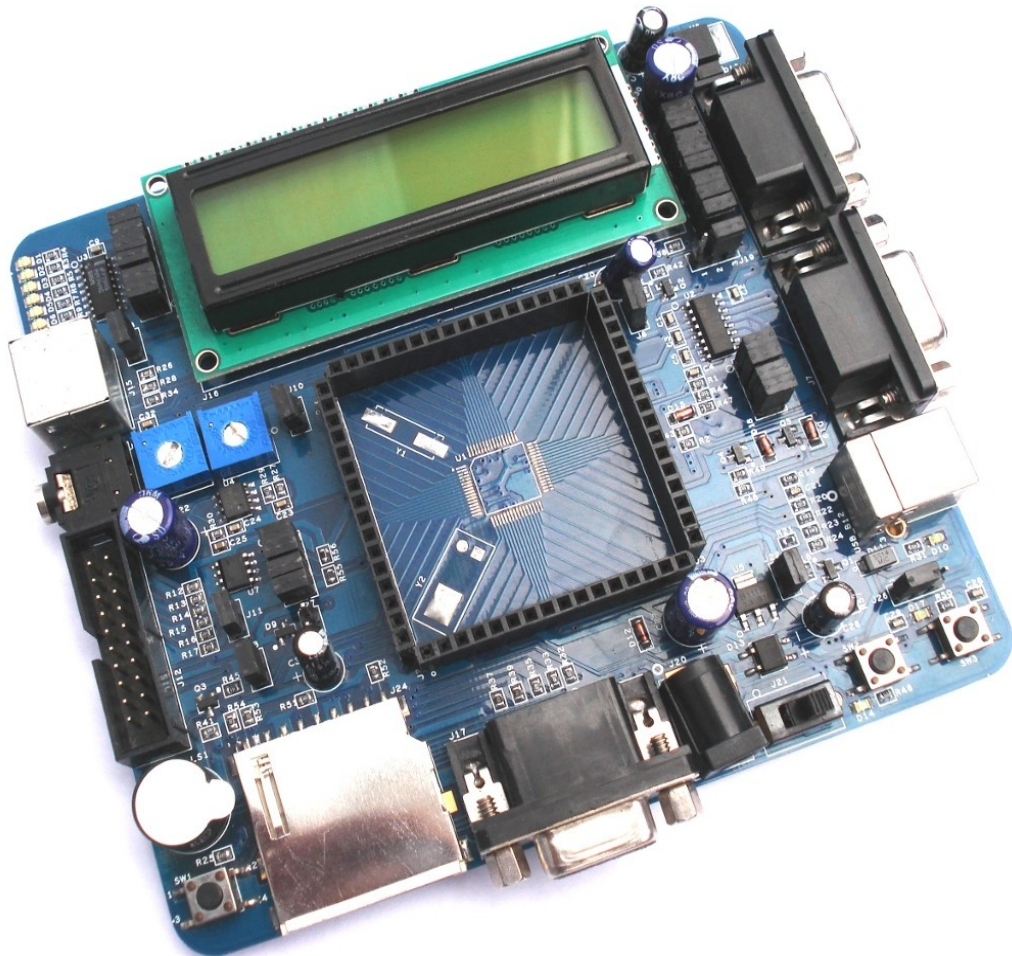


BlueBoard Base



USER MANUAL

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Introduction

BlueBoard Base is modular approach to the ever evolving design of our flagship product Blueboard-LPC2148. It is designed keeping in mind the requirements of a development engineer, who could be working on different controllers but would prefer the same peripheral interface or a company working on different products using different controller and would not prefer to invest huge amount in individual boards or a hobby enthusiast who would be trying out different controllers but would not be willing to invest in different boards for each controller. For all these, the user can buy the required stamp module and work on this board.

Features

BlueBoard Base has various peripherals with configurable jumpers. Extension headers for all microcontroller pins.

(1) Note: The functionality of the features mentioned for the BlueBoard Base in this document are directly dependent on the Stamp board(microcontroller) used. Ex: Using LPC2148 Stamp board all the features mentioned here are available. But if LPC1114 Stamp Board is used some features like USB, VGA, etc., are may not be available. This document is for the Blueboard Base + LPC2148 stamp.

Hardware

- Dimensions of 114 X 127 mm²
- Two layer PCB (FR-4 material)

- **Power**
 - Power supply: DC 6.5V with power LED
 - On-board linear regulators generate +3.3V/500mA and +5v/500mA from power supply
 - USB connector (as alternate power source)

- **Connectors**
 - Extension headers for all microcontroller pins
 - Two RS232 port connectors
 - VGA connector
 - PS/2 connector
 - JTAG connector
 - SD/MMC connector
 - USB B-type connector with Link-LED
 - All peripheral configurable via jumpers

- **Other Peripherals**
 - 256Kb I2C based EEPROM
 - Audio power amplifier with audio jack
 - 2 line X 16 character LCD with back light control

- Configurable for manual and automatic program download(ISP) via serial port
- 8 controllable LEDs on SPI using 74HC595

Software

- Firmware for USB bootloader
- Preloaded program to test the peripherals

Getting started

Before you start working with the board you need to have a few things available.

