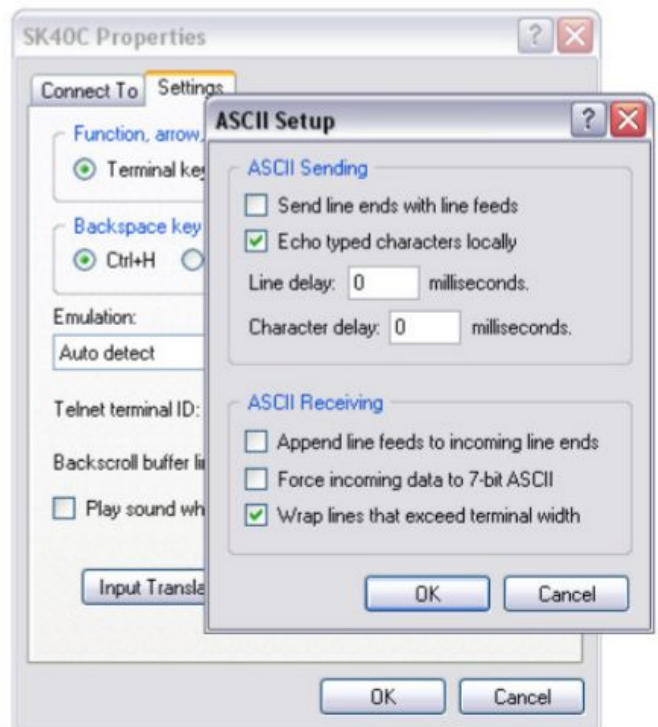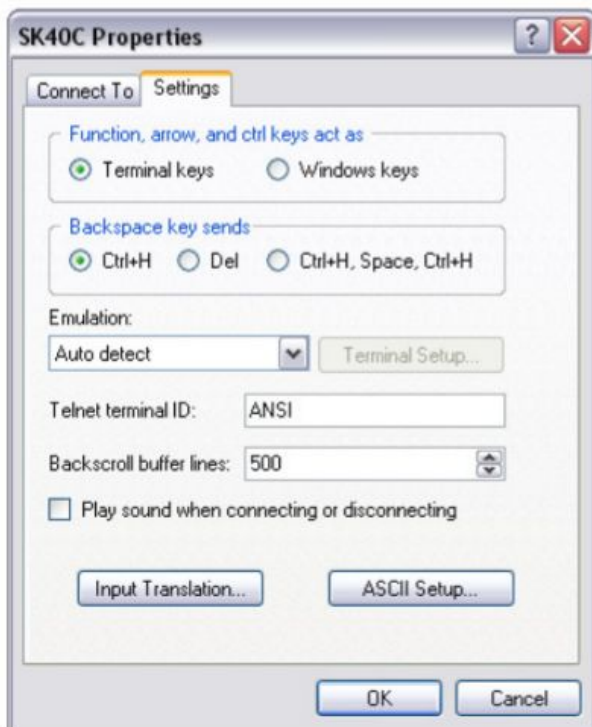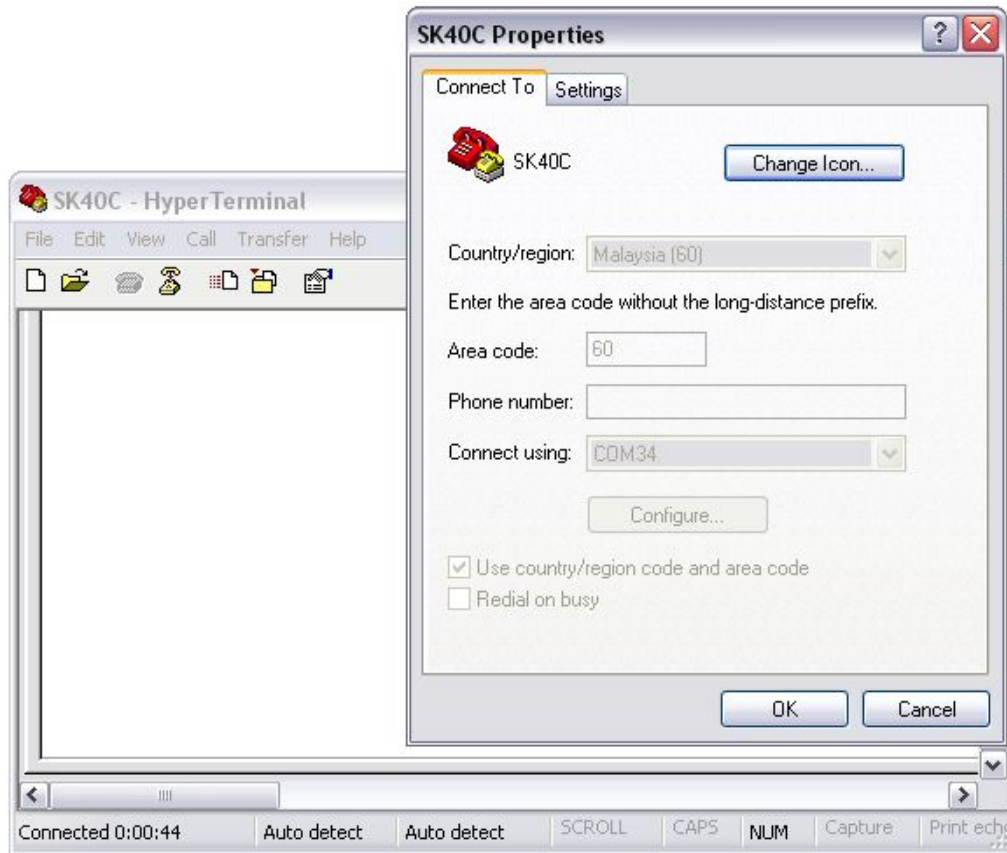
8. GETTING STARTED

