

In this lab, you will be learning about Universal Asynchronous Receiver-Transmitter (UART), which is a serial communication hardware. Refer to Prof. Dinesh Sharma's slides and notes on UART given here- <https://ee337.github.io/dks.html#serial-io>

1. [20 points] In this question, you will understand communicating between Pt-51 and a computer using UART. You need to send values from Pt-51 board to your computer, display those values on your computer and store it in a file.
 - i) To connect the kit to a computer, you will be using the USB-to-UART adapter Prolific PL2303 (Figure 1) that is part of 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 inputs from the board and capturing to text file in PC 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 Figure 2.

For Windows, download Realterm at: <https://realterm.i2cchip.com>

For Linux, you can download Putty.

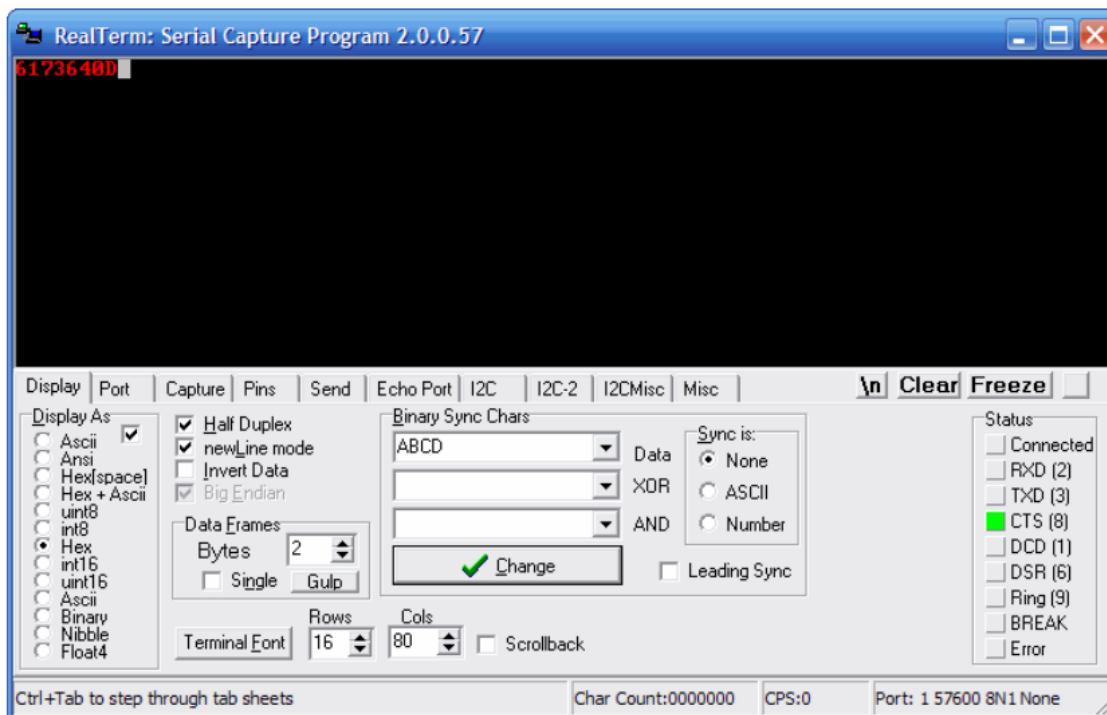


Figure 2: RealTerm: Serial/TCP Terminal

- 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 (the baud rate you have used in your program). Then click on **Open**. A screenshot of Realterm window with port and baudrate setting is shown in Figure 3.