Requirement

The requirements are divided in two sections.

Hardware

- The required controller Stamp board
- Power adapter – rating 7.5 V, 1 AMP
- USB cable
- VGA cable
- DB-9 straight Full and Half modem serial cable
- A headphone / speaker to verify the DAC
- USB / parallel JTAG

Software

- Keil MDK-ARM / Rowley CrossWorks tool for cross compiling
- Flash Magic tool
- Serial Terminal program

Setup

Hardware

- Connect the DC power
- Connect the monitor to VGA connector
- Connect the headphones to audio connector

- Connect the serial port 0 to PC
- Connect USB to PC
- Insert the required stamp board on to the Base

Software

- Start a terminal program like HyperTerminal in MS Windows / minicom in Linux (refer to configuring HyperTerminal / minicom)

Validating BlueBoard Base

Once you have all these accessories connected to the BlueBoard Base you can run a simple test to verify the proper working of all the peripherals. It is highly recommended that you test all the peripherals as soon you receive the BlueBoard. The BlueBoard is shipped with the preloaded firmware which can test all the peripherals.'

Hardware Configurations

The connectors on the board can be configured using jumpers. Refer to the table below.

Modules and Jumpers Relationship

Jumper	Related Module	Usage
J6	UART0 & UART1	Connecting all pins enables both UART0 and UART1. Pins 1 and 3 enable UART and pins 5 and 7 enable UART0.
J8	VREF voltage	Connecting this will set the VREF voltage to 3.3V.
J9	Test LEDs	Connecting all pins enables test LED's. Pins 3 to 9 are connected to SPI0 lines of LPC2148.
J10	ADC	This will enable the ADC interface
J11	JTAG	This will enable the debug mode on the microcontroller.
J12	Keyboard(PS/2)	This will enable the PS/2 peripheral.
J13	Keyboard(PS/2)	This will provide 5V supply to PS/2 connector.
J18	LCD	Connecting all pins enabled LCD. Pins 1 to 7 are data lines, 9 to 13 are control lines and pin 15 is 5V power pin.
J19	LCD Backlight	If pins 1 and 2 are connected the LCD back light will always stay ON and if pins 2 and 3 are connected the back light can be controlled by firmware.
J22	Power supply to board	Connecting this will provide 3.3V supply to board.
J25	I2C	By connecting all pins it enables I2C interface and its status

		is displayed on LCD.
J26	Bootloader select	If pins 1 and 2 are connected, manual bootloader mode is selected and if pins 2 and 3 are connected auto bootloader mode is selected. UART0 to be used for this purpose.
J27	RTC	Connect a battery to use RTC.

Switch on the BlueBoard Base. The interfaces are activated in the following manner: USB, VGA, Audio, Buzzer, LEDs, LCD, SD/MMC, I2C, UART, PS/2.

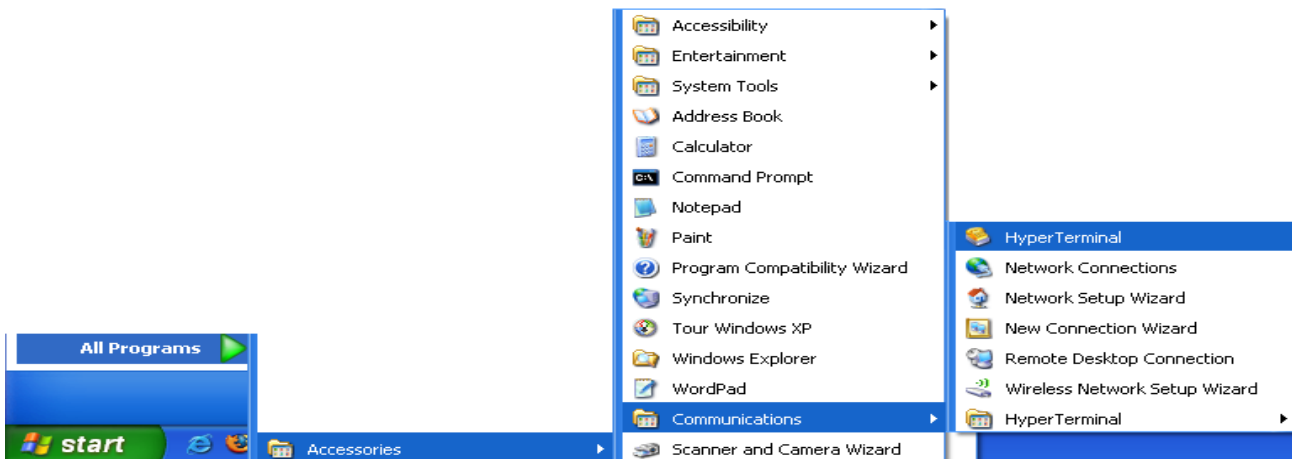
LEDs and SPI0

Test setup: Connect jumpers to all pins of J9 to enable the LED's.