SK40C is ready to be plug and use. 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.

8.1 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. Sample source code can be downloaded from SK40C product page. This sample source is provided for PIC 16F. Please refer UIC00A/B User's Manual to load hex code into PIC of SK40C.

LCD is not included in SK40C packing list. Please purchase it separately if displaying message is necessary. Please refer Section 6.3 for interface SK40C with LCD Display.

1. Plug in 40-pin PIC MCU. Make sure the PIC model is 8-bit (All PIC16F and PIC18F are 8-bit) and 5V power.
2. Connect Adaptor to SK40C DC Power Adaptor Socket. Connect UIC00A/B to ICSP programmer. Switch on toggle switch. Load hex code (LED_Blink.hex) into 40 pin PIC MCU using UIC00A/B. Please refer Section 6.1
3. LED1 and LED2 are blinking.
4. LCD Display will display "Cytron Tech." on 1st line and "SK40C" on 2nd line.

8.2 UART

UART (Universal Asynchronous Receiver Transmitter) can be used to communicate between:
- SK40C – Computer/Laptop
- SK40C – Microcontroller

UART to Computer/Laptop
UC00A is a USB to UART converter which can be used for UART communication between SK40C and Computer/Laptop. Please refer UC00A User's Manual for details. We have provided an example source code for UART communication between SK40C and Computer. This example source code is provided for PIC16F.

