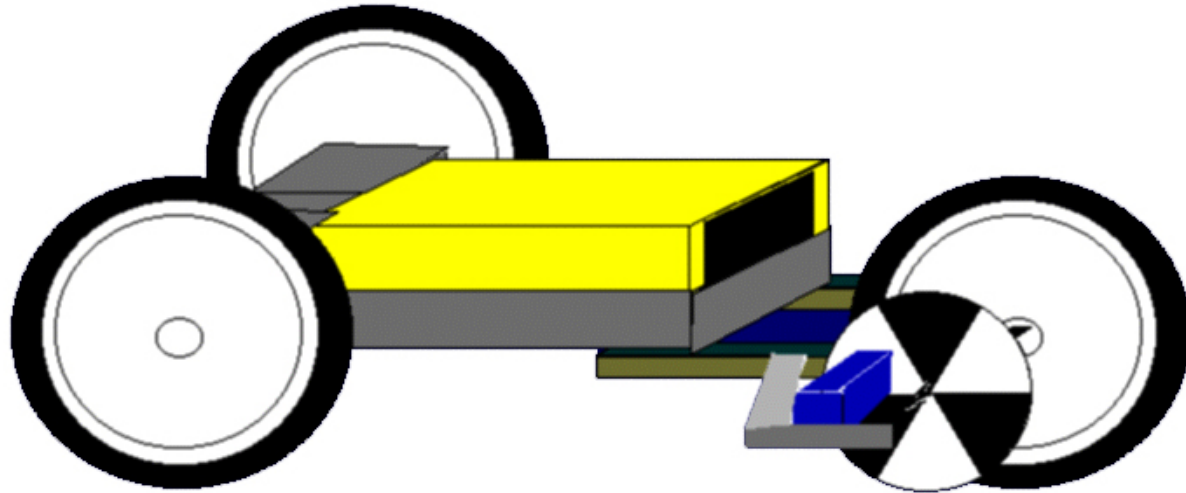
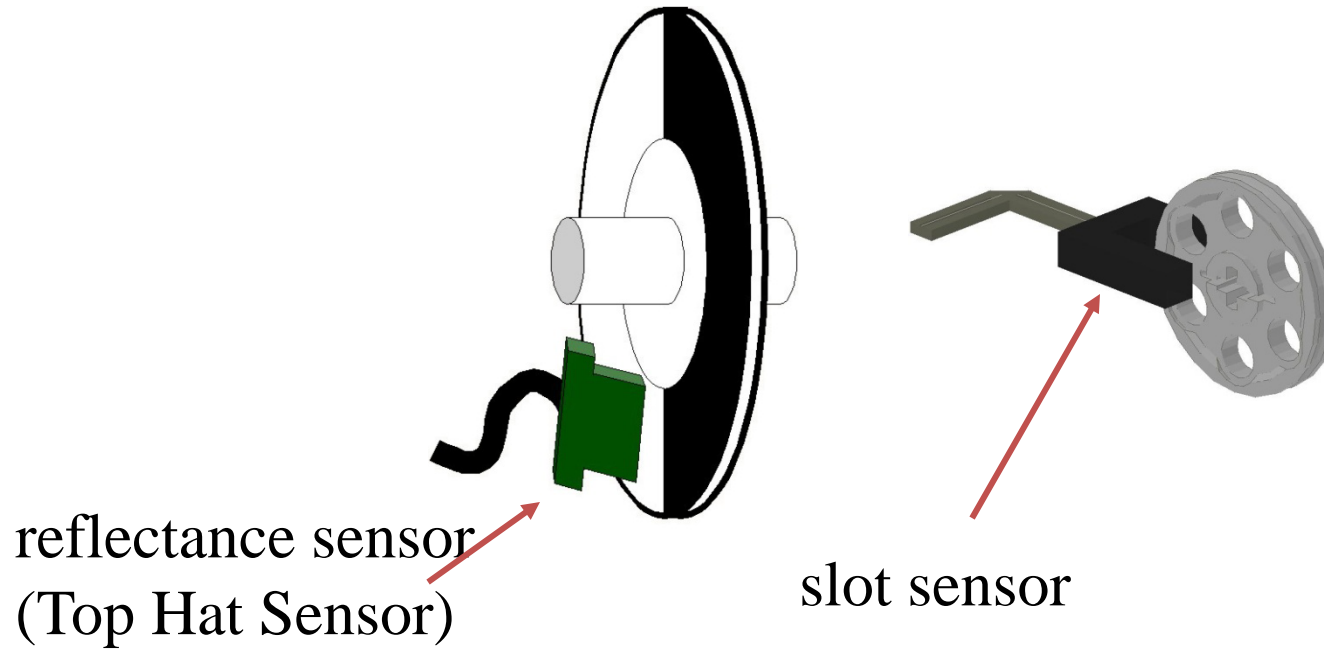


Speed and Distance Using Encoders



Wheel Encoders

- Two types of wheel encoders



Encoder Library Functions

The `enable_encoder()` library function is used to start a process which updates the transition count for the encoder specified. The encoder library functions are designed for sensors connected to (digital) ports 8-15. Every enabled encoder uses a lot of the processor -- so don't enable an encoder unless you are going to use it, and *never put an enable statement inside of a loop.*

```
enable_encoder(<port#>);
```

```
/* turns on the specified encoder (which are plugged into digital  
ports 8-15). This should be done only once - never enable an  
already enabled encoder. If an encoder is not enabled  
read_encoder will always return 0. */
```

```
disable_encoder(<port#>)
```

```
/* turns off the specified encoder */
```

```
reset_encoder(<port#>)
```

```
/* sets the specified encoder value to 0 */
```

```
read_encoder(<port#>)
```

```
/* returns an int that is the current value of the specified  
encoder */
```

