

Chapter 8

Digital and Analog Interfacing Methods

Lesson 12 Part a

Optical Rotatory Incremental Encoder

Incremental Rotatory Encoder

- When a shaft rotates by one step-angle, *clockwise* or *anticlockwise*, respectively
- Incremental encoder— a System, which notes the *increments* or *decrements* at each step change in the angle

Parts of an Incremental Rotatory Encoder

- Circular disc— two tracks with equally spaced slots and a index-hole
- Index-hole marks the 0° with respect to an assumed axis around which the disc rotates

Parts of an Incremental Rotatory Encoder

- Three LED-phototransistor pairs, two are for the two tracks a and c slots and one pair is for the hole and
- Tracks a and c slots have slight offset (angular displacement)
- Enables noting the increments by one step and also the direction of motion by phase detection

Parts of an Incremental Rotatory Encoder

- Each track on the disc has the slots at successive steps on the circumference over angle 0° to 360°
- A track, *a* or *c* counter notes the movements stepwise. Counter *a* or *c* counts the movements stepwise.

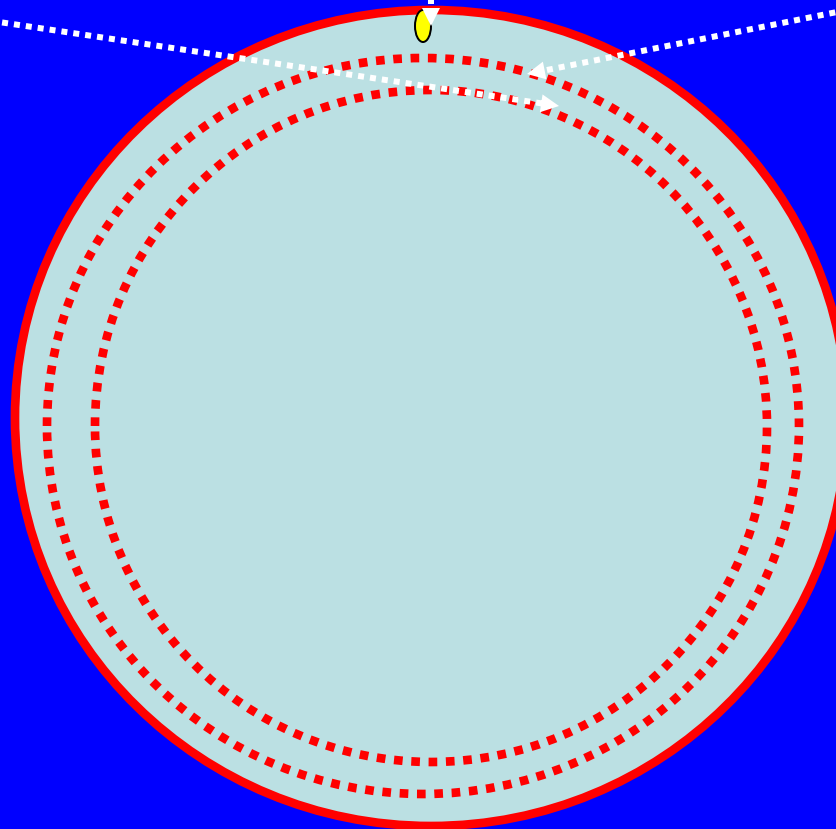
Index hole

track *c*

track *a*

64 slots in
6-bit
output
encoder

64 slots in
6-bit
output
encoder



Incremental Rotatory Encoder Disc

n-bit incremental rotatory encoder

1. Counts the clockwise and anticlockwise angular rotational steps
2. When the shaft rotates clockwise or anticlockwise, the numbers of occurrences of either '1's (or '0's) are counted.