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 SK40C DC Power Adaptor Socket. Connect UIC00A/B to ICSP programmer. Switch on the power. Load hex code (UART_PC.hex) into 40 pin PIC MCU using UIC00A/B. Please refer Section 6.1
3. Connect UC00A to SK40C and Computer. Please refer Section 6.4 UART Interface for connection between SK40C and UC00A
4. Setup HyperTerminal. Please refer Section 7.2
5. After all settings are completed, user may now check the functionality of SK40C UART. Below show massage displayed in HyperTerminal if the example source code is used.
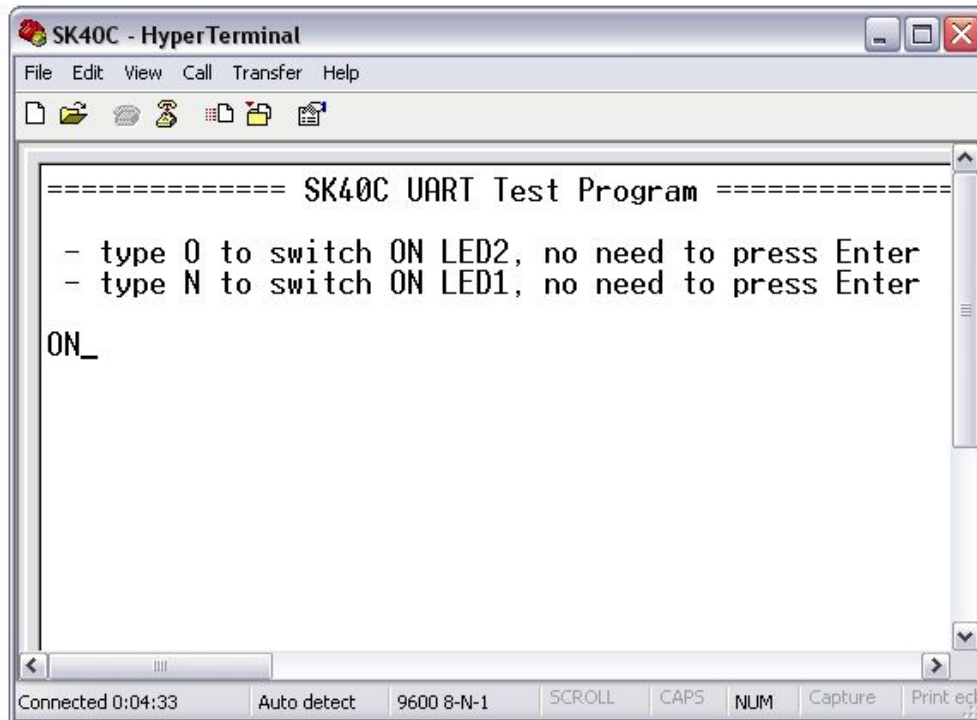
UART to Microcontroller

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. Please refer Section 6.4 UART Interface for example connection between SK40C and SKPS.
2. Sample source code is provided to show UART communication between SK40C and microcontroller (SKPS). User may download the source code in Cytron website under product page.
3. Connect Adaptor to SK40C DC Power Adaptor Socket. Connect UIC00A/B to ICSP programmer. Switch on the power. Load hex code (UART_SKPS.hex) into 40 pin PIC MCU using UIC00A/B. Please refer Section 6.1.
4. LCD will display "LEFT, RIGHT, UP and DOWN" if that button on PS2 Joystick is pressed.

8.3 USB

This section shows 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 SEL USB is connected (soldering). Please refer Section 6.5
2. Plug in 40-pin PIC MCU. Ensure that the PIC supports USB bootloader.
3. Connect Adaptor to SK40C DC Power Adaptor Socket. Connect UIC00A/B to ICSP programmer. Switch on the power. Load the hex file of SK40C HID Bootloader Firmware as mentioned in Section 7.1
4. After USB bootloader firm was loaded into PIC, unplug the UIC00A/B programmer. To enter bootloader mode, press and hold SW2 then connect the mini USB port on SK40C board to your PC, release SW2. Another way to activate the bootloader mode is to press and holds SW2, press and release RESET button without unplug the USB cable.
5. 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.


6. Open the "HIDBootloader.exe" file in 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. 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.


