MCLab Motor Board Documentation

Christian Trödhandl

June 13, 2005

1   Introduction

The MCLab Motor Board contains three different motors: A unipolar stepper motor, a bipolar stepper motor, and a DC motor, each with a suitable driver board and two photo-interrupter boards (see Figure 1).
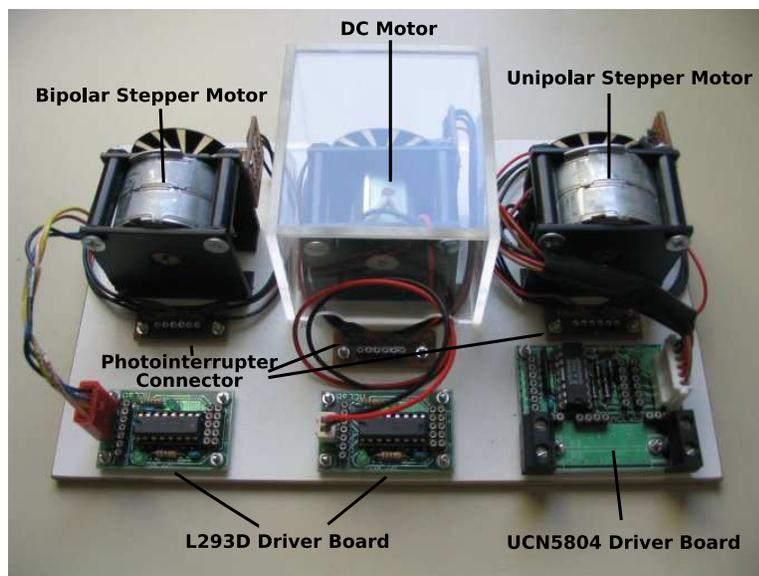

Figure 1: The Motor-board

2   Wiring

2.1   Photointerrupter

The photointerrupter board has six connectors which are connected to the two photointerrupters (see the TCST2103 datasheet [3] for a detailed description of the photointerrupter). A photointerrupter contains an infrared LED and a phototransistor which conducts if no obstacle blocks the infrared light. The schematic of the photointerrupter can be seen in Figure 2.

Two of these photointerrupters are connected to the connector board (see Figure 3). To use the photointerrupter with the microcontroller, the output of the transistor (PI1 or PI2) should be connected to the input of the microcontroller, VCC and the LED connectors are connected to 5 V, and the GND connector is wired to Ground.
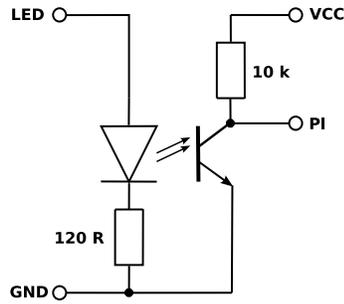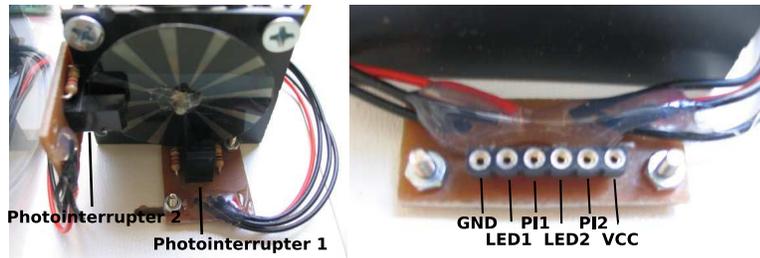
Figure 2: Photointerrupter schematic

Figure 3: The photointerrupter connector board

2.2   Bipolar Stepper Motor

The bipolar stepper motor (AEG SO21/24) is connected to a L293D driver board (see Figure 4). It has the following characteristics: 24 steps, 5 V supply voltage, 8 Ω resistance per coil.
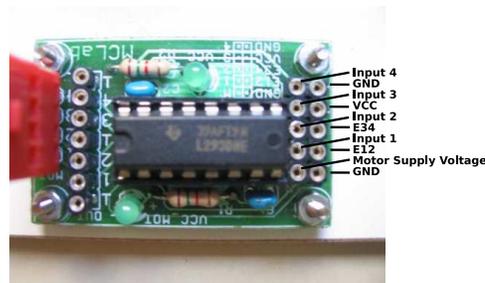

Figure 4: The L293D driver board

The L293D driver board has to be wired in the following way: VCC and the motor supply voltage M must be connected to 5V. The enable signals E12 and E34 must be set high for enabling the driver IC and should be therefore connected to the microcontroller (to allow software controlled enabling/disabling of the controller IC) or directly to VCC. The inputs 1, 2, 3, and 4 are the inputs for the four channels of the motor driver and should be connected to the output of the microcontroller (see the L293D datasheet [2] for more details). GND should be connected to 0 V.

