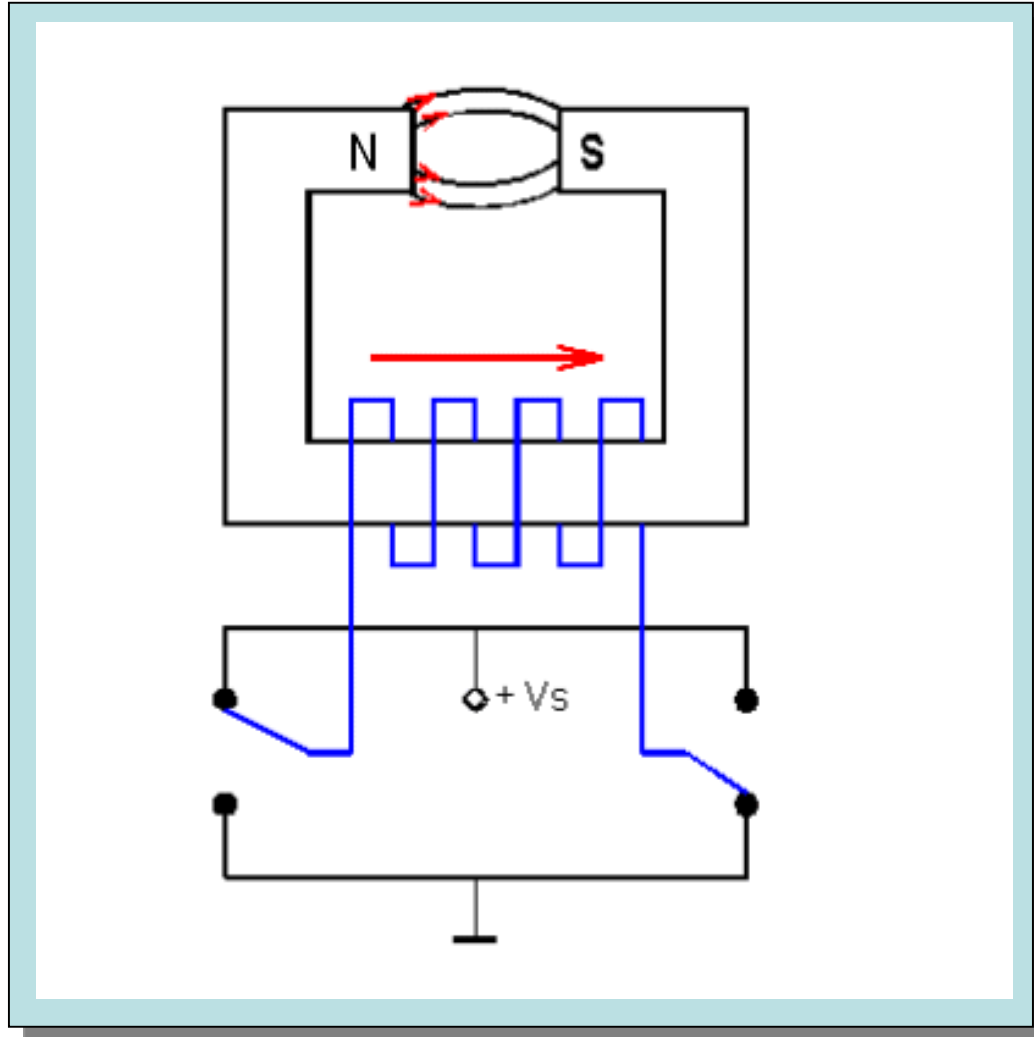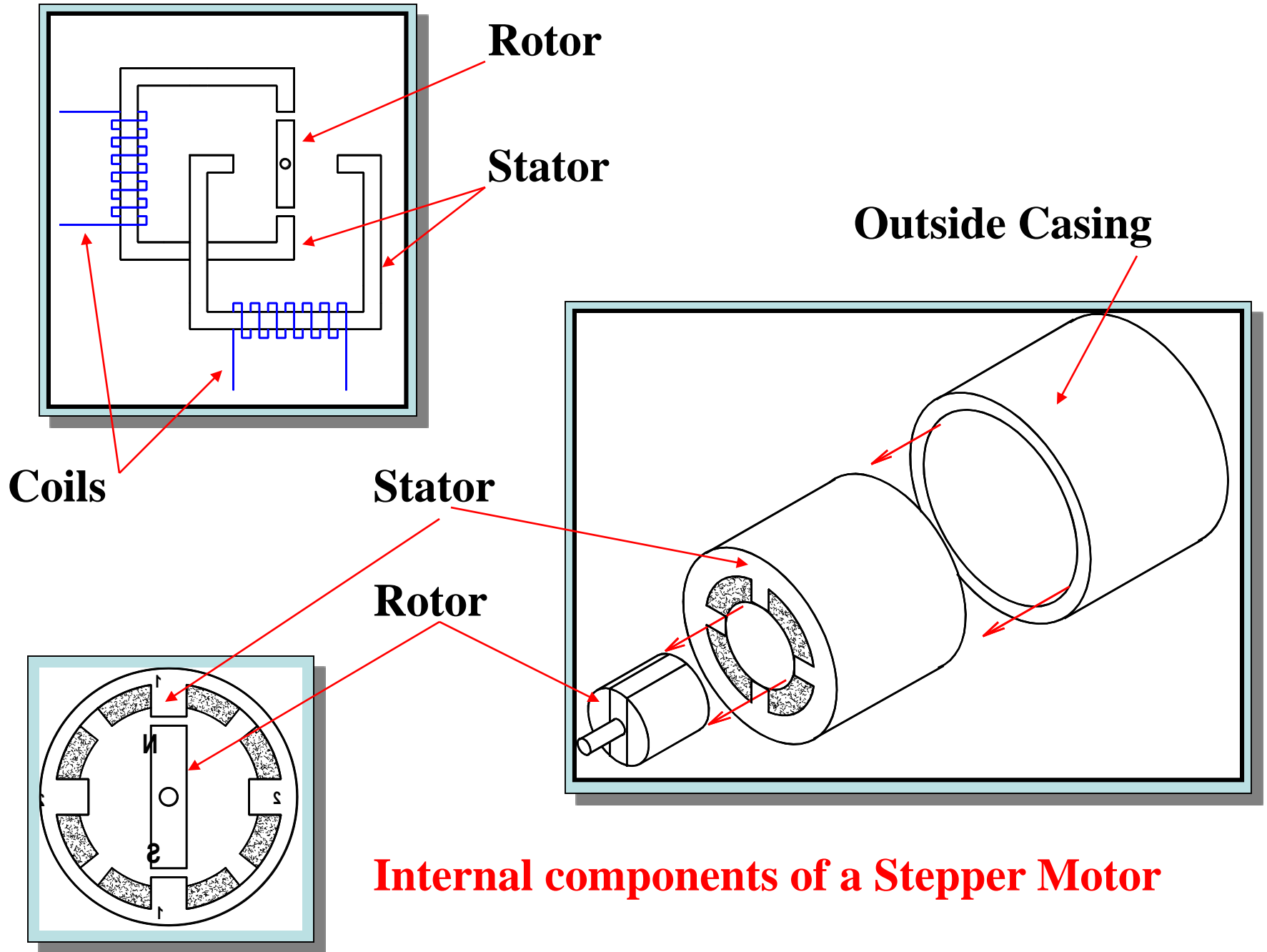- **Applied Control Systems**
- **Stepper Motors**