7. And this window will pop out and click "Open Hex File"
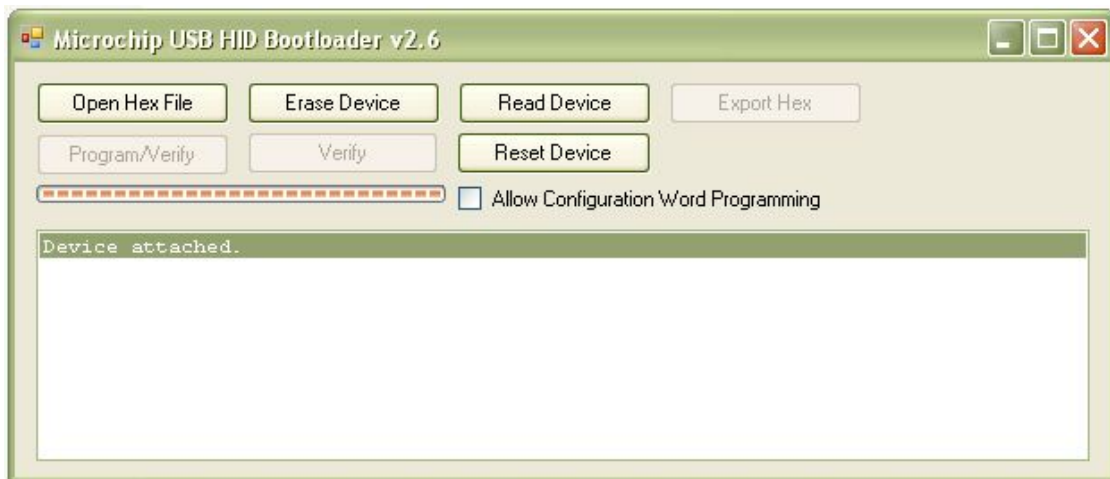
8. Search "SK40C 18F_USB Sample Program" folder which user has downloaded from website. There are 3 sample programs which are LCD Display, LED Blinking and UART. Click on LED Blinking folder.