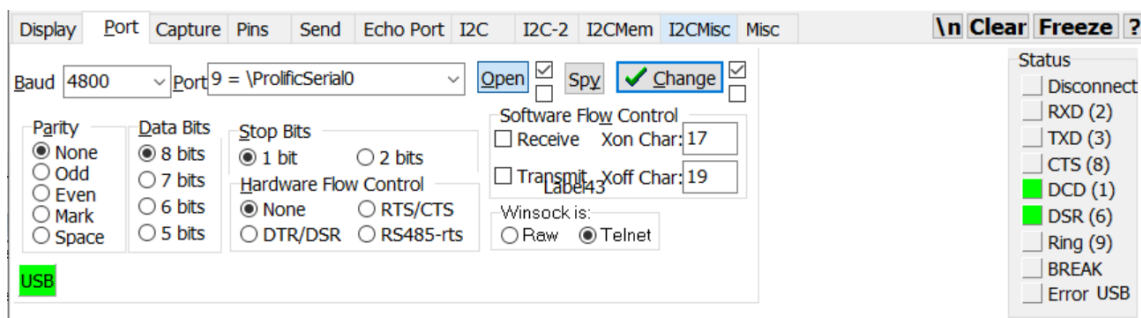


Figure 3: RealTerm: Baudrate

- v) **Use the same setup designed in previous lab to read sinusoidal signal from AFG onto Pt-51 board using SPI protocol.** With the setup connected to the computer using the USB-to-UART adapter, you will use it to get the digitized input printed on LCD to display it 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 present in Lab10.UART folder.

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.
2. Capture the values sent to the computer via UART using real term serial capture. Refer to Figure 4 to capture the values and save them in a text file. "Start Overwrite" will start saving the values printed on RealTerm to the text file (path specified). "Stop Capture" will stop saving the values.

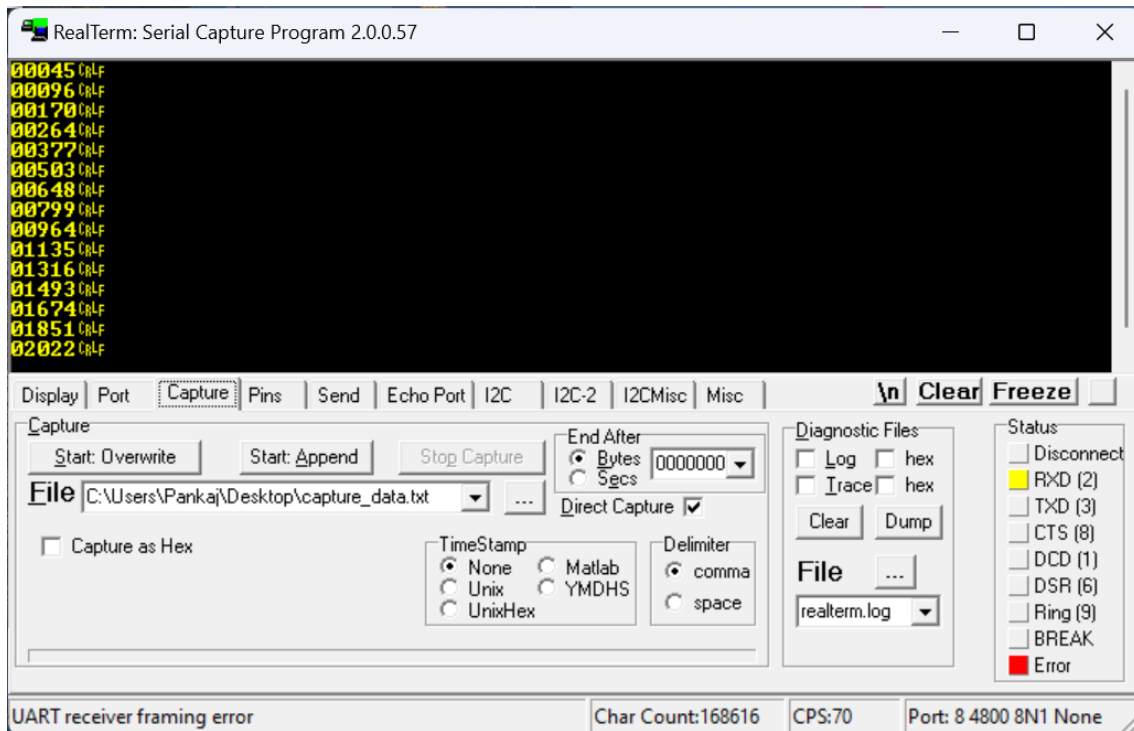


Figure 4: RealTerm: Serial/TCP Terminal

3. Plot the saved values using Python (or some plotting tool). You should be able to observe a sinusoidal wave. Note : The y-axis should be value and x-axis should be sample index.

TA Checkpoints

1. Check whether students have captured the input from board to the text file and all values are obtained properly.
2. Check whether students have plotted the sinusoidal wave output.