PAT 451/551 INTERACTIVE MEDIA DESIGN I

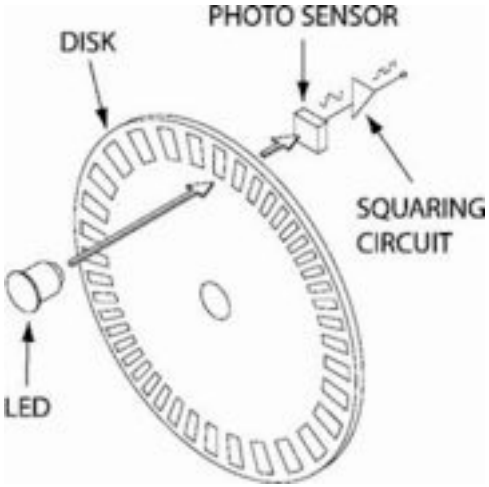
ENCODERS

ROTATION SENSING

Rotary encoder

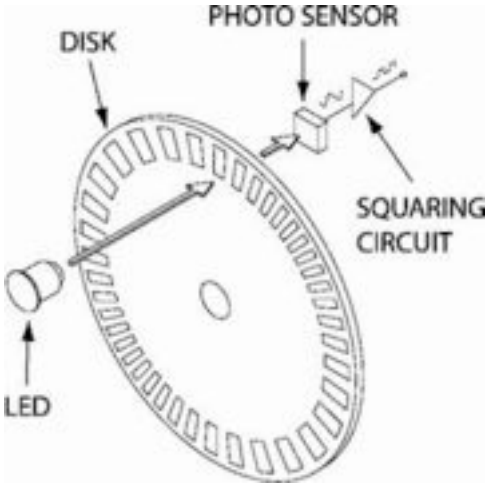
- Sequence of logic transitions
- Count number of transitions: tell how far you've traveled

Benefits?



Problems?

