



MICROCONTROLLER PROJECT LABORATORY

EDUCATIONAL STUDIES PROGRAM – HIGH SCHOOL STUDIES PROGRAM – SUMMER 2001
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

LABORATORY III INFRARED COMMUNICATION

GOALS

In this lab, students will:

1. Couple an infrared transmitter and receiver
2. Transmit data with light rather than electricity
3. Implement wires inter-processor communication

SUPPLIES

Hardware:

- 1) Completed Lab II project
- 2) Infrared LED (red rectangle)
- 3) Infrared photodetector (clear rectangle)
- 4) 10K potentiometer
- 5) Green pushbutton
- 6) 100 Ω resistor
- 7) 1 Green LED
- 8) 2 NPN transistors (2N3904 type)

Software:

- 9) io.asm

1.0 A LIGHT WIRE

In this section, you will configure the infrared transmitter and receiver to act like a wire, but using light.

- 1.1 Remove any extra hardware leftover from lab 2: you should have just the keypad and LCD attached to the processor and serial converter chip.
- 1.2 Connect a green pushbutton from power to the infrared led, and a 100Ω resistor from the IRLED to ground. Power goes on the right when the IRLED's eye is facing you. Test your connection on a visible LED to be sure it works.
- 1.3 Connect the infrared photodetector facing the IRLED, an inch away. Connect power to its left side, and feed its right side into the control lead of a transistor. Connect the input of the transistor to power, and the output of the transistor to a 10K potentiometer. The transistor will amplify the effect of the photodetector, and the potentiometer controls the sensitivity.
- 1.4 Connect a green LED between the output of the transistor and ground. You should be able to press the button and see the green LED light up. Try adjusting the potentiometer to change the light level. Try putting your finger between the IRLED and the IR detector – it should stop the signal.

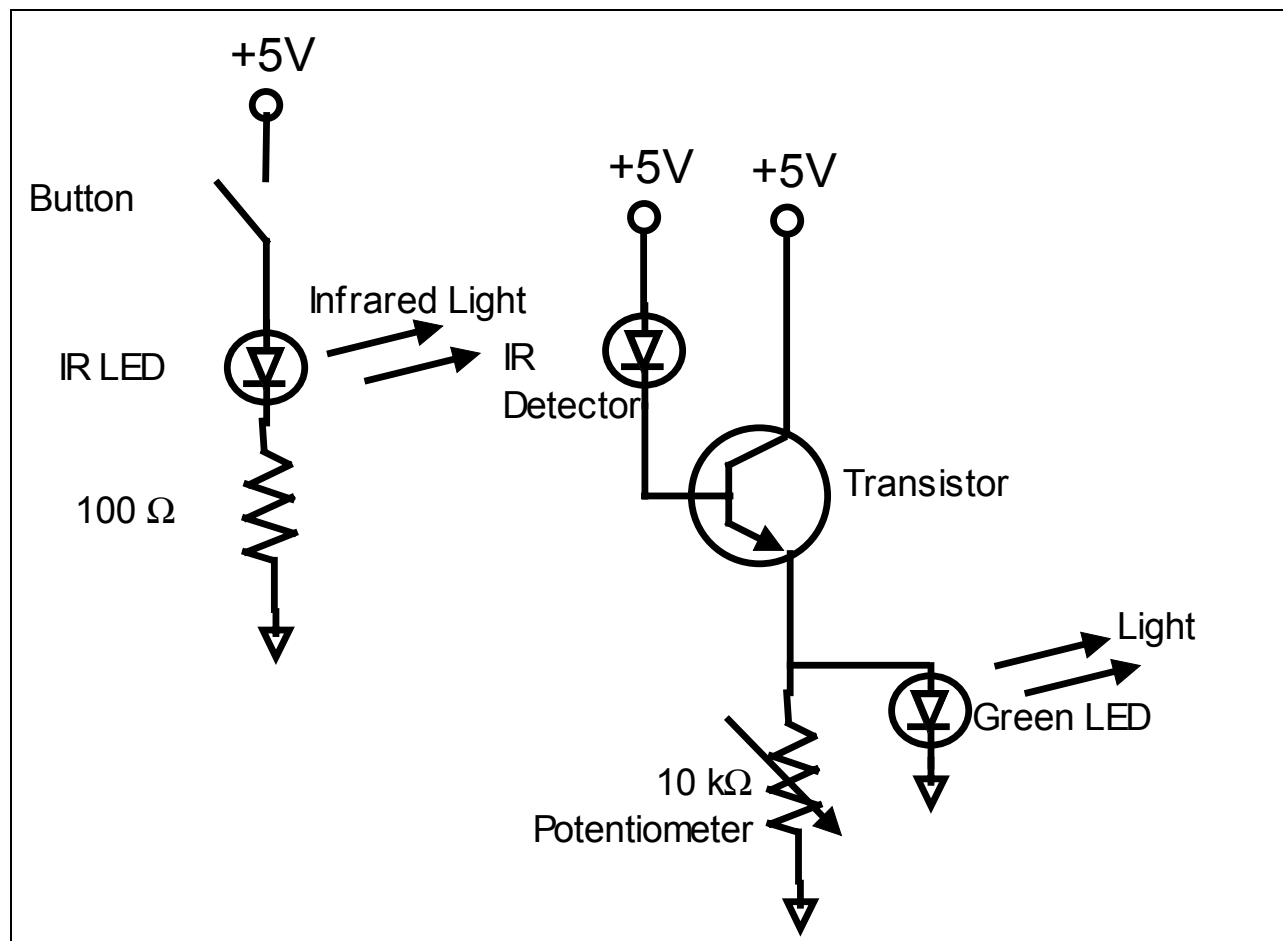


Figure 1

2.0 INFRARED DATA TRANSMISSION

In this section you will transmit data across the infrared link.