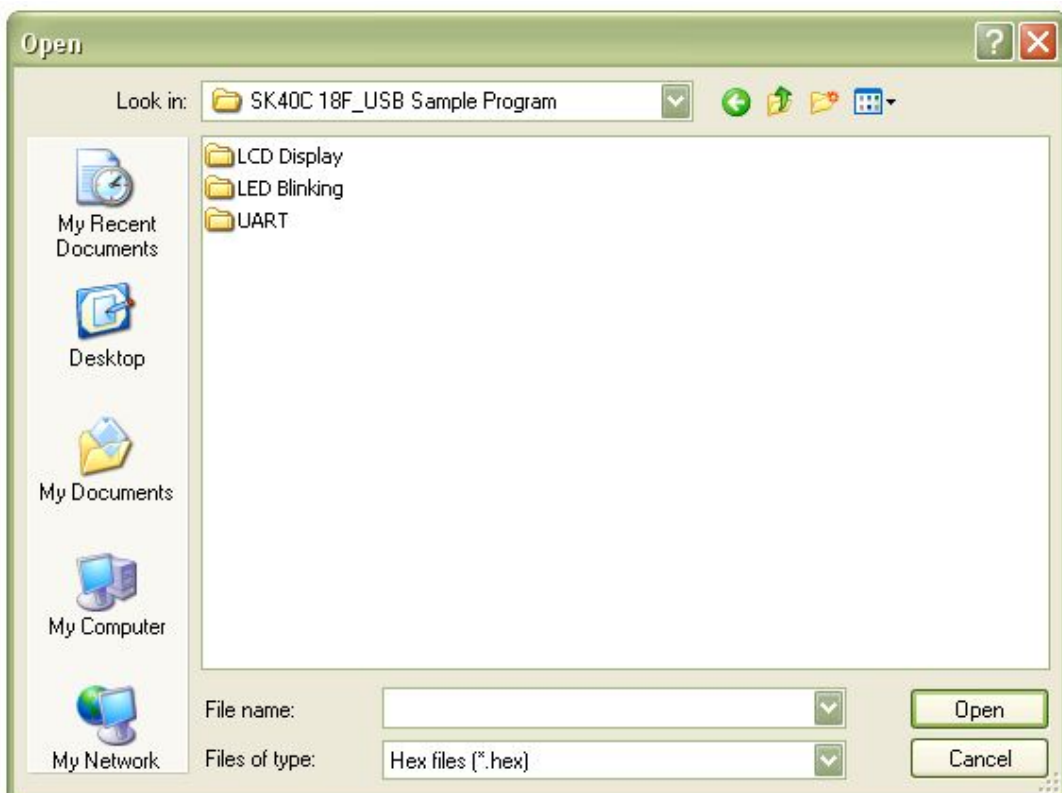
9. Select the given hex file "SK40C sample code (bootloader).hex" folder and click open. Note that the original sample hex file, "SK40C sample code (bootloader).hex" is for PIC18F4550.
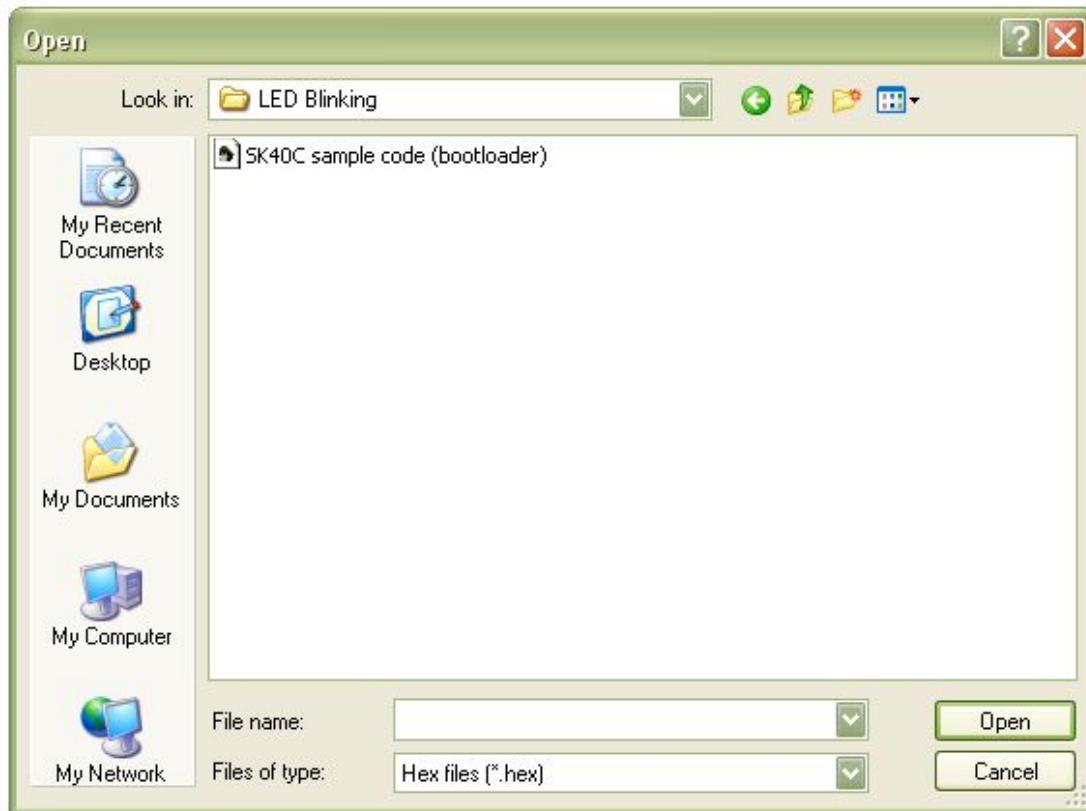

