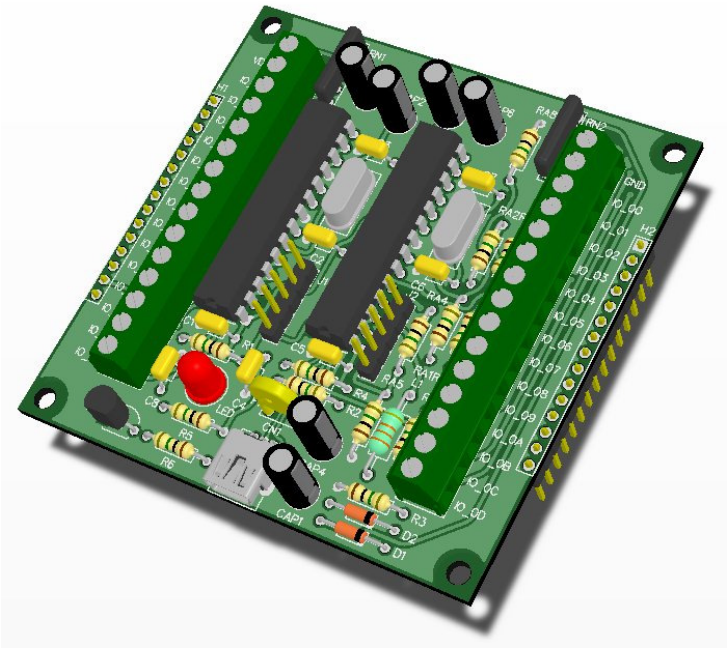
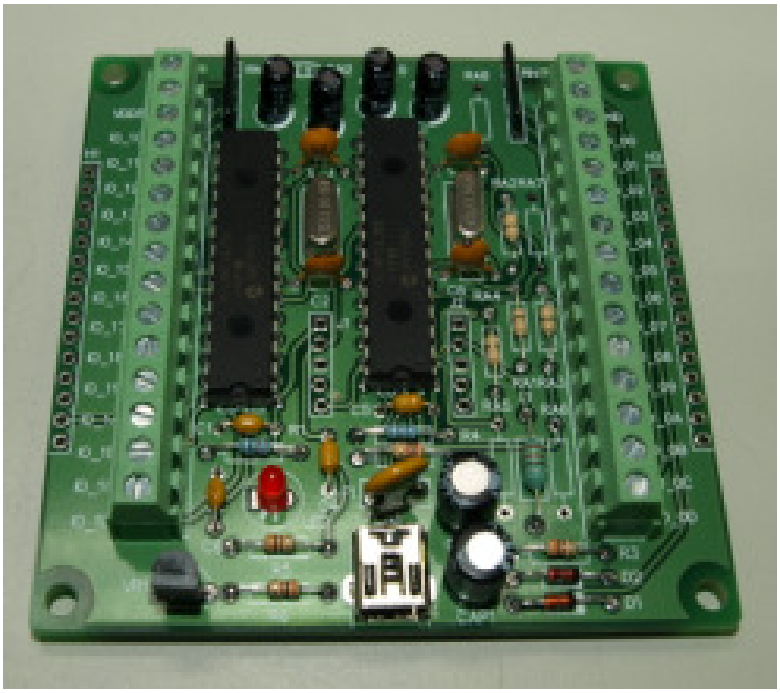
USB_IO_Plus
Data Acquisition Device
I/O & ADC & PWM(DAC) & Counter & UART





