Laser Pointer System Lab

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Lab Summary: In this lab, you will be using a simulator kit to that will control a laser pointer.

Lab Goal: The goal of this lab is to identify components of a system from the block diagram and wiring diagram.

Learning Objectives

1. Program a laser pointer to "hit" the three legs of a triangle and return to the "Home" or holster position.
2. Use a block diagram and wiring diagram to identify components of a system that should be checked when the system is not operating correctly.

Time Required

Approximately 1 hour

Equipment and Supplies

Part	Quantity
PC Programming Simulator Automation Kit (# 608005)	1
PC with Visual Basic 6.0 professional (or Visual Studio 6.0), Windows XP, parallel port	1

The Programming Simulator Automation Kit can be ordered from Torch Automation at www.torchautomation.com. The kit includes a base plate control and monitor interface board shown here with the horizontal and vertical motors with attached laser pointer, and the battery pack. The kit also includes the parallel cable and the power cord.

Lab Preparation

1. Assemble all equipment and components.
2. Read Introduction (below)
3. Review Lab Procedures (below)

Safety Precaution: A laser beam is used in this lab. Laser light can cause eye damage. Follow the instructions carefully to ensure the laser beam is not pointing toward any class members.

Lab Introduction

A system is usually made up of two or more pieces of electronic equipment interconnected to do some particular function. The generic definition of "system" is a combination of multiple related elements organized into a more complex whole to perform some useful purpose. For electronics, we can say that a system is an assembly of electronic and sometimes electro-mechanical components as well as the software that operate together as a unit to perform some function. Another definition is a collection of hardware, software, and related devices that operate as a unit to perform a particular service.

Electronic technicians and engineers used to work primarily with schematic diagrams, or drawings, that showed the interconnection of every resistor, capacitor, IC, and transformer. Those are still used but to a lesser degree. Today most diagrams are at a higher level. That is they do not show as many discrete components but show blocks representing ICs and other larger assemblies. These block diagrams are the key working documents of most electronic equipment and systems. Each block represents an IC, a circuit, or assembly that does some particular thing. It may be an amplifier, filter, memory, regulator, or disk drive. The diagram uses lines to show the various interconnections between the blocks. These lines may be copper traces on a PCB, wires, or cables with connectors. The block diagrams show the relationship between the blocks and the flow of signals between them.

The control system is an electrical, electronic, or mechanical system, or some combination of the three, that is used to perform a control function. Control means making adjustment to the system output to fit necessary or desired conditions. Some examples are the speed control of the motor on a CD player, the physical position of a robot arm, the liquid level in a tank, or the temperature in a house.

Control systems usually monitor some variable such as position, speed, level, or temperature then make adjustments as necessary to bring the system into compliance with some predetermined condition. The key characteristic of most control systems is the presence of feedback. Feedback permits control systems to be fully automatic. The two main types of control systems are open loop and closed loop. The open loop system is designed such that with a specific input it gives the desired output to achieve the desired performance.

An interface is the connection between two circuits, pieces of equipment, or systems. It is the place where the outputs of one circuit meet the inputs to another circuit. It is also the place where the signals in a system are transferred from one place to another. Interfaces are typically a formally defined interconnection subsystem. They consist of connectors, wire or cable, and printed circuit board conductors. These interfaces are usually designed to carry either analog signals or digital signals.

In this lab, you will be using an open loop system with a control system, power supply, and interface that will control a laser beam.

Lab Procedures

This lab is set up as a demonstration of a dual stepper motor laser pointer. Take notes during the demonstration so that you can set up your own targets and answer troubleshooting questions.

1. After the demonstration, work with another class member and determine a set of coordinates for a triangle that meets the following criteria:
   a. The holster (D) position is in the center of the triangle. (D coordinates will be 0,0 and should remain in the same position as the original triangle.)
   b. The AB leg of the triangle should be at the top and parallel to the original AC leg of the triangle.
   c. The C point of the triangle should be directly below the D position.
   d. Each group will be given one practice chance to enter your coordinates and make adjustments.
2. After each group has determined their coordinates, you will enter the values and draw your triangle.
   a. Use different colors or types of lines (dashes, dots, x's, circles) to distinguish between the triangles.
   b. Enter your values at the points so the other class members can compare the coordinates to their own.
   c. You are not allowed to change your coordinates after the others reveal theirs.
   d. The group that comes closest to meeting the criteria wins the Quick Draw contest.
3. Use the block diagram, wiring diagram, and circuit board to answer the lab questions.