Stepper Motor / Electro magnet

Rotor

Stator

Coils

Outside Casing

Stator

Rotor

Internal components of a Stepper Motor

Cross Section of a Stepper Motor

Stators
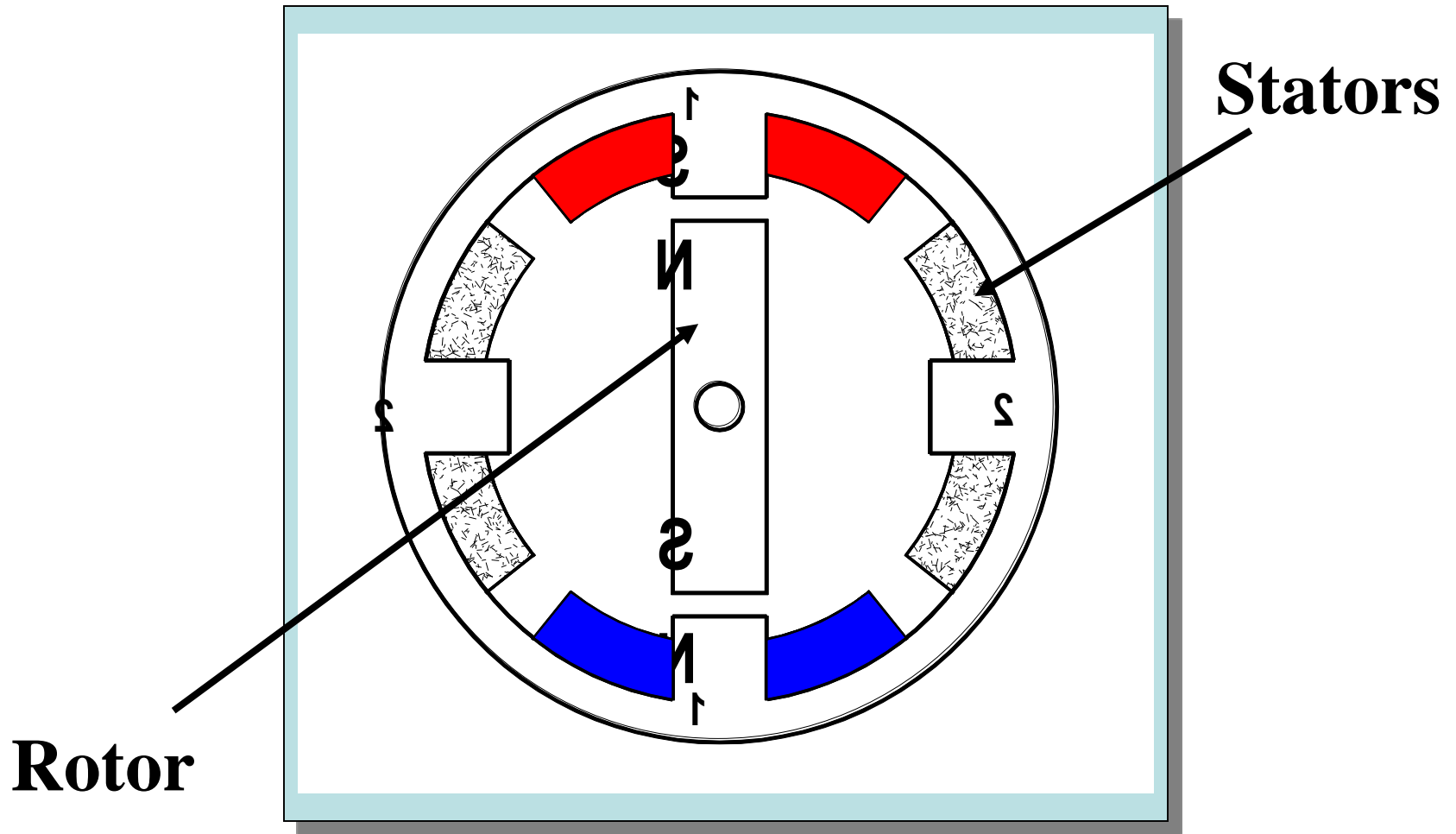
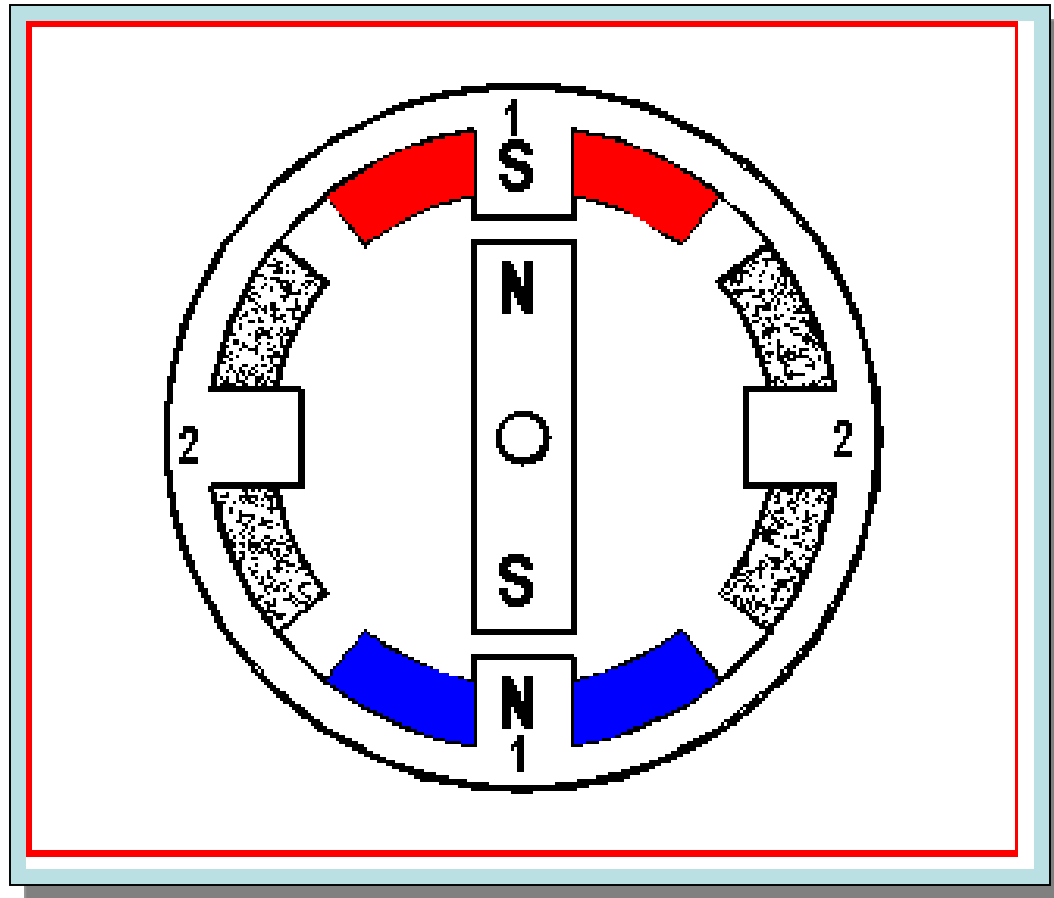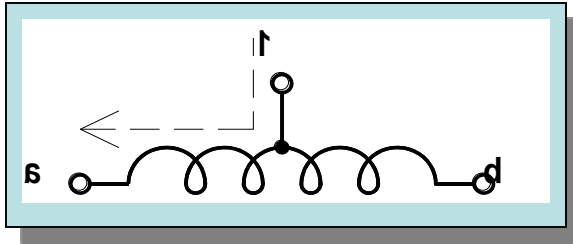**Rotor**