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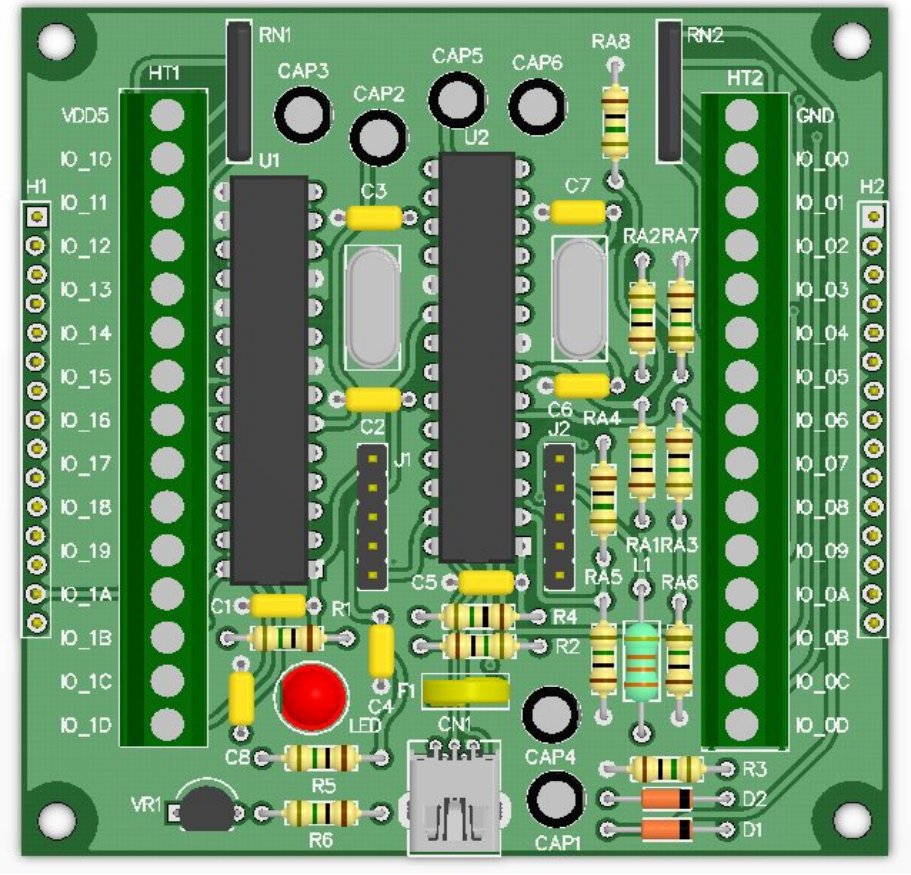
Features summary :

- ✓ Full-Speed USB 2.0 communication.
- ✓ Drivers available for Windows 2000/XP/Vista.
- ✓ Embedded command interpreter.
- ✓ 28 general purpose digital I/Os.
- ✓ 8 Analog Input Channels (10 bits ADC): ADC Range [0:1023].
- ✓ 4 Pulse Width Modulations: PWM Width Range [0:255].
- ✓ 4 Analog Output Channels: DAC Range [0:255].
- ✓ 2 Counters(16 bits Counter) : Counter Range [0:65535].
- ✓ 2 UART : TX0/RX0 and TX1/RX1 support.
- ✓ Powers from USB (5 Voltage, maximum 500mA) .
- ✓ Provide Visual Basic 6.0 Test Program Source Code. (VB 6 testing case)

USB data acquisition device control method is very easy for Windows XP / Vista operating system. The simplest way is through the virtual Com Port. Any existing software or programming environment that can send text string to a COM port will know how to talk to the USB data acquisition device. You can even perform simple tests with your favorite terminal emulator. The product needs assembled and soldered by yourself.

Six functional modules, I/O, ADC, PWM, DAC, Counter and UART are provided; the followings are the specifications for them.

USB Data Acquisition Device Pin definition:



IO Pin	Function	IO Pin	Function
IO_10	IO10/TX1	IO_00	IO00/TX0
IO_11	IO11/RX1	IO_01	IO01/RX0
IO_12	IO12/Counter1	IO_02	IO02/Counter0
IO_13	IO13	IO_03	IO03
IO_14	IO14	IO_04	IO04
IO_15	IO!5	IO_05	IO05
IO_16	IO16	IO_06	IO06
IO_17	IO17	IO_07	IO07
IO_18	IO18/ADC4	IO_08	IO08/ADC0
IO_19	IO19/ADC5	IO_09	IO09/ADC1
IO_1A	IO1A/ADC6	IO_0A	IO0A/ADC2
IO_1B	IO1B/ADC7	IO_0B	IO0B/ADC3
IO_1C	IO1C/PWM2	IO_0C	IO0C/PWM0
IO_1D	IO1D/PWM3	IO_0D	IO0D/PWM1

USB_IO Device Control Command Format:

✧ Read the version of the USB_IO device firmware.
~ver~ ……send to USB_IO
~VER:3.1~ ……Receive from USB_IO

✧ 28 Digital Input/Output Ports: **IO00~IO0D and IO10~IO1D**
~out00=1~ ……send to USB_IO (IO00='1')
~OK~ ……Receive from USB_IO
~out1A=0~ ……Send to USB_IO (IO1A='0')
~OK~ ……Receive from USB_IO
~in06~ ……Send to USB_IO
~in06=0~ ……Receive from USB_IO (IO06='0')
~in1A~ ……Send to USB_IO
~in1A=1~ ……Receive from USB_IO (IO1A='1')

~OUT0=00---------111~ ……Send to USB_IO
~OK~ ……Receive from USB_IO
Setup IO00='0', IO01='0', IO0B='1', IO0C='1', IO0D='1'.
'-':define don't care condition.
~OUT1=--1111--000---~ ……Send to USB_IO
~OK~ ……Receive from USB_IO
Setup IO12='1', IO13='1', IO14='1', IO15= '1',
IO18='0', IO19='0', IO1A ='0'.
'-':define don't care condition.