A few seconds after the Blueboard is turned ON or reset; the LEDs will turn ON in ascending pattern and will turn OFF in descending order and this pattern will repeat three times. Please note that all the LEDs should glow; this confirms the working of LEDs. Now, since the LEDs are connected through a serial to parallel converter this test also confirms the working of SPI0 of the LPC.

UART0 & UART1

Test setup: Connect jumpers to all pins of J6. Open the hyper terminal as shown in the image below. To test the UART you can use either a full modem or half modem cable.



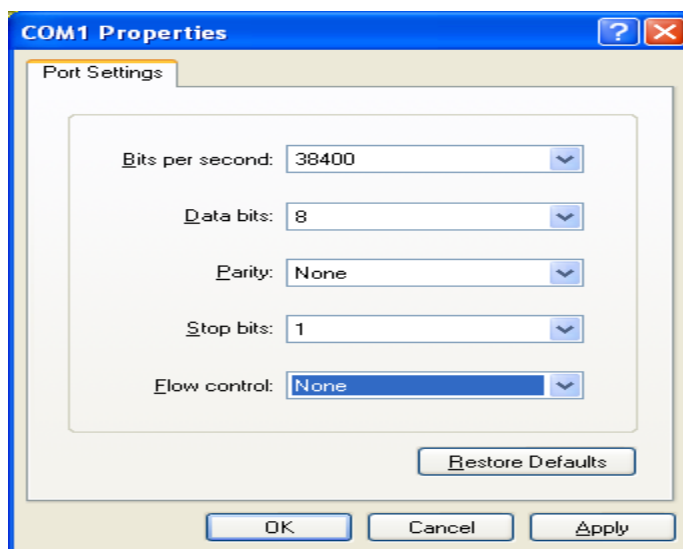
Click on hyper terminal a “Connection Description” window opens. Enter a name under the name tab e.g. BlueBoard and click OK.

A “Connect To” window opens where you have to select the COM port. In this example it is COM1. Click OK.

A “COM1Properties” window appears. Set the values as shown below. Click OK.

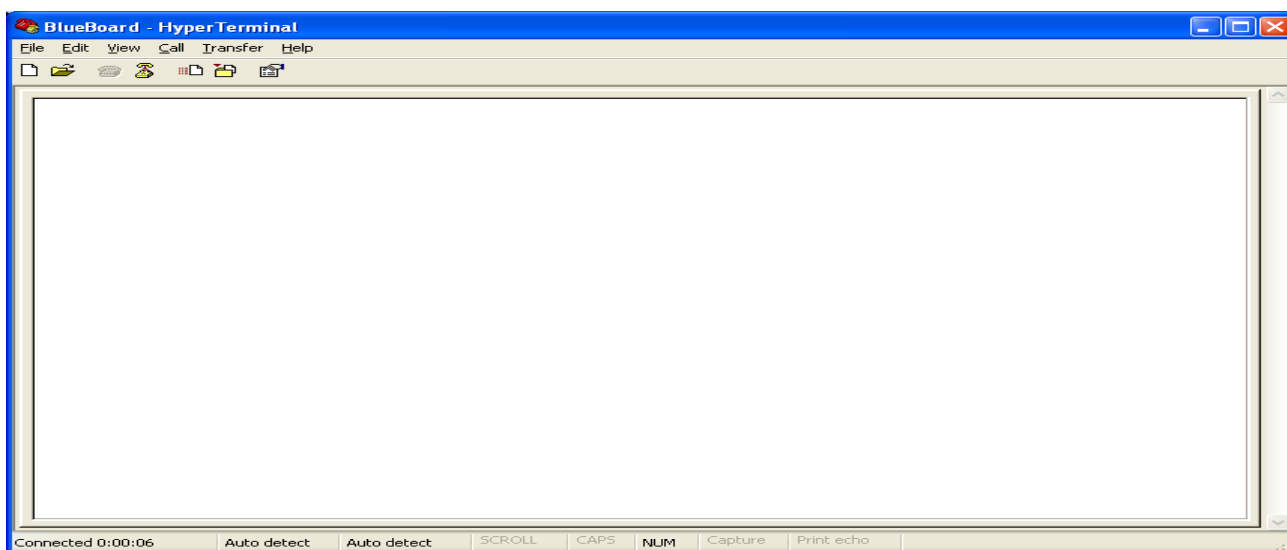


A “COM1 Properties” window appears. Set the values as shown below.



