



BE635 User Manual

Rev. V1.0



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Table of Content

Chapter 1 Introduction	7
1.1 Features	7
1.2 Board Layout	7
1.3 Block Diagram	8
1.4 Mechanical Dimension	8
1.5 Board Specification	9
1.6 Ordering Information	10
1.7 Package Content	11
1.8 Absolute Maximum Ratings	12
Chapter 2 Installation	13
2.1 Connectors	13
CN1: ISP Pin Definitions.....	14
CN2: System Reset Pin Definitions	14
CN7: Power Pin Definitions (micro FIT 3.0)	15
CN8: Dual RS232 Pin Definitions	16
CN8: One RS232 / One RS422 Pin Definitions.....	17
CN8: One RS232 / One RS485 Pin Definitions.....	18
CN9: SPI & IIC Pin Definitions	19
CN10: GPIO / ADC Pin Definitions	20
CN11: Mini USB Pin Definitions	20
2.2 How to install USB driver	21
Chapter 3 Software Development Tool & Utility	26
3.1 How to program the demo code	27
3.2 Connecting the device	31
3.3 How to operate the demo program	33
Running Hyper Terminal	33
2nd UART Test	37
EEPROM Test	39
I2C Test.....	40
SPI Test.....	41
ADC Test.....	42
GPIO Test.....	44
SD Card Test.....	46
Buzzer Test.....	48

Touch panel Draw Test	49
LCD Test	50
System Setting	51

Chapter 1 Introduction

Welcome to use BE635 which is designed for an embedded control board with 3.5" TFT LCD display for customer to control other peripherals or devices. This chapter is to offer you basic information regarding BE635 to help you incorporate BE635 into your system.

1.1 Features

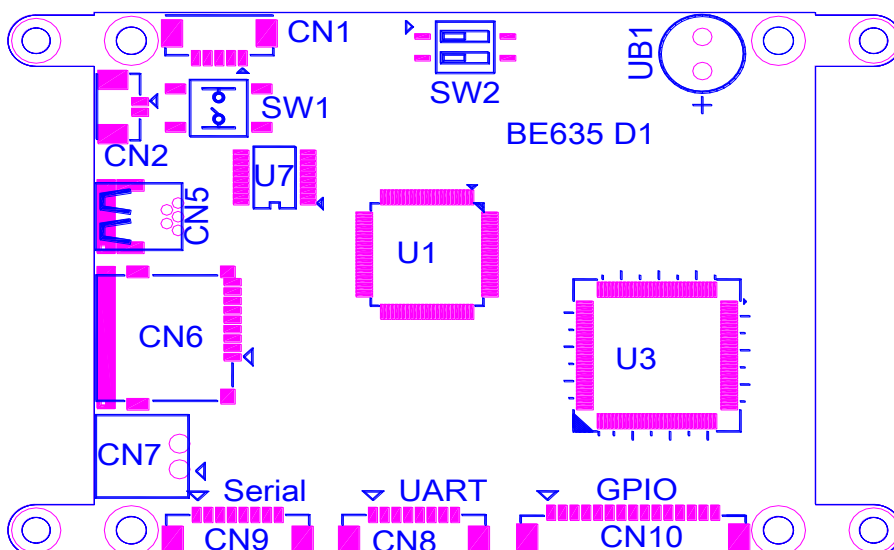
BE635 is designed based on PIC32 32-bit microprocessor, which requires no operating system to run on. Together with a 320x240 3.5" TFT LCD and LED backlight built-in, this all-in-one LCD embedded system BE635 helps designer to enhance a compact design with cost, space, and design phase saving.

Armed with RS232, RS422, RS485, USB, SPI, and I2C interface ports, BE635 is capable of interfacing and communicating with many devices and peripherals. The BE635 is therefore suitable for any industrial control panel for factory automation equipment, electronic instrument, HMI (human-machine interface), office automation equipment, medical equipment, parking system, ticketing system and so on. 512KB in-system self-programmable Flash offers sufficient ROM size for designers to develop their applications.

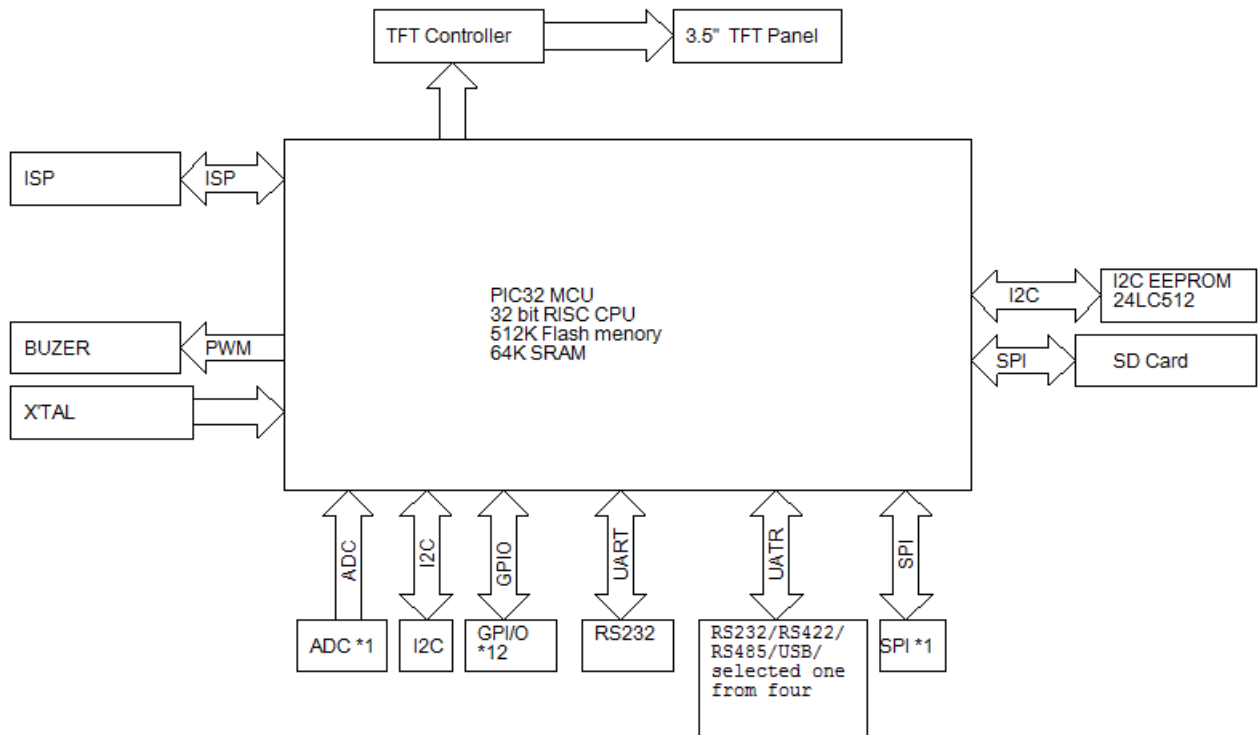
BE635 is more than simply a Microchip development board: it integrates display and I/O so that developers may start her application without the hassle of hardware integration. Henceforth, a quick time to market for customers' innovative product is ensured.

1.2 Board Layout

This layout shows the location of each important IC, connector and jumper. Please refer to chapter 2 for further information on jumpers and connectors.

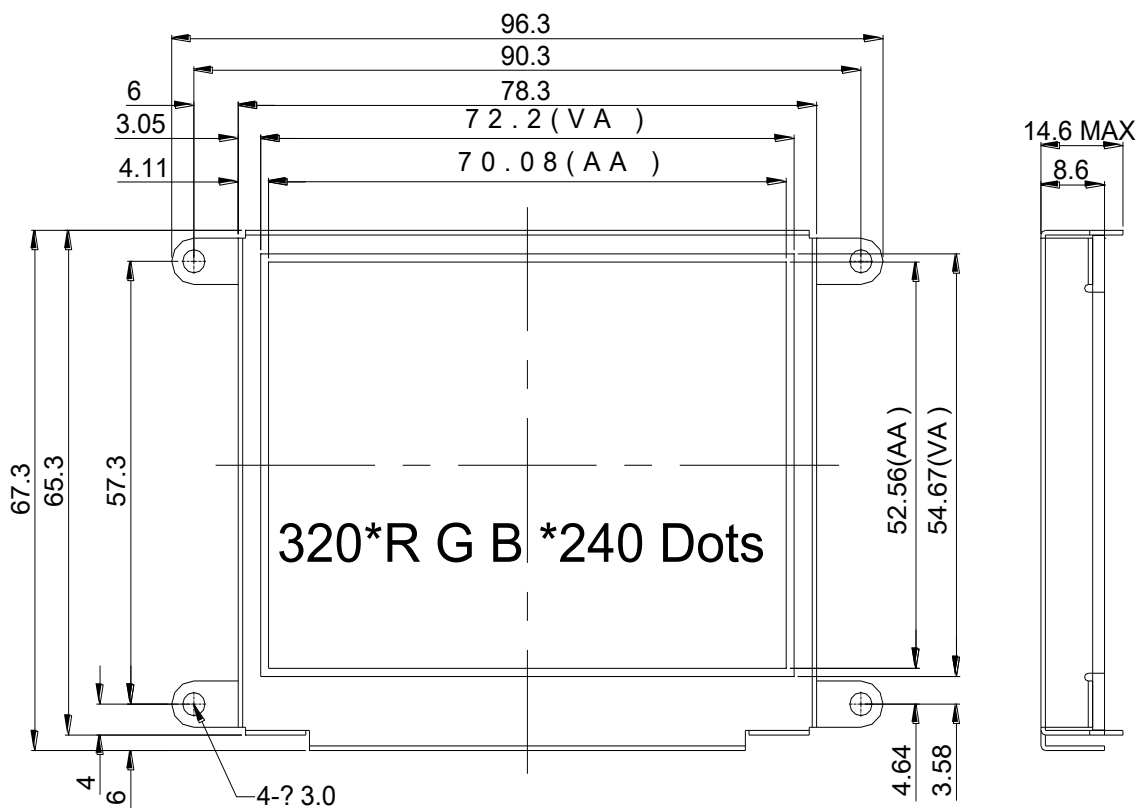


1.3 Block Diagram

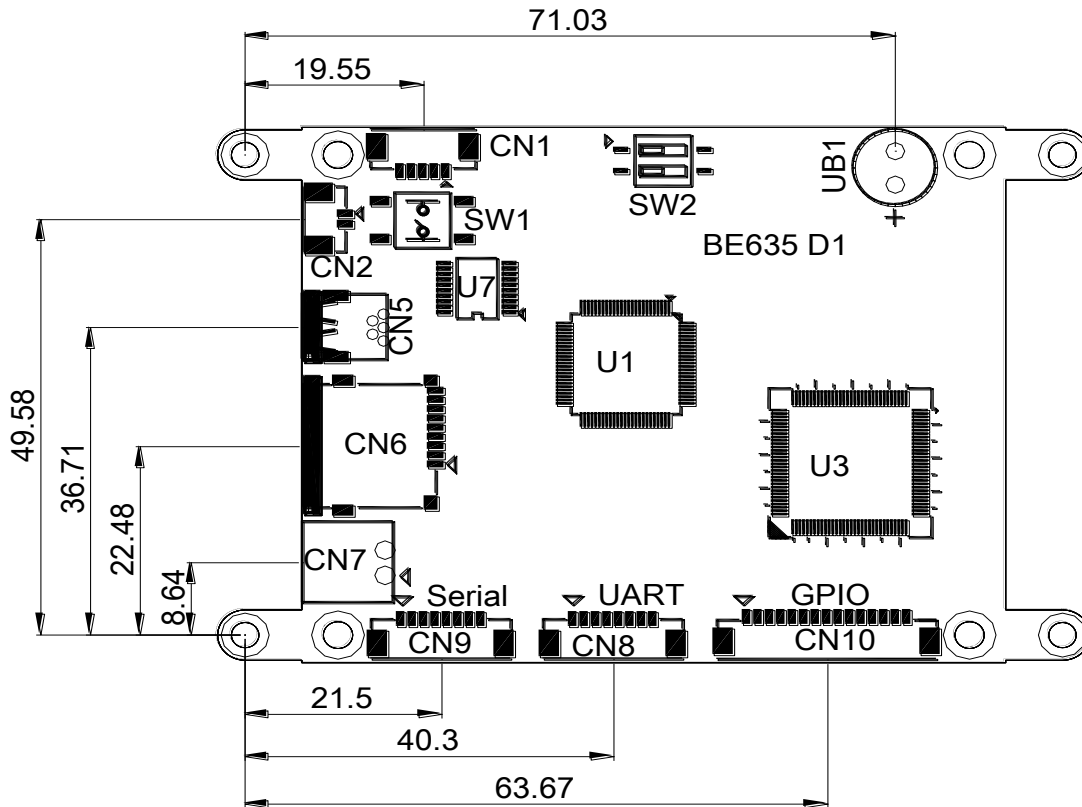


1.4 Mechanical Dimension

(Front and side view)



(Bottom view)



1.5 Board Specification

MCU	High-performance, low-power PIC® 32-bit microprocessor Microchip PIC32 MCU
Memory	512K Bytes In-System Self-Programmable Flash 64K Bytes Internal SRAM 16K Bytes EEPROM
Display	3.5" TFT LCD with 320x240 resolution with LED backlight
Touch Panel	Supports four-wired resistive touch panel
Serial Ports	Supports 1 x RS232 port, and 1 x RS232/RS422/RS485/USB shared port
Power	DC 5.0V

1.6 Ordering Information


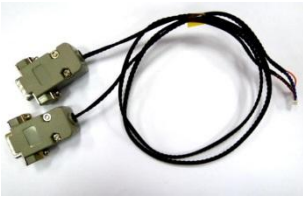
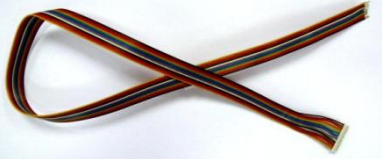






Part No. (P/N)	Resolution	Voltage	RS-232	RS-232	RS-422	RS-485	USB (UART)
BE635BM1A1N	320 * 240	5V	✓	✓			
BE635BM1A2N	320 * 240	5V	✓		✓		
BE635BM1A3N	320 * 240	5V	✓			✓	
BE635BM1A4N	320 * 240	5V	✓				✓

Note1. If you select USB interface version, you need to install the USB to RS232 driver.
Please refer the [section 2.2](#) to know how to install the driver.

1.7 Package Content

Please check your package content upon receiving the product parcels. Besides the BE635 unit, make sure the following accessories (User selection) are included as well.

NOTE: The term as "S/N Number" is the serial number of all accessories provided by Bolymin.

S/N: OPBE657AM1E00	S/N: OPBE657AM1F00	S/N: OPBE657AM1G00
		
Cable 1: SPI, I2C (20cm)	Cable 2: UART (50cm)	Cable 3: GPIO, ADC (50cm)
S/N: OPBE657AM1010	S/N: OPBE657AM1020	S/N: OPBE657AM1030
		
Micro SD 4GB	Micro SD 8GB	Micro SD 16GB
S/N: OPBE657AM1040	S/N: OPBE657AM100A	S/N: OPBE657AM100B
		
Micro SD 32GB	Microchip PICKIT 3 + Program line	Program line

Note1. The Cable 1~3 is used for developed.

Note2. The Micro SD 4GB is standard accessory.

1.8 Absolute Maximum Ratings

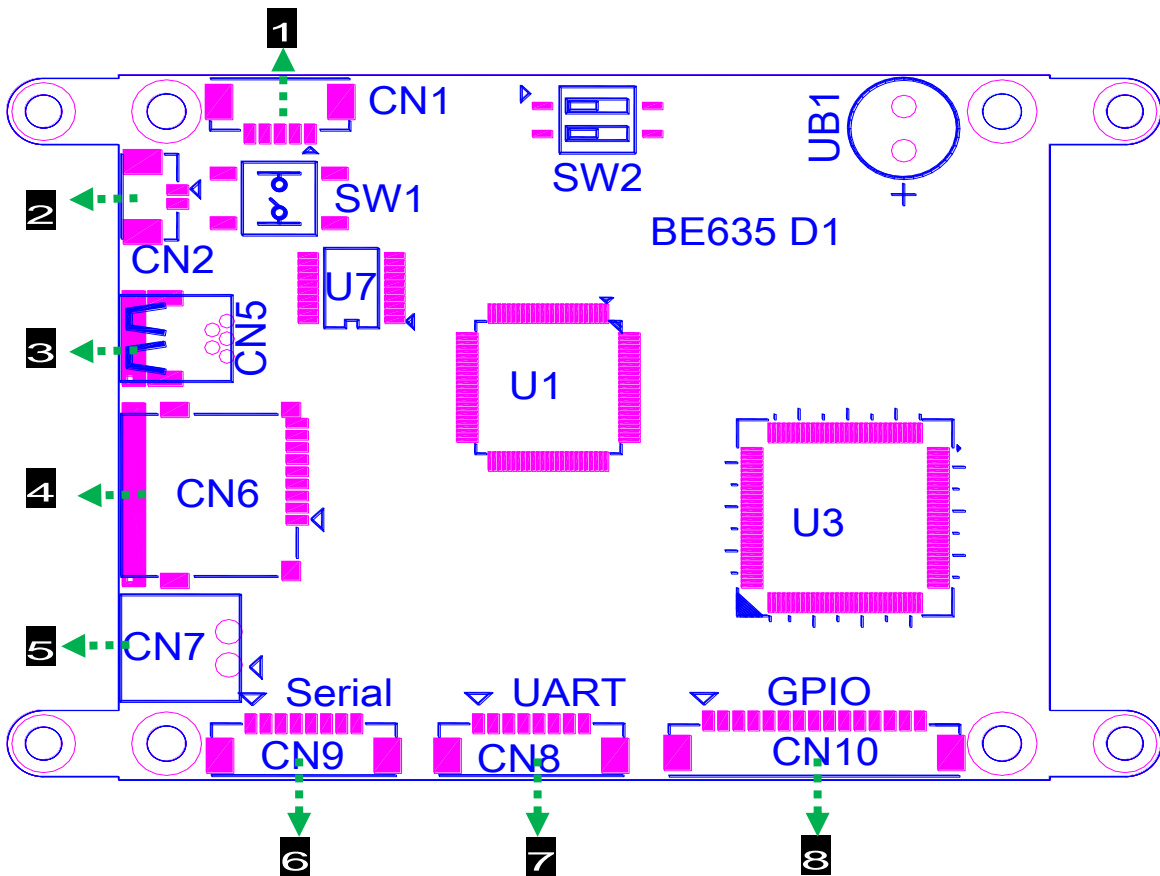
Item	Symbol	Min	Typ.	Max	Unit
Operating Temperature	TOP	-20	—	+70	°C
Storage Temperature	TST	-30	—	+80	°C
Supply Voltage For BE635	Vdd-Vss	—	—	6.0	V

Chapter 2 Installation

This chapter covers fundamental information of BE635 connectors, in order to help designers to configure correct settings and connections between BE635 and the respective application.

2.1 Connectors

Connectors are the key link between BE635 and external devices. Detailed locations and functions of available connectors are tabled and illustrated below.