~IN0=--1111-----111~ ……Send to USB_IO
~in0=--0011-----010~ ……Receive from USB_IO
Input IO02='0', IO03='0', IO04='1', IO05='1',
IO0B='0', IO0C='1' and IO0D='0'. '-':define don't care condition.
~IN1=111---------11~ ……Send to USB_IO
~in1=001---------01~ ……Receive from USB_IO
Input IO10='0', IO11='0', IO12='1', IO1C='0' and IO1D='1'.
'-':define don't care condition.

✧ 4 Pulse Width Modulations(DAC function): **PWM0~PWM3**
Output Frequency=2.9KHz, PWM Width Range [0:255].
~pwm0=160~ ……Send to USB_IO (Width Range=160)
~OK~ ……Receive from USB_IO
~pwm2=009~ ……Send to USB_IO (Width Range=9)
~OK~ ……Receive from USB_IO
~pwm3=025~ ……Send to USB_IO (Width Range=25)
~OK~ ……Receive from USB_IO

✧ 2 Counters (16 bits Counter) : **Counter0 ,Counter1**

Counter Range [0:65535].

~ct0h~ ……Send to USB_IO

Clear Counter0 and to start measurement on falling edge (high to low) of incoming signal.

~ct0l~ ……Send to USB_IO

Clear Counter0 and to start measurement on rising edge (low to high) of incoming signal.

~ct1h~ ……Send to USB_IO

Clear Counter1 and to start measurement on falling edge (high to low) of incoming signal.

~ct1l~ ……Send to USB_IO

Clear Counter1 and to start measurement on rising edge (low to high) of incoming signal.

~crd0~ ……Send to USB_IO (Read Counter0 Value)

~C0=12345~ ……Receive from USB_IO

~crd1~ ……Send to USB_IO (Read Counter1 Value)

~C1=00567~ ……Receive from USB_IO

✧ 2 UART:**TX0/RX0 and TX1/RX1**

1 Start bit + 8 Data bits + 1 Stop bit.

The TX/RX Buffer = 32 bytes.

~rate0=2~ ……Send to USB_IO (UART0 Rate=9600 bps)

~OK~ ……Receive from USB_IO

~rate1=1~ ……Send to USB_IO (UART1 Rate=4800 bps)

~OK~ ……Receive from USB_IO

Parameters	1	2	3
bps	4800	9600	115200

~tx0=12345789~ ……Send to USB_IO (TX0: Send Data)

~OK~ ……Receive from USB_IO

~rx0~ ……Send to USB_IO (RX0: Receive Data)

~RX0=123456789~ ……Receive from USB_IO

~tx1=abcdefg~ ……Send to USB_IO (TX1: Send Data)

~OK~ ……Receive from USB_IO

~rx1~ ……Send to USB_IO (RX1: Receive Data)

~RX1=abcdefg~ ……Receive from USB_IO

✧ 8 Analog Input Channels: **ADC0~ADC7**

10 bits ADC, The ADC Value Range [0:1023]. The ADC input maximum sample rate is 1000 per/second.

