

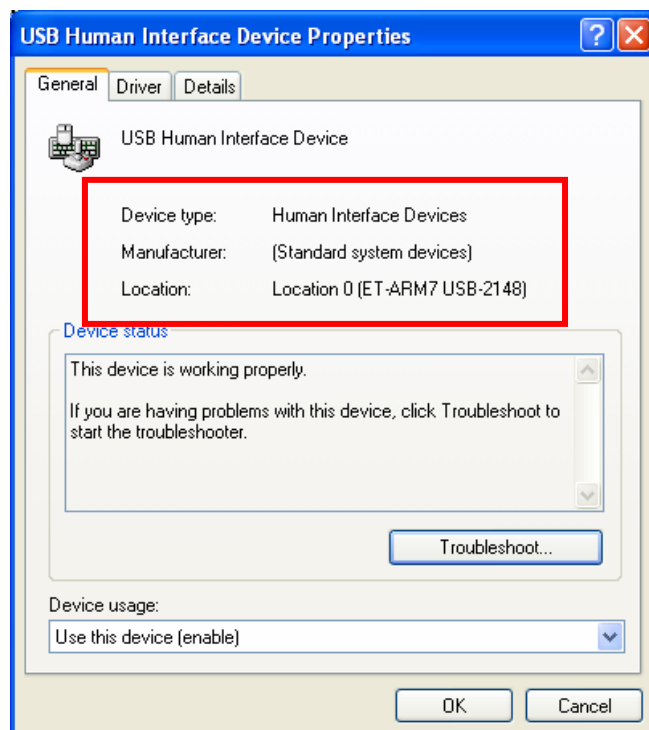
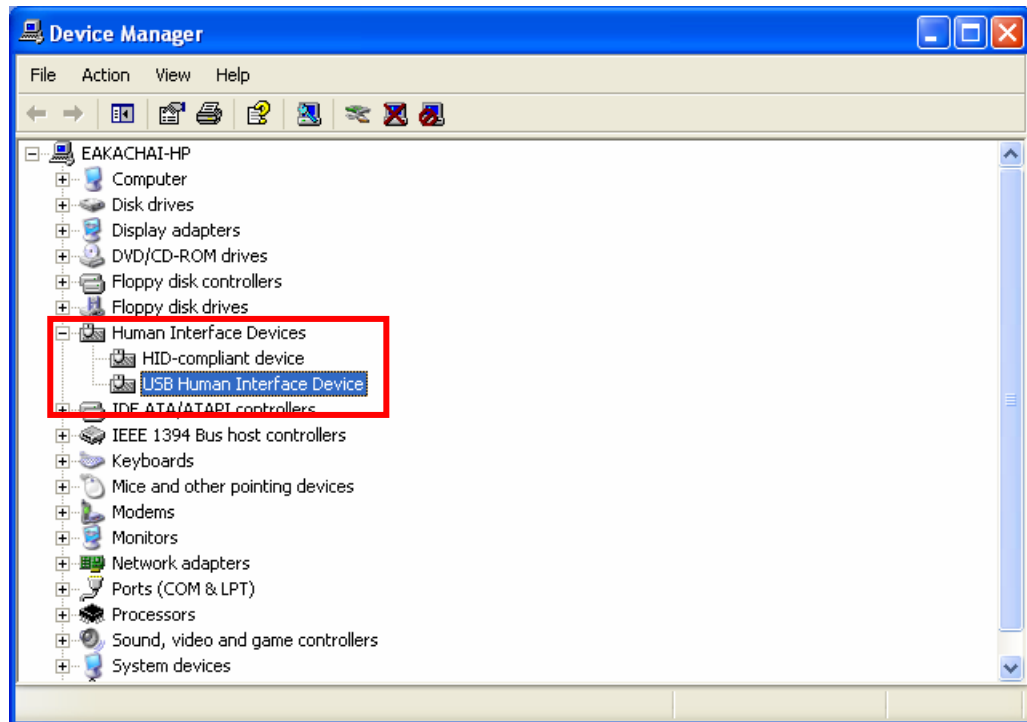
Example of using USB of LPC2148 from ETT

The example to application USB of LPC2148 with Board "CP-JR-ARM7 USB-LPC2148" from ETT, we recommend an example of using USB as USB Control I/O type to control operation of I/O internal board. In this case, we use HID Class to test connection Hardware system as follows.

- 14 Bit Input Logic (Push Button Switch Active "0")
 - o Use GPIO1[16..23] and GPIO0[2..7], we maybe use 4 Push Button Switch that is internal board to be tester device or maybe use 2 Board "ET-TEST 10P/INP" to be tester device.
- 4 Channel Analog Input (10 Bit ADC = 0-3V3)
 - o Use GPIO1[25,28,29,30], we can use Volume 1-4 that is internal board to be tester device. We must connect cable from GPIO0[25,28,29,30] into Volume VOL[1..4] respectively.
- 15 Bit Output Logic (LED Control Active "0")
 - o Use GPIO0[8..15] and GPIO0[16.22], we maybe use 4 LED that is internal board to be tester device or maybe use 2 Board "ET-TEST 10P/OUT" to be tester device.
- 1 Bit Mini Speaker (Beep)
 - o Use GPIO1[24], we must connect cable from P1[24] into SPK1 to test.
- 1 Character LCD Display (16 x 2)
 - o Use GPIO1[25..31], we can interface LCD with Connector CLCD of board instantly.
 - o If we do not want to interface LCD Display while testing operation, must interface signal D7 of LCD (GPIO1[31]) into GND, otherwise the Board can not run.