Full Step Operation
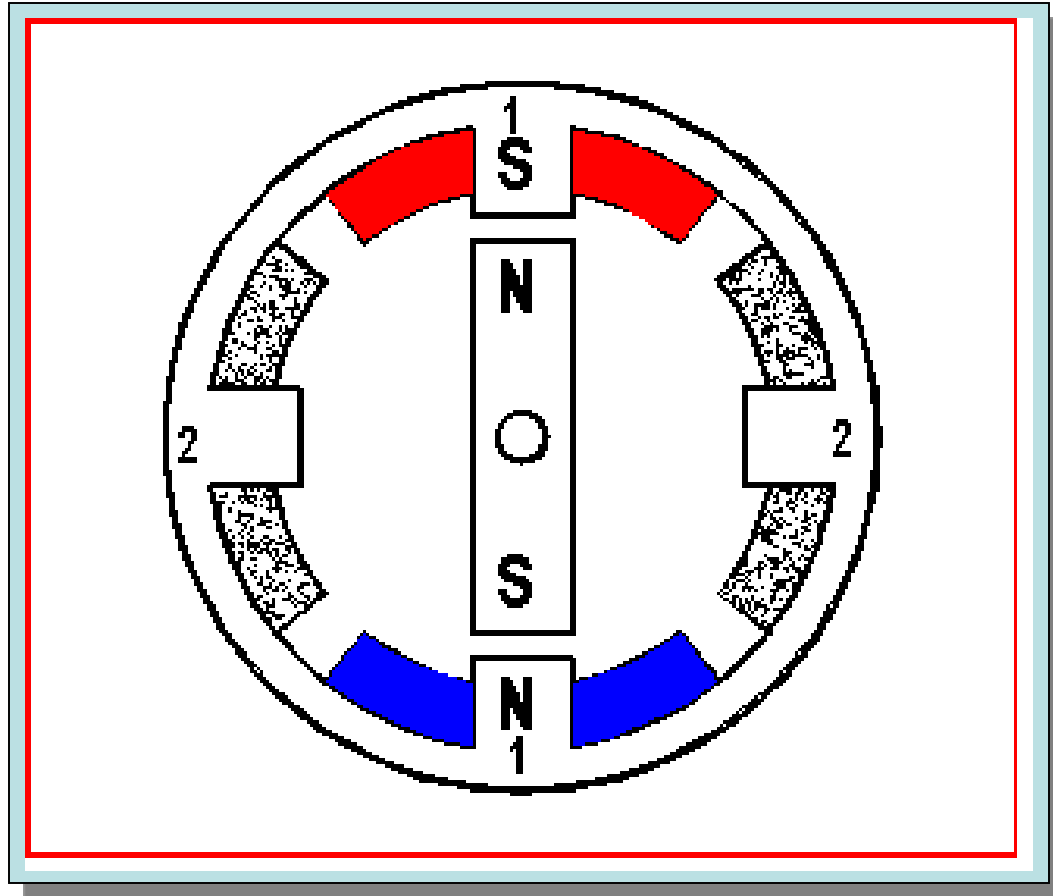
Four Steps per revolution i.e. 90 deg. steps.
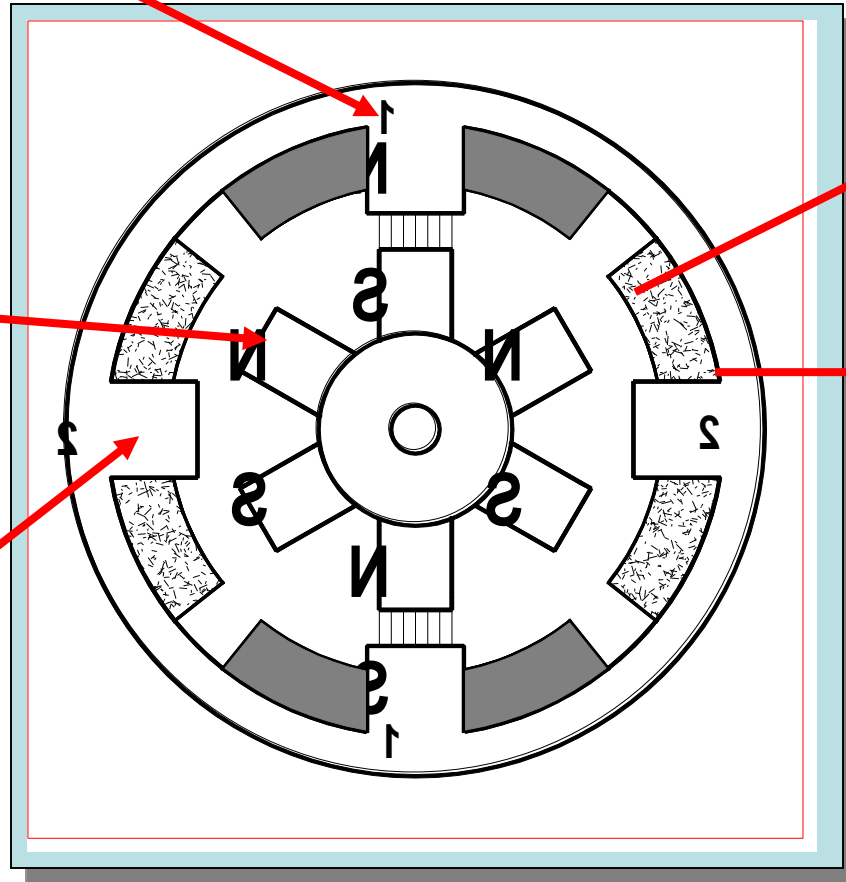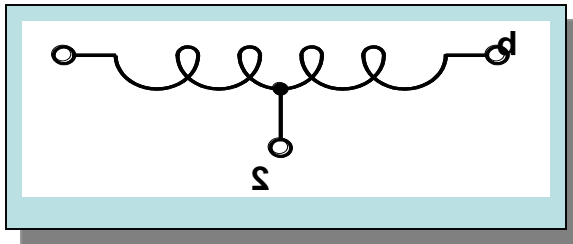
Half Step Operation