ROTATION SENSING



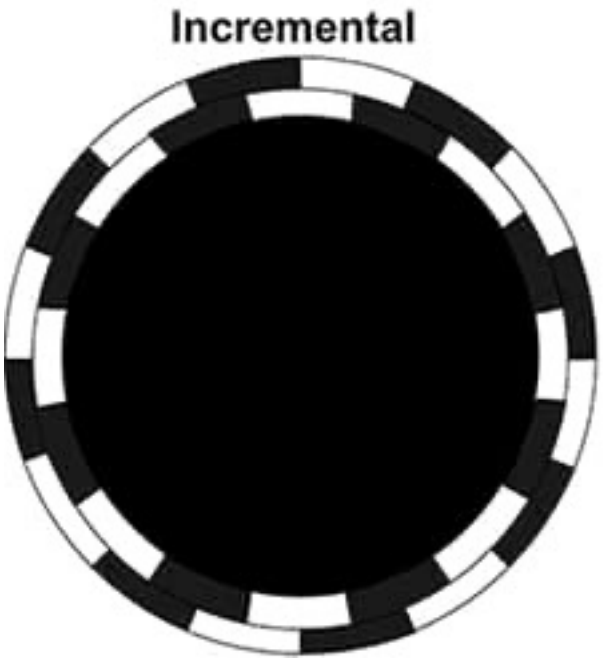
Benefits

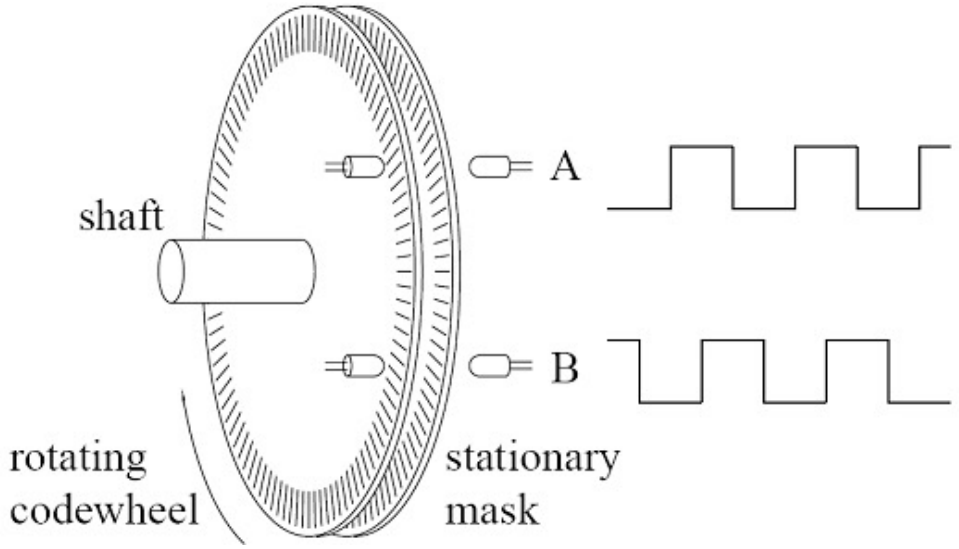
- Can be non-contact
- Can turn infinitely
- In practice, can be very high resolution, depending on technology

Drawbacks

- Can never know absolute position
- With just 1 emitter/detector, we can’t tell which direction we’re turning
- Finite resolution
- Missed detections -> drift

QUADRATURE ENCODER





2 signals with a 90˚ phase offset allow us to sense direction

QUADRATURE ENCODERS (INCREMENTAL ENCODERS)

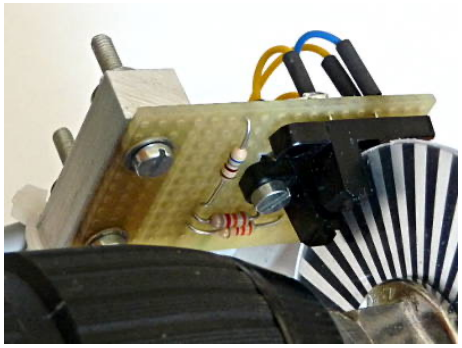
Form Factors / Technologies

- Can be optical, magnetic, mechanical
- Can be prepackaged / DIY

Applications

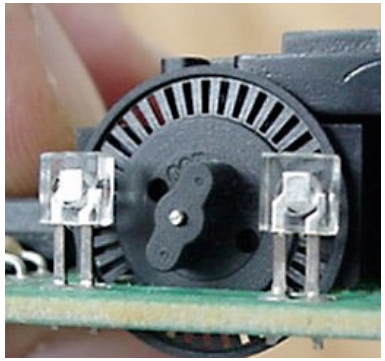
- Position control in robotics / automation
    - CNC Machines, laser cutters, manufacturing robots
- Speed Control in motorized systems
- Consumer electronics
    - Volume knob
    - MIDI controllers

QUADRATURE ENCODERS (INCREMENTAL ENCODERS)