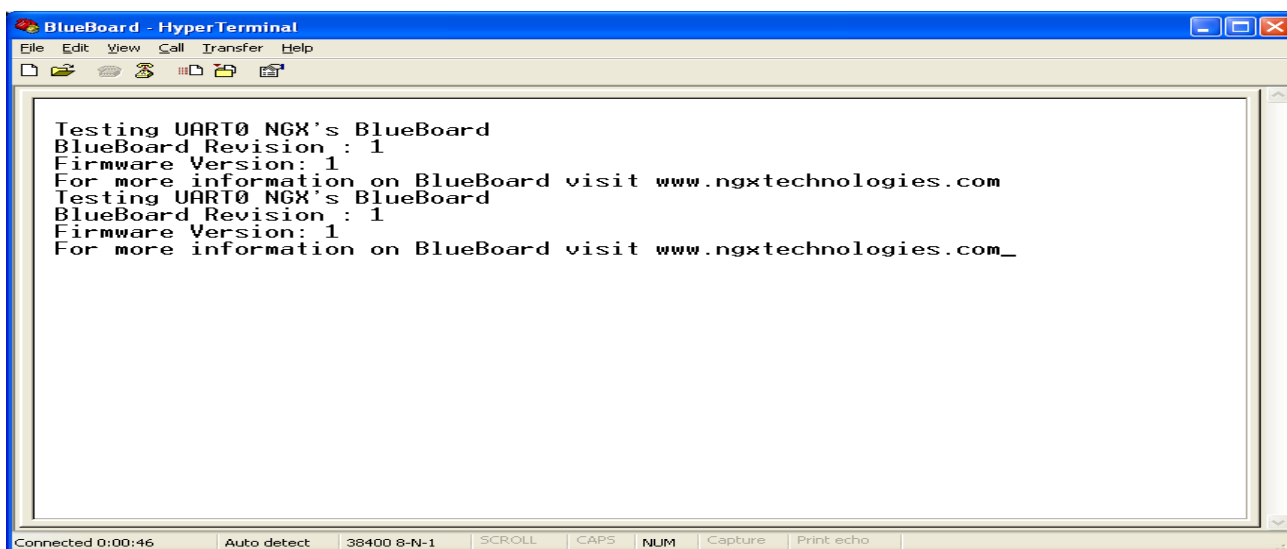
Click OK.

Next an empty “BlueBoard-Hyper Terminal” window opens as shown.



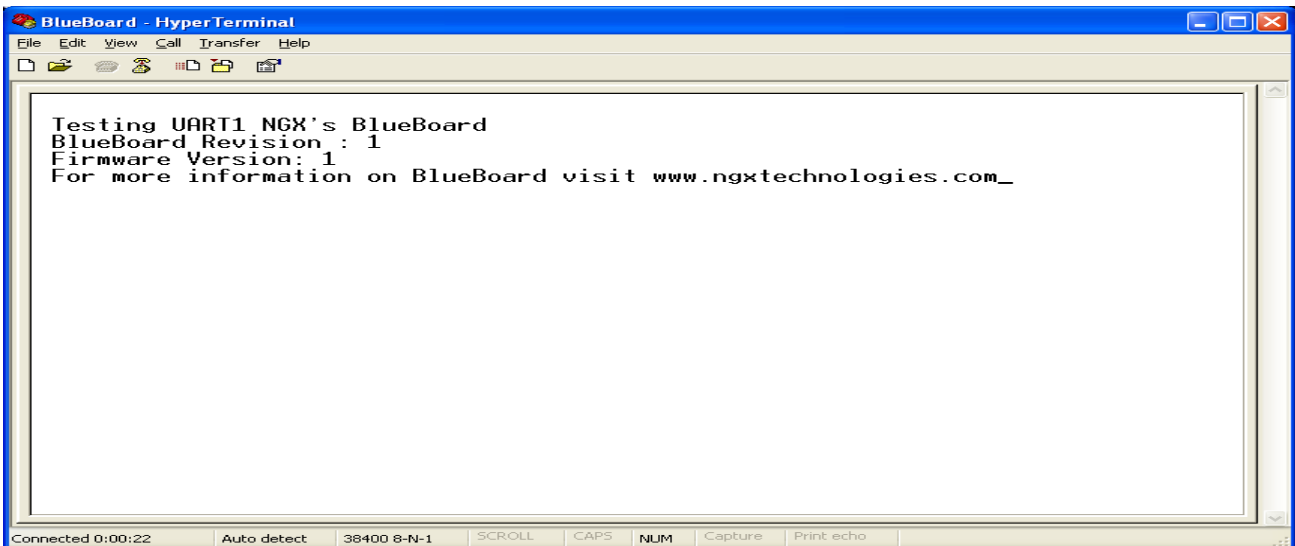
Now make sure that the BlueBoard is powered and the serial port is connected to the respective port to be tested (UART0 or UART1). By pressing any key from keyboard the following message will appear for the respective UART.

For UART0:



UART0 can also be used for serial programming. If the selected bootloader mode is Manual then Half modem cable should be used, else if it is in Auto mode use full modem cable. Note that after programming in auto mode the serial cable should be disconnected.