Eight steps per. revolution i.e. 45 deg. steps.
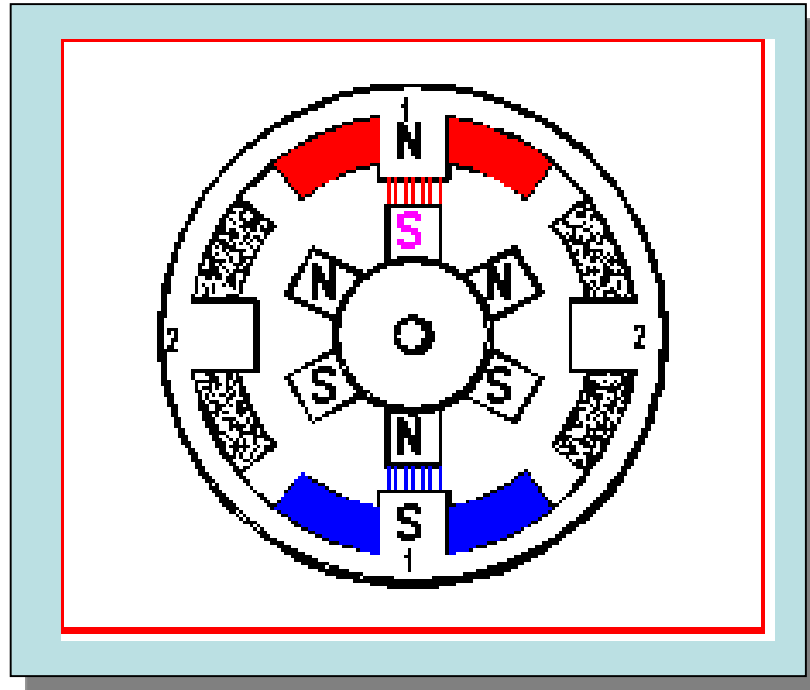
Winding number 1