~adc3~ ……Send to USB_IO

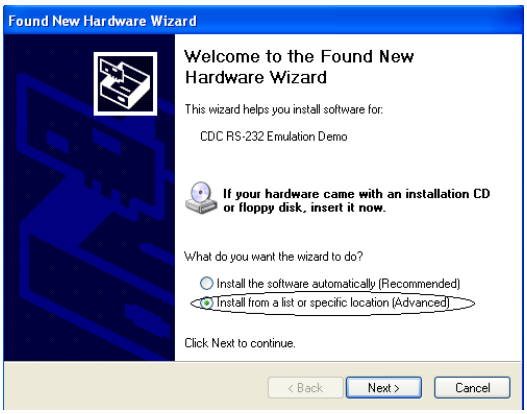
~A3=0256~ ……Receive from USB_IO

~adc5~ ……Send to USB_IO

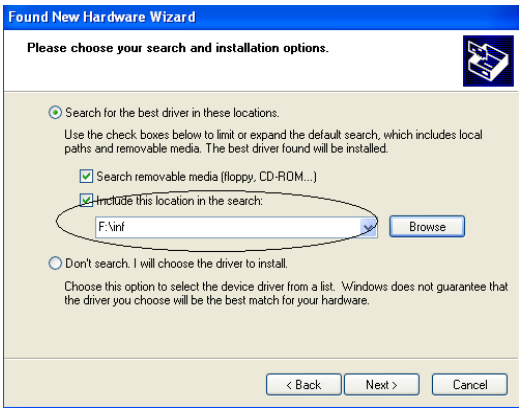
~A5=1023~ ……Receive from USB_IO

Installation drivers :

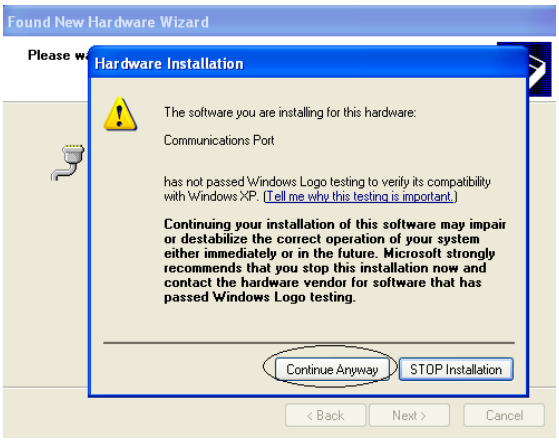
Plug USB data acquisition device into USB port; if your OS is Windows, it will be detected automatically.You will see a pop-out window as the picture shown below.Click on “Install from a list or specific location”.



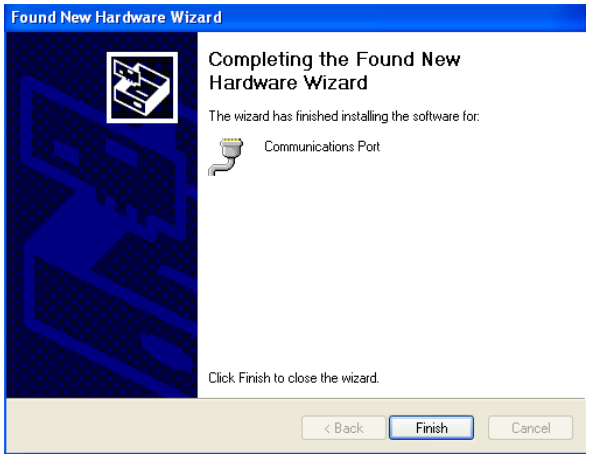
Set the installation path to CD_ROOT₩inf



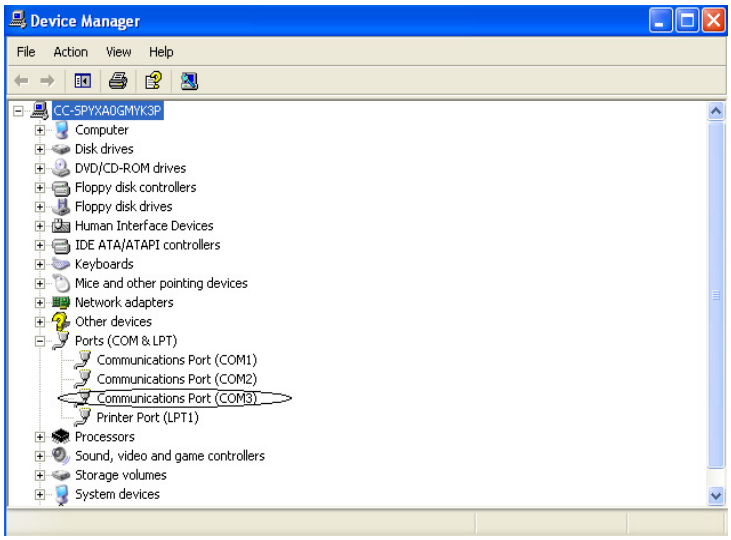
A security alert would come out; just click on “Continue Anyway”