For testing operation of board, we should download Hex File named **"ET_USB_HID_DEMO1.HEX"** into board, reset board and then interface cable of USB between board and USB-HUB of computer PC. Remember, we must interface LCD monitor with board. If we do not interface LCD Display, while testing operation we must interface signal D7 of LCD (GPIO 1[31] into GND otherwise board can not run. After connected USB cable completely, if everything is correct, the green LED for displaying LINK status of USB is in status ON and Windows will detect the connection between USB Device that is HID Class type is added into computer PC. We can detect the result of the connection by using Device Manager; click **"Control Panel**

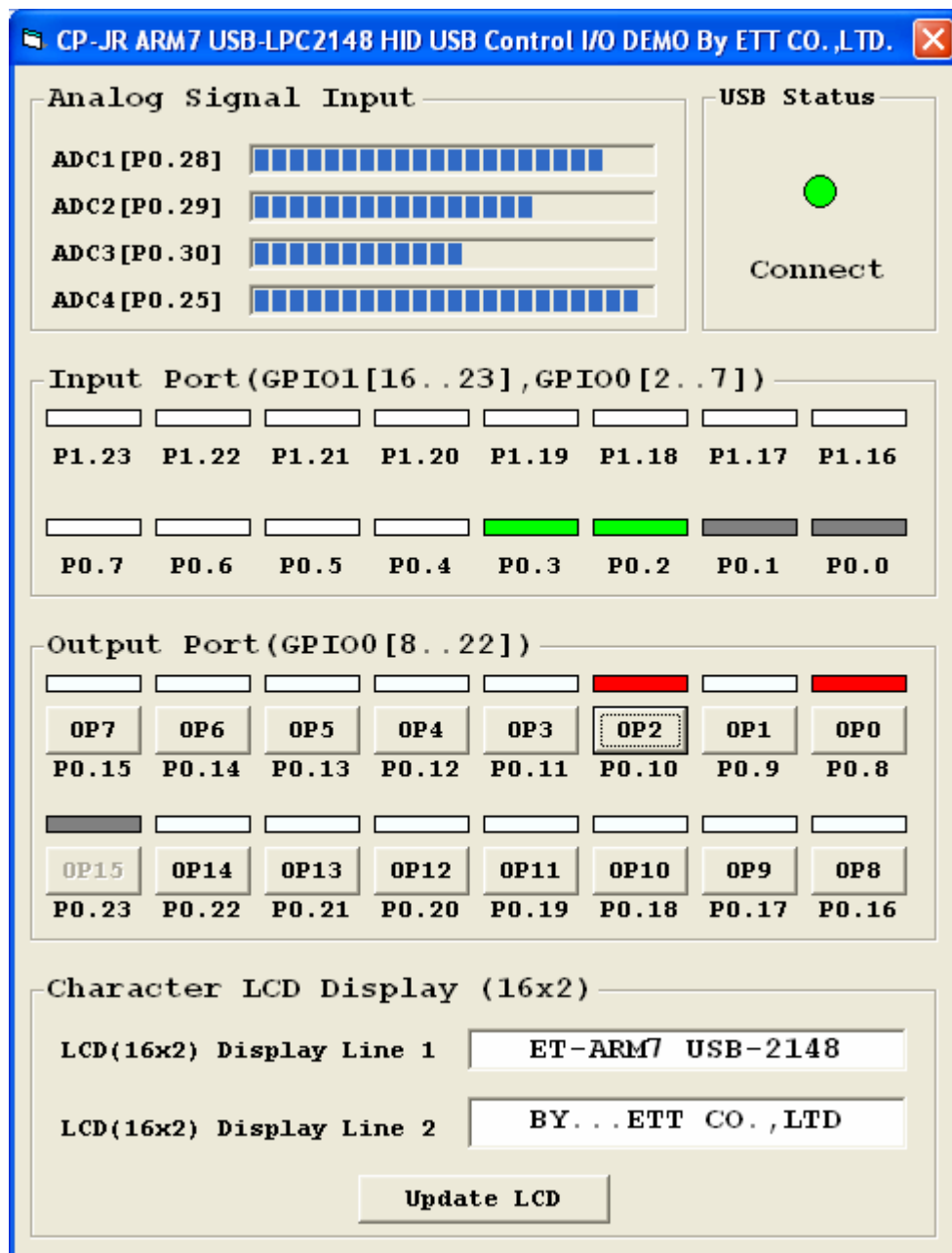
→ **System → Hardware → Device Manager**” as in the picture below.