6 pole rotor

Winding number 2
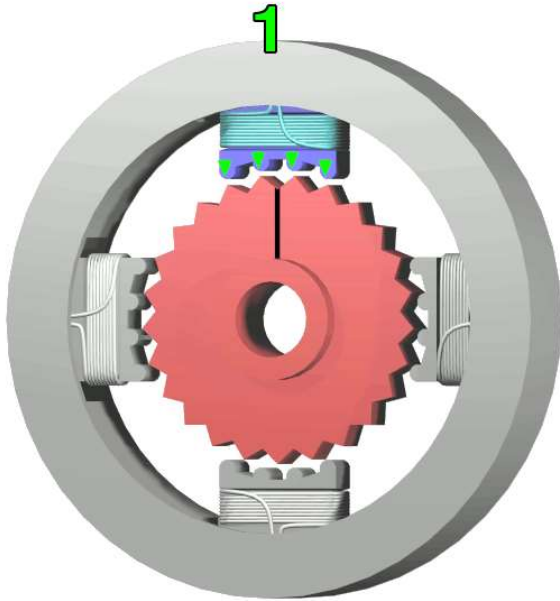
One step

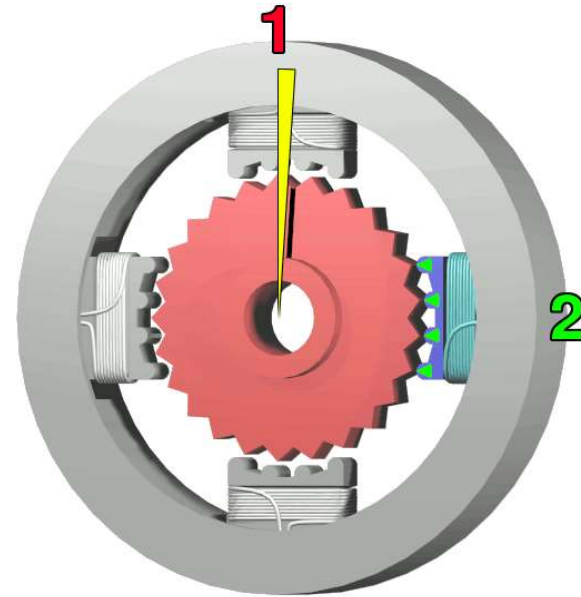# Six pole rotor, two electro magnets.

How many steps are required for one complete revolution?

Practical Stepper motor operation
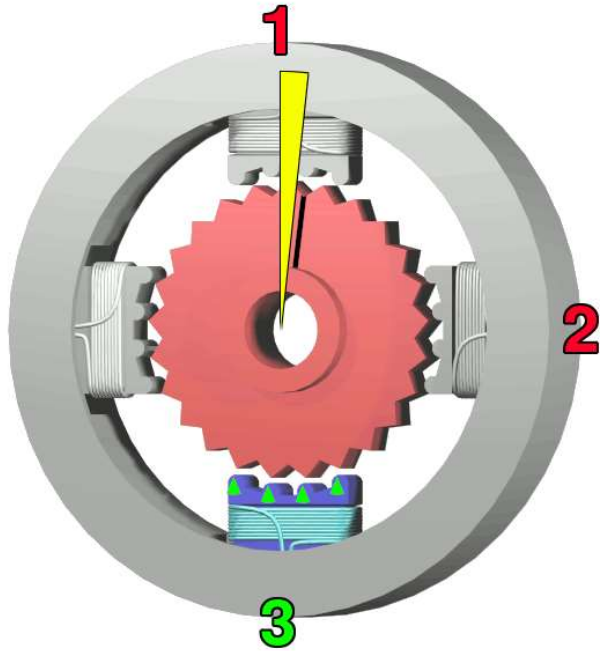

The top electromagnet (1) is turned on, attracting the nearest teeth of a gear-shaped iron rotor. With the teeth aligned to electromagnet 1, they will be slightly offset from electromagnet 2