10. Click "Program/Verify" to load hex file to your PIC and programming status will be shown as below. Next, click "Reset Device" to run your program. LED1 and LED2 will blink like strobe on police car if "SK40C sample code (bootloader).hex" is loaded. LEDs will stop blinking if either SW1 or SW2 button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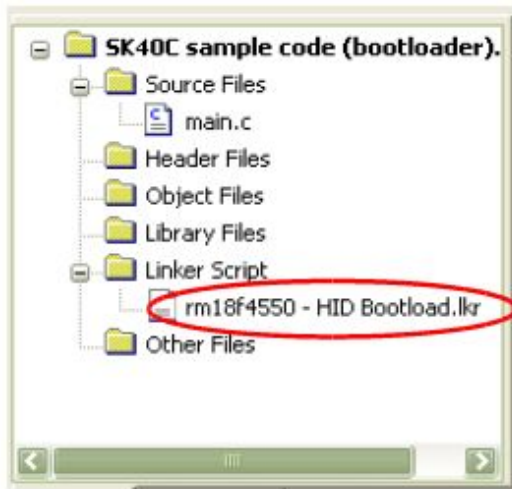

11. User need to do some modification for other USB PIC. Change the device by clicking Configuration>>Select Device as shown below.
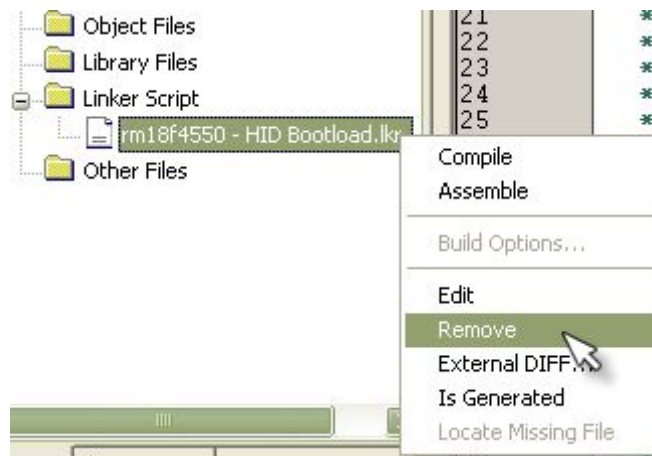
12. Choose decided PIC let say PIC18F4553 then click "OK".
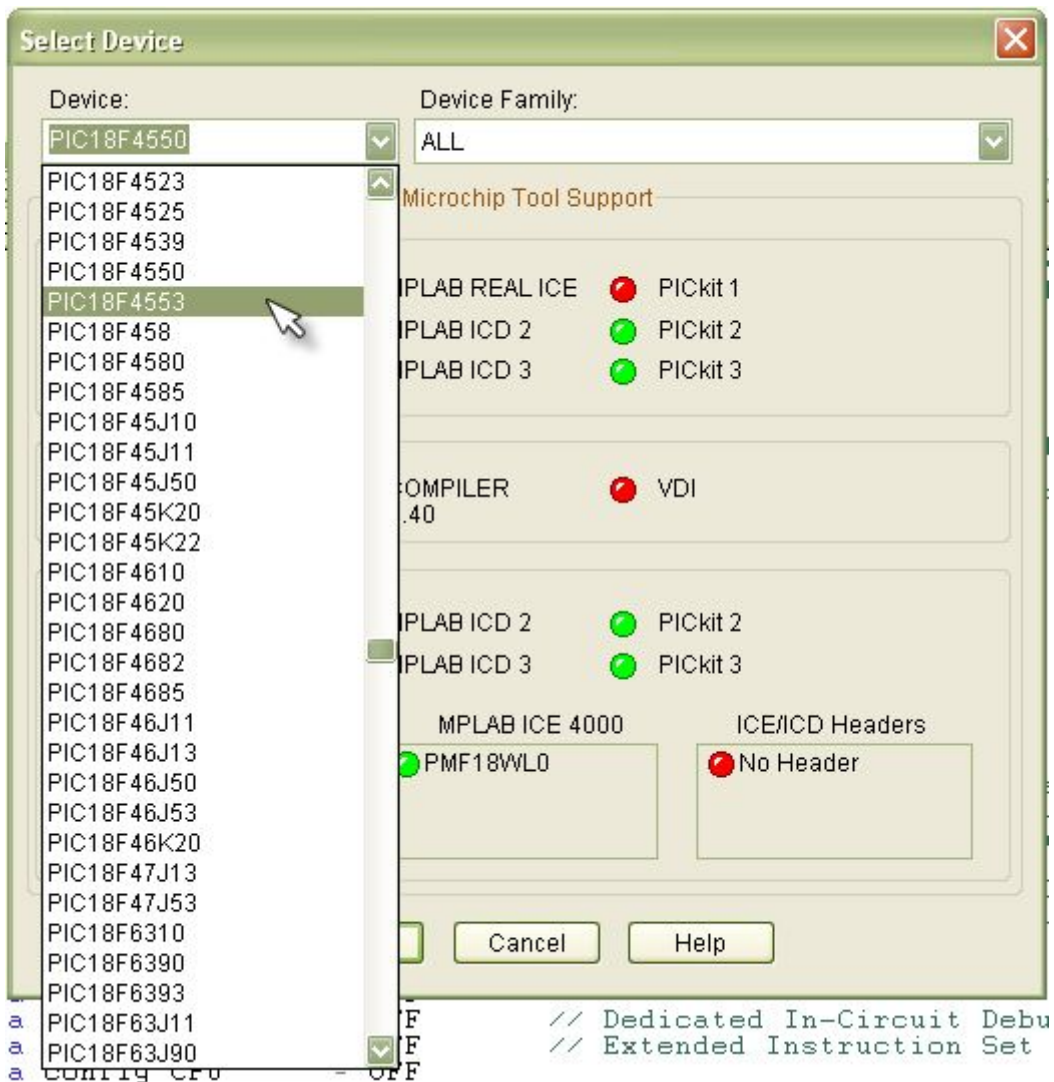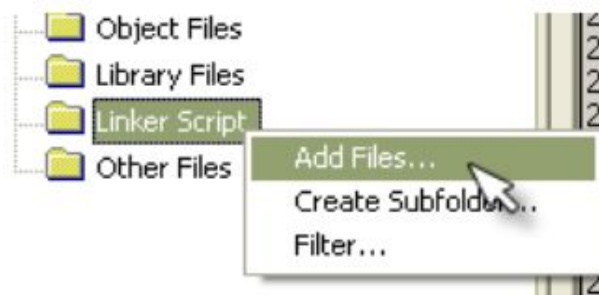