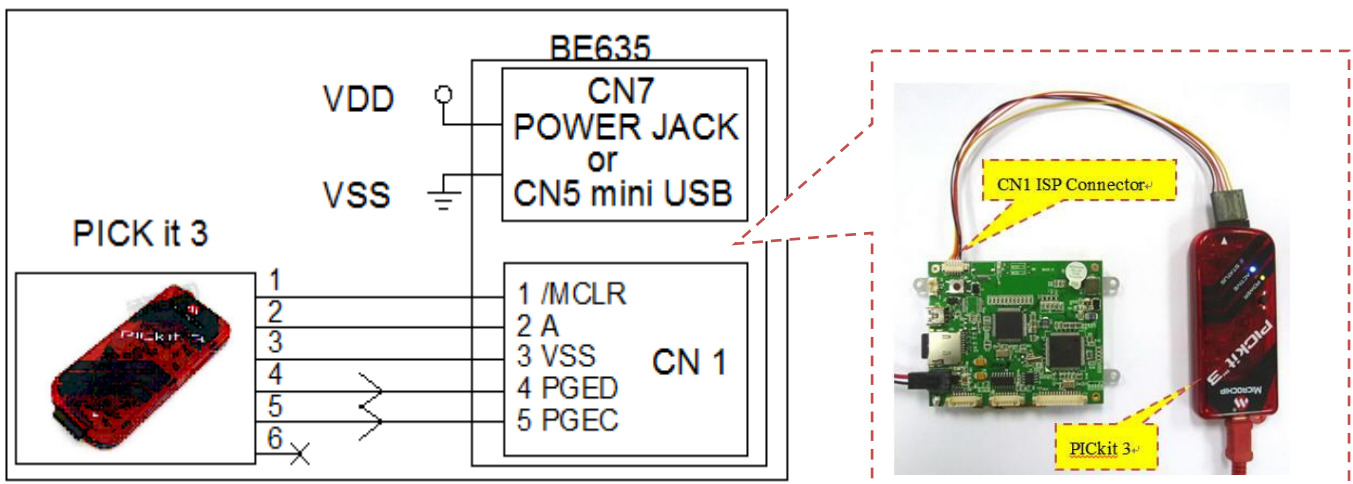


Label	Pin No.	Function
1:CN1	5	In-System Programming (ISP)
2:CN2	2	System Reset
3:CN5	5	Mini USB Connector
4:CN6	9	Micro SD
5:CN7	2	DC Power Jack
6:CN9	8	SPI / I2C
7:CN8	8	Series Interface Input
8:CN10	15	GPIO / ADC Input

CN1: ISP Pin Definitions

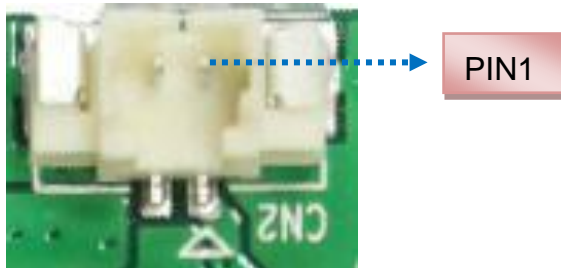
Pin No.	Signal	Description
1	/MCLR, VPP	Power
2	VDD_TGT	Power on Target
3	GND	Ground
4	PGD	Connects to PIC32 port PGD1, ICSPDAT
5	PGC	Connects to PIC32 port PGC1, ICSPCLK

We recommend using the Microchip PICKit 3 for ISP. Here is the connector definition about ISP. Please refer to the section 1.4 of the programming guide for detailed software operation.

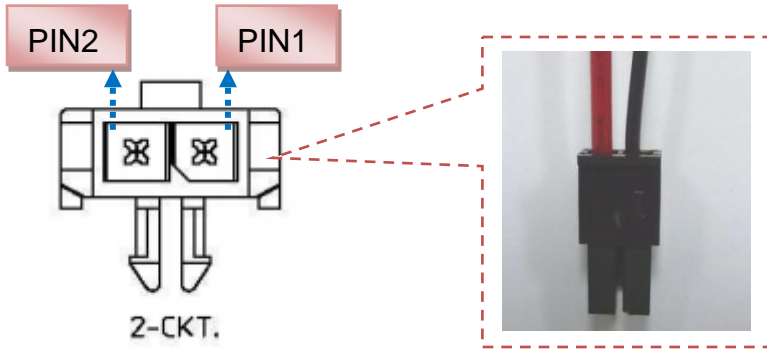


CN2: System Reset Pin Definitions

Pin No	Signal	Pin No.	Signal
1	System Reset	2	VSS



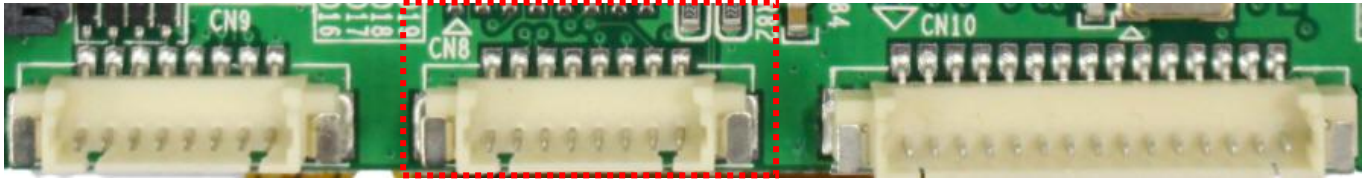
CN7: Power Pin Definitions (micro FIT 3.0)



Signal	Type	Pin No.	Description
VSS	P	1	Logic Power Supply (ground)
VDD	P	2	Logic Power Supply DC 5.0V,

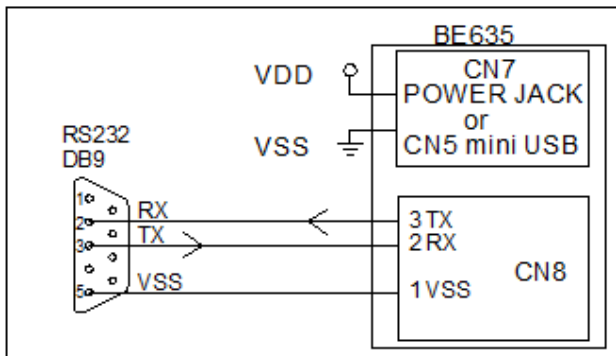
Mates with micro FIT (3.0) receptacle 43645-0200

CN8: Dual RS232 Pin Definitions

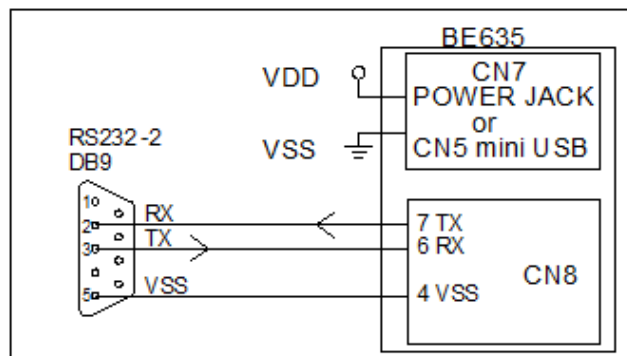


Pin No	Signal	Pin No.	Signal
1	VSS	5	NC
2	RS232 RX_1	6	RS232 RX_2
3	RS232 TX_1	7	RS232 TX_2
4	VSS	8	NC

UART1 of BE635 offers one RS232 port (the voltage level is +/- 12V) for connection with a PC or other RS232 devices.

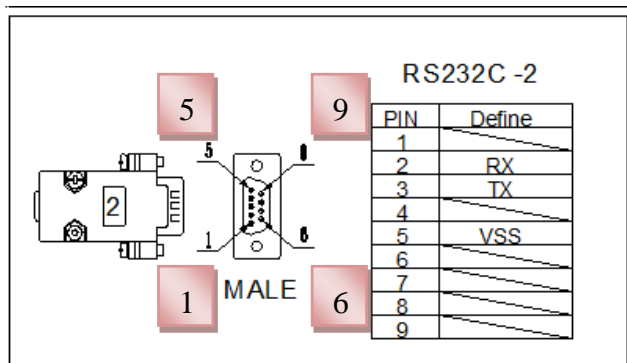
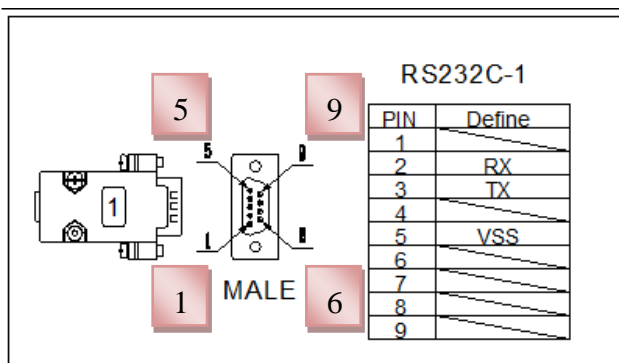


RS232-1



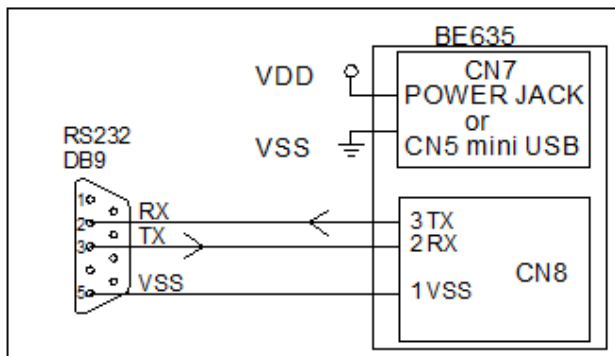
RS232-2

Pin Definition of DB9 Connector:

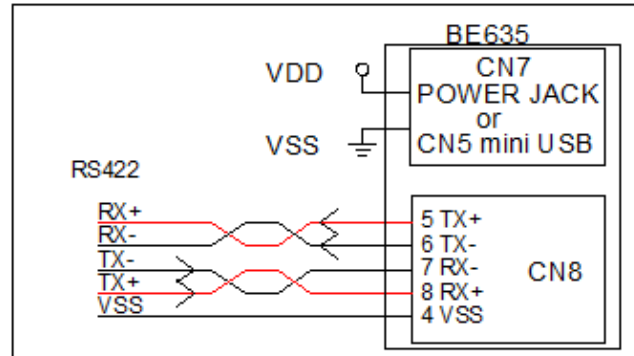


CN8: One RS232 / One RS422 Pin Definitions

Pin No	Signal	Pin No.	Signal
1	VSS	5	RS422 TX+
2	RS232 RX	6	RS422 TX-
3	RS232 TX	7	RS422 RX-
4	VSS	8	RS422 RX+

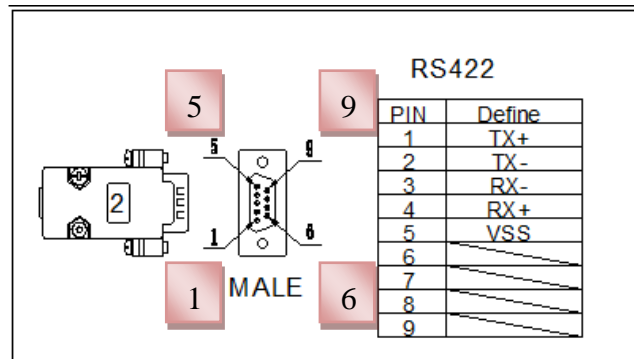
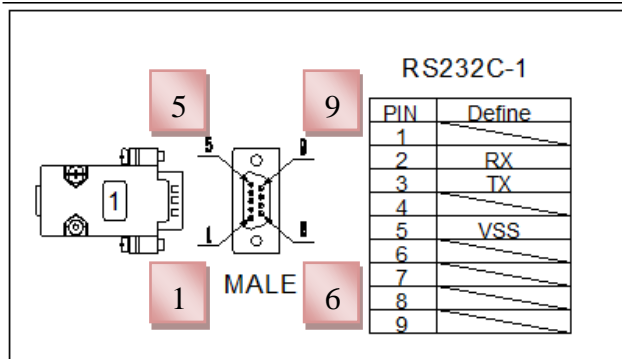


RS232



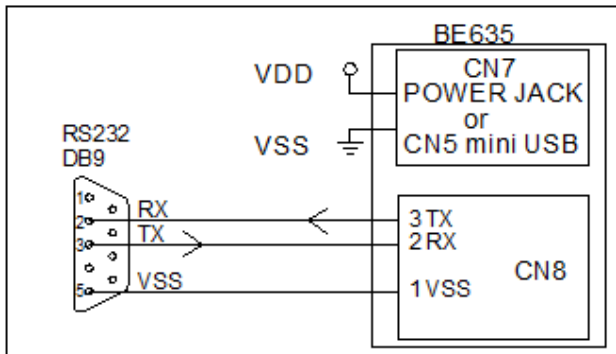
RS422

Pin Definition of DB9 Connector:

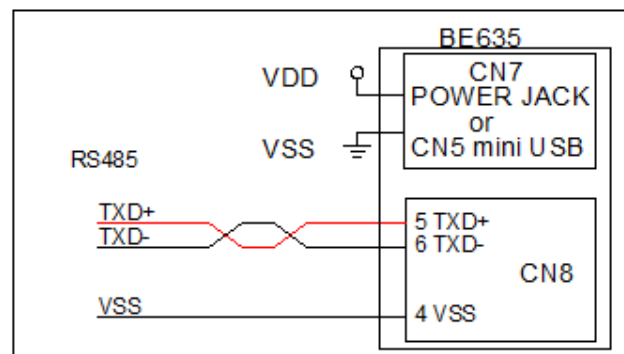


CN8: One RS232 / One RS485 Pin Definitions

Pin No	Signal	Pin No.	Signal
1	VSS	5	RS485 TXD+
2	RS232 RX	6	RS485 TXD-
3	RS232 TX	7	NC
4	VSS	8	NC

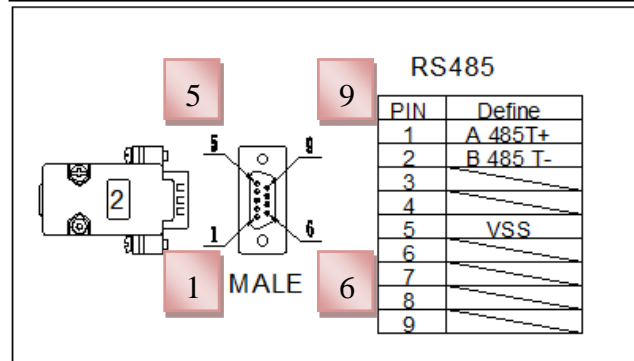
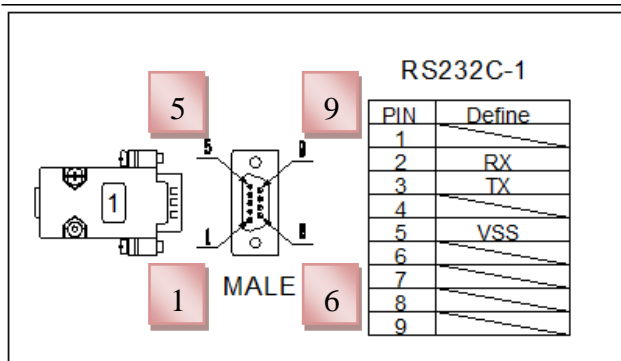


RS232

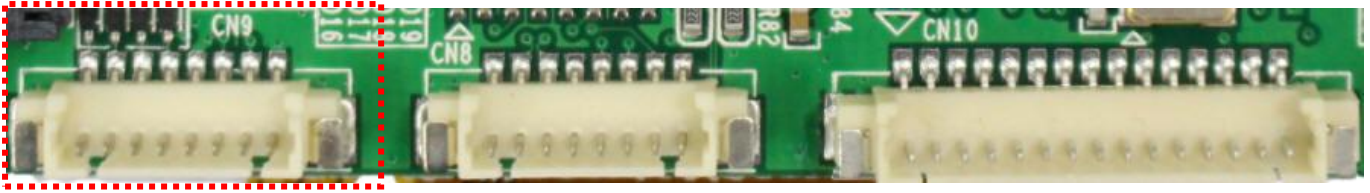


RS485

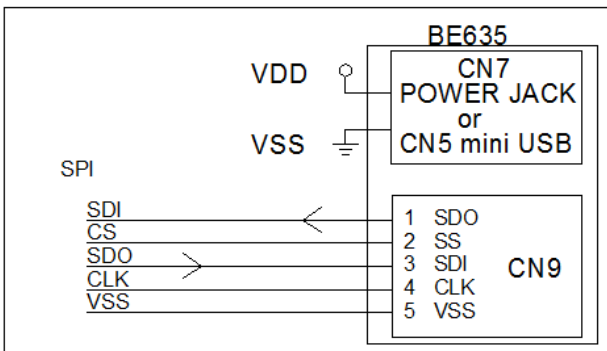
Pin Definition of DB9 Connector:



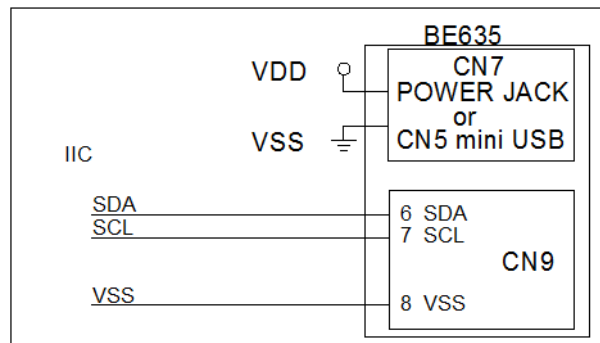
CN9: SPI & IIC Pin Definitions



Pin No	Signal	Pin No.	Signal
1	SDO	5	VSS
2	SS	6	SDA
3	SDI	7	SCL
4	CLK	8	VSS

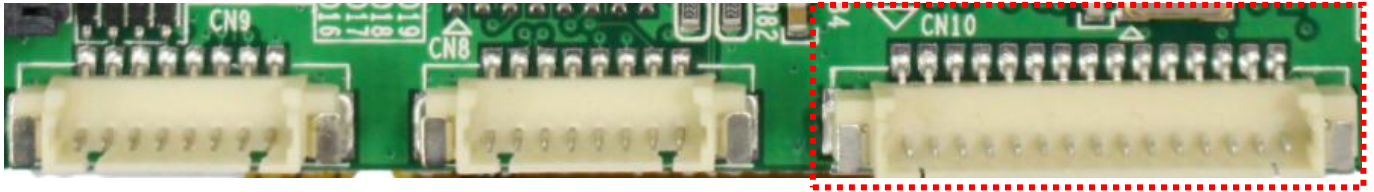


SPI

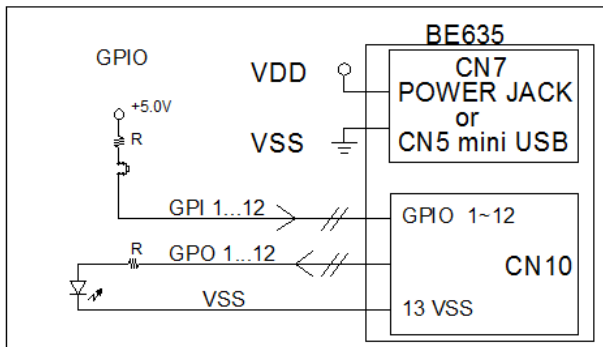


IIC

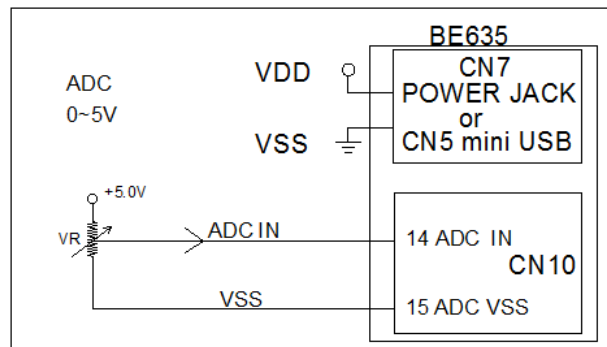
CN10: GPIO / ADC Pin Definitions



Pin No	Signal	Pin No.	Signal
1	GPIO1	9	GPIO9
2	GPIO2	10	GPIO10
3	GPIO3	11	GPIO11
4	GPIO4	12	GPIO12
5	GPIO5	13	VSS
6	GPIO6	14	ADC IN
7	GPIO7	15	ADC VSS
8	GPIO8		



GPIO: (I/O Voltage 5.0V / 25mA max)



ADC: (Voltage Range = 0~5V)