The top electromagnet (1) is turned off, and the right electromagnet (2) is energized, pulling the nearest teeth slightly to the right. This results in a rotation of 3.6° in this example.
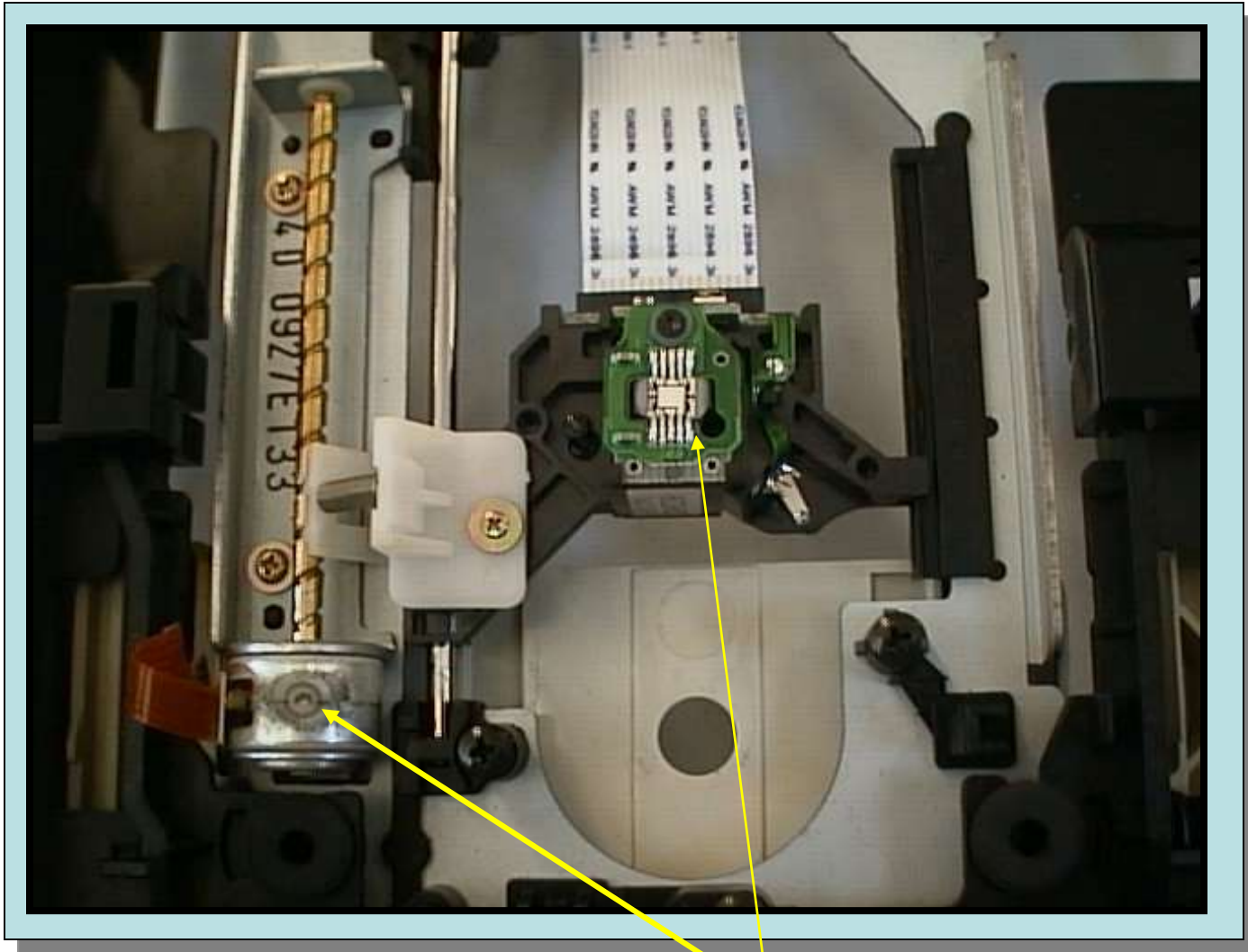
The bottom electromagnet (3) is energized; another 3.6° rotation occurs.
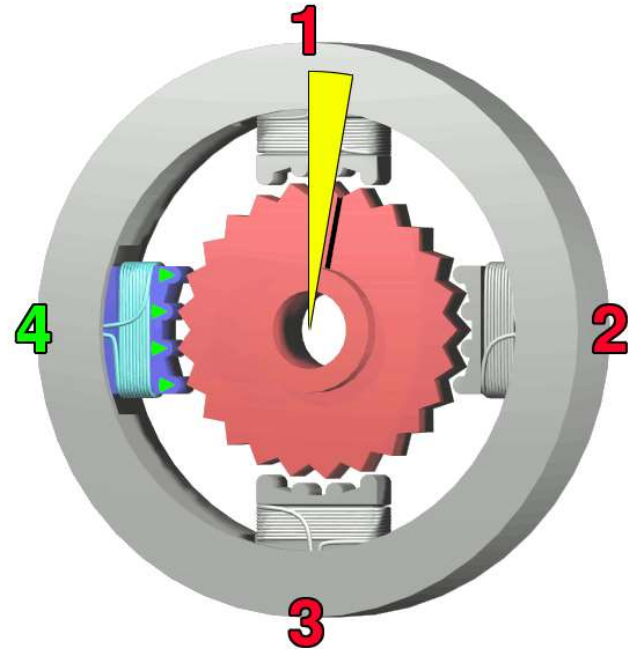
