USER MANUAL
FOR
H-BRIDGE (REED RELAY)
FUNCTIONAL MODULE

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1. INTRODUCTION

H-Bridge is a method used to control the activation and output rotational direction of a motor. The H-Bridge uses the four relays to control the directional flow of current through the motor. Two of the relays are used to close circuits from a 5V power source to the motor while the other two relays are used to close the circuit to ground. Figure 1 shows the circuit diagram for a single-directional motor.

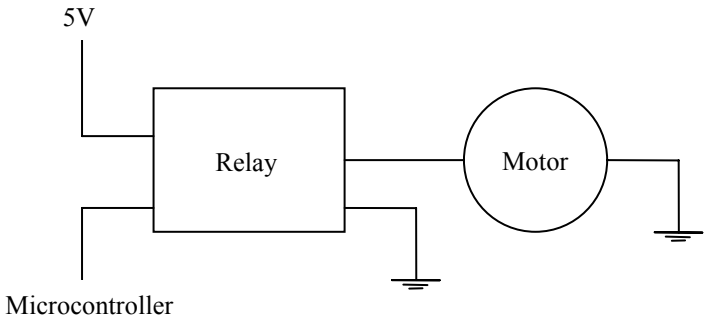


Figure 1: Single-Directional Motor Circuit Diagram

If a high signal from the microcontroller is sent through the relay then 5V will be sent to the motor and the motor will activate. A more elaborate circuit (an H-bridge) must be used if the operator desires a circuit which will allow the motor output to rotate clockwise and counter-clockwise. Figure 2 shows the circuit diagram for an H-bridge controlled dual-directional motor.

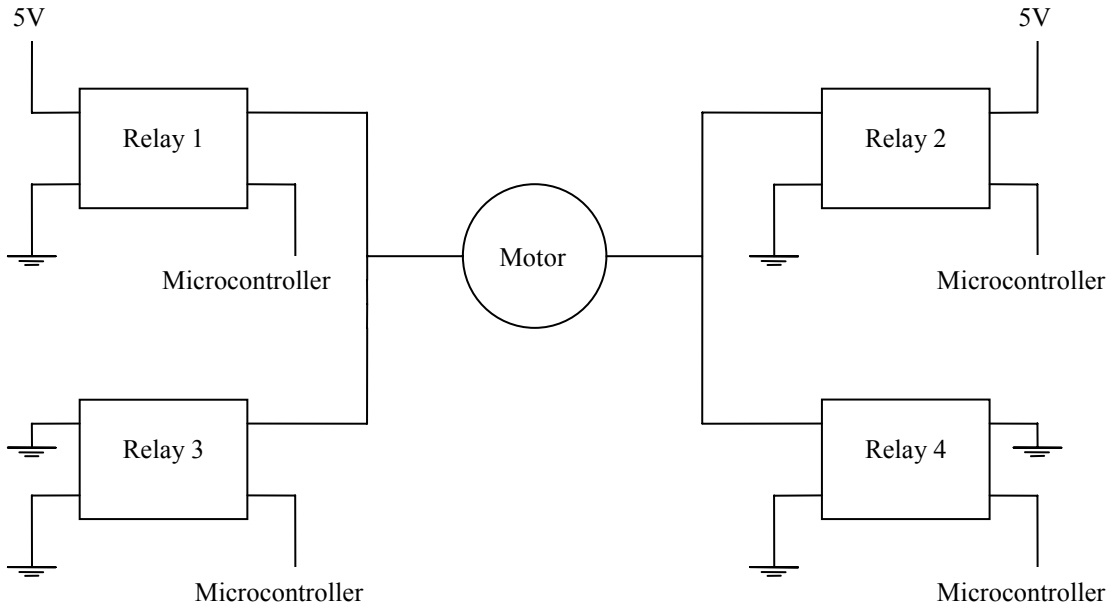
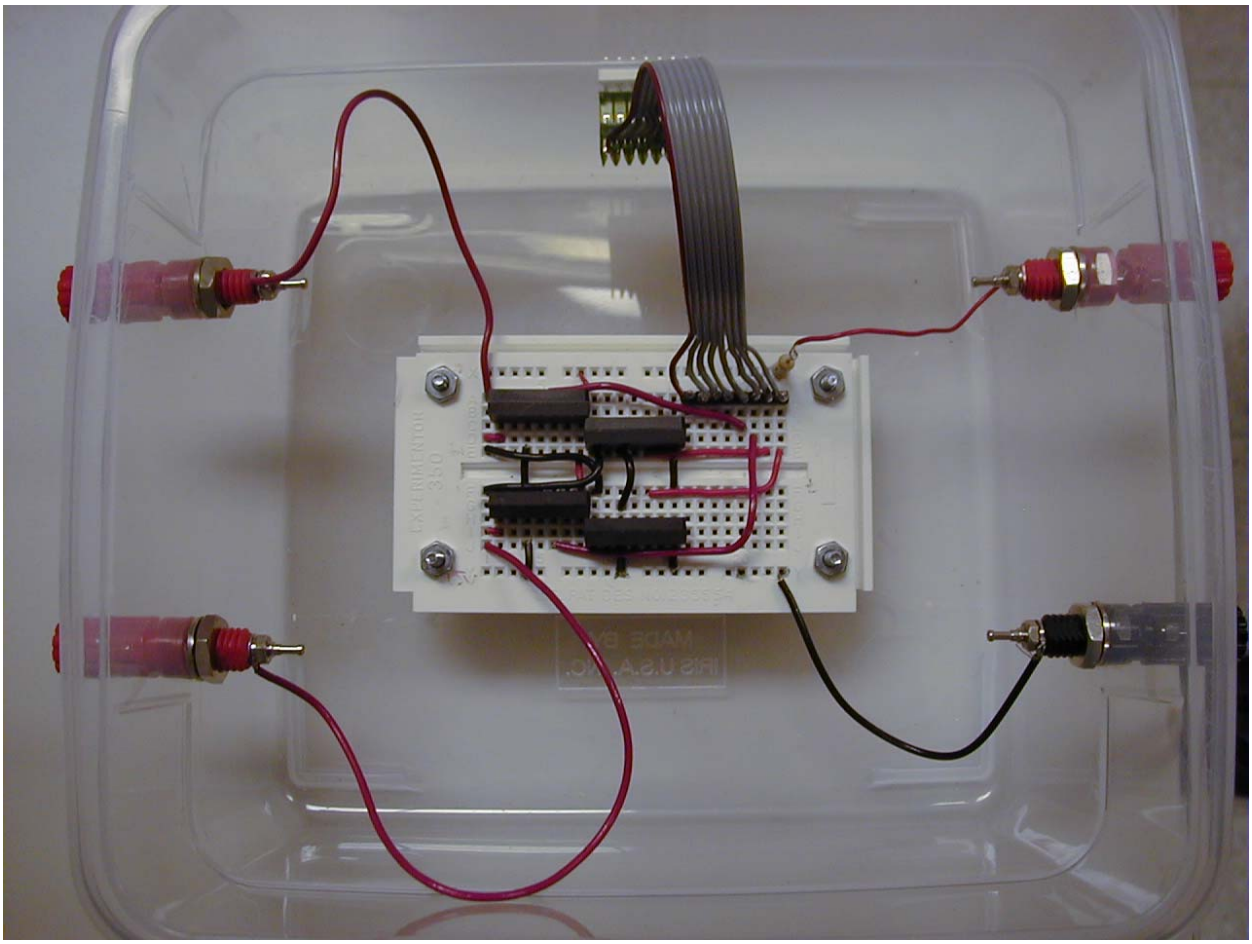