n-bit incremental rotatory encoder

- Counting is upwards for clockwise rotation and downward for anticlockwise rotation

n -bit incremental rotatory encoder

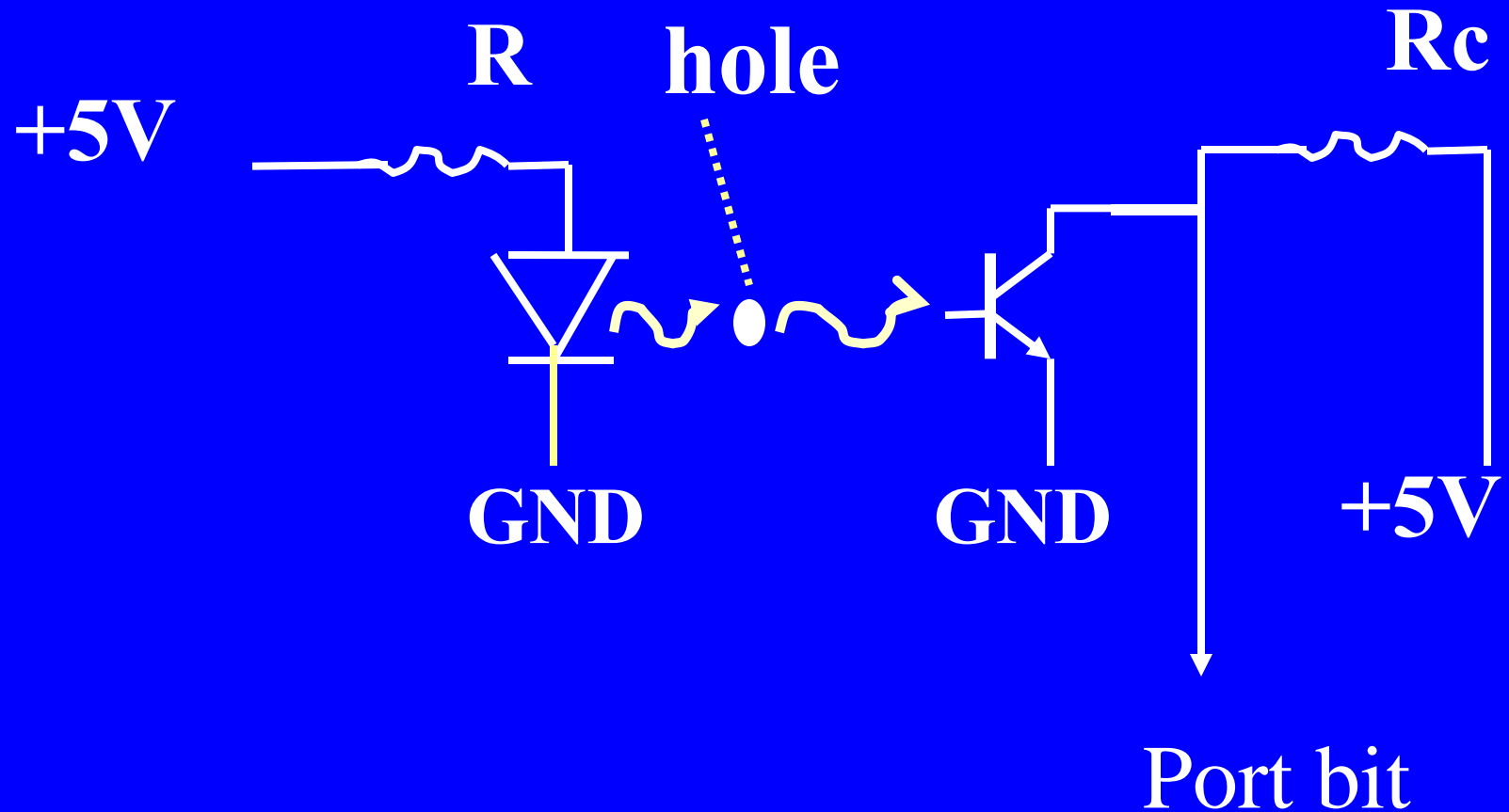
3. Resolution is $(360^\circ/n)$ when there are n slots