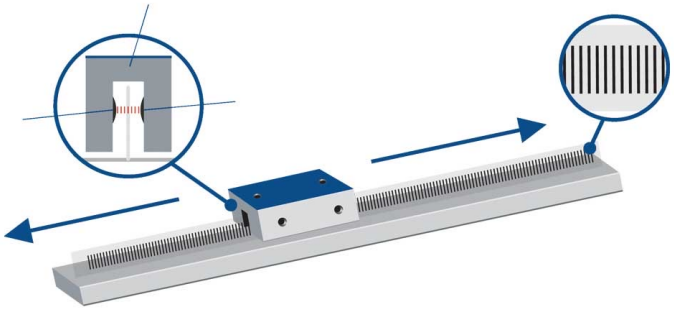


DIY with reflective optical sensor

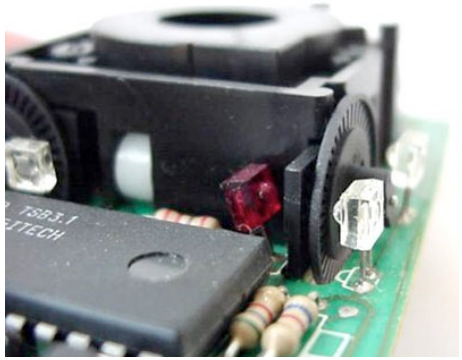
Automotive volume knob



Manufactured wheel with stock LED/phototransistors



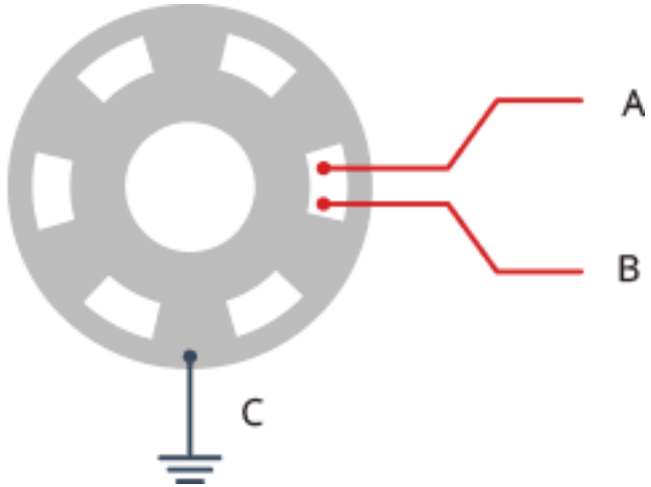
Linear configuration to position laser cutter



Inside a ball mouse

MIDI controller with LED feedback

QUADRATURE ENCODER

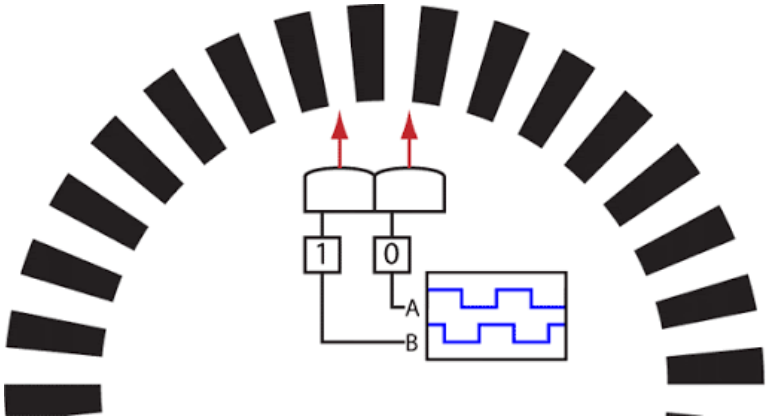


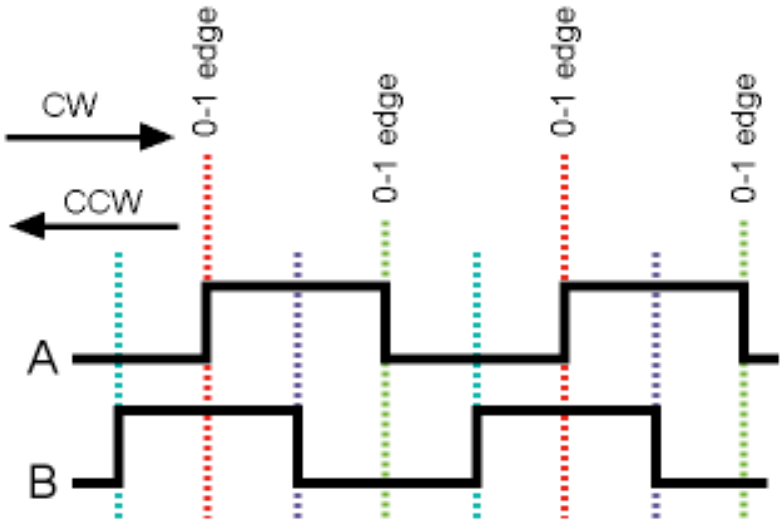
Schematic illustration of a mechanical encoder

