

# UNC Charlotte, ECGR 4892/6090/8090, Spring 2004: Lab 2

Building an IR Communications Device and "Speeding it up"

## Learning Objectives

This lab will extend lab 1 (interfacing two MSV30262-SKP boards via an Infrared (IR) Link) by making the link run faster, and operate in duplex.

## General Information

The general steps for this lab are:

1. Create a new folder for lab 2. Copy your files from lab 1 into the new folder.
2. Generate a new project using the files you just copied. Name your new project Lab2.
3. Open and edit your main.c file to perform the lab functions.
4. Program the lab. Don't forget the necessary include files to get the correct functionality.
5. Compile the code into an .x30 file, and load onto the board.
6. Test the program and repeat steps 4, 5, and 6 until the program works as required.
7. Write your lab report.
8. Demonstrate for the professor and turn in your report.

## Prelab Activity

None.

## Laboratory Assignments

You may use the PCs in Smith 347 or your own PC to do this lab experiment. The machines in Smith 347 already have the software tools loaded. In this lab you will be utilizing onboard timers, serial UARTs, and I/O ports of the starter kit to create an IR communications device. The main objective is to create a board which can attach to a PC and transmit/receive data via an IR link. Two boards should be programmed with the same code and have the same IR hardware. IR hardware has been provided. You will need two serial cables and one PC with two serial ports.

## Steps

1. Modify the main.c file and include the appropriate files. Include commenting along the way.
2. Build your program slowly, testing along the way. Perform compiles and solve each requirement one at a time. Make sure comments are written as you progress.
3. Continue to build and test the program until all of the requirements have been met. Did we mention you should write your comments as you progress, not at the end?
4. If you run into problems, use the break point functionality of KD30 to step through the code until you find the problem.
5. Once all the requirements have been met, ensure that everything works.
6. Finish lab write-up and demonstrate for the professor.
7. Submit your C code (\*.c) and .map files on a floppy disk, CD ROM, or email.

## Requirements

Changes to the Requirements (from lab 1) are in **bold lettering**.

Req. 1 – The code generated is written in C for the MSV30262-SKP

Req. 2 – The code is well commented and easy to follow

Req. 3 – Your lab report should include the final build output from the builder

Req. 4 – Both boards should run the same code

**Req. 5** – The serial communications with the PC should operate at **19200** baud 8,N,1

Req. 6 – HyperTerm will be used to transmit and receive characters (you can run it on one PC with two serial ports, but with two HyperTerm applications open).

Req. 7 – The general operation will be that a character will be typed in a HyperTerm window, transmitted via RS-232 link to one board, transmitted via IR link to another board, then transmitted via RS-232 link to another HyperTerm window. This transmission is bi-directional.

**Req. 8** – Transmit via IR with three start bits, **eight** data bits, one parity bit (odd), and two stop bits.

**Req. 9** – **Transmit via IR all values between 0x00 and 0xFF, including ACK and NAK**

Req. 10 – Each IR transmitted byte should be acknowledged. The receiving board should acknowledge a valid transmission with a NAK character (0x06). If the transmission is invalid, acknowledge with a NAK (0x15).

Req. 11 – A valid IR transmission will be characterized by the correct number and type of start, data, parity, and stop bits.

Req. 12 – A valid IR transmission will have the correct parity.

Req. 13 – Each byte transmitted via IR should be acknowledged within 0.01 seconds. (Extra credit for faster transmission).

Req. 14 – The LCD does not need to show characters, but can be used during debug.

Req. 15 – Use the IR hardware provided by the professor.

Req. 16 – The minimum transmission distance is 1.5 meters . (Extra credit for transmission over greater distances).

Req. 17 – The IR hardware should be powered by the Renesas boards.

**Req. 18** – **The PC will send one character every 0.01 seconds (you will need queues to transmit the data fast enough).**

## Lab Report

Include in your lab report observations and procedure like the following:

*The general learning objectives of this lab were . . .*

*The general steps needed to complete this lab were . . .*

*Some detailed steps to complete this lab were . . . .*

1. *Step one*

2. *Step two*

3. *. . . .*

*Code generated for this lab...*

*Some important observations while completing/testing this lab were . . .*

*In this lab we learned . . . .*

Send the code the .map file, and the report to Dr. Conrad via email. Turn in a hard copy of the report, but not the code.