

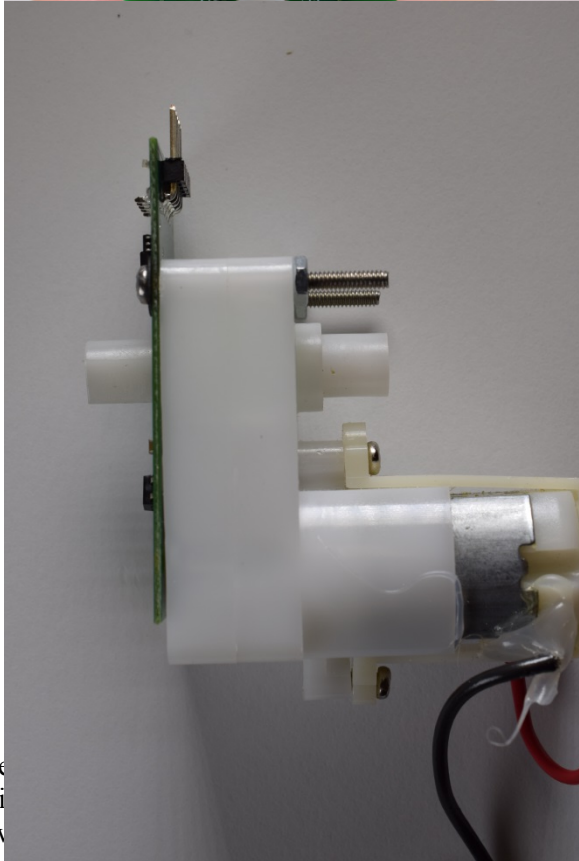
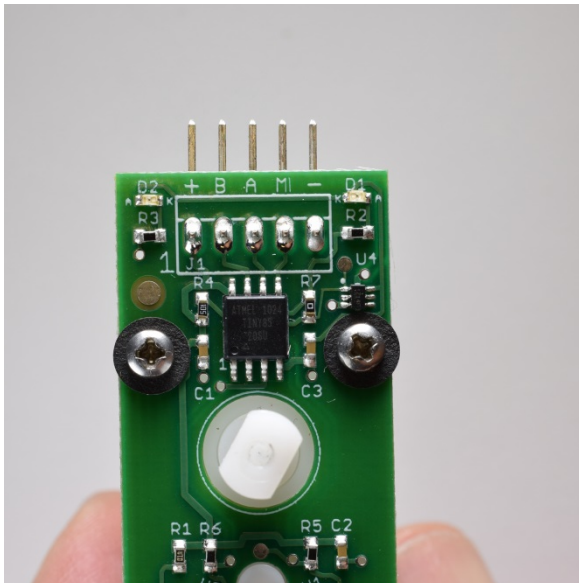
The following assignment is given to teach students how to use interrupts on a microprocessor. It is a precursor to a lab where we compare open-loop and closed-loop control of speed and distance.

Experiment 4:

1. You need to mount the wheel sensor and wheel to one of your motors. There are several very small parts and few or no replacements. Be careful. You should have the following wheel-encoder parts: (actually, you should have 2 wheel encoder kits – we will only use one today)

WW-12 Parts List

- a. printed circuit board, preassembled
 - b. self-adhesive codewheel
 - c. 6" five lead color-coded ribbon cable
 - d. two insulated washers
 - e. two 2-56 hex nuts
 - f. two 2-56 1" pan head machine screws
2. You should also have two GM-2 gear motors and 2 GMWWS wheel spacers. Take out one of each. Return the ribbon cable parts to the TA. You will use the pre-built 5-pin cable instead.
 3. Lower the board over the motor output shaft, with the shaft going into the largest hole in the center of the WW-12, making sure the raised alignment pin on the motor housing enters the matching hole on the board. Make sure the slightly raised area around the motor shaft fits entirely inside the hole in the circuit board.
 4. Mount the WW-12 to the motor using 2-56 machine screws and 2-56 nuts; place insulated washers between the screw heads and the circuit board.



5. Peel off the adhesive from the wheel (the side with the nub). Attach the code wheel to the PCB, ensuring it is centered with the nub.

Spacer onto the back of the PCB. Ensure to center it; then attach the motor while also ensuring it is centered.