For UART1:



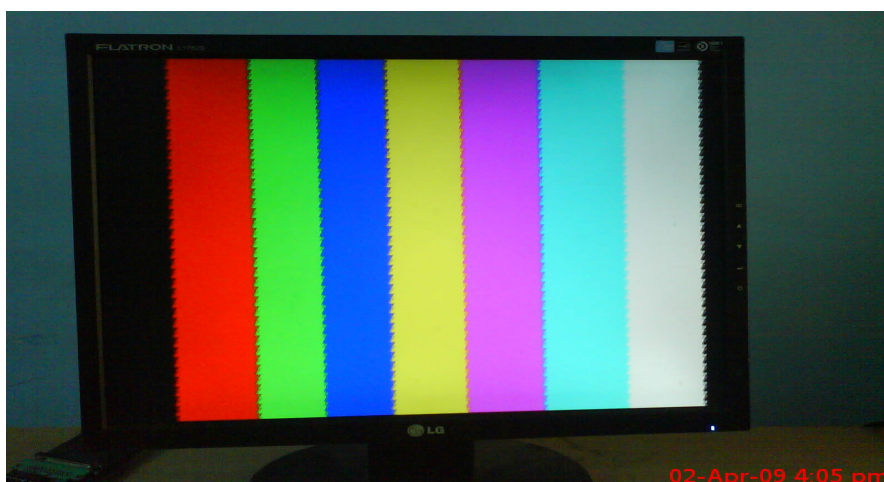
USB

Before moving ahead with this section, refer to [USB Virtual COM Port Installation for Windows XP](#) section in Appendix.

Test setup: Connect the USB cable to USB connector. The power LED (D14) and USB connect LED (D10) turn ON. The USB enumeration can be checked in device manager. The BlueBoard enumerates as a Virtual COM port. To test the Virtual COM port; we can test it as we tested the UART0/1 of BlueBoard.

VGA connector

Test setup: Connect the VGA connector on board (J17) to the computer monitor. A default image will appear. This confirms the working of VGA interface. Please note that to test the VGA interface the user has to power cycle the BlueBoard or reset it. The VGA is active only for few seconds.



JTAG connector

Test setup: To enable debugging on the board connect jumper to J11 and connect the JTAG to debug port. We have successfully tested the BlueBoard with JTAG interface using a Wiggler Clone JTAG. To test this feature you need to have the necessary software support on your PC.

User Interface Switch

Test setup: The Switch SW1 is connected to one of the external interrupt lines of LPC. To test this interface simply press the switch and you should hear the beep sound on the buzzer. This confirms that both the interrupt line and the buzzer module are working fine. Please ensure that you have connected the buzzer jumper appropriately.

Buzzer

Test setup: Connect jumper to J23, when the board is turned on or RESET you will hear a beep after few seconds. This is how the user can confirm the status of the Buzzer.

SD/MMC connector

Test setup: Insert a SD card in the SD card holder (J24), the status of the SD card will be displayed on LCD upon power cycle or reset of the BlueBoard. If the SD card is inserted properly “SD card – OK” is displayed on LCD else it displays “SD card- Not OK”. During manufacturing the board is tested with Kingston’s 1GB SD card.

Note: The SD/MMC card being tested should be formatted with FAT file system (Not FAT32 or NTFS format).

Audio jack

Test setup: Connect a headset to the audio jack connector. You should hear a ding sound being played. The sound is heard only for few seconds after power ON or RESET.

PS/2 keyboard

Test setup: To enable PS/2 connect jumper to J15. Connect a PS/2 keyboard to this connector. Now press any key on the keyboard. The user can see which key he/she has pressed on the LCD.

LCD display

Test setup: To enable the LCD connect jumpers to all pins of J18. A default message “NGX TECHNOLOGIES” will be displayed and later status of SD/MMC and I2C is displayed. The back light of LCD can be controlled by connecting jumper to appropriate pins of J19. The contrast of LCD can be varied using the POT.

RTC: A 2 - pin connector J27 is provided for RTC. Connect an external battery to use the to this connector to work with RTC.

ADC: The ADC is connected to a potentiometer. To test the ADC turn the potentiometer, as the position varies the output number of LEDs that are turned ON varies.

Programming BlueBoard Base

BlueBoard Base can be programmed through wiggler clone JTAG or through serial port using 'Flash Magic'. 'Flash Magic' is a freeware windows utility used download the hex file format onto the BlueBoard. Flash Magic can be downloaded from here <http://www.flashmagictool.com/>. If your PC does not have a serial port; use a USB to serial converter to download the hex file using the Flash Magic utility. For programming with JTAG your system should have a parallel port or you can use the USB to JTAG from NGX Technologies and the supporting IDE which can communicate to the processor core over JTAG interface. We have successfully tested BlueBoard with wiggler clone JTAG and USB JTAG with CrossWorks IDE. A LINUX utility to download the hex file can be found here http://www.pjrc.com/arm/lpc2k_pgm/.⁽¹⁾

Programming BlueBoard Base Through ISP

The BlueBoard Base can be programmed through ISP in two modes:

1. Auto Mode
2. Manual Mode

1. Auto Mode:

To program in Auto mode you need a full serial cable. Set the jumper to pins 2 & 3 of J26 and connect the full serial cable to UART0 (J5). When BlueBoard is powered ON black boxes will be displayed on LCD. Open Flash Magic tool, select the appropriate COM port, set the Baud rate to less than or equal to 38400 bps, select device as LPC2148, interface as 'None (ISP)' and oscillator frequency as 12MHz. Specify the path of your HEX file and click START. The status is shown at the bottom on the Flash Magic window.