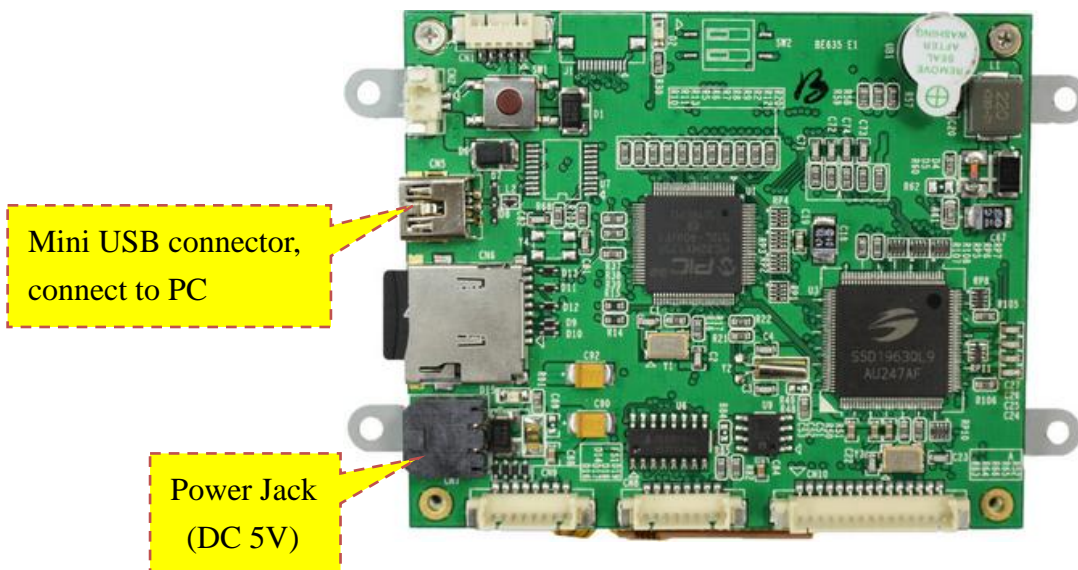
CN11: Mini USB Pin Definitions

Pin No	Signal	Pin No.	Signal
1	VUSB	4	NC
2	D-	5	VSS
3	D+		

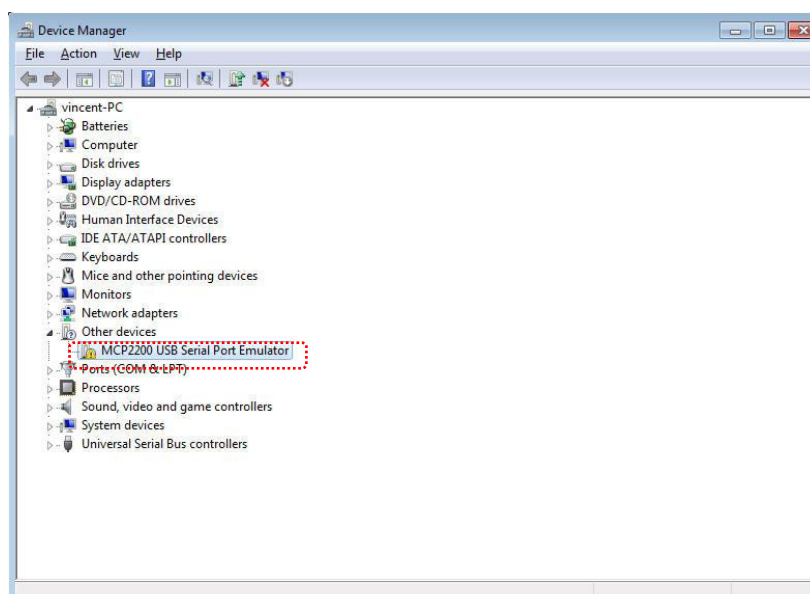
2.2 How to install USB driver

The BE635 provides a stand-alone USB to RS232 serial converter (optional). If you select this interface, all what you need to do is to install the USB driver (please download USB driver from URL: http://www.bolymin.com.tw/dl/BE6XX_USB_driver.rar) to your Windows System by referring to below instructions. Take Windows 7 for example, to install the USB driver on Windows 7 for the first time.

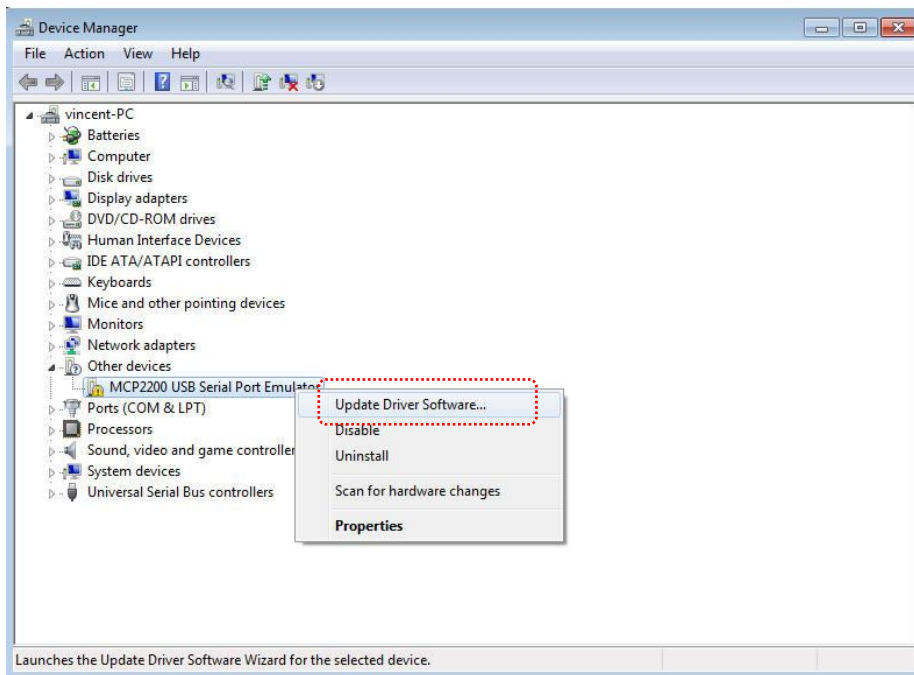
Step 1: Connect BE635 device to your computer's USB port and power on the BE635.



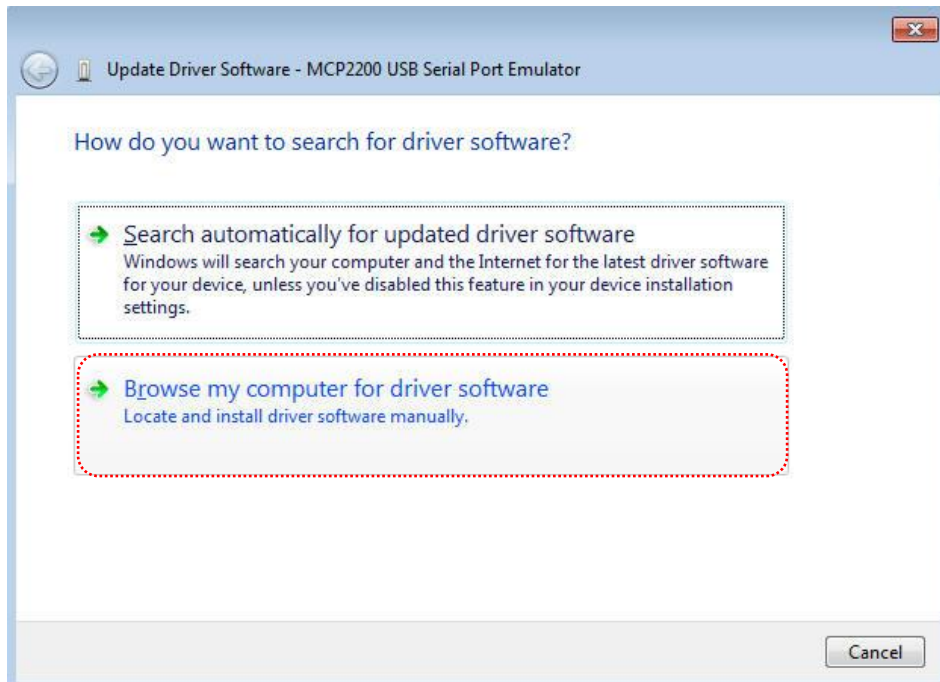
Step 2: Right-click on **Computer** from your desktop or Windows Explorer, and select **Device Manager**. Locate and expand **Other device**, you can see the MCP2200 USB Serial Port Emulator.



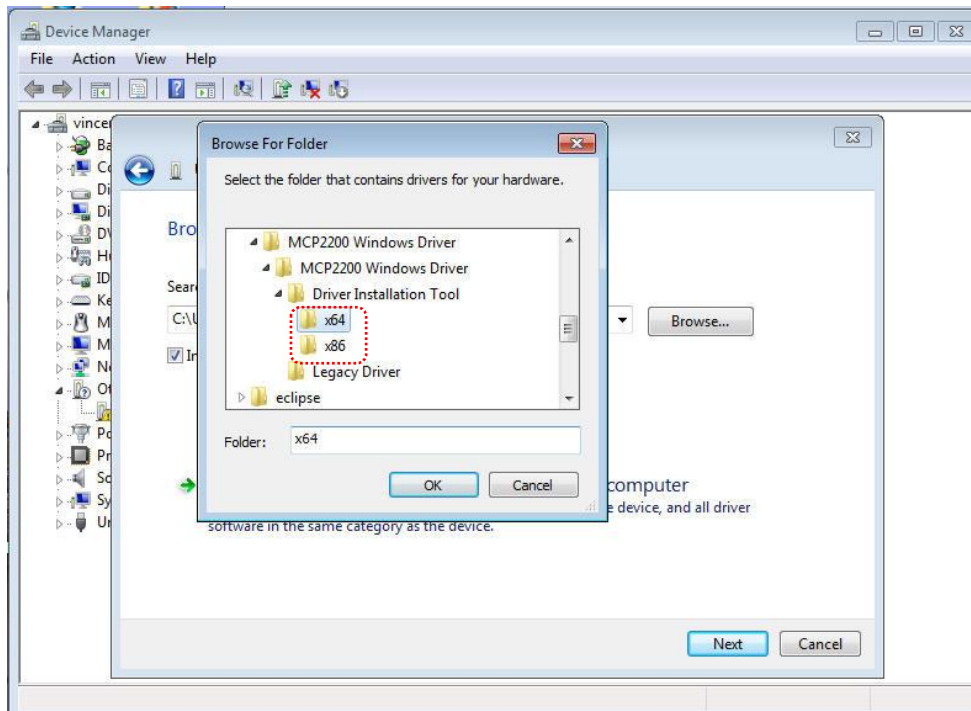
Step 3: Right-click the device name (such as **MCP220 USB Serial port Emulator**) and select Update Driver Software. This will launch the Hardware Update Wizard.



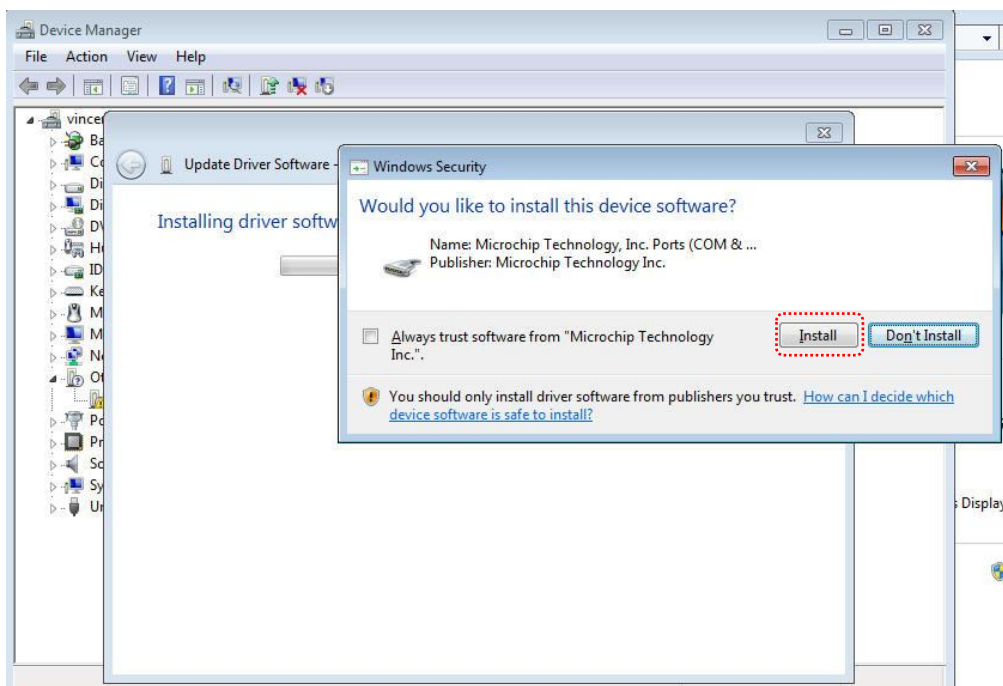
Step 4: Select “Browse my computer for driver software”.



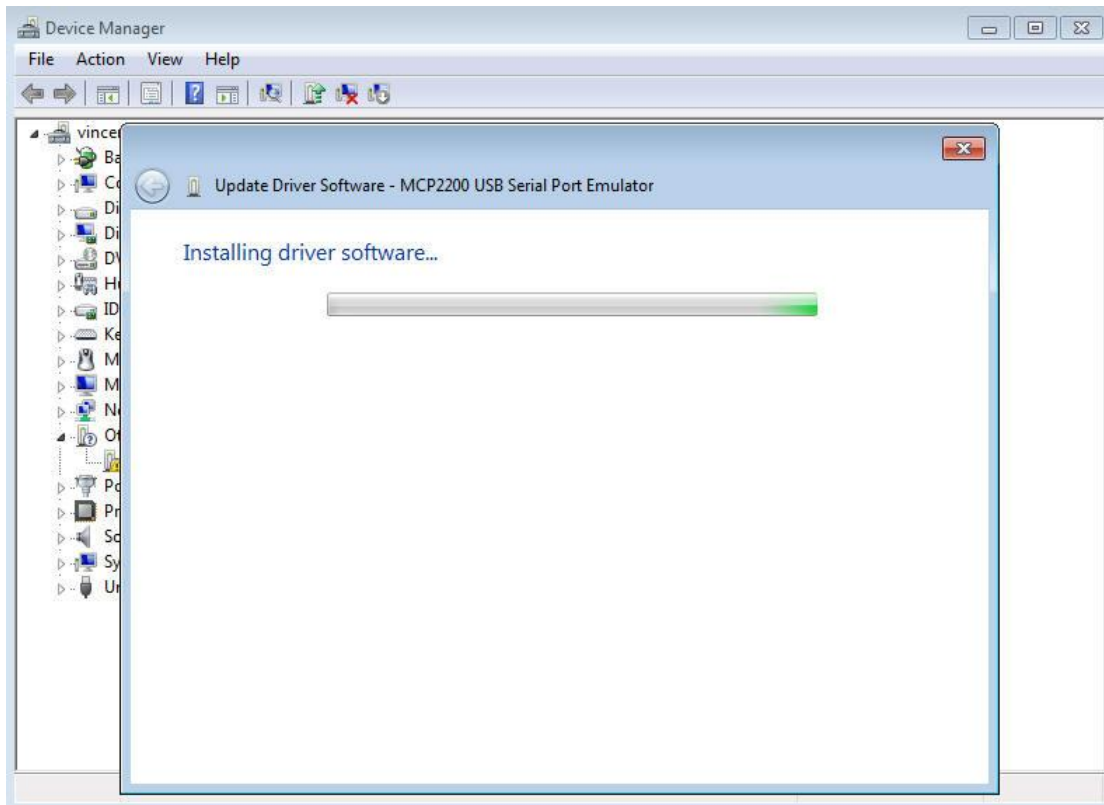
Step 5: Click Browse and locate the USB driver folder (X64 for windows 64 bit system, x86 for windows 32 bit system) and click “OK” to next.



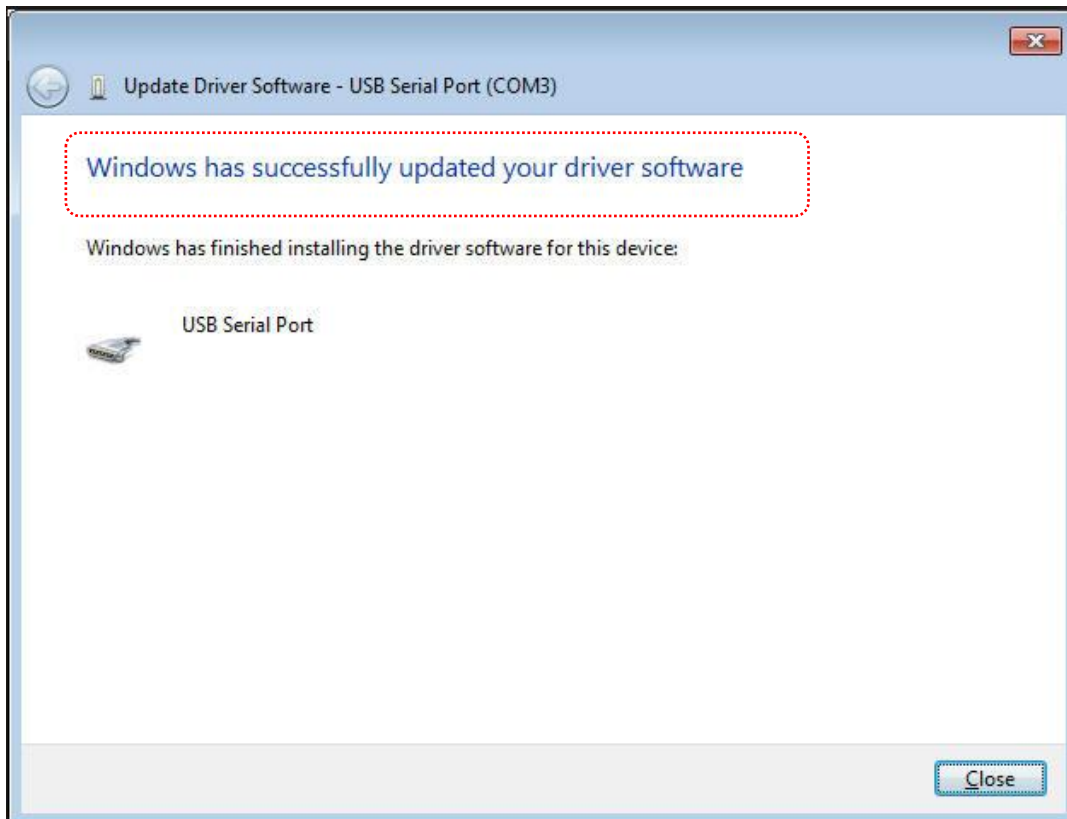
Step 6: Click **Install** to install the driver.



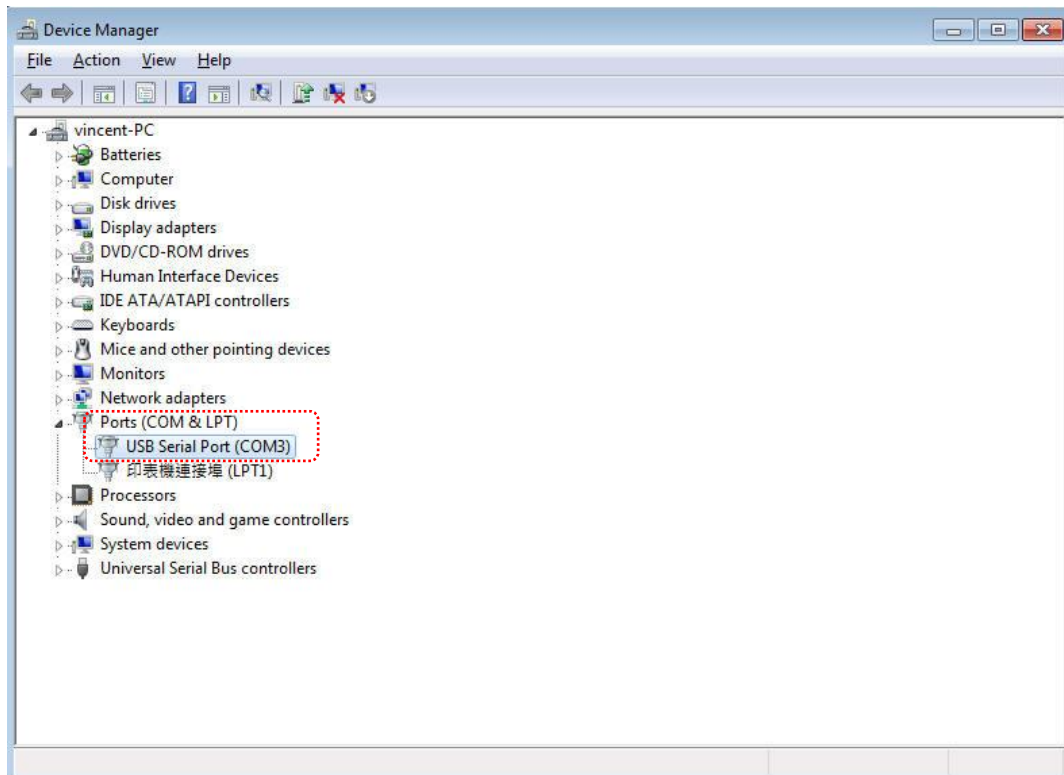
Step 7: Installing driver software.