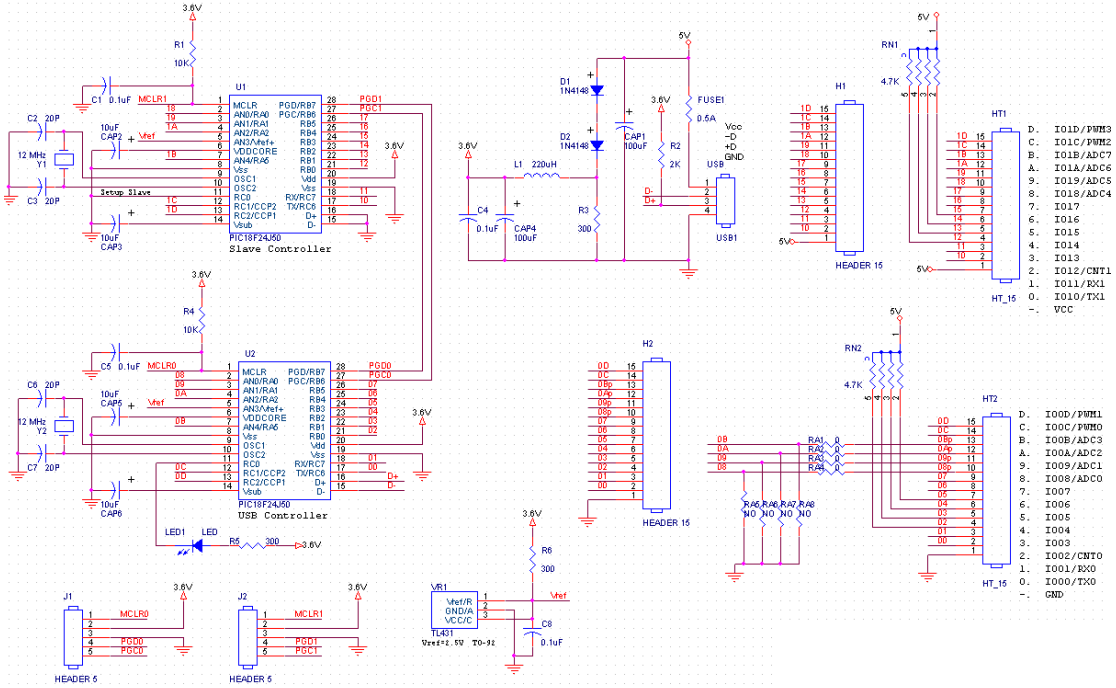
The window will appear after the hardware installed done.



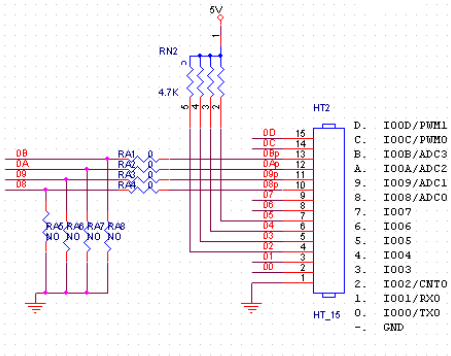
In Device Manager, you will see it. Please refer to following figure.



USB_IO data acquisition device circuit:



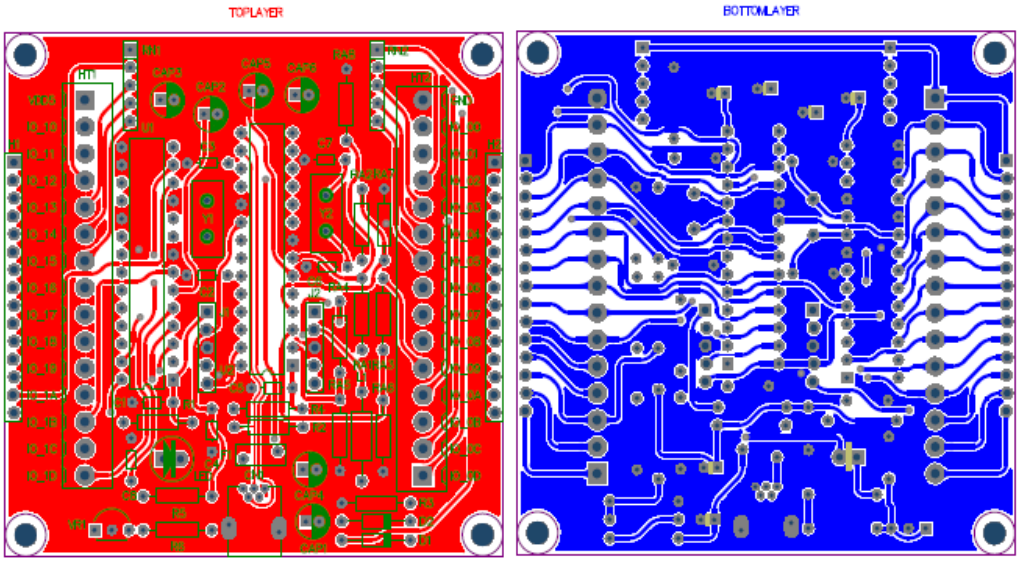
The 8 analog input channels (ADC0~ADC7) reference voltage is 2.5V. The analog input of ADC0 ~ ADC3 are resistor dividers. It means that you can control the ratio of resistor, manually. For example, RA1/RA8=10k/10k and the analog input voltage equals 2.5V, the ADC3 reads 0512. The analog input voltage equals 5V, the ADC3 reads 1023.(For a 10-bit ADC, the range is 0000 - 1023).