13. Edit the appropriate linker file. User MUST use the given remapped linker files for the application if bootloader is used.
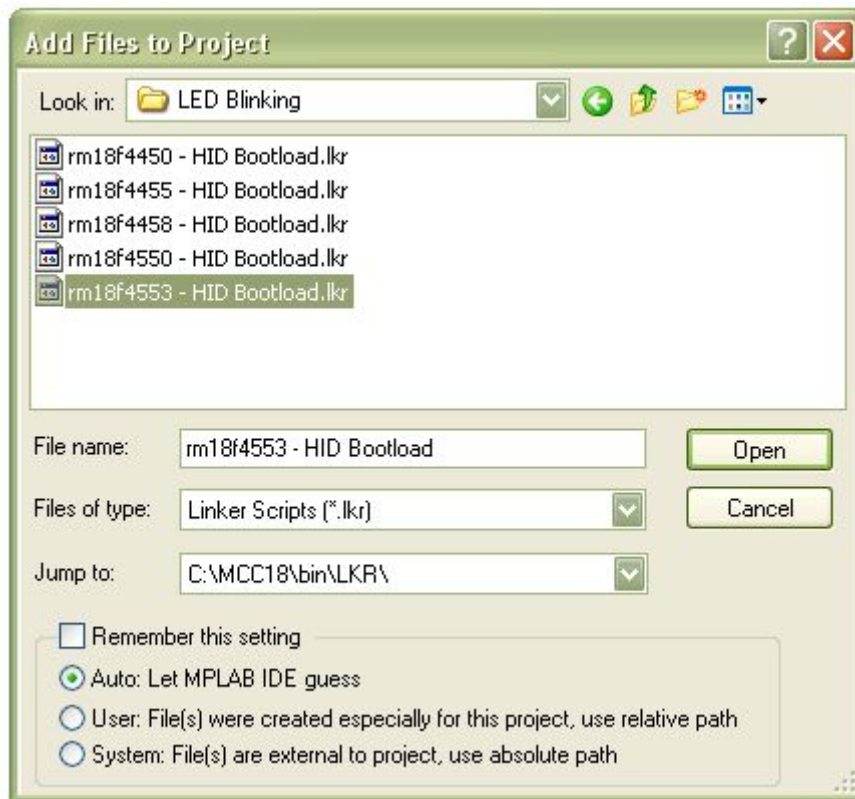
14. Right click the   linker file under Linker Script folder and remove it.