Step 8: Now the USB driver installation for BE635 is completed.

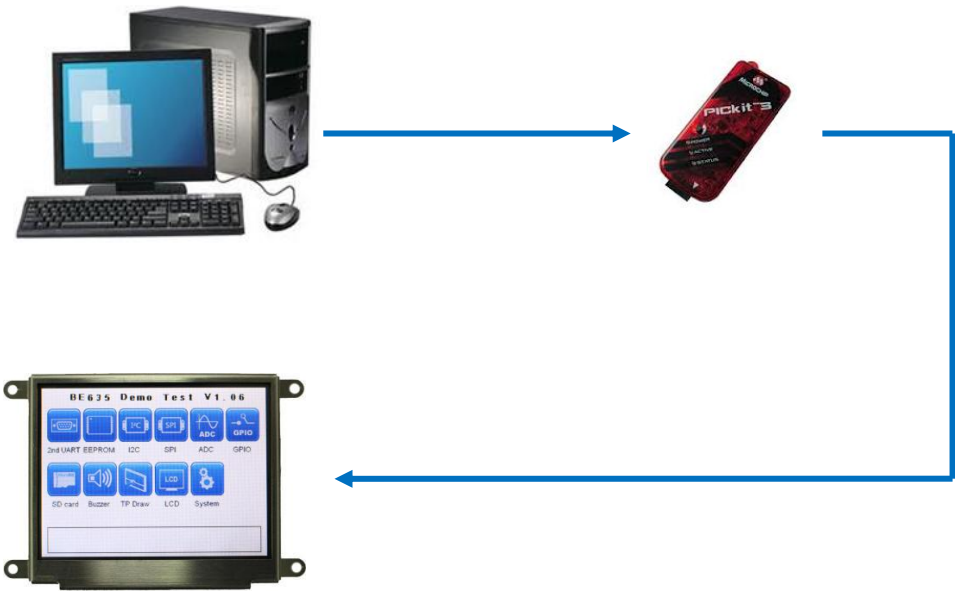


Step 9: You can see the **USB Serial Port** at **Ports (COM & LPT)** of device Manager. The following example shows **COM3** is available.



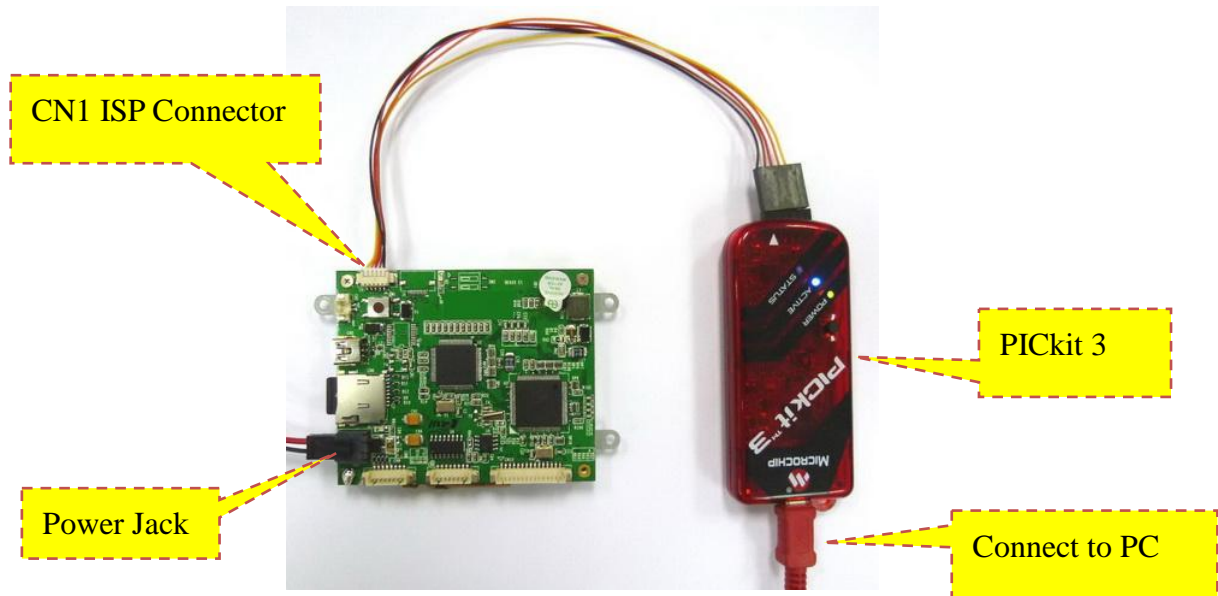
Chapter 3 Software Development Tool & Utility

This chapter will show you how to setup and how to use the hyper terminal to operate the demo program on BE635. Following table lists the recommended software development tool and hardware connection of BE635.

Item	Description
Software Development Tool	MPLAB Version 8.85
Programmer	PICkit3
Hardware Connection	 <p>The diagram illustrates the hardware connection. On the left, a desktop computer (PC) is shown. A blue arrow points from the PC to a red PICkit3 programmer. From the PICkit3, another blue arrow points to a BE635 demo board. The demo board's screen displays 'BE635 Demo Test V1.06' and various test options: 3rd UART, EEPROM, I2C, SPI, ADC, GPIO, ID card, Buzzer, TP Draw, LCD, and System.</p>

3.1 How to program the demo code

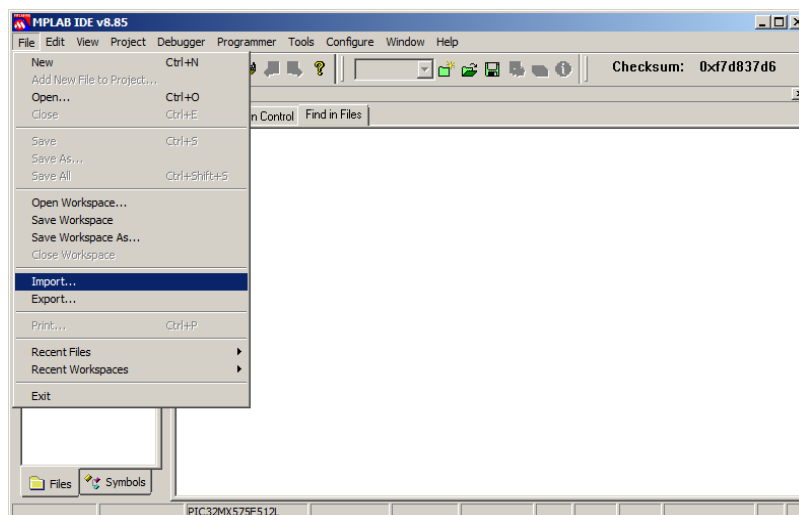
Step 1: Connect PICkit 3 programmer to the connector **CN1** and provide the power to BE635, which is indicated in below image.



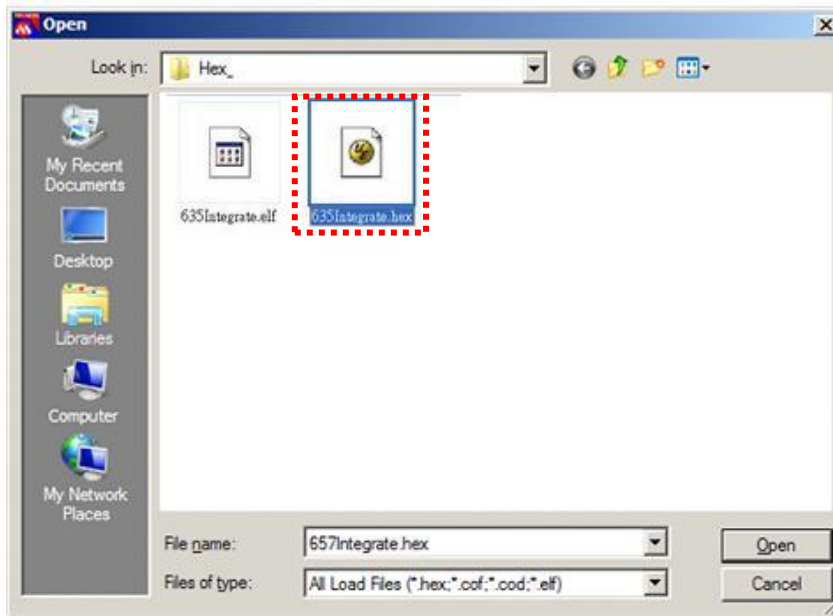
Step 2: Start MPLAB IDE by clicking either on the Desktop or Start menu item, how to install the MPLAB IDE, please refer to the BE635 programming guide section **1.2 Software Development Tool Installation**.



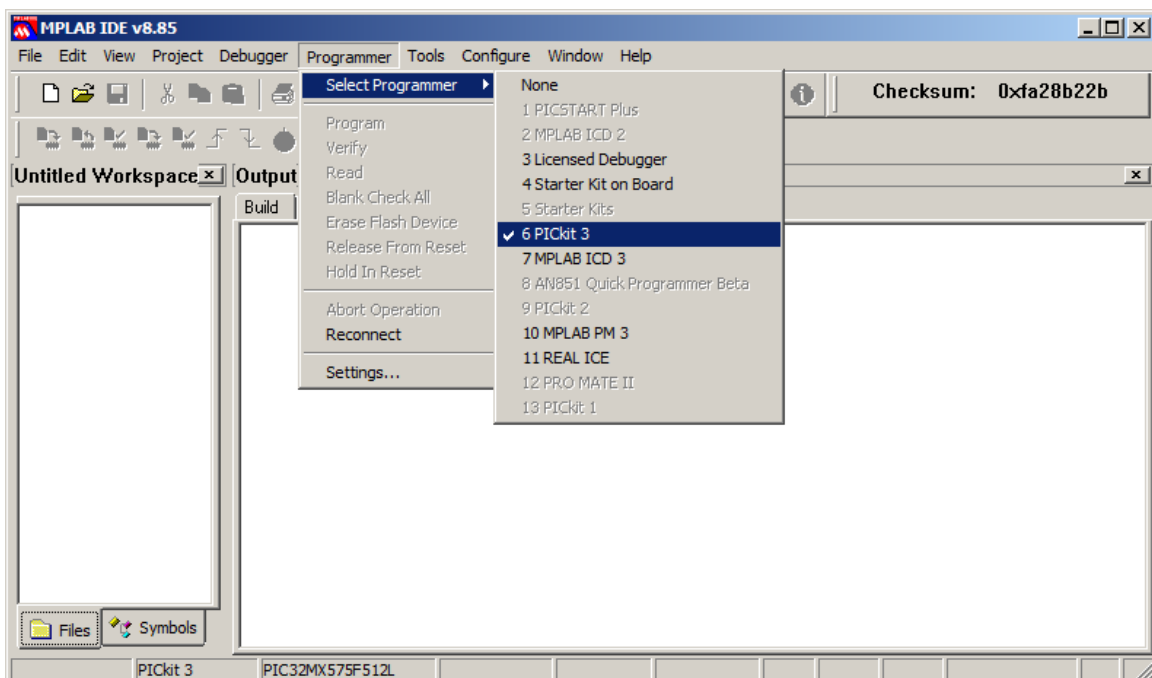
Step 3: Inside MPLAB IDE, click in the menu bar on **File** → **Import** and load the hex file into MPLAB IDE.



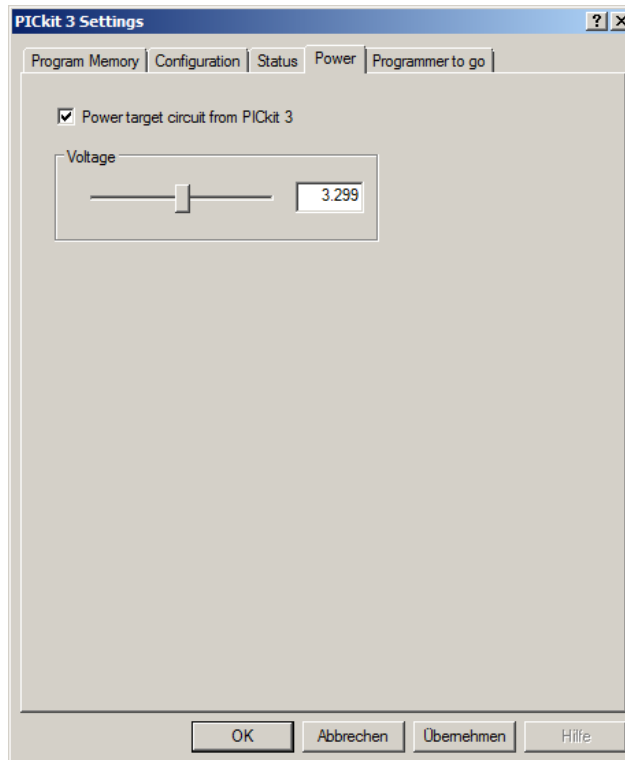
Step 4: Import Hex file.



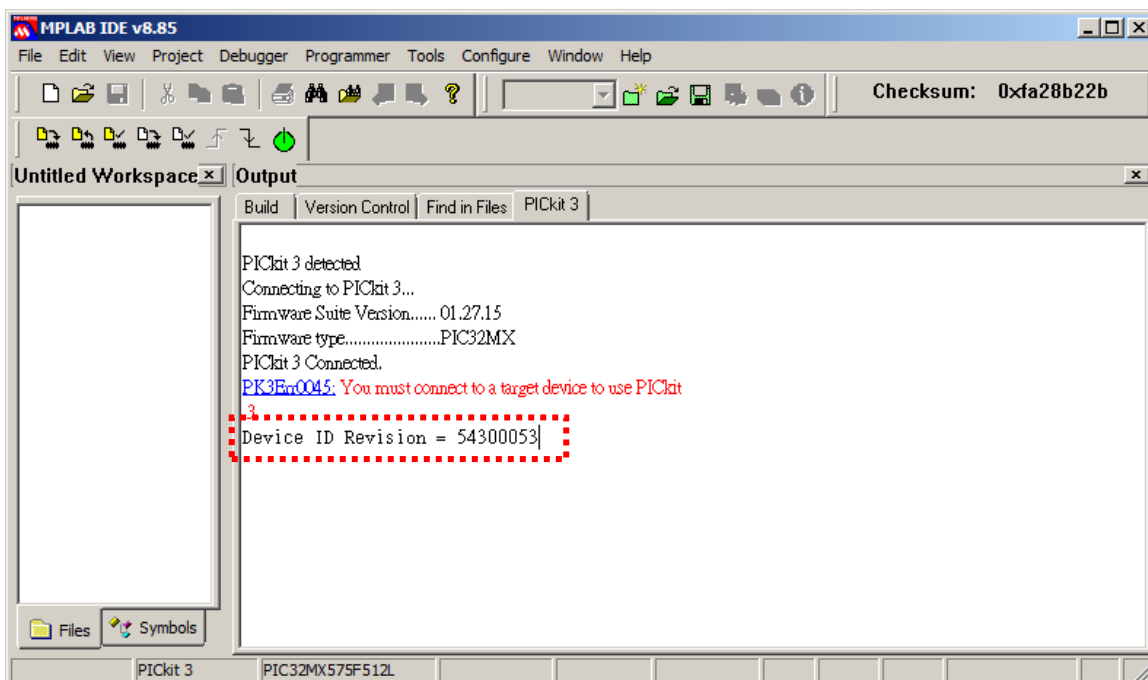
Step 5: Select Programmer: Inside MPLAB IDE, please select the correct programmer according to your configuration. In the menu bar, please click on **Programmer** → **Select Programmer** → **PICKit3**.



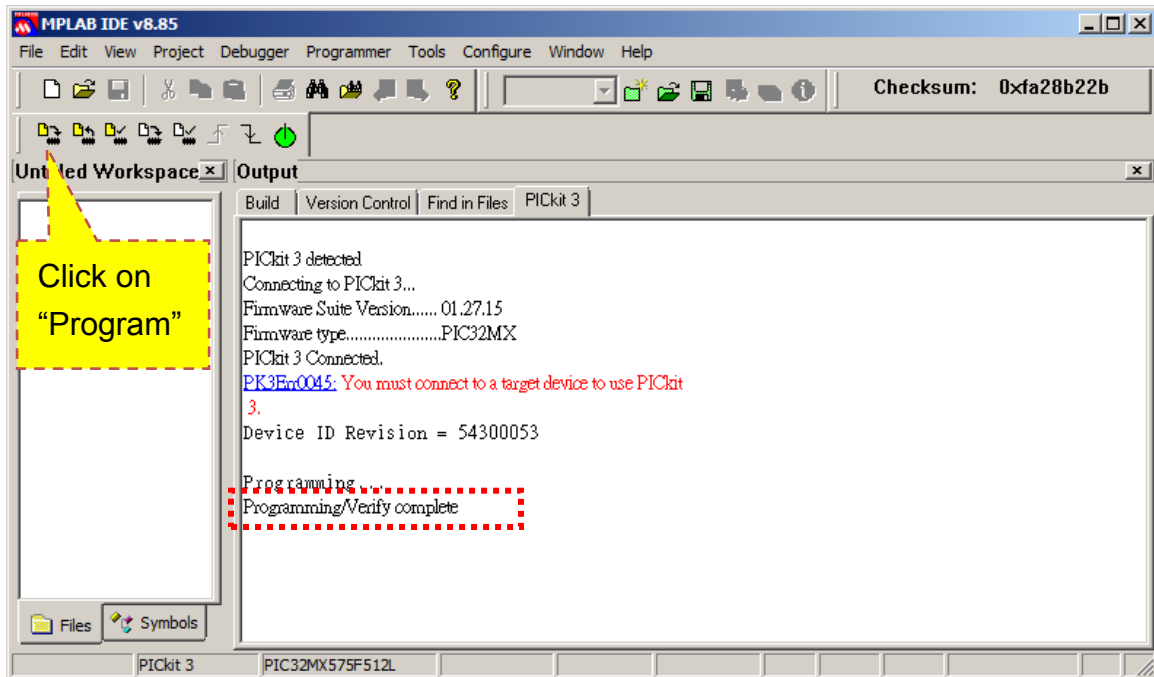
Step 6: Power target circuit from PICkit3, check **Programmer** → **Setting** → **Power** and place a checkmark at “Power target from PICkit3”.



Step 7: The programmer is connected to MPLAB IDE successfully, when it shows the Device ID Revision in MPLAB IDE.

