Interfacing a Photoreflective Sensor to the Handy Board

Pre-Lab Questions

1. What is the absolute maximum current that the IR LED in the OPB703 can take?

2. Assuming you drive the IR LED in the OPB703 via the +5 V bus on the Handy Board, what value of current limiting resistor should you use in your interface?

Purpose

- To become familiar a common type of photoreflective sensor

- To practice programming in IC

- To explore how to detect lines on a simulated playing field

Components

Qty.	Item
1	Handy Board with expansion board and serial interface/charger
1	Serial cable with DB-9 to DB-25 adapter
1	RJ-11 cable
1	OPB703 photoreflective sensor
1	220 Ω resistor
1 ft	28 AWG stranded cable (a pair of wires peeled from ribbon cable)
4.5 in.	1/16 in. dia shrink tubing
1	Male header pins, single row (4 pins)

Introduction

In this lab you will investigate how to interface a photoreflective sensor with the Handy Board (HB) and write a program to detect and distinguish between several black tape lines on a white surface.

Procedure

Wiring the photoreflective sensor

1. Split the four stranded wires approximately 1¼ inches at each end.

2. Strip approximately 1/2 inch of the insulation off of each end of the wires. Twist the conductors, so the wire strands do not splay out.

3. Cut the shrink tubing into nine, 1/2-inch sections, and slide the four of the sections over a set of four ends of the wires.

4. Solder these four ends of the wire to the leads on the OPB703. (Note: it may help to make a few wraps of the wire around the pin before you try to solder the wire to the pin. Also, keep the shrink tubing as far away from the soldering iron as possible to avoid shrinking the

tubing prematurely.) Verify that you have a good solder joint for each wire before you go on to the next step.

5. Slide the heat shrink tubing over the pins you just soldered.

6. At the other end of the wires, twist the two ends of the wires that connect to the cathode of the LED (K) and the emitter of the phototransistor (e) together, and slide a section of shrink tubing over the end. Solder them to the pin on the header that will connect to ground on the Handy Board. (See Figure 2.) (*Don't forget the heat shrink tubing **before** you solder these and the remaining wires to the header*!)

7. Solder the wire from the collector of the phototransistor to the pin on the header that will connect to V_{sense} on the Handy Board. (See Figure 2.)

8. Split the remaining wire back about 2 inches. Solder it to the header pin that will connect to 5 V on the Handy Board.

9. Slide the shrink tubing over the pins, and use the heat gun to shrink the tubing over the solder joint and pins.

10. CRUCIAL STEP! You need to limit the current going to the IR LED of the OPB703 (what value should you use?). An easy way to do this is to splice the current limiting resistor into the wire you just soldered in Step 8. Do this by cutting the wire approximately 1 1/4 inch from the end that is soldered to the header pin. Strip both ends of the wire you just cut about 3/16 in. Slide two, 1/2 in. lengths of shrink tubing over the ends of the wire you cut. Trim the leads of the current limiting resistor to about 1/8 in. long, and solder the wire ends to the leads of the resistor. Slide the shrink tubing over the solder joint, and shrink with the heat gun.

11. Before proceeding, verify that your wiring of the OPB703 is correct.

Testing the sensor

12. Write a test program called photoref_test.c that will allow you to test that the OBP703 has been wired correctly. Your program should read the state of pin that you have connected the sensor to using the digital() function, and print the result to the LCD screen. Verify that your program functions properly by checking that the state of the pin changes when you move the sensor over white and black areas on your test sheet. (You may want to also print out the state of one of the pins that is not connected and compare its value to the pin that has the OPB703 connected to it. With nothing in front of the sensor, the state of both pins should be the same.)

Line detector program

13. Write a program that will allow you to detect and discriminate between one black line and two black lines on your test sheet when you move the OPB703 across them at a constant speed. Have your program print out, "One line crossed!" or "Two lines crossed! depending on which event has taken place.
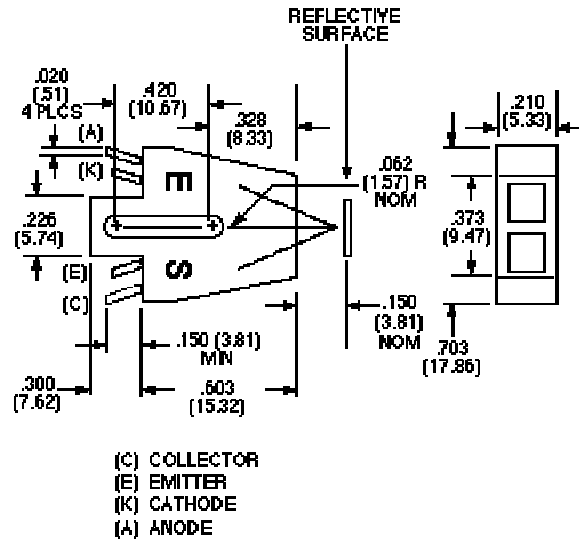
Figure 1   OPB703 Photoreflective sensor. The package combines an IR LED with a phototransistor. The IR LED is housed beneath the letter 'E', and the phototransistor is housed beneath the letter 'S'. The legend below the figure decodes the pins. (ref.: www.fairchildsemi.com)
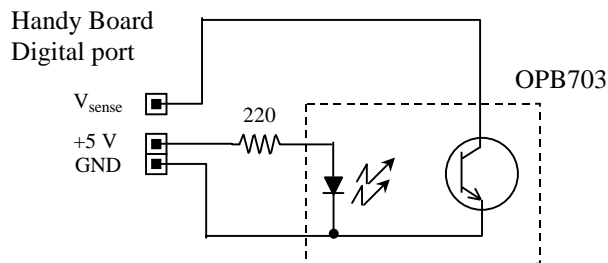

Figure 2   Interface between OPB703 and the Handy Board. Note the 220 Ω resistor. You __*must*__ include a current limiting resistor to avoid damaging the IR LED in the OPB703.