The left electromagnet (4) is enabled, rotating again by 3.6°. When the top electromagnet (1) is again enabled, the teeth in the sprocket will have rotated by one tooth position; since there are 25 teeth, it will take 100 steps to make a full rotation in this example.
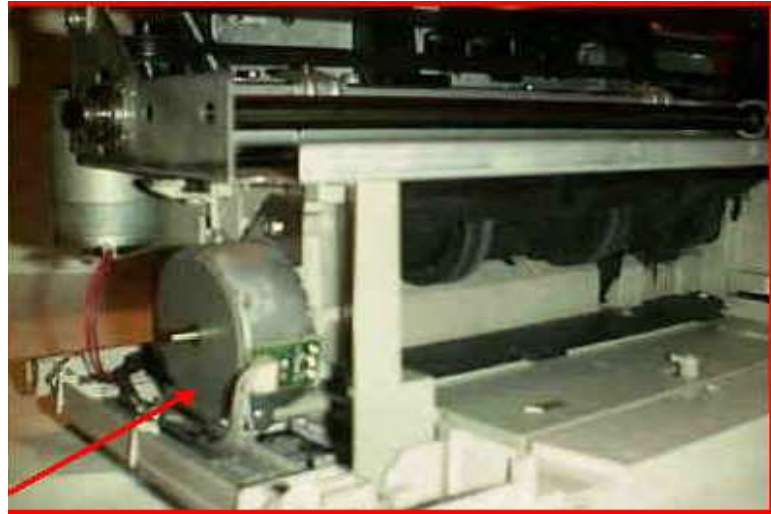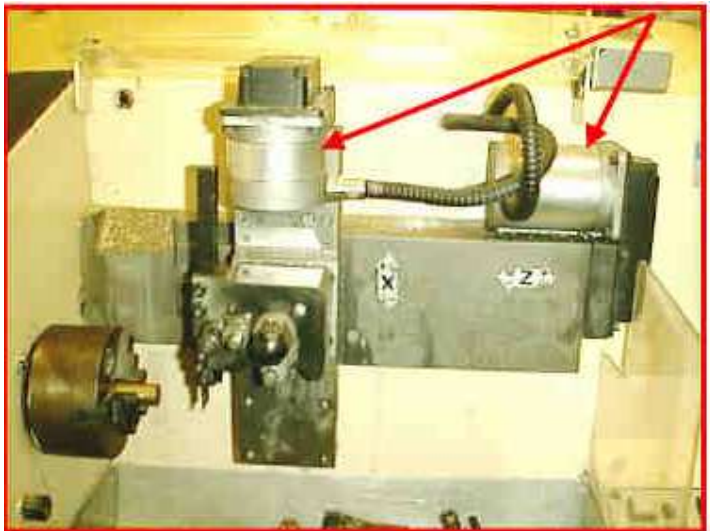
Stepper motor applications