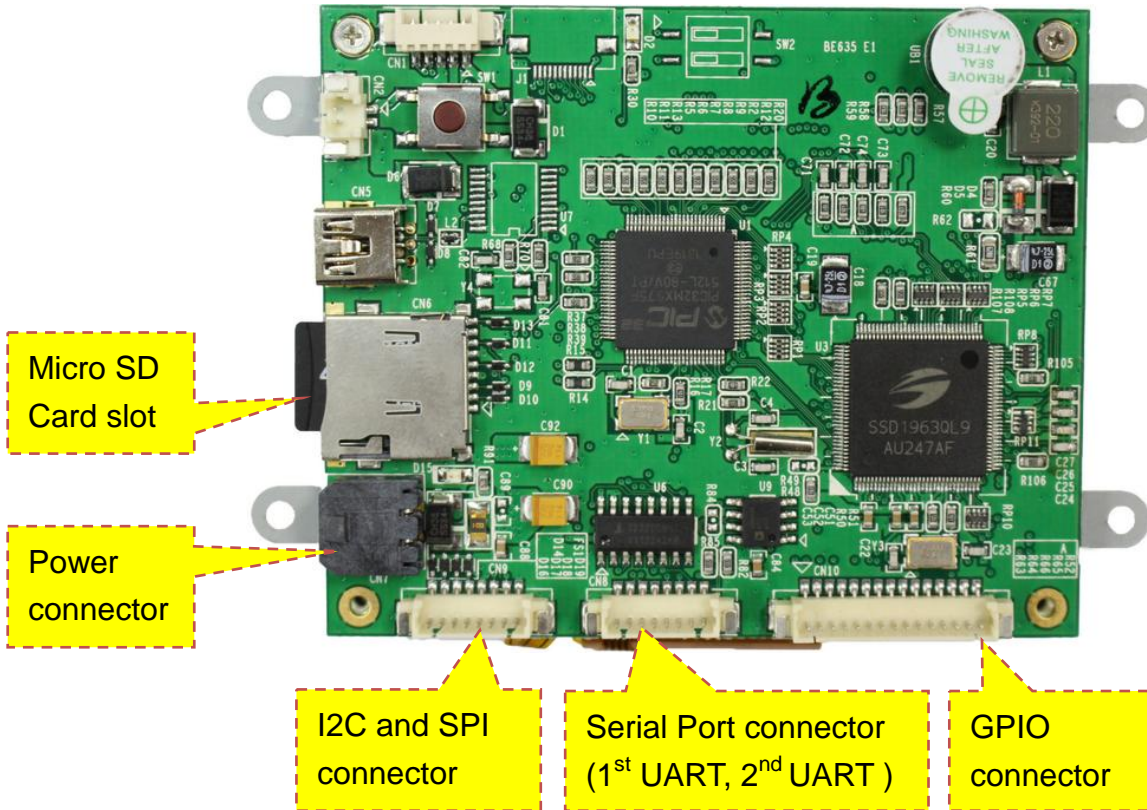


Step 8: To upload the hex file to your target, please click “Program” icon to upload the hex file to BE635.



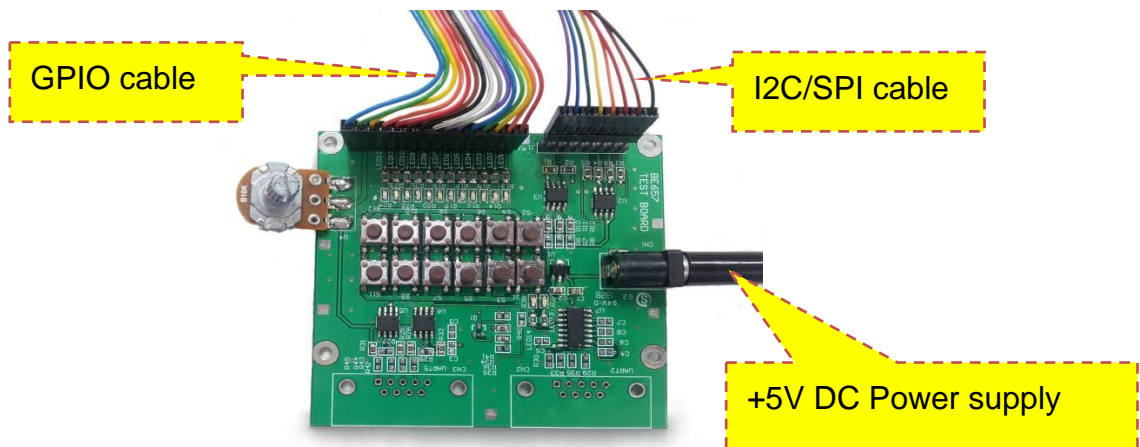
3.2 Connecting the device

Below image illustrates how to connect BE635.



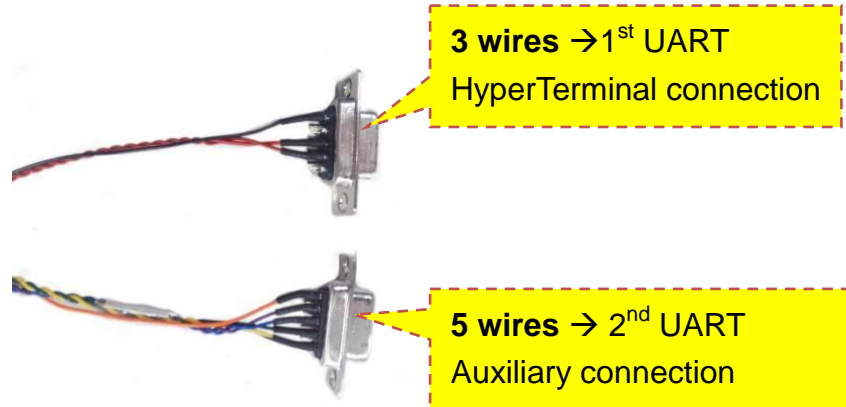
Step 1: Connect the test board connectors (GPIO, Serial port, I2C & SPI connector) if you want to test or use these functions.

Step 2: Connect the test board with the cable configuration as shown below. Connect the test board to +5V DC

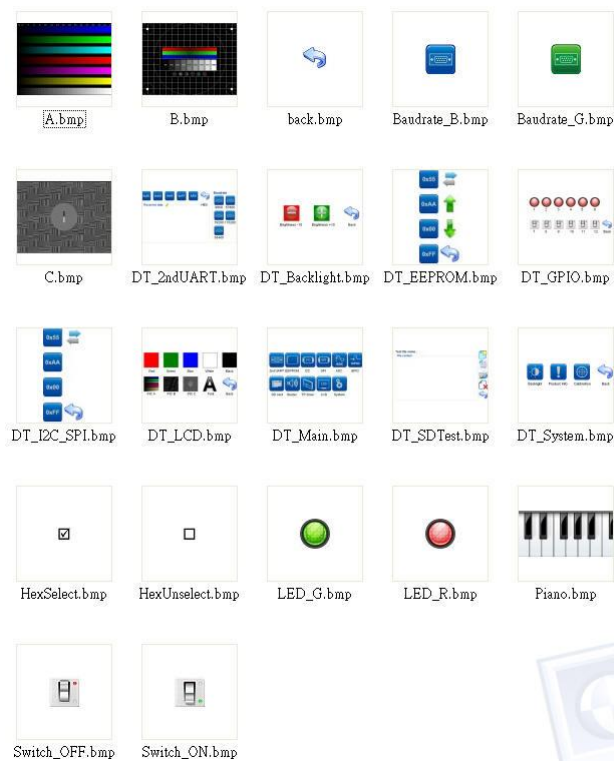


Test board

Step 3: To control the device in terminal mode or send / receive data using the 2nd UART, please connect the serial port (1st UART, 2nd UART) cable. The 1st UART serial cable with 3 wires controls the device using a terminal emulator such as HyperTerminal. In order to send and receive data via the RS232/RS422/RS485/USB, connect 2nd UART according to below image (cable with 5 wires).



Step 4: Next, decompress files (**BE635_DTP_XXXXXXXX_vXXX.rar**) that Bolymin provides and copies the content of demo_pic folder to the micro SD card's main folder and insert the card into BE635.



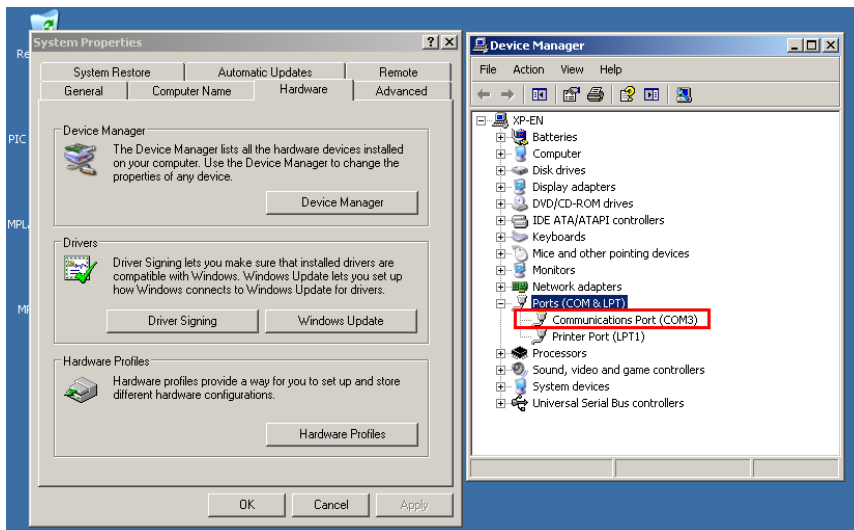
Demo picture

3.3 How to operate the demo program

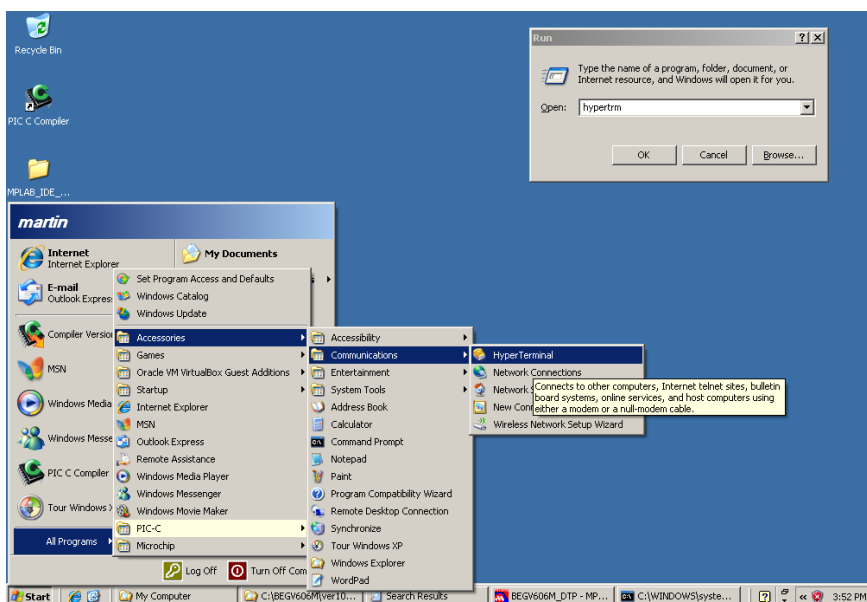
BE635 supports touch panel. Bolymin will calibrate the touch panel before shipping out. User can click the screen of BE635 to operate the demo program, if touch panel couldn't work, you can use hyper terminal for terminal emulation and recalibration. The PC keyboard can emulate as an input device to BE635. Here is the step-by-step guide.

Running Hyper Terminal

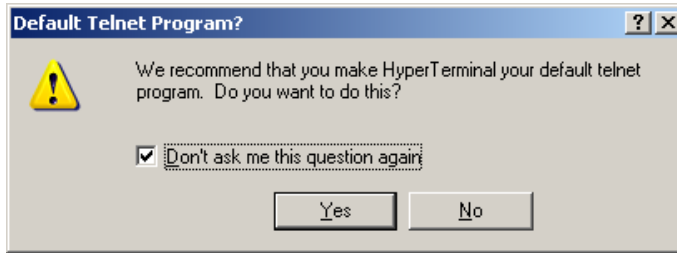
Step 1: Make sure you have at least one **RS-232 serial port** available. The following example shows **COM3** is available.



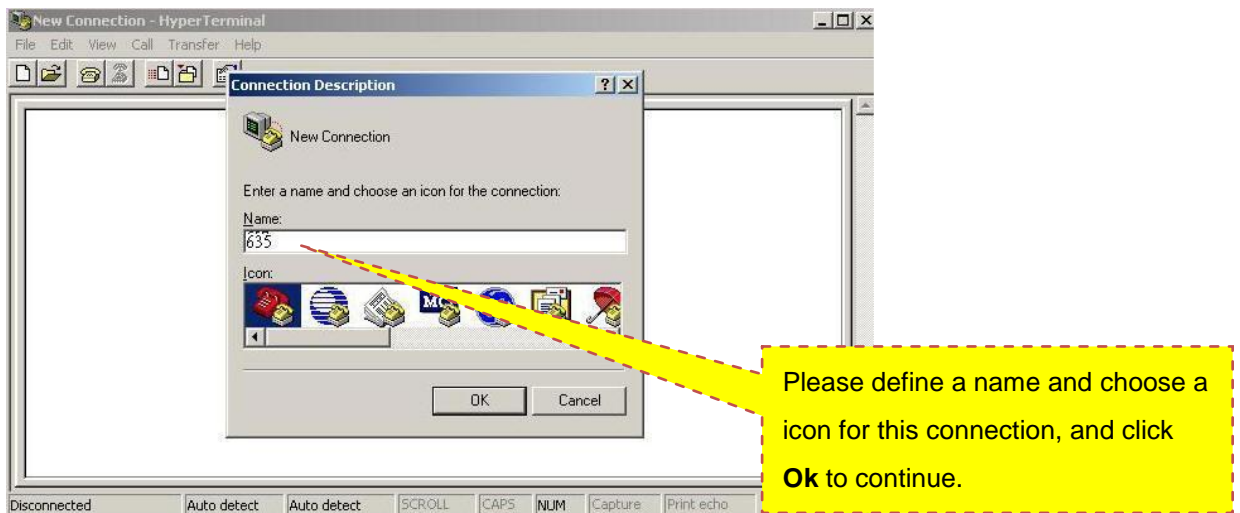
Step 2: On Windows XP PC: **Start → All programs → Accessories → Communication → HyperTerminal** (or Windows key +R, enter "hypertrm ")



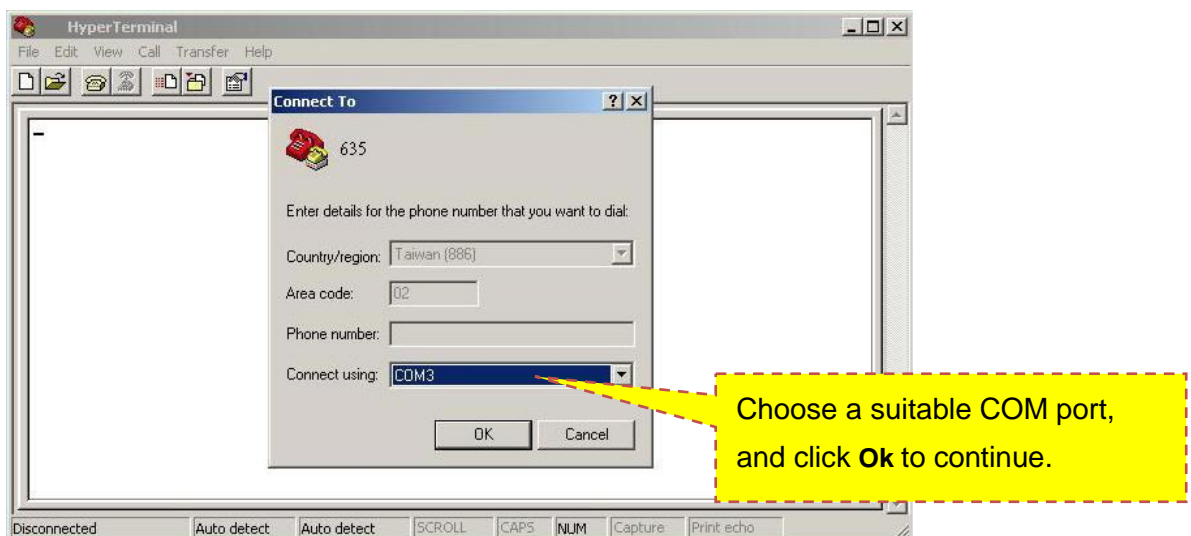
Step 3: Click **No** if you do not use hyper terminal to telnet to default host.



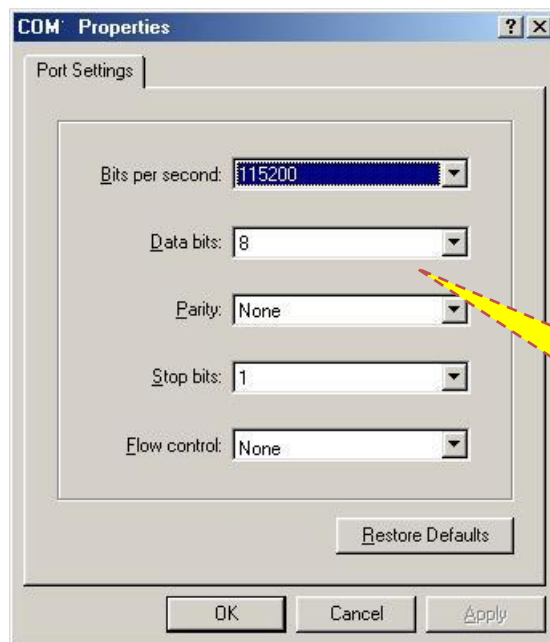
Step 4: Enter the file name to store the hyper terminal settings. System will auto add a .ht extension name.



Step 5: Select **COM** port as appropriate. Hyper terminal will pull down only valid COM ports.

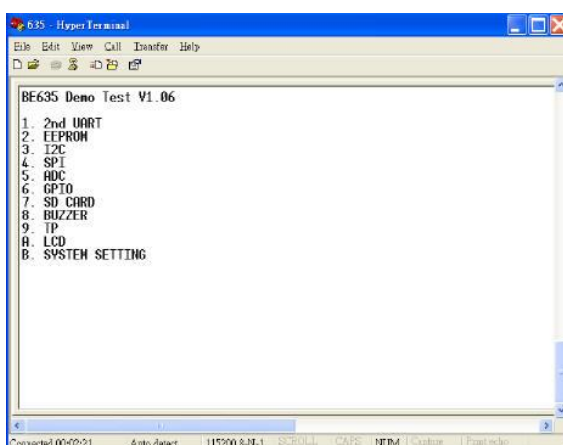


Step 6: It is required to set the serial communication as follows – **115200 bps, / 8/ None/ 1/ None**

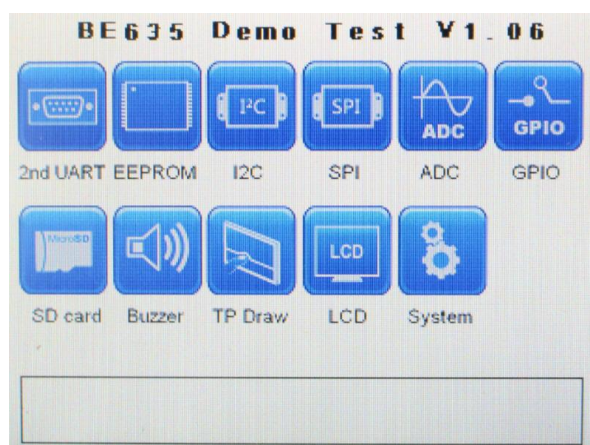


Key in COM port setting:
115200/ 8/ No/ 1/ No, and click
ok to continue.

Step 7: Now you plug in the power connector into the unit. The main screen on the device lets you choose the operations. Available operations are showed in Hyper Terminal Screen as depicted below. On your keyboard, hit the respective number to execute the operation.