*****Note***** If we have already connected cable but it is an error as **"USB Device Not Recognized"**, must check the connection of LCD Display with Board are correctly or not. If we do not want to use LCD, during testing we must interface signal D7 (GPIO1[31]) at Connector of LCD internal Board with GND of board.

To test operation of board

We use program **"ET_HID_USB2148_DEMO_VB.EXE"** to be tester, when we command running program, it will be look like these.



Show feature of program for testing operation of USB.

The Operation of Program Tester

1. When we command running program, it will be Beep for a time and a green LED that displays status of connection between USB and computer PC is in status ON in the blank of USB Status.
2. We can test operation of ADC by adjusting Volume VOL [1..4] to input Voltage value into ADC and test operation. Notice, default values in Progress Bar will be changed follows adjustment of all 4 Volume.
3. We can test operation of all 14 Bit Input by pressing Switch. We can see status Input is changed to be green color instantly when switch is pressed.
4. We can test operation of all 15 bit Output by click Button OP0-14. Every time that we click button, it will be Beep for a time and status of LED is changed to be reverse.
5. We can test operation of LED by typing or rewriting message in the blank of received message with 16 characters per blank. When we type preferred character completely, click button **Update LCD** and we can notice that LCD Display will display message that we have already typed instantly.

Program of Board "CP-JR ARM7 USB-LPC2148"

This function of USB that is recommended for testing operation of USB, it is written from the sample "LPC2148_USBHID" of Keil that is used with development set version "MCB2140" of Keil. Operation of program is developed to be suit with Hardware system that is internal Board "CP-JR ARM7 USB-LPC2148". We can summarize operation of program as follows;

- Configure the connection of USB as USB Link Mode and use Power Supply from Bus Power = 400mA
- Configure size Packet of End Point as 64 Byte type
- Configure Class as HID type by using Non Protocol that has 1 Interface (Interface Number 0)
- Use Interrupt Transfer and configure Scan Time as 1mS
- Configure Manufacture Name as "ETT CO.,LTD"
- Configure Product Name as "ET-ARM7 USB-2148"
- Configure Product Serial Number as "HID DEMO V10"
- Configure usage for End Point-0 to Setup and receive data and configure usage for End Point-1 to send data
- Sending/receiving data and command for using HID Report, we must configure format of Report as follows
 - Configure Input Report as 10 Byte/8 Bit
 - **Byte-0** is value of Input[0..7] that is comes from GPIO 1 [16..23]
 - **Byte-1** is value of Input[10..15] that is comes from GPIO0[2..7] (Bit0,1 = Ignore)
 - **Byte-2,3** is value of ADC1 Result Byte High, Low
 - **Byte-4,5** is value of ADC1 Result Byte High, Low
 - **Byte-6,7** is value of ADC1 Result Byte High, Low
 - **Byte-8,9** is value of ADC1 Result Byte High, Low
 - Configure Output Report as 35 Byte / 8 Bit
 - **Byte-0** is value of Code Controller, must configure as follows;
 - ❖ **0x00** means that it is all Update Output (LED + LCD).
 - ❖ **0x01** means that it is only Update Output LED.
 - ❖ **0x02** means that it is only LCD Display.
 - **Byte-1** is value of Output[0..7] to control GPIO0[8..15].
 - **Byte-2** is value of Output[8..14] to control GPIO0[16..22] (Bit7=Ignore).
 - **Byte-2..34** is 32-character message for LCD Display.

Program of Host (Visual Basic V6.0)

This sample program of Host or Computer PC is developed by Program Microsoft Visual Basic 6.0. We use the theory from the website of Intel (<http://www.intel.com/intelpress/usb/examples/download.htm>) that is the sample for writing program to connect with USB Device in Class of HID. We use standard Driver of Windows through API Function and DLL and can use it with Windows98Se up. We have already tested it and operation result is quite well. Additionally, functions are not complex and difficult, so we can understand easily.

Intel creates Code that is divided into Library Module for user to include with code of main program that is written. There are three files as follows.

- **OSInterface.BAS** is the part of connection with Window through API Function. It is the part for declaring and using functions in DLL file.
- **USBInterface.BAS** is the part to declare variable for connecting with USB Protocol through functions in API Function.
- **HIDInterface.BAS** is the part of function that connects with USB Devices. There is the necessary part as follows;
 - **Function OpenUSBdevice:** It opens the connection with USB Device. We must use it through String value of Product Name of desired USB Device that we want to open the connection for function. If we can open the connection with Device successfully, the result will be true; on the other hand, if we can not open the connection with Device, the result will be false.
 - **Sub ReadUSBdevice:** It commands reading data from USB Device that is opened the connection completely. We must use it through Pointer value of variable as Array type for receiving data and desired amount of Byte that we want to read data from Device for sub-program.
 - **Sub WriteUSBdevice:** It commands writing data into USB Device that is opened the connection completely. We must use it through Pointer value of variable as Array type that stores data for sending or writing data into Device and desired amount of Byte data that we want to write into Device for sub-program.

For application, when we create Project file of Visual Basic successfully, must compile all 3 files together by using command "**Project Add → Module → Existing**" and then select file one by one until it is completely. User can learn more information about example program for testing by self from sample Source code.