In the 'Step 4 - Options' check 'Verify after programming' and 'Fill unused flash' options. Checking the 'Set Code Read Prot' option will not allow you will program with JTAG. So keep it unchecked unless required.

Note:

1. *In Auto mode under the 'Options' tab select 'Advanced options'. In this under 'Hardware Config' tab make sure the options 'Use DTR and RTS to control RTS and P0.14' and 'Keep RTS asserted while COM port open' are checked. The values of T1 and T2 are set to 100ms and 200ms by default.*
2. *After programming the board in Auto mode you should disconnect the serial cable from J5. This is a known issue.*

2. Manual Mode:

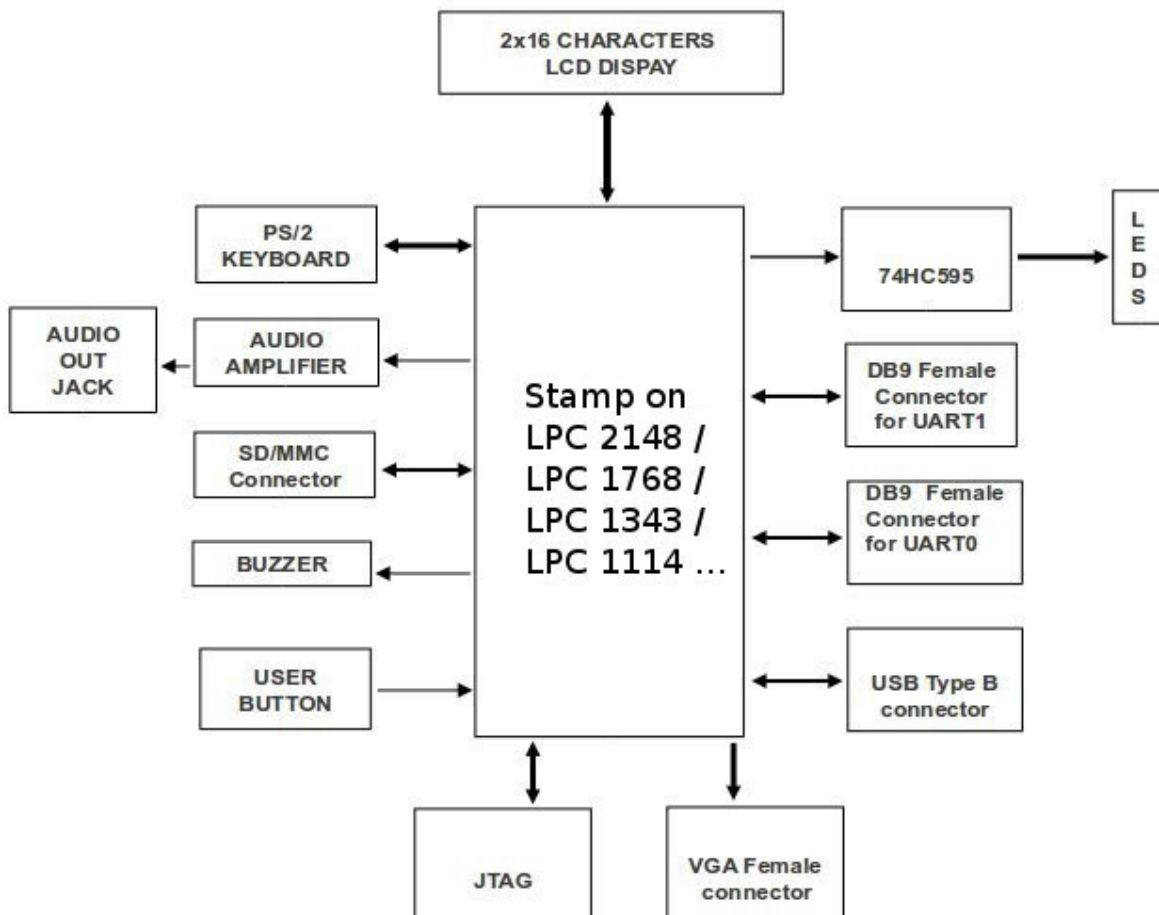
To program in Manual mode you need a half serial cable (which just has TX, RX and GND wire connected). Set the jumper to pins 1 & 2 of J26 and connect the half serial cable to UART0 (J5) and power the board.

To make the board enter programming mode

- Hold down SW2 (ISP) and SW3 (RESET), then release SW3 first and finally SW2
- The controller enters the bootloader mode if during reset the SW2 pin is low

Appendix

Functional Overview



BlueBoard Base Utilitties

For the working with BlueBoard Base there are certain tools that need to be installed. The tools required are:

Flash Magic Tool.