6. Attach the wheel to the hub – preferably with a ¼” #2 screw.

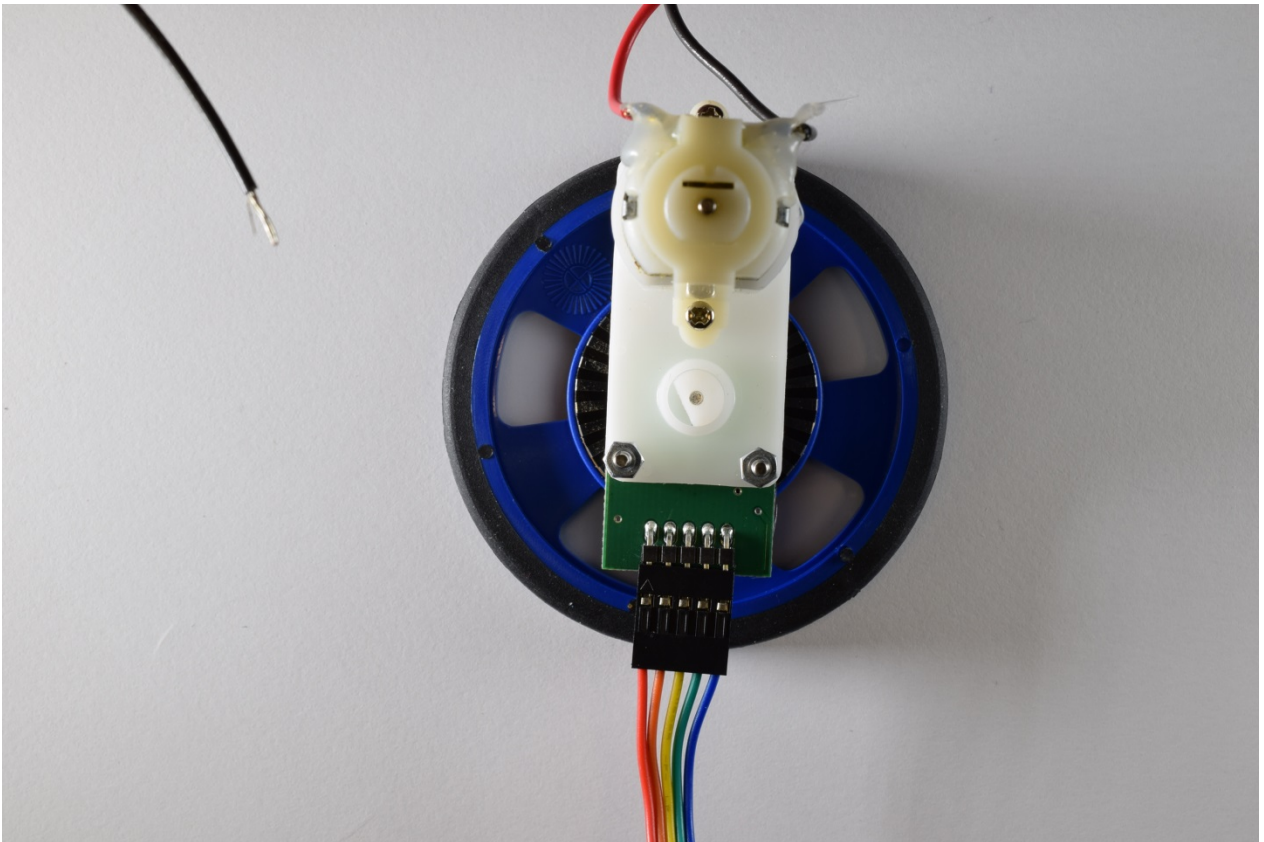


7. Attach the 5-wire cable as shown. Match the markings on the PCB.

Connector Pinout

(color suggestions based on cable assembly photos below)

1. Vcc - red
2. ChB / Direction / Serial Mode select (if low on reset) - orange
3. ChA / Clock / Serial TX Out - yellow
4. Quadrature Mode (if high or floating on reset) / Sign-Magnitude Mode (if low on reset) / Serial RX In - green
5. Gnd - blue



8. Using jumpers connect the VCC and ground on the encoder board to +5 and ground on the Arduino, respectively. Connect channel A to pin 2 of the Arduino and channel B to pin 3.
9. Write a program to generate an interrupt on every rising edge of channel A. The interrupt service routine should check the value on channel B. Based on the timing diagram in Figure 8 in the WW-12 documentation, increment a counter by one each time the wheel moves in one direction and generates a pulse on channel A and decrement the counter each time the wheel moves in the opposite direction and generates a pulse on channel A. Print out this counter value every time it changes.

10. Run this program. It should measure the distance travelled by the wheel in both directions. Determine how many counts correspond to one full wheel rotation. (Demo #4). In your lab report, calculate the distance travelled per count. The wheel diameter is 69mm.