ELEC-240 Lab6
Communicating over USART (RS-232 terminal) on the STM32F429 Nucleo-144 Development Board *

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1   Introduction

In this lab you will configure the on-board USART module to communicate with the RS-232 serial port on the PC. Refer to Table 1 for information.

1.1   Learning Outcomes

By the end of this lab exercise you should be able to:

1. Demonstrate an understanding of USART functionality and timing

2. Produce code to enable the on-board USART module and communicate over RS-232

There are various programs that can be used to interface the PC terminal. PUTTY is used on the lab machines.

Task 1

The example code provided on the DLE repeatedly sends the letter 'A' to the terminal.

1. Open PUTTY

2. Select 'Serial' as the connection type, 'COM1' as the serial line and 9600 as the baud rate

Build and download the code to the development board then use the oscilloscope to probe the TX/RX pins on the board to verify the correct signals are being sent. Refer to Figure 1 to confirm the correct character is being sent. Be aware that you will be seeing the transmission in its TTL format whereas Figure 1 shows a line-driven RS-232 transmission which is inverted and level shifted.

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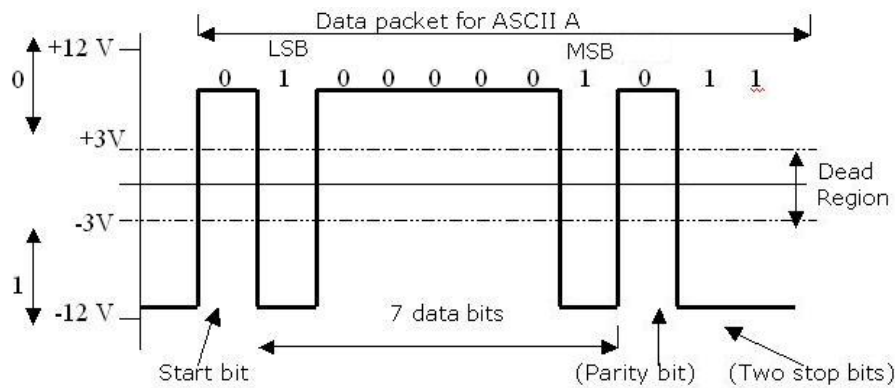
Figure 1: RS-232 timing diagram for the ASCII character 'A'
(Note that the waveform shown here has passed through a line driver and has been level shifted and inverted)

Task 2

Measure the time of the shortest pulse and confirm that it corresponds to the required baud rate. The example code uses 9600bps (Bits per Second) therefore each bit period is given by

$$T_{bit} = \frac{1}{BAUDRATE}$$

and should be $104\mu s$ at 9600bps.

Task 3

Modify the program to write a string to the PC terminal (PUTTY) such as "Hello World".

Task 4

Incorporate USART read functionality into the program using the RXNE bit in the USART Status Register to detect when a char has been received.

Task 5

Modify the read functionality to include the use of interrupts. An interrupt can be generated when the RXNE bit is asserted. You can refer back to Lab3 for enabling interrupts.

Bonus Task

Redirect the "printf" function from the standard library to send characters to the PC terminal over USART.

Hint: Refer to USART lecture notes.

2 Support Documentation

Document Name	Contained Information
UM1974 User manual	- Pin identification and the supported special functions - Circuit schematics - Jumper and component identification - Header pinouts
RM0090 Reference manual	- MCU memory and peripherals architecture - Peripheral control registers, addresses and bit-fields

Table 1: Table of relevant support documentation for Nucleo-144 development boards (The document names are hyperlinks, please click on them to access the documents)