(Hyper Terminal Screen)

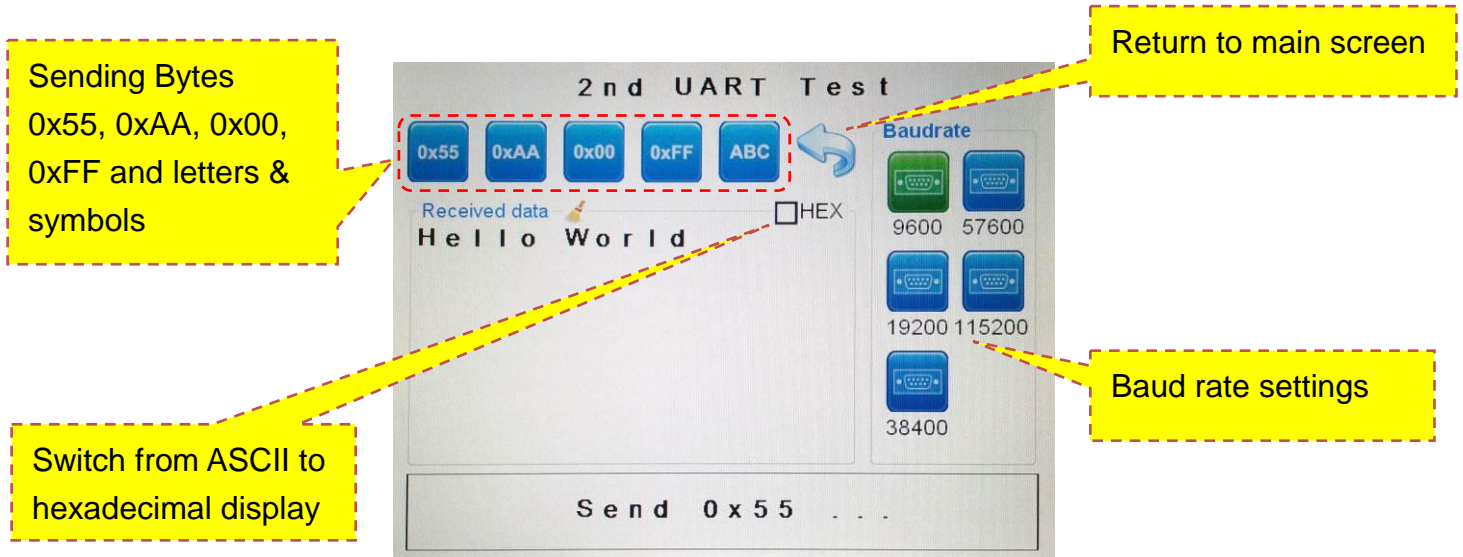


(BE635 Screen)

Name	Description
2nd UART	Test of 2 nd UART sending/receiving functionality at different baud rates
EEPROM	Test of EEPROM reading/writing functionality
I2C	I2C EEPROM; test of EEPROM reading/writing functionality
SPI	SPI FLASH; test of FLASH reading/writing functionality
ADC	Oscilloscope display of ADC values versus time
GPIO	General purpose I/O testing. Setting output pins, reading input pins
SD Card	Create File/Read/Write/Delete functionality testing
Buzzer	Application example: Piano
TP Draw	Application example: Touchpad drawing program
LCD	Screen filling examples, displaying images examples
System	Backlight Intensity setting, product information, T/P calibration

2nd UART Test

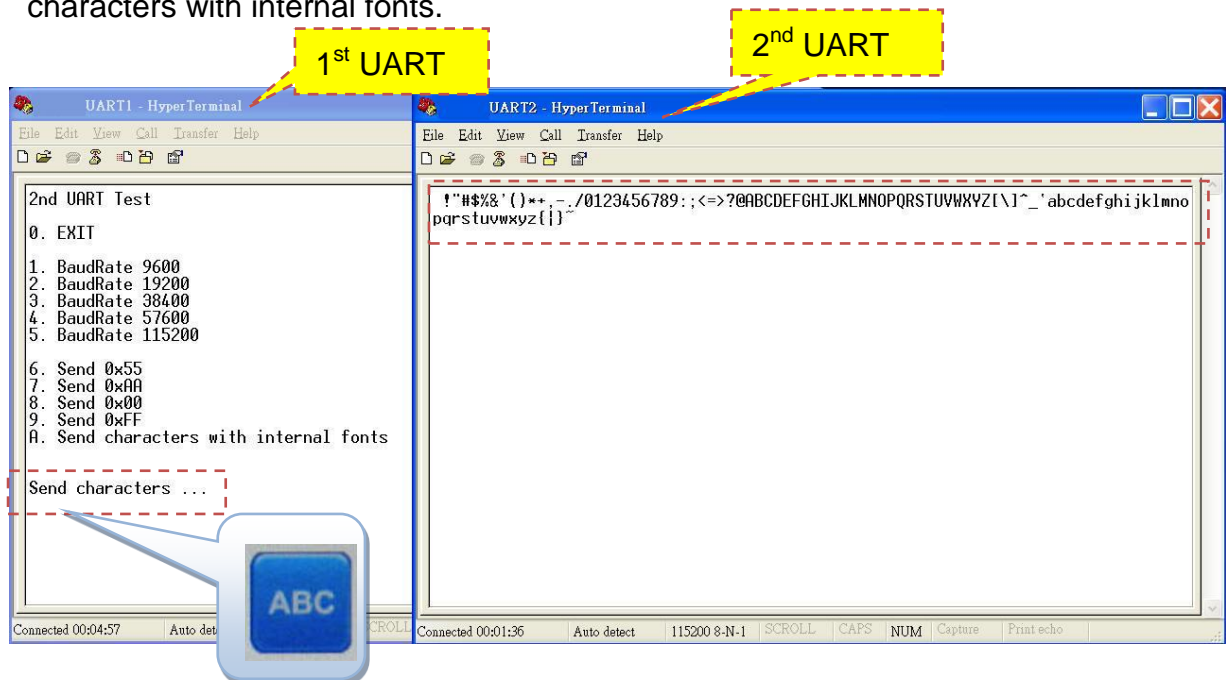
This screen lets you test the 2nd UART functionality



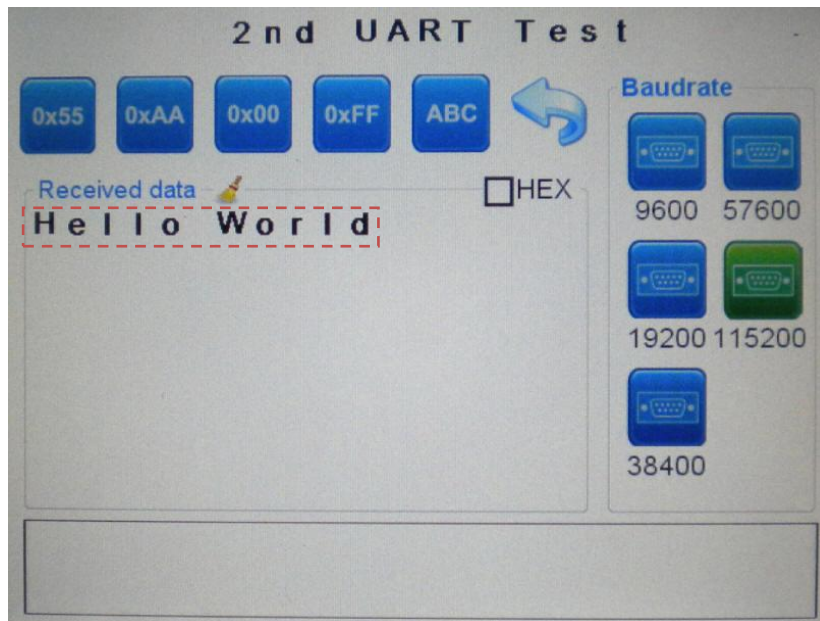
Step 1: First, connect the 2nd UART to your PC in the same way as you connected the 1st UART as described in [section 3.2 connecting the device](#).


Step 2: Set a baud rate in HyperTerminal. On BE635, set the same baud rate in the GUI. Available baud rates are **9600, 19200, 38400, 57600, 115200** .

Step 3: On BE635, tap on one of the send buttons (0x55, 0xAA, 0x 00, 0xFF, ABC) to send the characters to the 2nd UART's Hyper Terminal. For example that to send the characters with internal fonts from 1st UART, the Hyper Terminal of 2nd UART will show the characters with internal fonts.

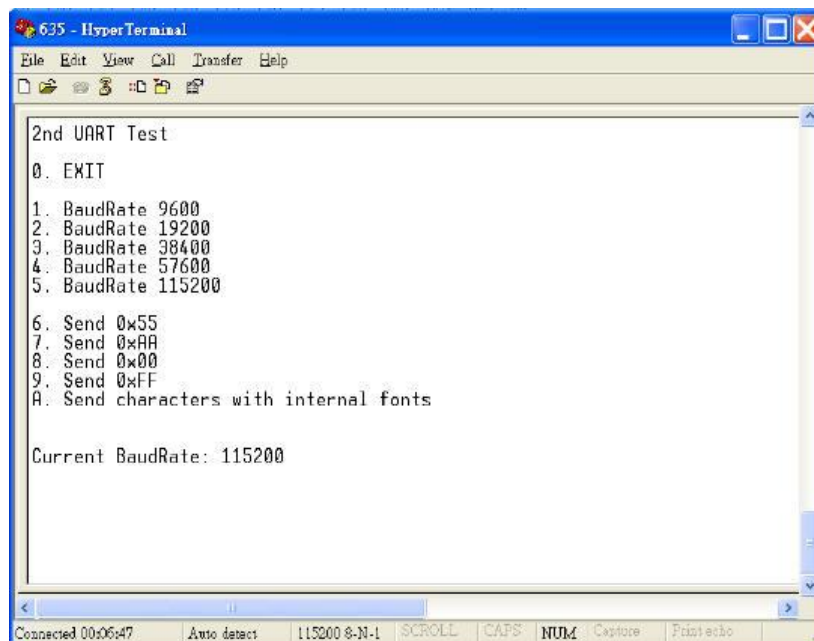


Step 4: Type in the 2nd UART's HyperTerminal "Hello World". The sent string now shows in the receive area on the device.



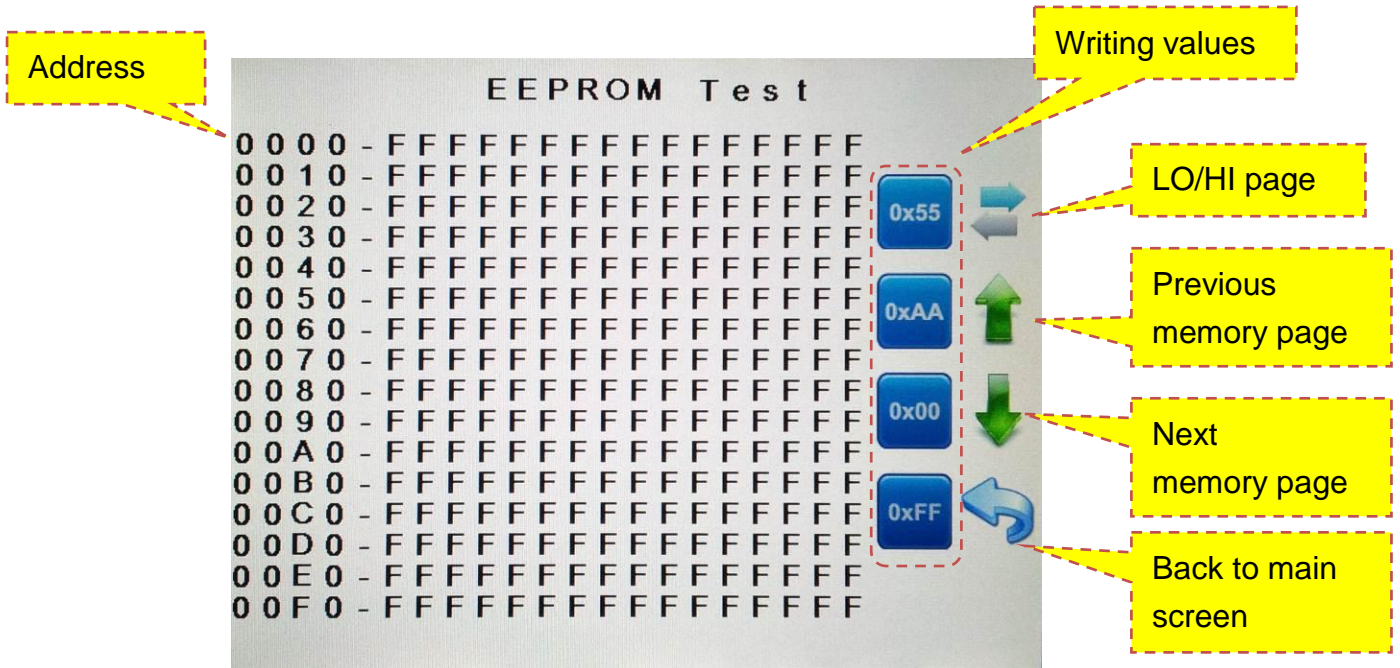
Step 5: Once the receive area is full, you can delete the contents with the broom 



Step 6: In Terminal mode, the screen shows as depicted below. Please hit the respective number to execute the operation on your keyboard,.




EEPROM Test

This screen lets you test the EEPROM's functionality

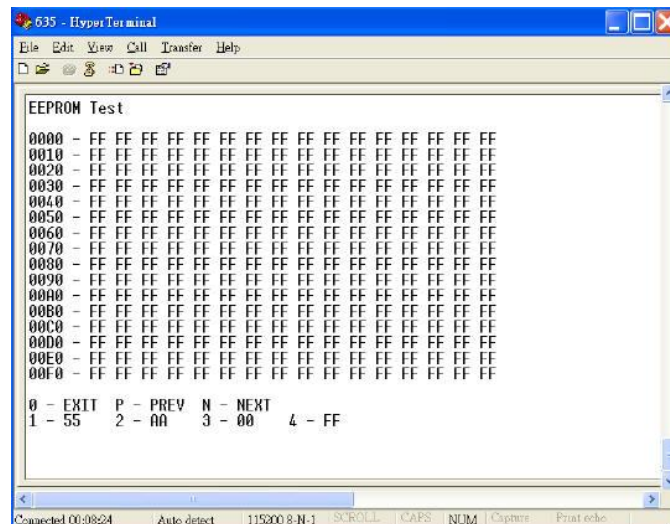


Step 1: Select a memory page you would like to see by using the   buttons.

Step 2: With the LO/Hi page button , address are switched to current address + 8 and back.

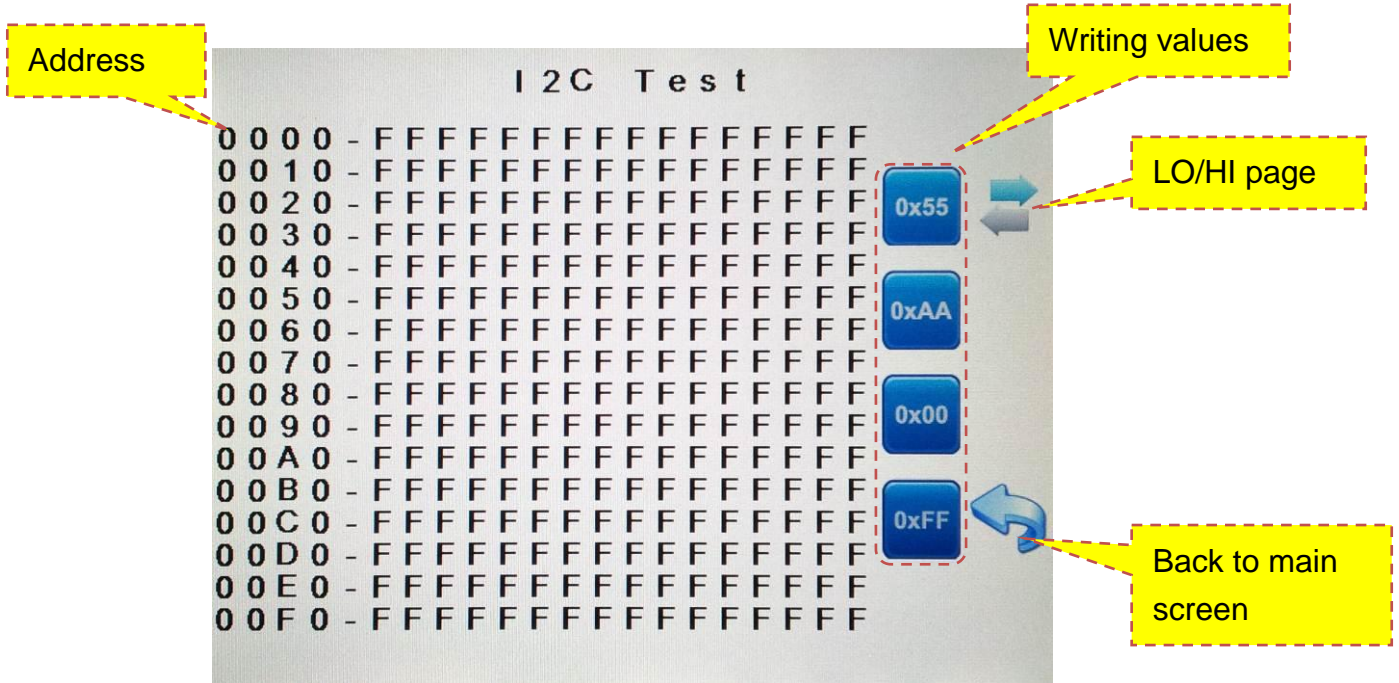
Step 3: Select a value (0x55, 0xAA, 0x 00, 0xFF) with which you would like to fill the current memory page (fills low and high page).

Step 4: In Terminal mode, the screen shows as depicted below, on your keyboard, please hit the respective number to execute the operation.




I2C Test

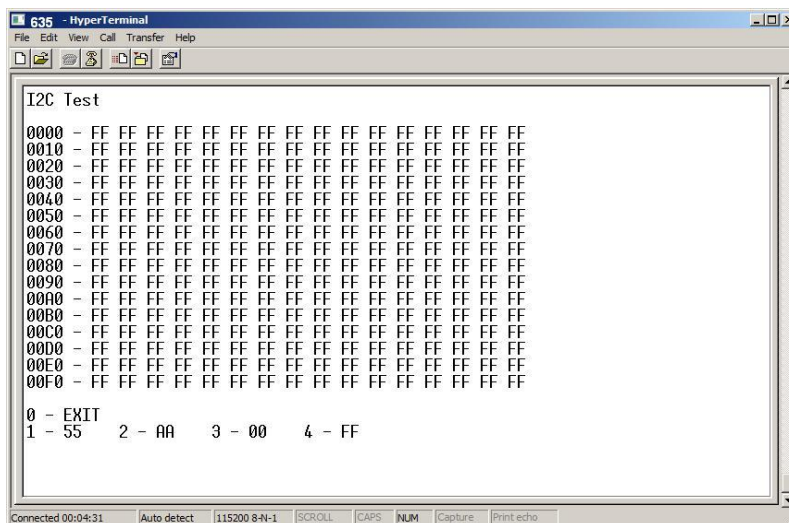
This screen lets you test the I2C EEPROM's functionality¹. Please make sure the test board is connected to BE635 and 5V power supply is connected to the test board.



Step 1: Select a value with which you would like to fill the current memory high and low memory page: 0x55, 0xAA, 0x 00 or 0xFF.

Step 2: With the LO/Hi page button , address are switched to current address + 8 and back.