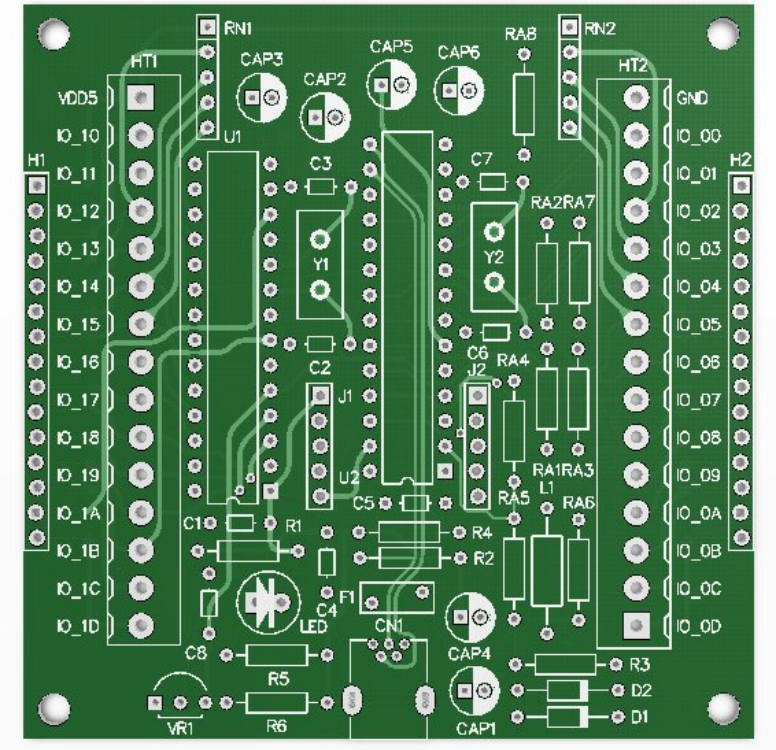
The pwm function makes it very simple to generate a programmable control voltage. It is also possible to use the pwm outputs without any filtering, the pwm output connected directly.

A simple R-C filter will generate a clean, linearly varying analog voltage, and by changing this voltage at regular intervals, it is also possible to generate arbitrary waveforms.

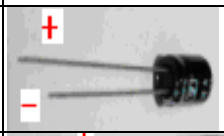
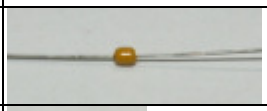
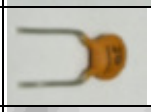
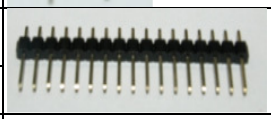
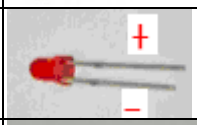
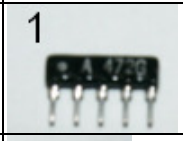
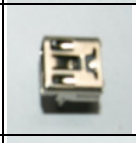
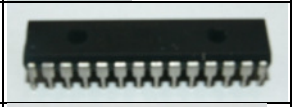
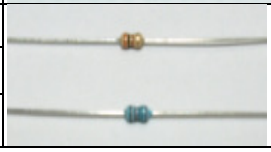
USB data acquisition device PCB:

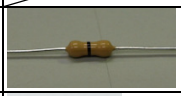
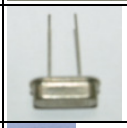
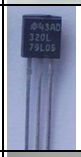
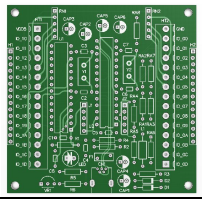


USB data acquisition device outline:



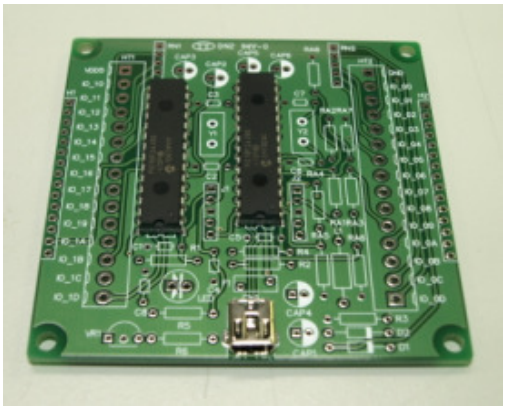
USB data acquisition device the parts list:

	Name	Spec.	Note	Entity picture
1	CAP1,CAP4	100uF	Capacity (Attention polarity)	
2	CAP2,CAP3, CAP5,CAP6	10uF	Capacity (Attention polarity)	
3	C1,C4,C5,C8	0.1uF	Capacity	
4	C2,C3,C6,C7	20P	Capacity	
5	D1,D2	1N4148	Diode (Attention polarity)	
6	FUSE1	0.5A	Polymer Resettable Fuse	
7	H2,H1	HEADER 15	None	
8	J1,J2	HEADER 5	None	
9	HT2,HT1	Terminal Block Connector		
10	LED1	LED	DIP LED 3mm (Attention polarity)	
11	L1	220uH	DIP inductance	
12	RN1,RN2	4.7K ohm	DIP 5P4R resistance (Attention Pin 1)	
13	USB1	USB	Mini USB Connector	
14	U1,U2	PIC18F24J50	USB Controller	
15	R4,R1	10K ohm	1/8W resistance	
16	R3,R5,R6	300 ohm	1/8W resistance	
17	R2	2K ohm	1/8W resistance	

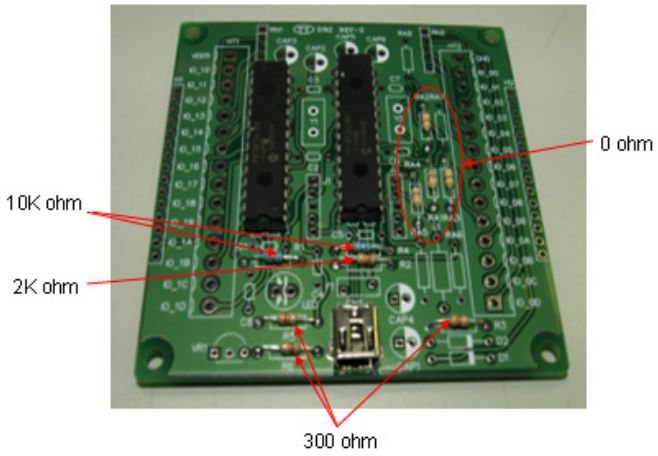
18	RA5,RA6, RA7,RA8		None	
19	RA1,RA2, RA3,RA4	0 ohm	1/4W resistance	
20	Y1,Y2	12 MHz	Quartz crystal	
21	VR1	TL431(LM431)	Voltage Reference	
22	USB Line		Mini USB Line	
23	PCB		PCB	

Steps for installation the components of USB data acquisition device:

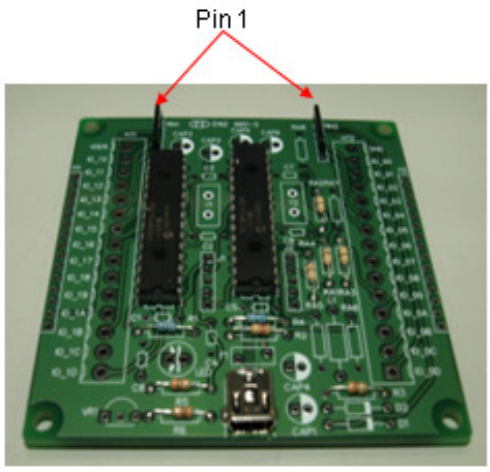
1. Assemble the USB connector and micro-controller U1 and U2.