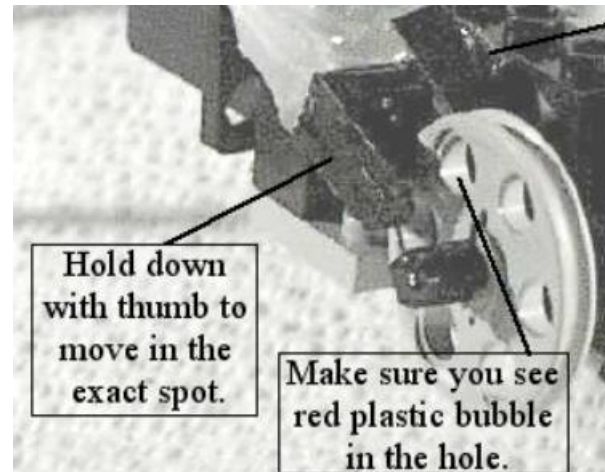
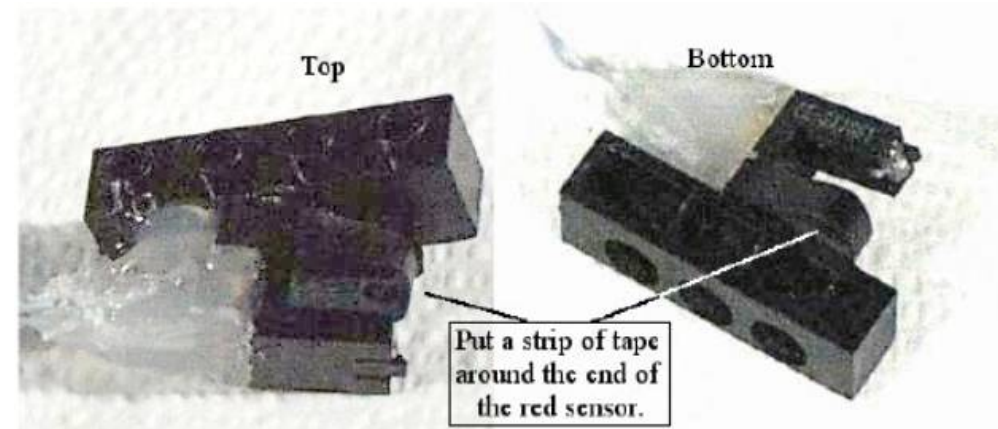
Simple Encoder Program

```
void main(){
    int enc1, enc2;
    enable_encoder(8); // turn on the encoders; sensors
                       // plugged into ports any of the
                       //digital ports

    enable_encoder(15);
    while(!b_button())
    {
        enc1=read_encoder(8); /* read each encoder */
        enc2=read_encoder(15); /* and show values */
        printf("Enc1=%d Enc2=%d\n",enc1, enc2);
        sleep(0.1); /* wait a bit and do it again */
    }
}
```

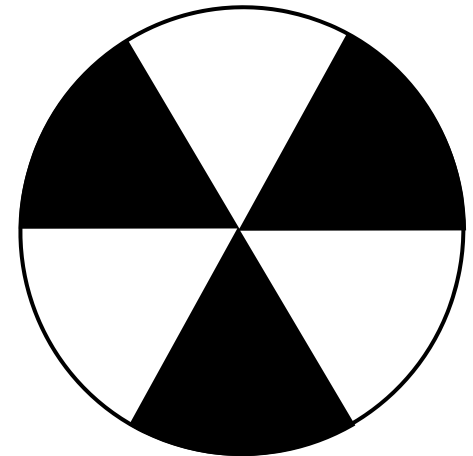
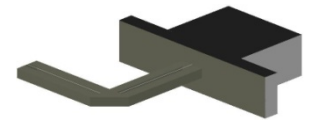
Mounting a slot sensor encoder

Carefully align
sensor with
encoder
wheel



Optical Encoders

- The encoder sensor consists of a light reflectance sensor and a paper disc:
 - As the disc rotates, the reflectance sensor can read the light and dark areas on the disc.
 - This particular disk would give six counts per revolution (6 transitions from light to dark or dark to light)
 - Wheels with more partitions for more accurate control can be found on page 136 of Robot Explorations



Measuring Distance

- Divide the circumference of the wheel by the resolution of the encoder (number of clicks per distance moved).

Recording Speed

- Speed can be measured by recording the distance traveled in a certain amount of time
 - 6 counts per revolution
 - each revolution covers a certain distance (based on the size of the wheel and the gear ratio between the encoder disk and the wheel)
 - Speed is distance per unit time
 - On the library functions **seconds** () returns the elapsed time in seconds

Last Word on Encoders

- Every enabled encoder uses a lot of the HB's processor -- so don't enable an encoder unless you are going to use it, and *never put an enable statement inside of a loop*
- Just because you count an encoder does not mean that the robot moved that distance
 - tires slip on the ground (and tires slip on the wheels)
 - Legos bend, gears skip, etc...