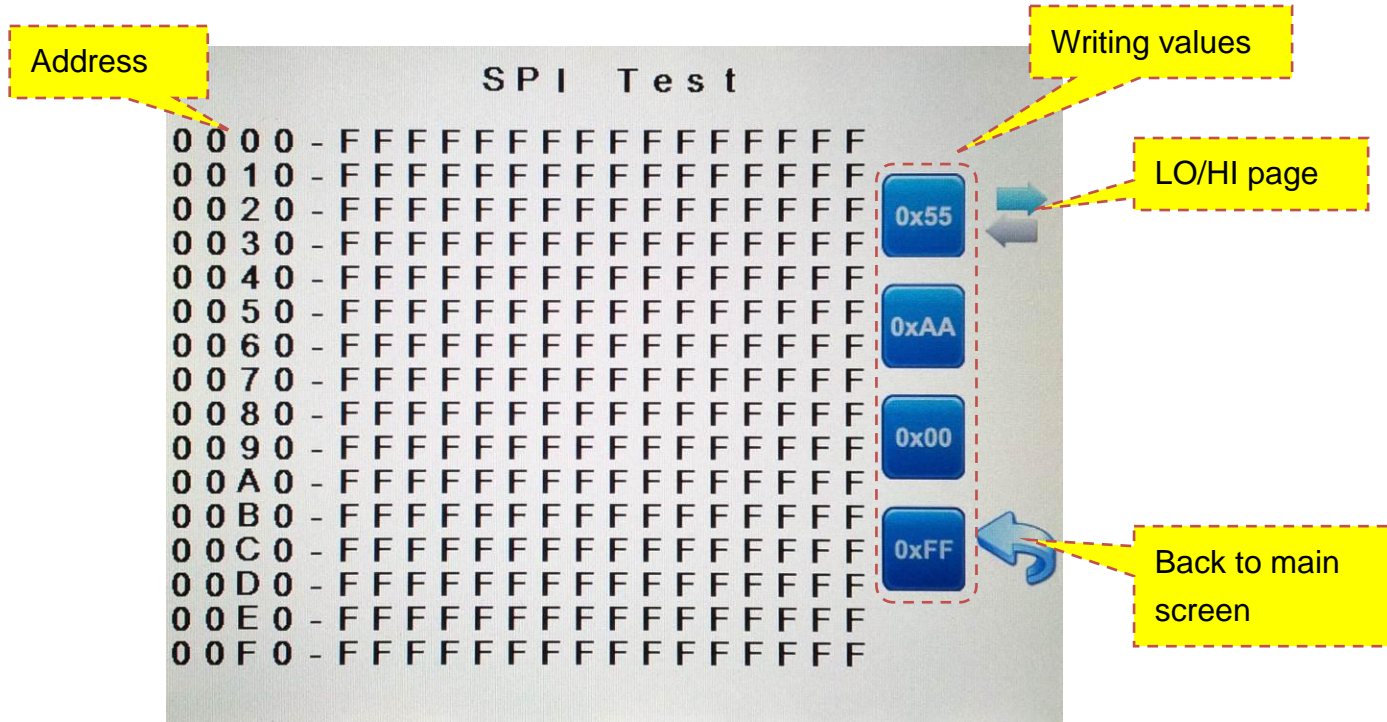
Step 3: In Terminal mode, the screen shows as depicted below, on your keyboard, please hit the respective number to execute the operation.




¹ The I2C EEPROM is an application example by Bolymin. Any kind of I2C device can be connected to BE635

SPI Test

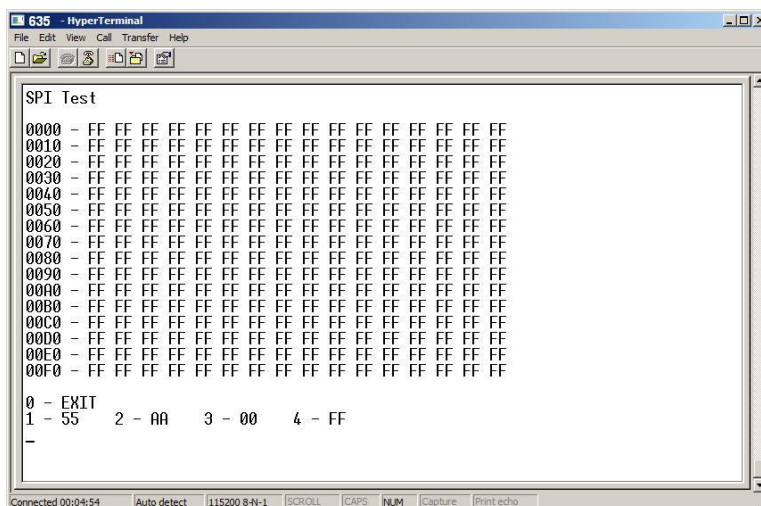
This screen lets you test the SPI FLASH's functionality². Please make sure the test board is connected to BE635 and a 5V power supply is connected to the test board.



Step 1: Select a value with which you would like to fill the current memory high and low memory page: 0x55, 0xAA, 0x00 or 0xFF.

Step 2: With the LO/Hi page button , address are switched to current address + 8 and back.

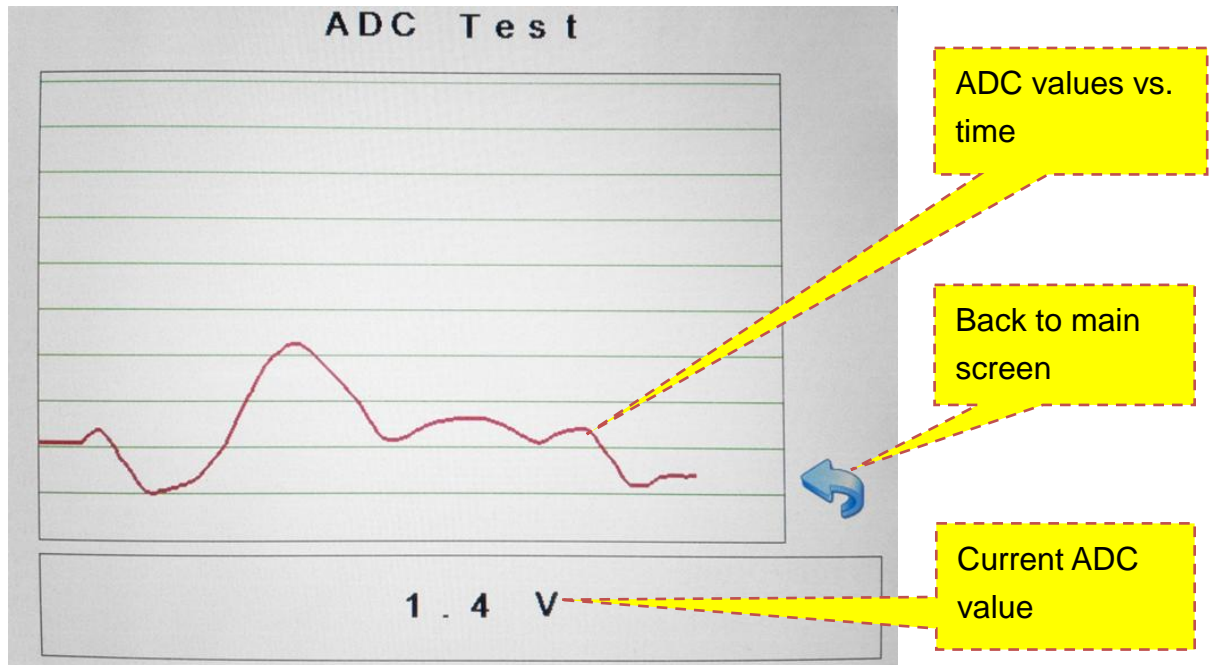
Step 3: In Terminal mode, the screen shows as depicted below, on your keyboard, please hit the respective number to execute the operation.



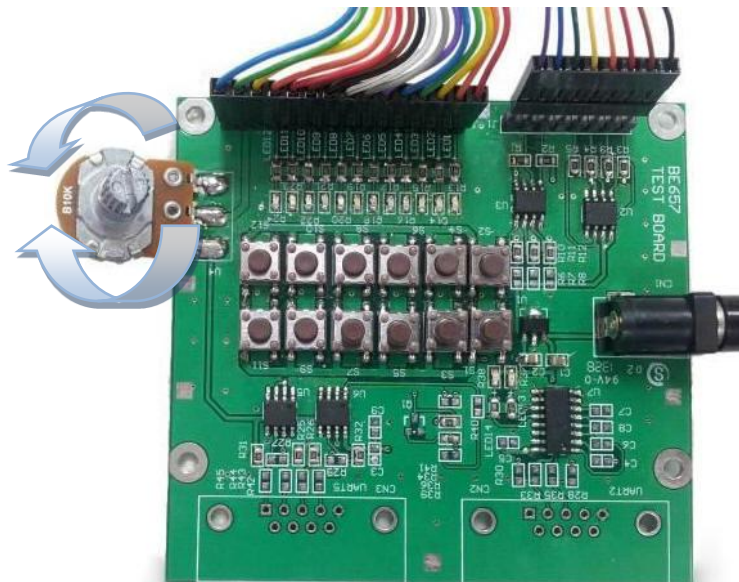
² The SPI FLASH is an application example by Bolymin. Any kind of SPI device can be connected to BE635

ADC Test

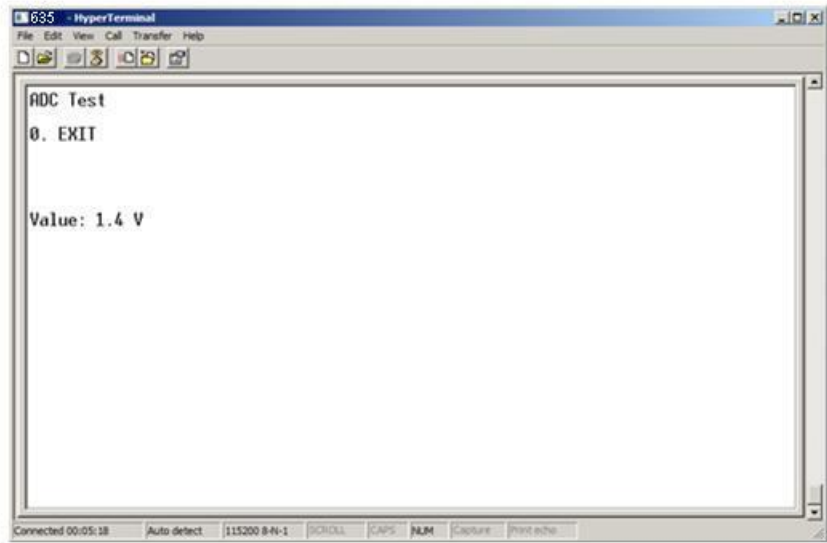
This screen lets you test the ADC's functionality. Please make sure the test board is connected to BE635 and a 5V power supply is connected to the test board.



Step 1: Vary the potentiometer on the test board and observe the values being drawn on the screen.

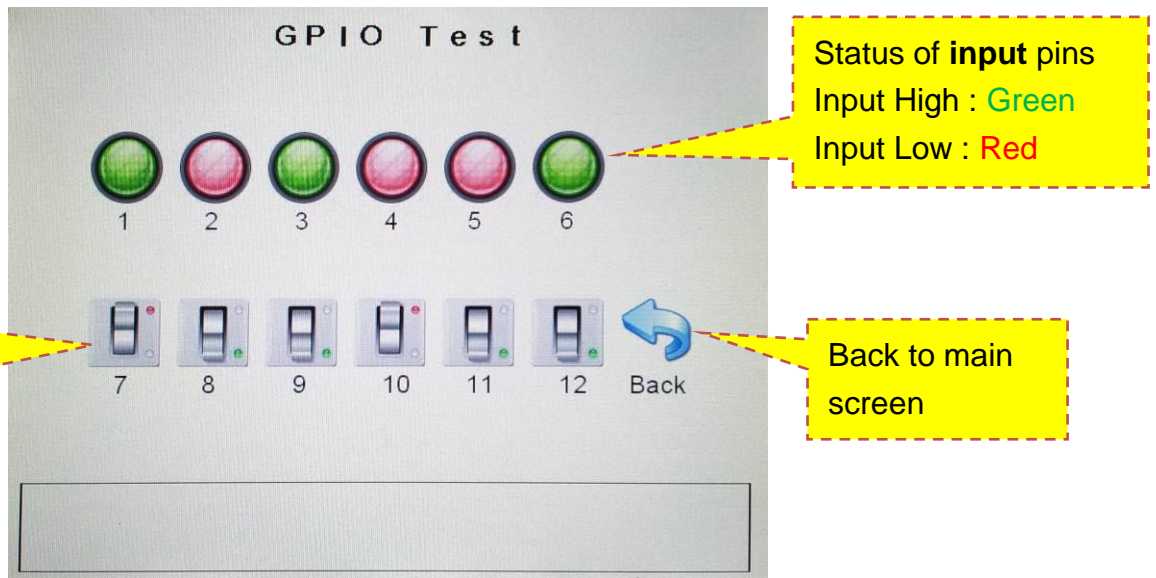


Step 2: In Terminal mode, the screen shows as depicted below, on your keyboard, please hit 0 to exit the test.



GPIO Test

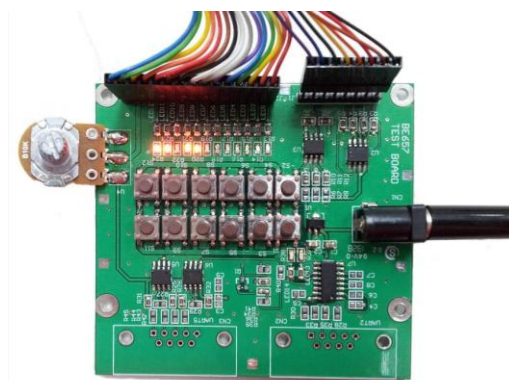
This screen lets you test the general purpose I/O functionality, please make sure the test board is connected to BE635 and a 5V power supply is connected to the test board.



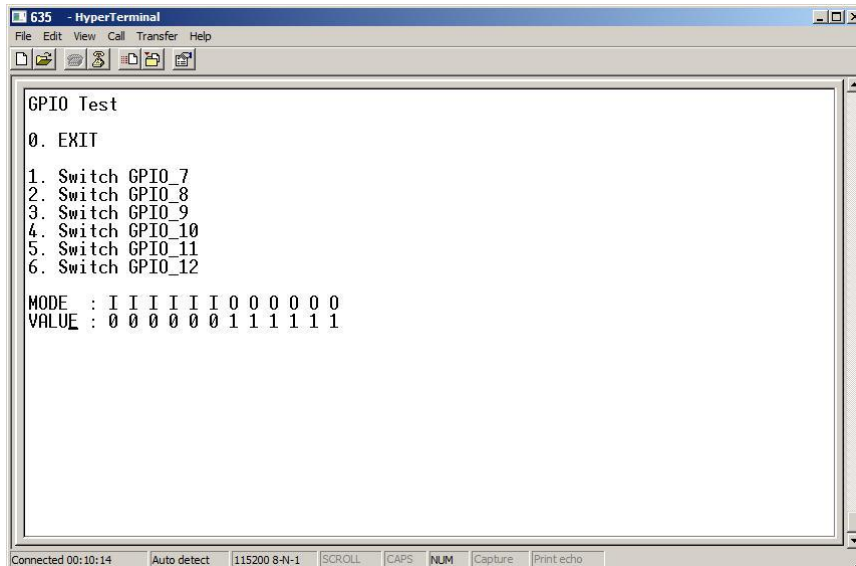
Step 1: The GUI lets you see the state of the GPIO pins. In the demo test program, GPIO_1 ~ GPIO_6 are set as input pins and GPIO_7 ~ GPIO_12 are output pins. Whenever the value of the input pins change, the value of related output pins will change accordingly. Here is the mapping table of demo test program. You can change the I/O mode of each pin in your program. Detailed information about GPIO control can be found in **section 2.8 of the programming guide**.

Input pin	GPIO_1	GPIO_2	GPIO_3	GPIO_4	GPIO_5	GPIO_6
Output pin	GPIO_7	GPIO_8	GPIO_9	GPIO_10	GPIO_11	GPIO_12

For above setting of the output pins (8, 9, 11, 12 high level), the results can be seen in the image below.



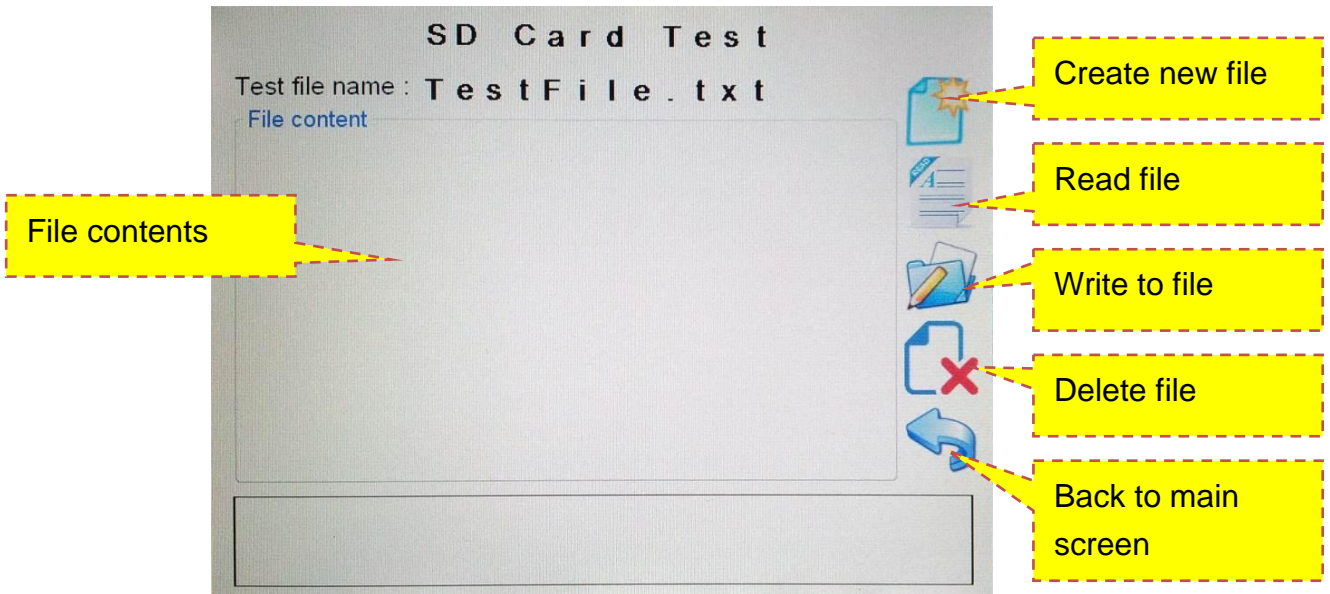
Step 2: In Terminal mode, this screen shows as depicted below. On your keyboard, please hit 1-6 to toggle the state of the output pins. In the **MODE** line, the mode of the GPIO pins are shown with GPIO pin 1 on the left and pin12 on the right (**I**=Input, **O**=Output). The **VALUE** line displays the state of the pin. Press 0 to return to the main screen.







```
635 - HyperTerminal
File Edit View Call Transfer Help
GPIO Test
0. EXIT
1. Switch GPIO_7
2. Switch GPIO_8
3. Switch GPIO_9
4. Switch GPIO_10
5. Switch GPIO_11
6. Switch GPIO_12
MODE : I I I I I I O O O O O O
VALUE : 0 0 0 0 0 0 1 1 1 1 1 1
Connected 00:10:14 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo
```

SD Card Test

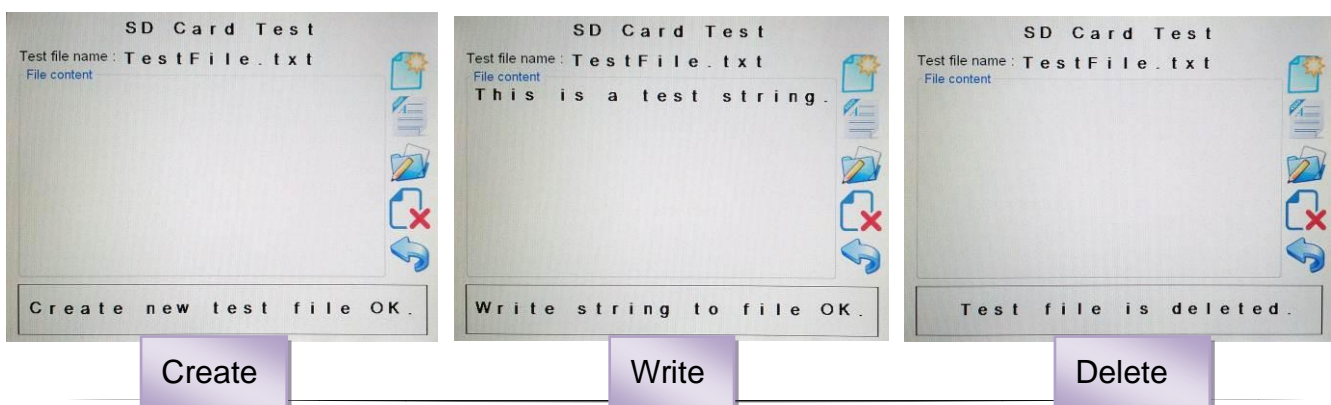
This screen lets you test the SD Card's read/write/delete functionality.