- 2.1 First, load io.obj onto your microcontroller. It sends keypad presses to the serial port output, and sends serial port input to the LCD. After testing it (push the keypad, type a character), you're done with programming for this lab – let someone else use the computer.
- 2.2 We're going to transmit data from the microcontroller over the IRLED, so we need a transistor to amplify the microcontroller's small current. The input to the transistor gets power, its output goes to the input end of the IRLED, and the middle lead should be connected to the serial port out from the microcontroller (pin 11).
- 2.3 Now connect the output from the photodetector's transistor to the serial input of the microcontroller (pin 11). You will have to disconnect the connection from the serial converter chip (DS14C232) to the microcontroller's pin 11 to avoid interference.
- 2.4 Now press a button on the keypad, and you should see it show up on the LCD. You may have to adjust the potentiometer, and possibly remove the green LED (it sucks up power that could go to the microcontroller). Find the range that it works in. Notice how it behaves differently if you put a shadow over the detector.

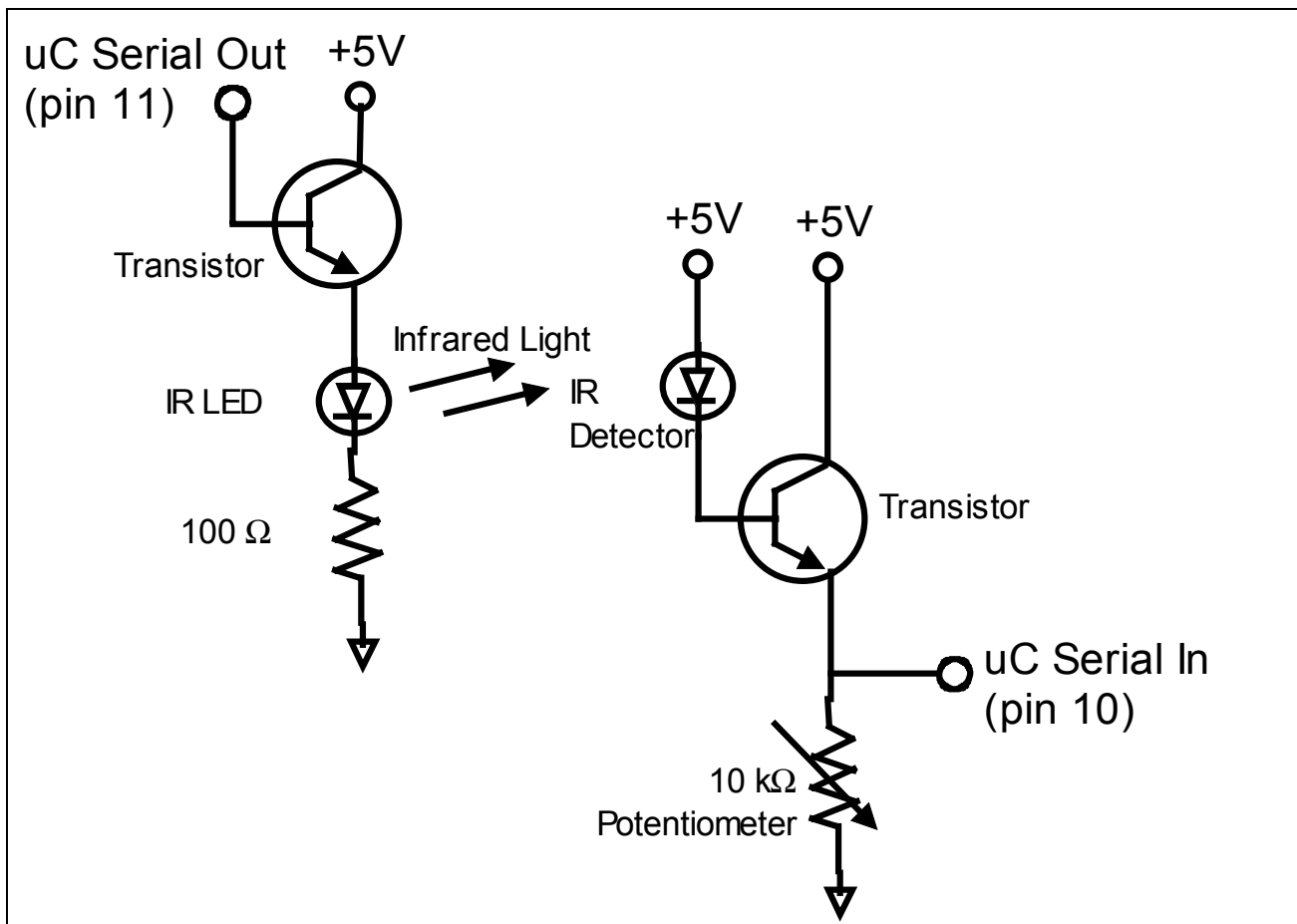


Figure 2

3.0 WIRELESS COMMUNICATION

In this section you will communicate with another processor using the infrared link.

- 3.1 Try communicating with another student's board. Put your transmitter and receiver near the edge of your boards, and see if you can press keys and have them show up on the other student's display. You don't need any new hardware or software, but you may have to rearrange your board to the components close enough to transmit data.