4. For a resolution of $(360^\circ/64)$, each track has 64 arcs, which are dark and 64 slots or transparent areas. Six bit counter can be external or internal timer-counter in MCU

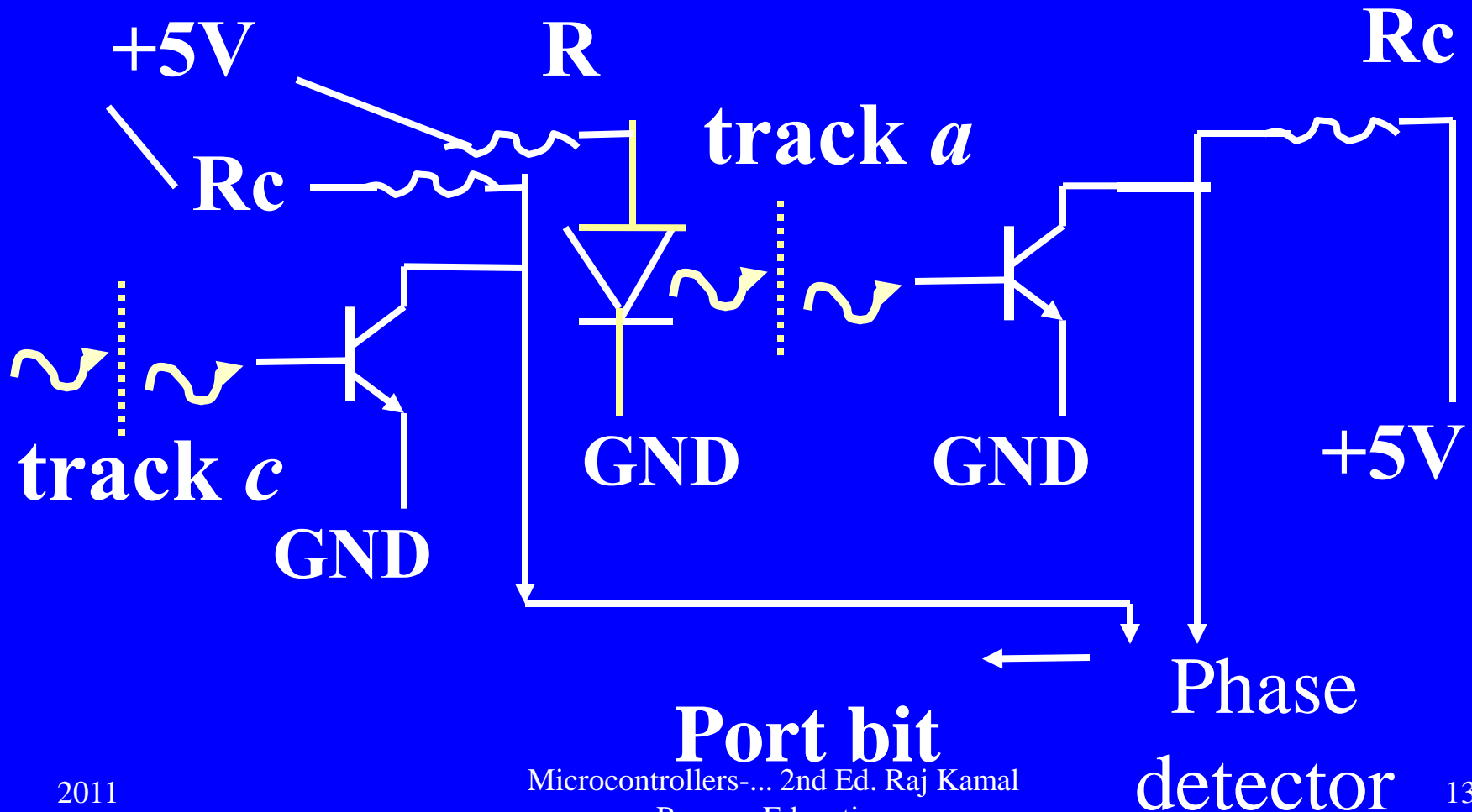