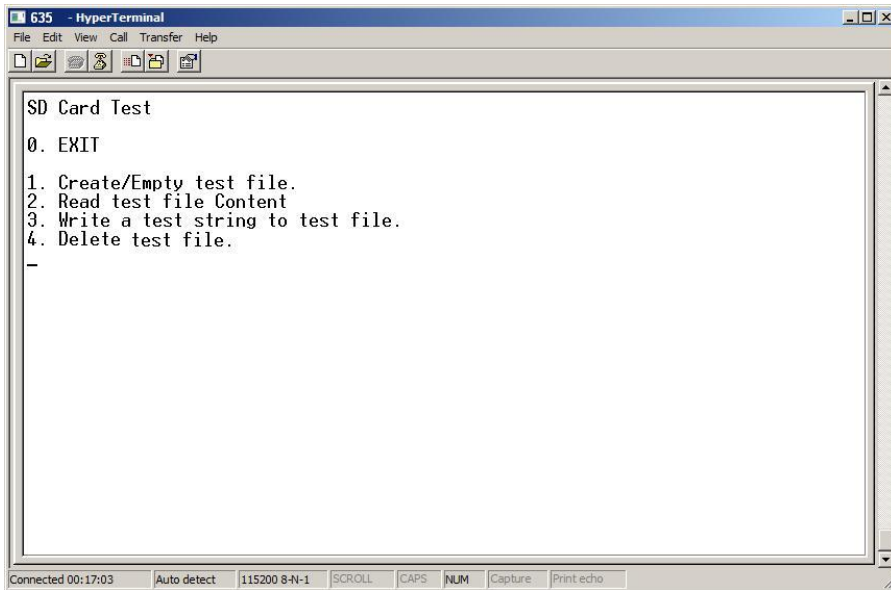
Step 1: From the operations on the right hand side, choose “**Create**”, “**Read**”, “**Write**” or “**Delete**”. The contents of the file on the device are shown in the contents area.

ICON	Description
	Create new txt file on SD card
	Read txt file contents of SD card and display on BE635
	Write the string to txt file on SD card
	Delete the txt file of SD Card

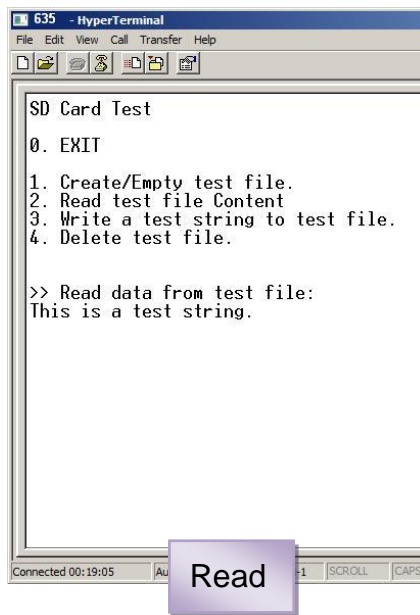
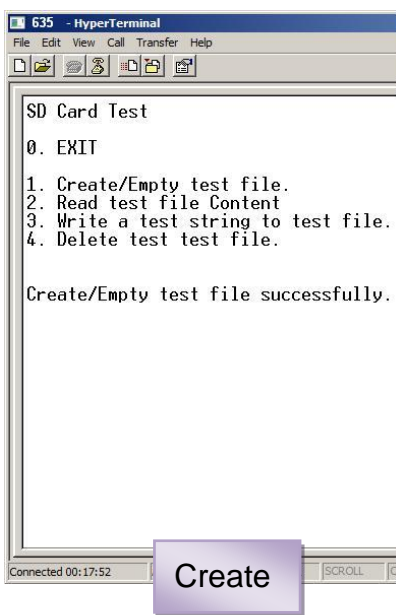
Step 2: The different operations performed on the device will show the results as depicted in below images.



Step 3: In Terminal mode, the screen shows as depicted below.

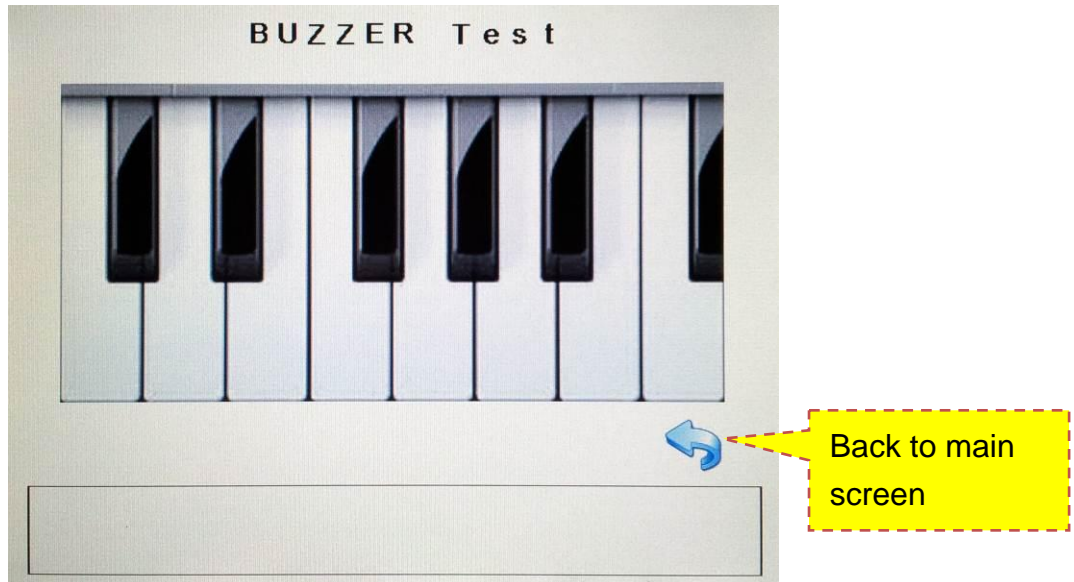


Step 4: On your keyboard, please hit the respective number to execute the operation.



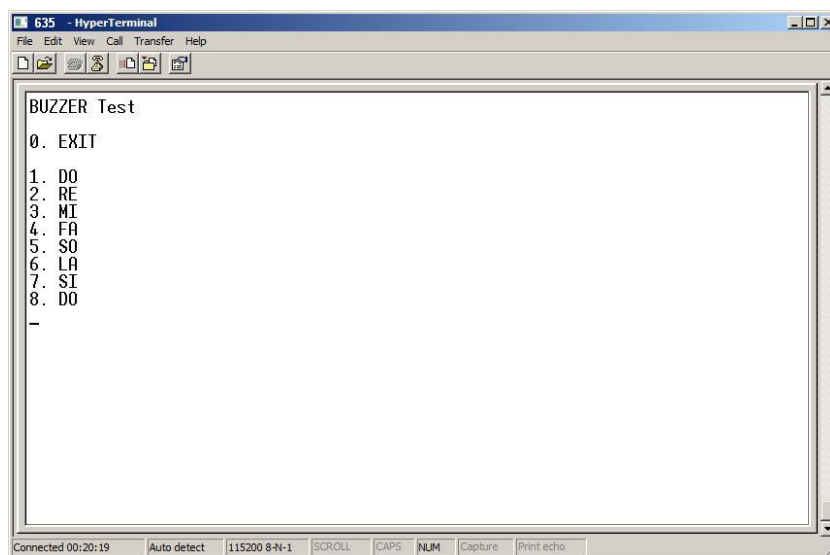
Buzzer Test

This screen lets you test the Buzzer functionality.



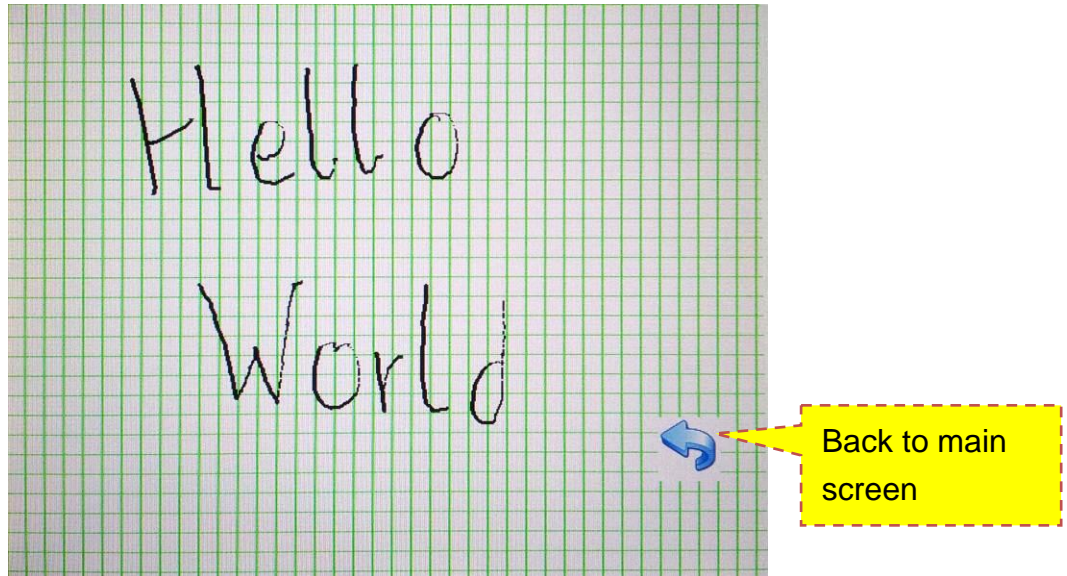
Step 1: Hit the black or white keys on the piano. The respective note will be played through the buzzer.

Step 2: In Terminal mode, the screen shows as depicted below, on your keyboard, please hit the respective number to play a certain tone. Press 0 to return to the main screen.

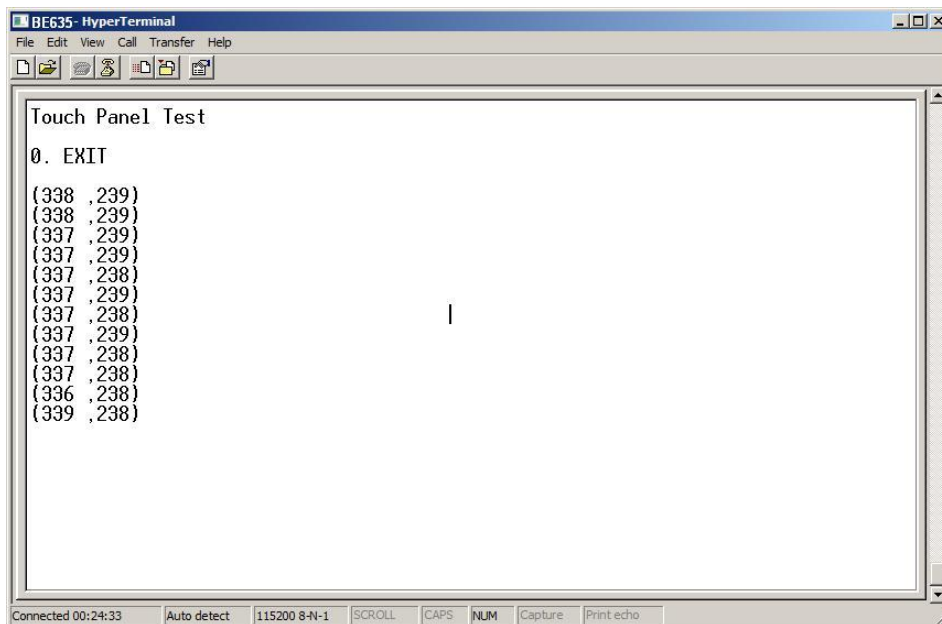


Touch panel Draw Test

This screen lets you test the touchpad functionality using a simple drawing program.

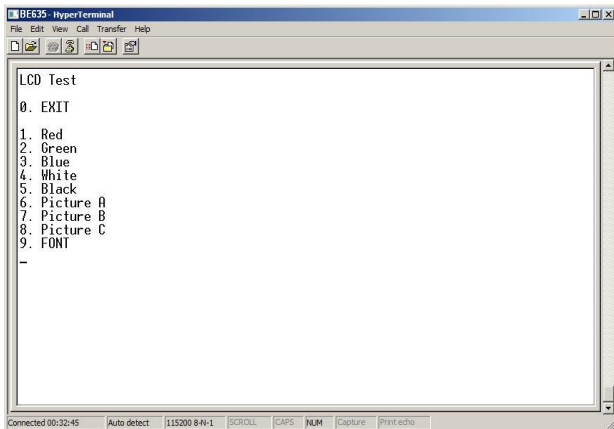


Step 1: Write text or hit certain coordinates and check in the terminal window, if the coordinates is not match the coordinates of the touched point. A calibration might be necessary before using the drawing program.

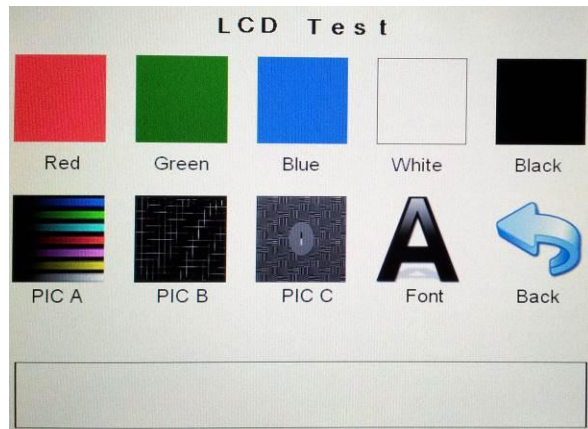


LCD Test

This screen lets you test the image and built in font functionalities.

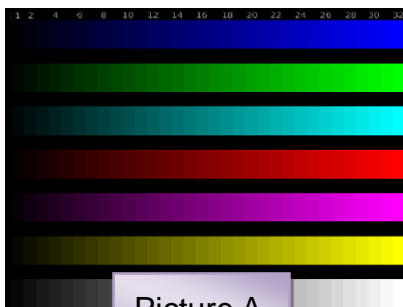


(Hyper Terminal Screen)

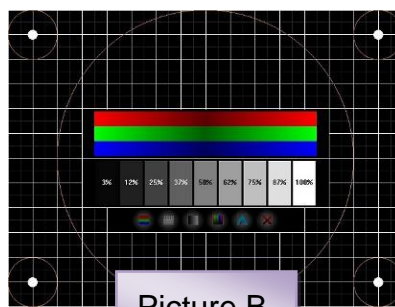


(BE635 Screen)

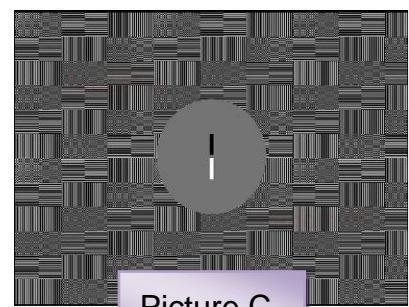
Step 1: Operations that can be performed are filling the screen with red, green, blue, white, and black as well as showing images and fonts.



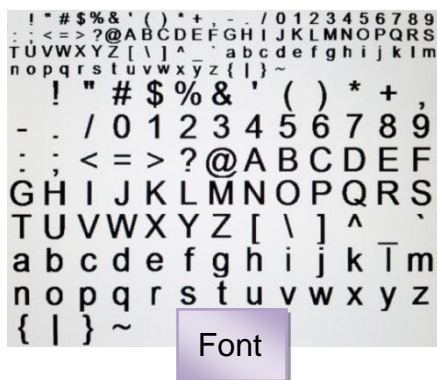
Picture A



Picture B



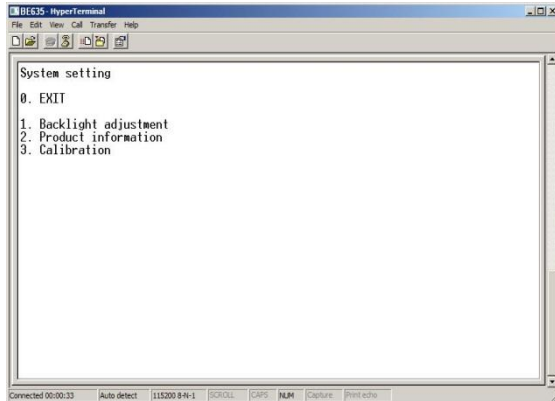
Picture C



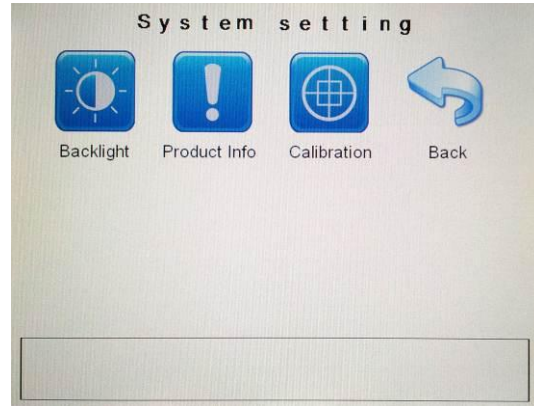
Font

System Setting




This screen lets you set the system's backlight intensity, display the product information and calibrate the touch panel.

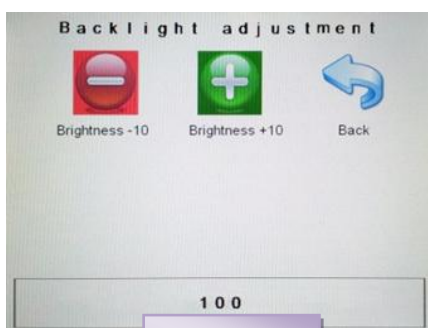


(Hyper Terminal Screen)

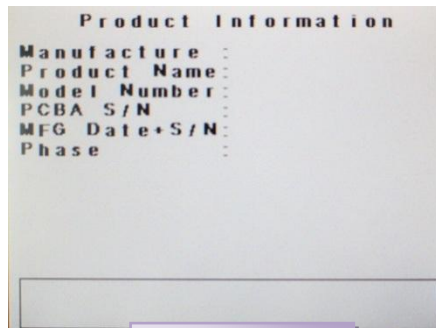


(BE635 Screen)

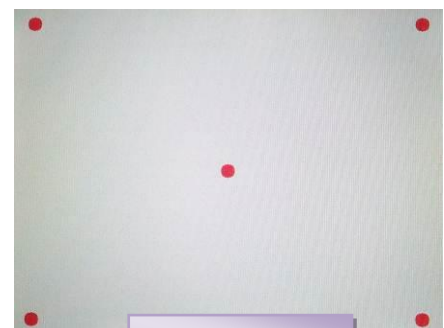
ICON	Description
 Backlight	The backlight can be adjusted from 10% to 100% in steps.
 Product Info	The product information displays the product information stored in memory.
 Calibration	Calibration is performed by using 5-points calibration where each of the 5 points is being touched successively.



Backlight

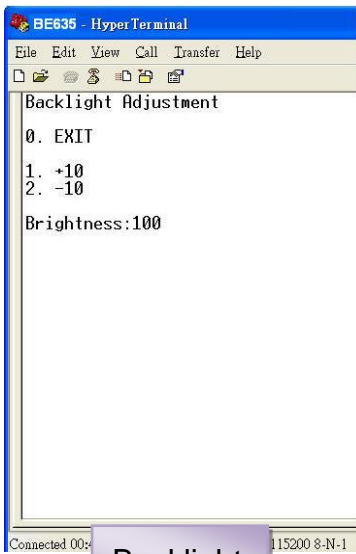


Product info.



Calibration

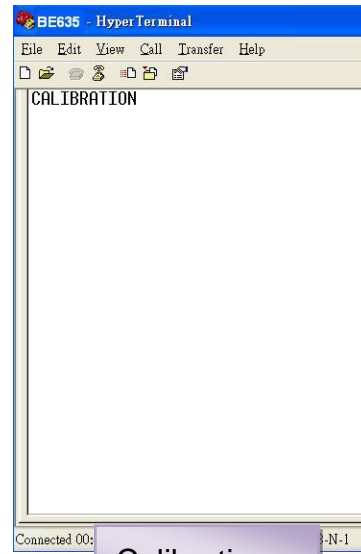
In terminal mode, the screens show as depicted below.



Backlight



Product info.



Calibration

< End of BE635 User Manual >