QUADRATURE ENCODER

Animation of a mechanical encoder

QUADRATURE ENCODER





2 square wave signals, 90º out of phase

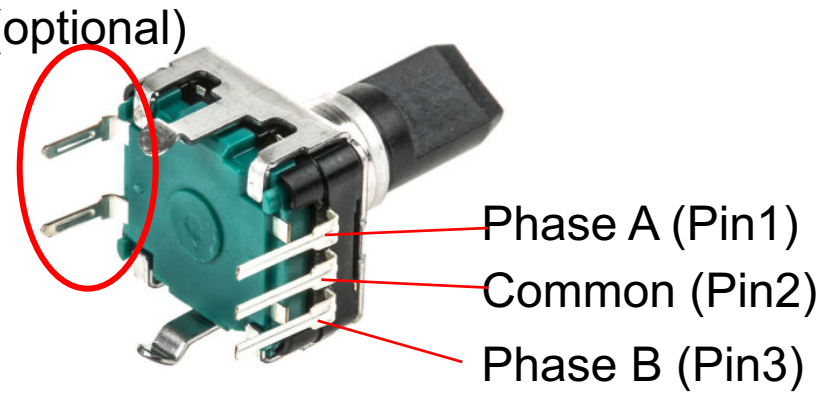
Basic operation:

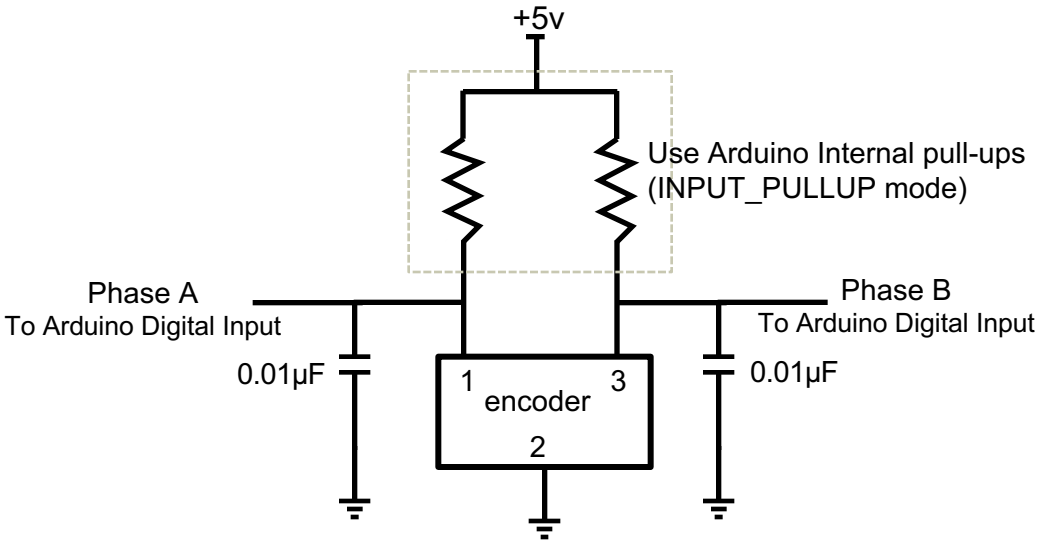
- Read signal A
- If A goes from Low to High
  - Read Signal B
  - If B is High, moved 1 tick CW
  - If B is Low, moved 1 tick CCW