n-bit incremental rotatory encoder

5. Counts reset to 0 on active input when index-hole passes through the LED radiation

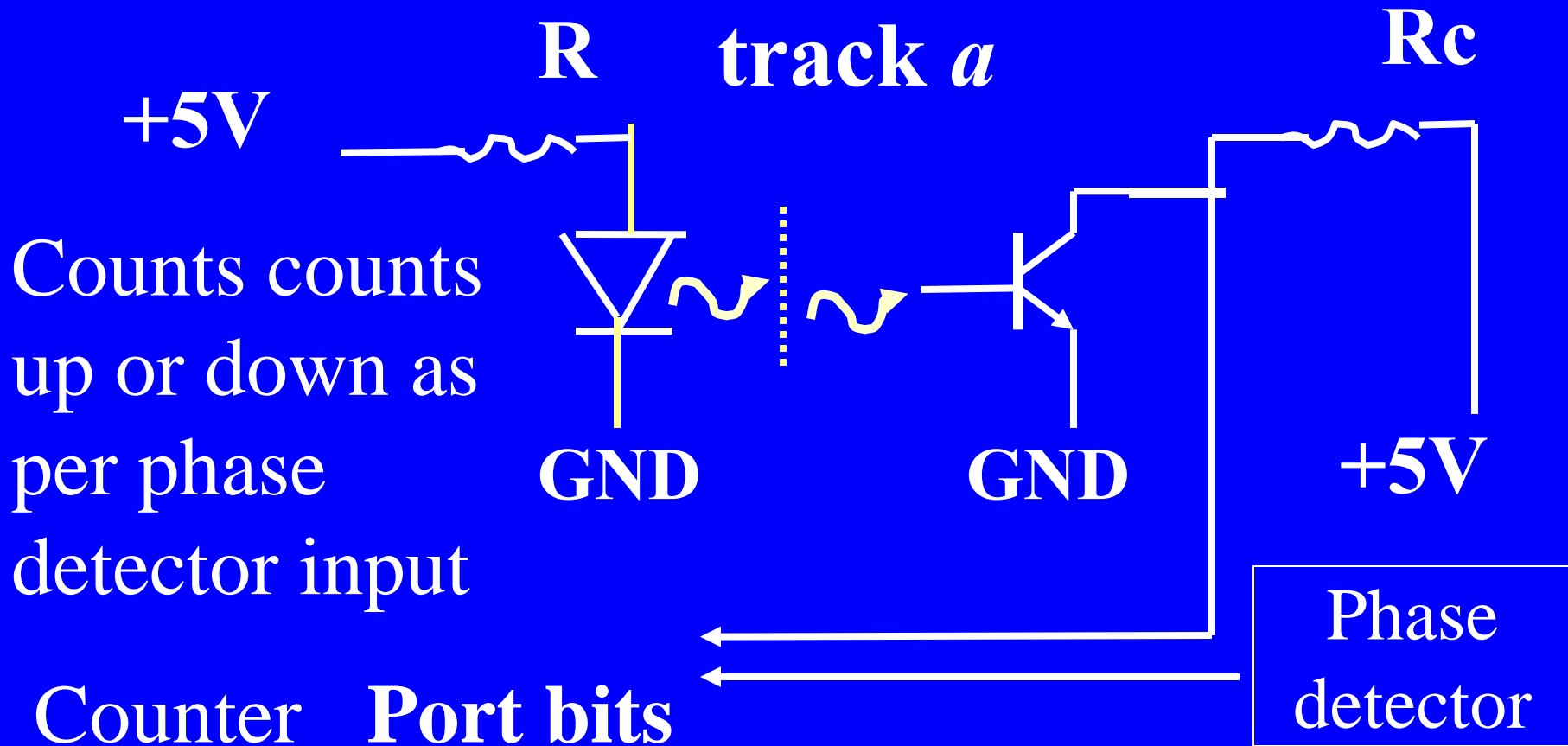
Incremental Rotatory Encoder Interface using LED-PT Pairs