2

2.3 DC Motor

The DC motor is connected to the same type of motor driver board as the bipolar stepper motor (see Figure 4). Other than the stepper motor, it has a higher supply voltage (3 to 12 V) and only uses 2 connectors. Therefore the motor supply voltage should be connected to PWR (VCC also possible). Input 1 e.g, may serve as direction signal and Input 2 may be connected to the PWM output of the microcontroller.

2.4 Unipolar Stepper Motor

The unipolar stepper motor (AEG S21/24 A) is connected to a UCN5804 stepper motor driver board (see Figure 5). It operates with 6 to 12 V supply voltage, 24 steps per rotation and its coil resistance is 56 Ω.
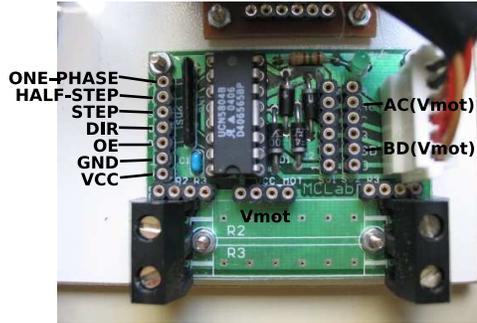

Figure 5: The L293D driver board

The driver board should be connected as following: VCC and GND should be connected to 5 V and 0 V respectively. The signals ONE-PHASE, HALF-STEP, STEP, and DIR must be connected to the outputs of the microcontroller. Thereby ONE-PHASE and HALF-STEP determines the sequence format of the driver output, DIR controls the direction of the motor, and a falling edge on the STEP pin initiates a step of the motor (see the UCN5804 datasheet [1] for more details). The OE signal is low-active and can be either controlled by the microcontroller or directly connected to GND.

The motor supply voltage Vmot and the two common motor pins AC and BD should be connected to a voltage supply suitable for the connected motor (PWR or VCC).

3 Photointerrupter Signals

3.1 Stepper Motors

The encoder discs attached to the motors contain 12 black sections each. To ensure that a single step of the stepper motor can be detected, the two photointerrupters are adjusted to a 180° phase difference (see Figure 6).

3.2 DC Motor

Other than the photointerrupters of the stepper motors, the photointerrupters of the DC motor are adjusted to a 90° phase difference, so that the direction of the rotation can be detected (see Figure 7).
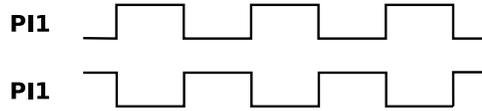
PI1

PI1

Figure 6: Photointerrupter signals for stepper motors

PI1
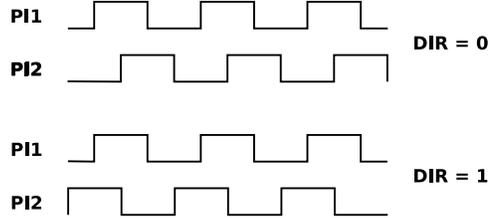
PI2

DIR = 0

PI1

PI2

DIR = 1

Figure 7: Photointerrupter signals for DC motor

References

[1] Allegro MicroSystems Inc. *5804 BiMOS II Unipolar Stepper-Motor Transla-tor/Driver datasheet.* 115 Northeast Cutoff, Box 15036, Worcester, Massachus-setts, 1998.

[2] SGS-THOMSON Microelectronics. *L293D Push-Pull four Channel Driver with Diodes datasheet*, Jun. 1996.

[3] Vishay Semiconductor GmbH. *TCST110. up to TCST230. Transmissive Optical Sensor with Phototransistor Output datasheet*, Jun. 1999. Available at `http://www.vishay.com`.