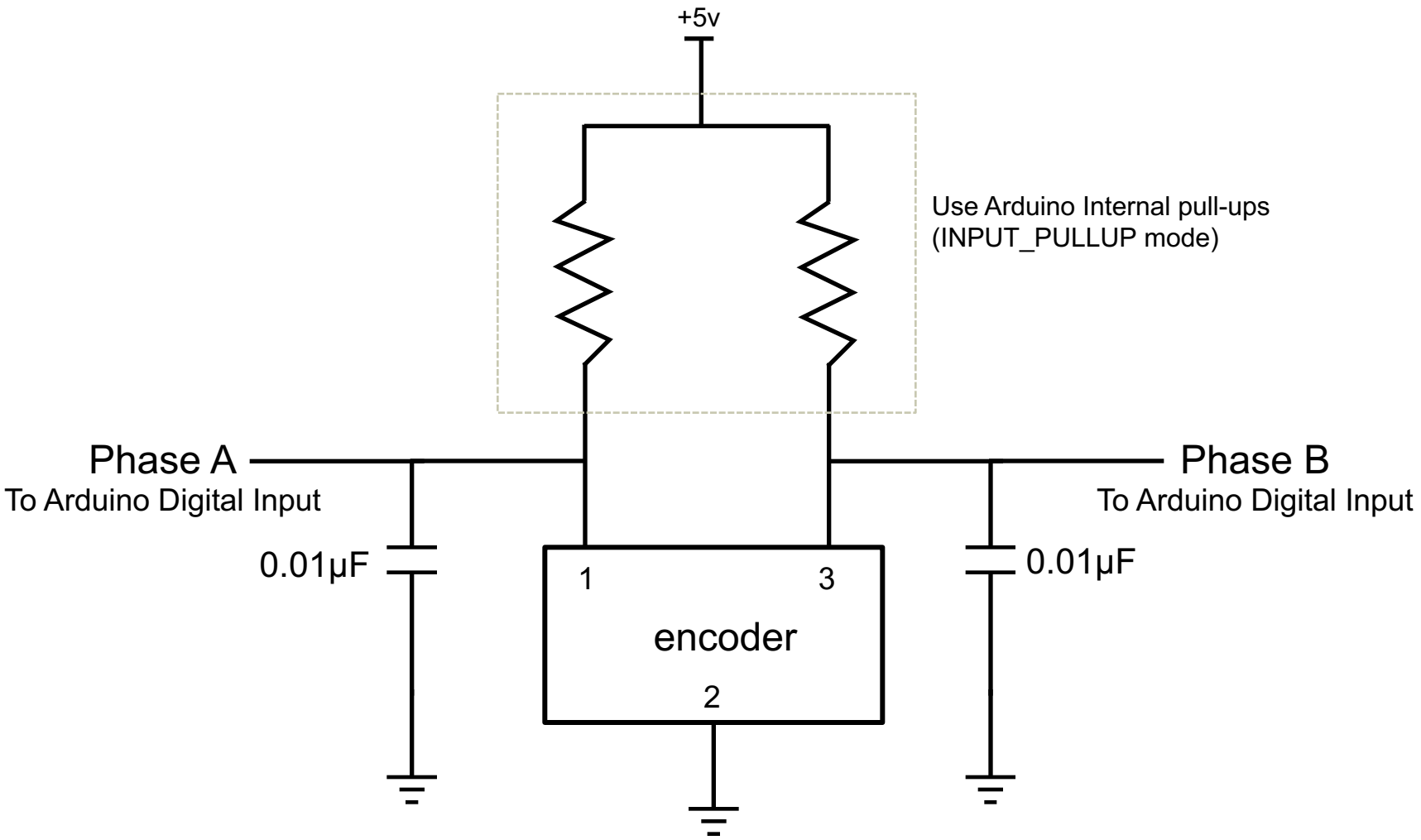
MECHANICAL ENCODER

Options:

- Detents
- Counts per revolution
- Switch






+5v
Use Arduino Internal pull-ups
(INPUT_PULLUP mode)
Phase A
To Arduino Digital Input
Phase B
To Arduino Digital Input
0.01µF
0.01µF
1
3
encoder
2

EXAMPLES

Arduino programs

See also:

http://www.arduino.cc/playground/Main/RotaryEncoders