15. Right click the   Linker Script folder then click "Add Files"

16. This window will appears and search your file directory, select the appropriate linker file. All these linkers are special modified for USB bootloader.
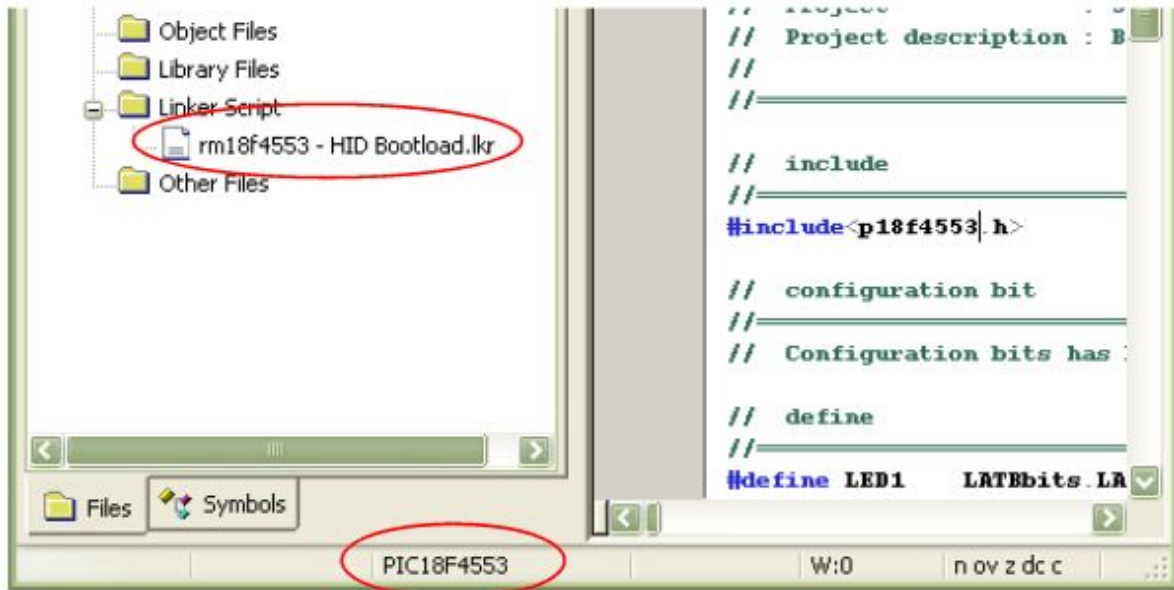

17. Lastly, do not forget to change the include file before rebuild it. User is free to edit the sample program.

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

19. 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.

9. WARRANTY

- Product warranty is valid for 12 months.
- Warranty only applies to manufacturing defect.
- Damaged caused by misuse is not covered under warranty
- Warranty does not cover freight cost for both ways.

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