

Refer to Prof. Dinesh Sharma's slides and notes on serial I/O to do this lab.

1. [20 points] In this lab you will understand and use a program for communicating between Pt-51 and a computer using UART. This program will take inputs from the computer's keyboard that can be used in programs running on the kit, to perform appropriate operations.
 - i) To connect the kit to a computer, you will be using the USB-to-UART adapter Prolific PL2303 (Fig. 1) that was shipped along with the kit. The driver software for this adapter and the instructions for installing it can be found at the following link: http://www.miklor.com/COM/UV_Drivers.php
After installing the software, connect the PL2303 adapter to one of the USB ports of your PC.

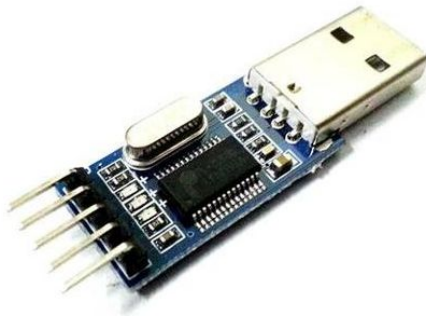


Figure 1: USB to UART adapter.

- ii) Connect the Pt-51 kit to the USB-to-UART adapter using F-F wires as described next. In the Pt-51 kit, port pin P3.0 is the serial data input and P3.1 is the serial data output. Connect P3.0 of the kit to transmit data line (TxD) of the adapter. Connect P3.1 of the kit to receive data line (RxD) of the adapter. Connect the GND pin of the kit to GND pin of adapter.
 - iii) For recognizing keyboard inputs on the computer and transmitting to the kit, through the serial terminal, you need to use the **Realterm** software (or any equivalent software). This software will also be used to display the messages received from the Pt-51 kit on the PC. A screenshot of Realterm window is shown in Fig. 2.
For Windows, download Realterm at: <https://realterm.i2cchip.com>
For Linux, you can download putty.
 - iv) Configure **Realterm** (or equivalent tool) to use the appropriate COM port and baud rate. This can be done by clicking on **Serial Port/Port** tab and choosing appropriate COM port as the port to which the USB-to-UART adapter is connected. Set the baud rate to 4800 (or that used in your program). Then click on **Open**.

With the kit connected to the computer using the USB-to-UART adapter, you will next write code to recognize key presses, perform an operation on the kit, and display messages sent by the kit on the computer.

Use `main.c` as starting (template) code. This uses `serial.c` and `lcd.h` for initialisation of UART and LCD, respectively. These files are part of the zip file shared with you.

The flow of the program is given below.

1. Complete the function `uart_init()` in `serial.c` to configure the serial port for UART communication. Use timer T1 and a baud rate of 4800 bps.

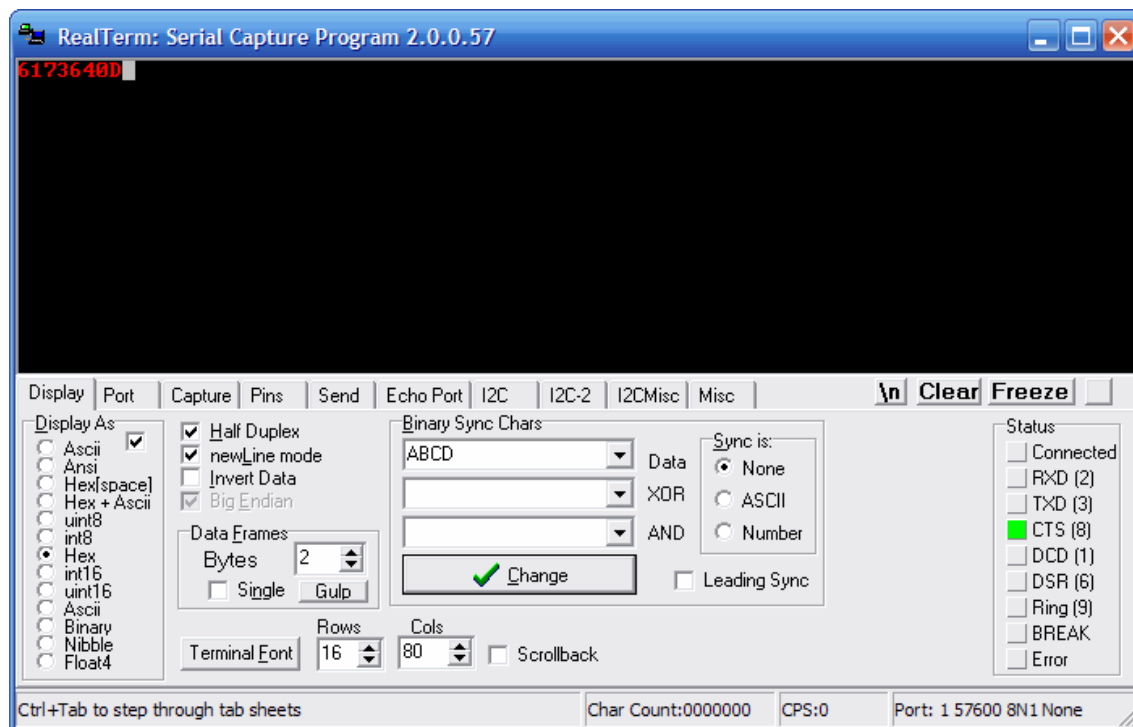


Figure 2: RealTerm: Serial/TCP Terminal

- The given `main.c` has code for transmitting a set of strings and to capture a key press on the PC. Compile the project, dump the hex file on to Pt-51 and run the program. Launch the **Realterm** window on your PC and you can see that the following is displayed on the window.

```
*****
*****8051 Tests*****
*****
Press 1 to test the LCD
Press 2 to test the LED
```

- Now, Pt-51 should respond to the key presses on the PC's keyboard. With **Realterm** window in focus (active window), any key press on PC's keyboard will be captured by it and transferred to Pt-51.
 - When 1 is pressed, it will be detected by Pt-51 and you will see a message "LCD Ok" on the LCD screen and "LCD tested" display on the **Realterm** window. This happens because of the function `lcd_test` in `main.c`.
 - When 2 is pressed, it should be detected by pt-51 and should glow all four LEDs and display "LED tested" on the **Realterm** window. For this to happen, you will have to update the function `led_test` in `main.c`
 - When any other key is pressed, you will see the message "Incorrect key pressed" displayed on the **Realterm** window.

TA Checkpoints

- Verify that the student can demonstrate the UART setup.