Lab Questions

Use the block diagram, assembly, and wiring diagram as needed to answer the following questions.

1. According to the wiring diagram, what is the number of the motor driver chip? Be able to point it out on the assembly.

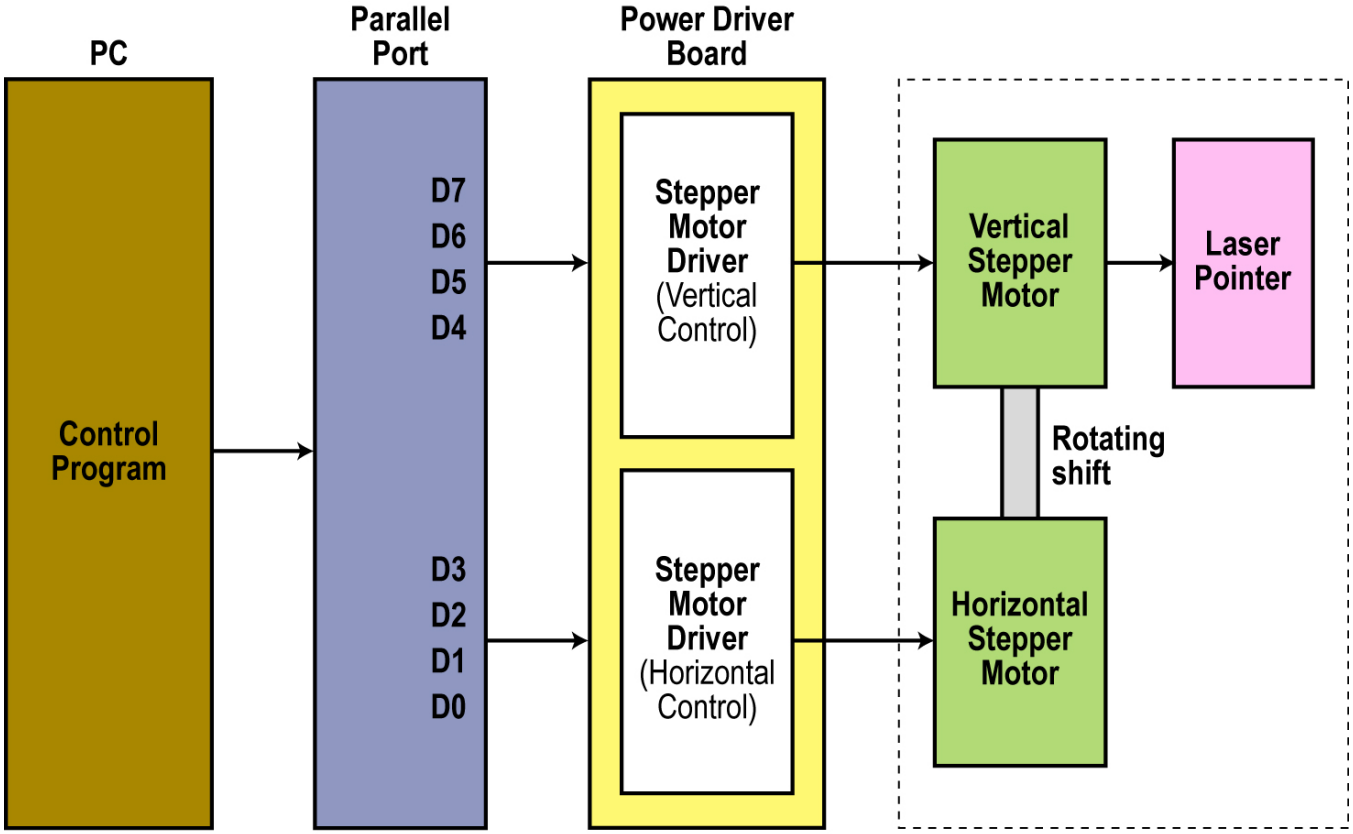
2. Assume the system has been operating correctly earlier but now when you enter in the values, the horizontal motor not moving.
   a. What are some of the possible causes?

   b. Where would you check for signals? (Be specific.)

3. What are the LED's for?
   a. Red:
   b. Green:
   c. Yellow:

4. The assembly used here has two stepper motors controlling the position of a laser. As a class, discuss other applications that could use the position control system.

Block Diagram



Stepper Motor Controlled Laser Pointer System Block Diagram

Wiring Diagram