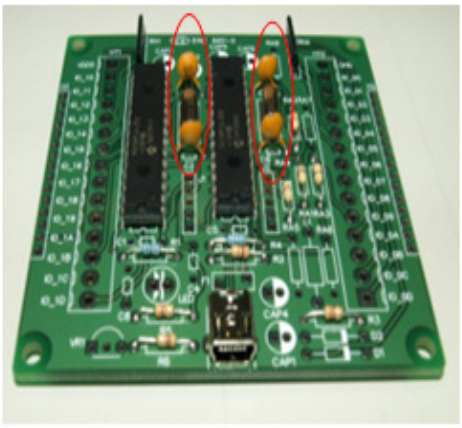
2. Assemble resistance R1,R4(the 10K ohm), RA1,RA2,RA3,RA4(the 0 ohms), R2(the 2K ohm), R3,R5,R6(the 300 ohm).



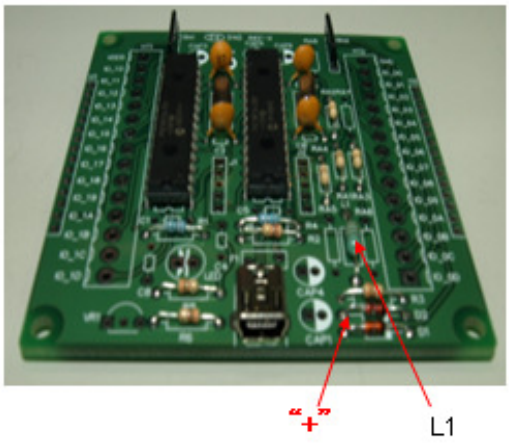
3. Assemble resistance RN1,RN2 (the 4.7K ohm, attention installs Pin 1).



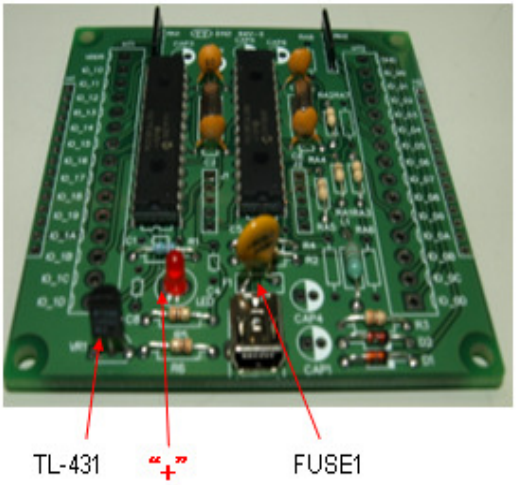
4. Assemble quartz crystal Y1,Y2(12MHz), C2, C3, C6,C7 (capacity 20pF).



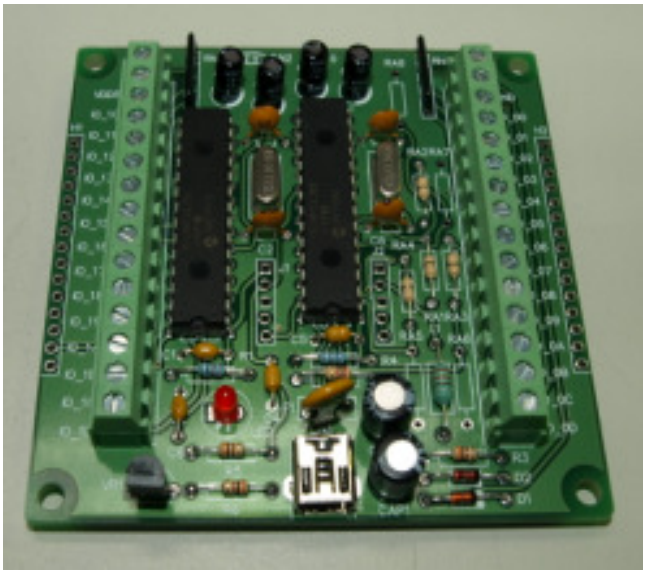
5. Assemble D1 and D2(the 1N4148 diode, attention polarity) and inductance L1(220uH).



6. Assemble LED1 (LED, attention polarity). polymer resettable fuse FUSE1(0.5A) and VR1(TL431).



7. Assemble capacity CAP1, CAP4 (100uF, attention polarity), CAP2, CAP3, CAP5, CAP6 (10uF, attention polarity), C1, C5, C8(0.1uF), and Terminal Block Connector.



Visual Basic 6.0 Test Program：