The flash magic tool can be downloaded from the following link:

<http://www.flashmagictool.com/>

H-JTAG

<http://www.hjtag.com/>

For LINUX machines you may use http://www.pjrc.com/arm/lpc2k_pgm/

Tool chain:

To be able to generate the hex or the binary file the user needs to install the tool chain for ARM based microcontrollers. Any toolchain can be used as long as it is able to generate the necessary files for downloading onto the BlueBoard. Here are few toolchain suggestions:

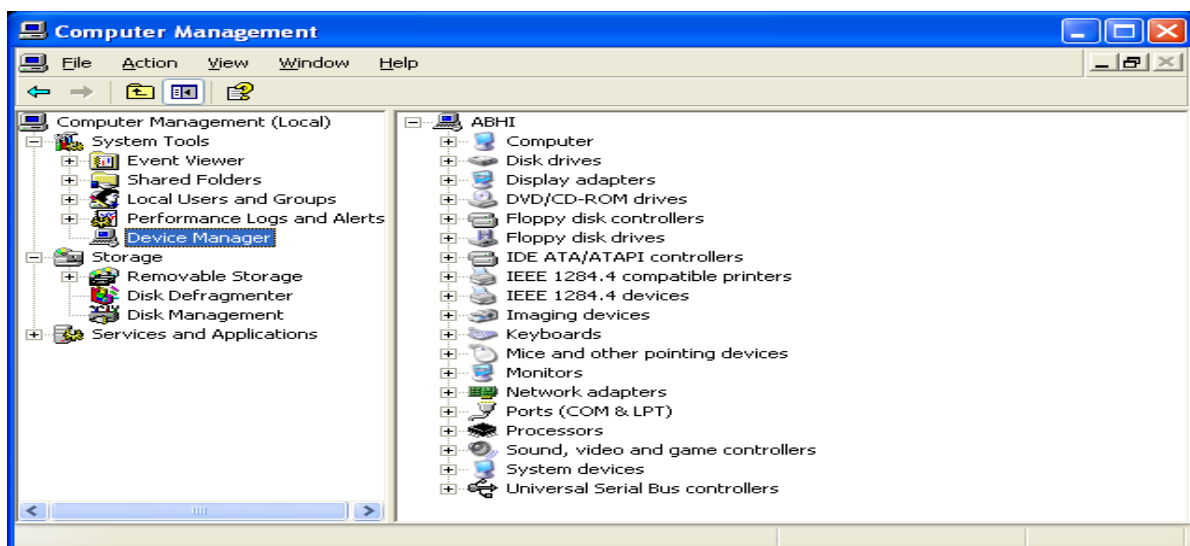
GNUARM Toolchain: <http://winarm.scienceprog.com/winarm-tools/prepare-gnuarm-compiler-toolchain-for-windows.html>

Crossworks IDE: <http://www.rowley.co.uk/arm/>

IAR Systems: <http://www.iar.com>

USB Virtual COM Port Installation For Windows XP

The USB in BlueBoard might not get enumerated if it does not find the appropriate driver for it. To check USB enumeration status Right Click on “My Computer” icon and select Manage. A “Computer Management” window opens. In this select Device Manager as shown below:

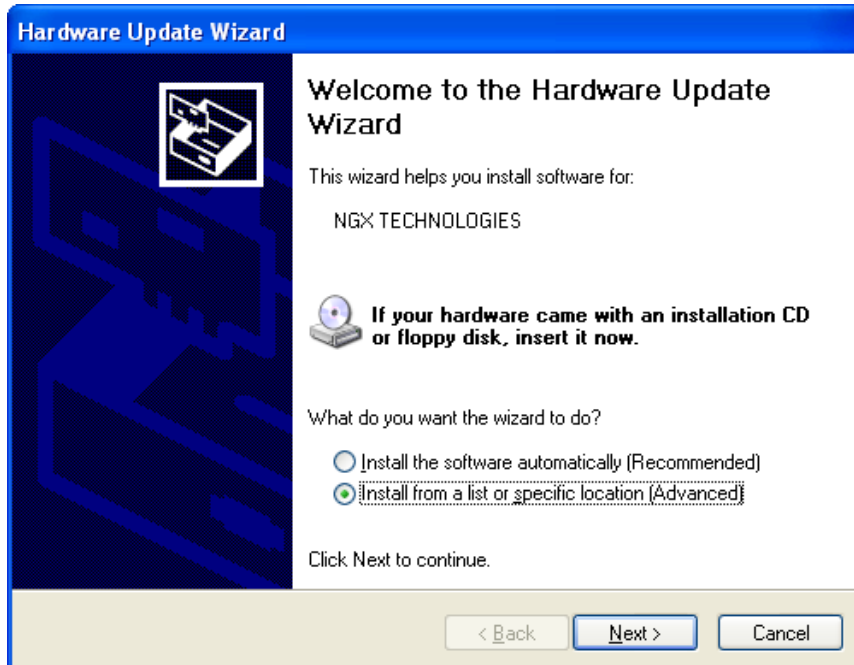


The device uses the **usbser.sys** driver. This driver file is not unpacked in Windows by default and needs to be extracted from a Windows .cab file which should be in the C:\WINDOWS\Driver Cache\i386 directory for Windows XP SP2. Change directory to C:\WINDOWS\Driver Cache\i386 expand the CAB file by running the below command in Command-Prompt
`expand sp2.cab -f:usbser.sys C:\WINDOWS\system32\drivers`