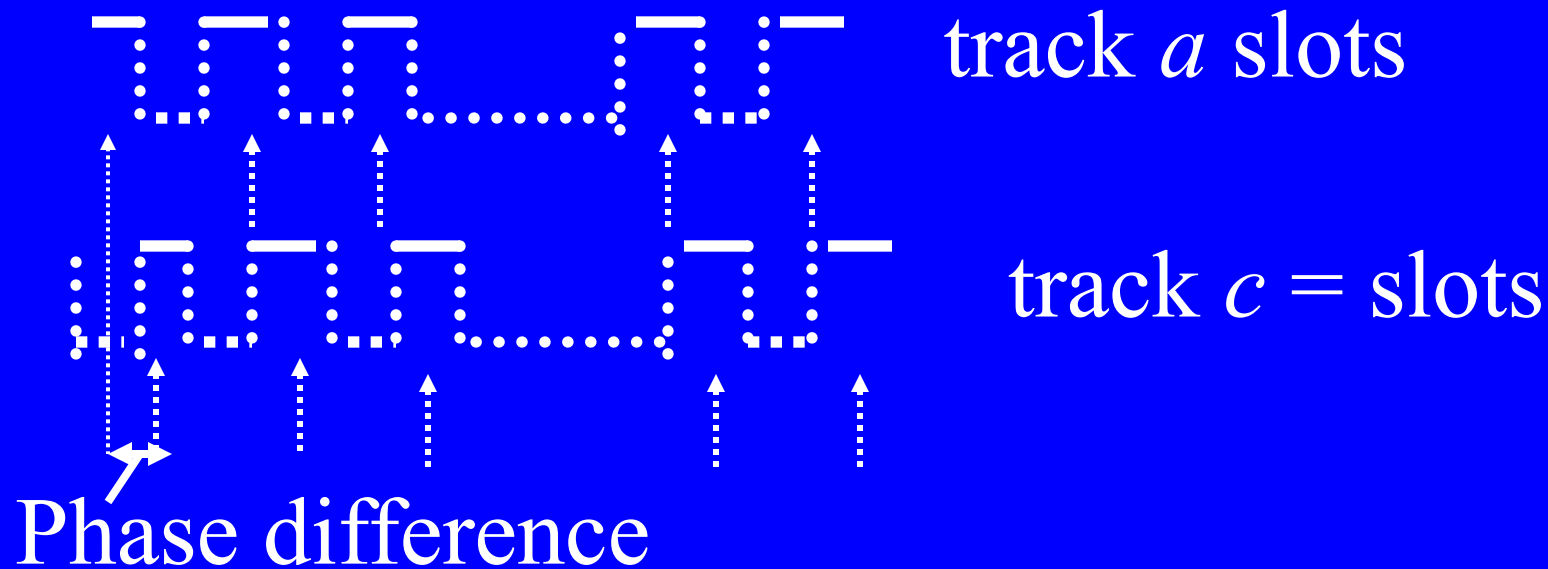
Incremental Rotatory Encoder Interface using LED-PT Pairs



Incremental Rotatory Encoder LED-PT Pairs



Pulses for Inputs from a and c and hole



Pulses of index hole on each full rotation



Summary

We learnt

Incremental rotatory encoder

- Enables the measurement of a shaft angular position at an instant with respect to an origin (at a fixed initial angular position).
- Enables measurement of the rotational speeds also from number of input pulses per second.

End of Lesson 12 Part a

Optical Rotatory Incremental Encoder