Figure 2: Picture of H-Bridge Wiring Diagram

If a high signal from the microcontroller is sent to the 5V relay on one side of the bridge and a high signal from the microcontroller is sent the ground relay on the other side of the bridge the motor will spin. If a high signal from the microcontroller is sent to either both ground relays or both 5V relays the motor will stall (and possibly be damaged). If a high signal from the microcontroller is sent to the ground and 5V relays on one side of the H-bridge then the circuit will burn and smoke will result.

2. DESCRIPTION OF THE H_BRIDGE RELAY FUNCTIONAL MODULE



3. WIRING INSTRUCTIONS

The assignment of terminal label (either left or right) can be made arbitrarily but most remain consistent for wiring or the circuitry will be damaged. The pin assignments for the relays are given in figure 3. The instructions for the wiring of the H-Bridge are given in table 1.

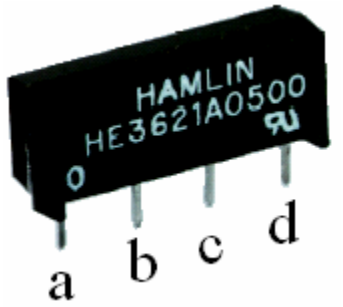


Figure 3: Picture of Pin Assignments for the Relays

Table 1: Wiring of H-Bridge Relay Motor

Red	V_{in} (5V) to Relay 1 (pin d) V_{in} (5V) to Relay 2 (pin d) Relay 1 (pin a) to motor (left terminal) Relay 2 (pin a) to motor (right terminal)
Black	Relay 3 (pin a) to ground (0V) Relay 4 (pin a) to ground (0V) Relay 1 (pin b) to ground (0V) Relay 2 (pin b) to ground (0V) Relay 3 (pin b) to ground (0V) Relay 4 (pin b) to ground (0V) Relay 3 (pin d) to motor (left terminal) Relay 4 (pin d) to motor (right terminal)
Yellow	Port C (pin 0) to Relay 1 (pin c) Port C (pin 1) to Relay 2 (pin c) Port C (pin 2) to Relay 3 (pin c) Port C (pin 3) to Relay 4 (pin c)

4. APPARATUS

Table 2: Apparatus Needed for Testing

Power source
Voltage box, with ground (0V) and 5V outlets
Microcontroller

5. TESTING SEQUENCE

The motor is capable of running in either a clockwise or counter clockwise manner. The direction of rotation will depend upon the name assignment of the motor terminals. The Port C pin assignments given in table 3 should yield the corresponding results also given in table 3.

Table 3: Port C Pin Assignments and their results

Pin 0	Pin 1	Pin 2	Pin 3	Results
1	1	0	0	The motor will stop (brake)
1	0	1	0	The circuit will burn (smoke)
1	0	0	1	The motor will spin (forward)
0	1	1	0	The motor will spin (reverse)
0	1	0	1	The circuit will burn (smoke)
0	0	1	1	The motor will stop (brake)

6. LIST OF PARTS

Table 4: List of Required Components

Motor
4 Relays
Red Wire
Black Wire
Yellow Wire
Bread Board
Microcontroller

7. REFERENCES

BROWN, Jim. (1998) Brief *H-Bridge Theory of Operation*. Revised (2000) by Bob Jordan. Dallas Personal Robotics Group. http://www.dprg.org/tutorials/1998-04a/. May 24, 2004.