Note: On some systems like the XP home edition; extraction of driver files from cab files might not be supported. In such situation the user can download the usbser.sys file from <http://blueboard-lpc214x.googlecode.com/files/usbser.sys> and copy it to C:\WINDOWS\system32\drivers folder Next, download the usbser.inf file from <http://blueboard-lpc214x.googlecode.com/files/usbser.inf> Place it in any convenient folder.

Plug in the device. A Hardware Update Wizard opens up. Select the second option as shown

and Click Next.



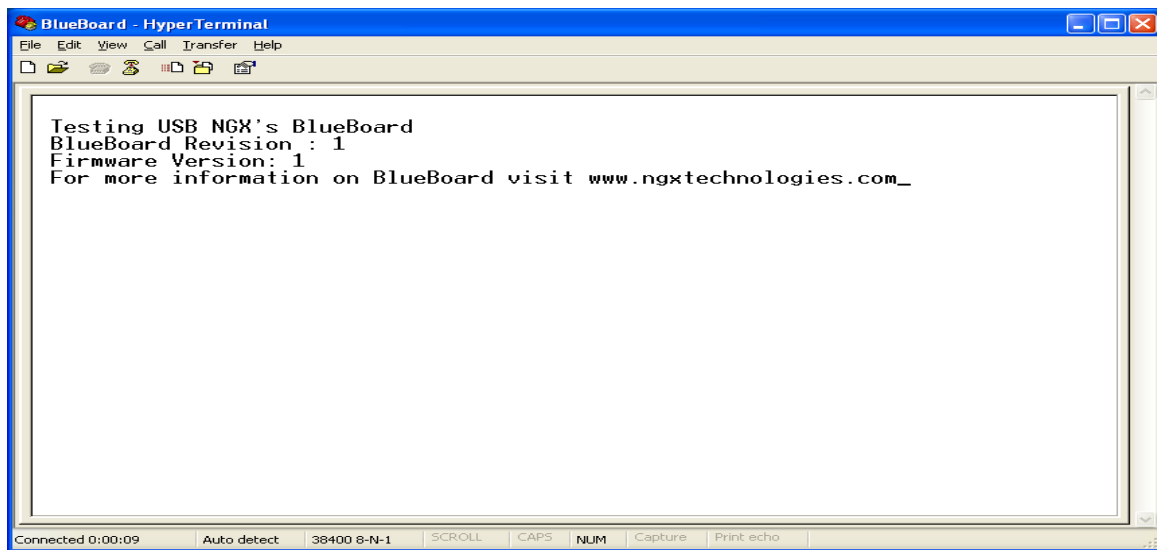
Note: If the wizard does not open up automatically then the user needs to go the ‘Device Manager’ window and right click on the device and select ‘update driver’

Set the new hardware Wizard to search a specific location for the driver, and specify the folder containing usbser.inf

The Wizard will prompt for the location of usbser.sys. Specify its location (i.e. C:\WINDOWS\system32\drivers) and Click Next.

The installation should now complete and indicate the device has been installed. The device should now get enumerated under “**Ports(COM & LPT)**” option in ‘Device Manager’ window.

To test the USB interface open Hyper Terminal by selecting the COM port specified by the system. The COM port number assigned to the USB serial device is not fixed and can change. To know the current COM port number the user needs to look into the ‘Device Manager’ page under “Ports(COM & LPT)” . After selecting the appropriate COM PORT, press any key on keyboard; a message will be displayed in the hyper terminal window as shown below. This confirms that the USB interface on the BlueBoard is fine.



Schematics

Currently use the schematics for the BlueBoard LPC2148. *Refer to the link [here](#).*

Sample Programs

The source code to demonstrate the usage of the following peripherals can be found at <http://code.google.com/p/blueboard-lpc214x/source/checkout>

- Analog to Digital Converter
- UART
- I2C
- E2PROM Driver - Reading and writing to an i2c-e2prom
- SPI - Using SPI in polled master mode to drive 8 x LEDs
- FIQ Handler
- VGA
- Timer
- Soft Timer - Demonstrates multiple timers with callbacks
- Watchdog
- SD/MMC access
- PS2 - Code to demonstrate PS2 keyboard
- Audio - Code to demonstrate wav playback
- Buzzer- Code to demonstrate buzzer on external interrupt

Known Issues

While using the Auto-program mode for ISP; after programming the BlueBoard Base, user needs to unplug the full modem serial cable for the program to execute.

Information

Revision History

version: v1.0 author: Milind Kakati

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