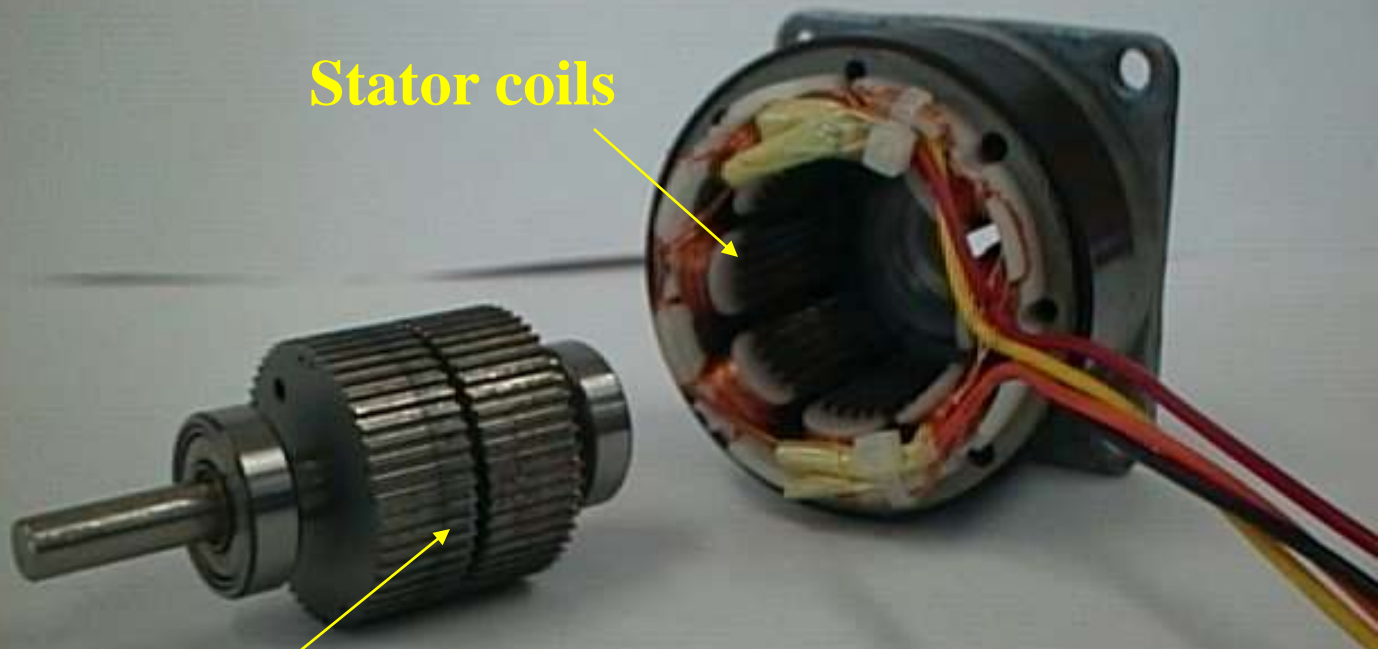**Stepping Motor to move read-write head**

Stepper motor applications

Paper feeder on printers

Stepper motors

CNC lathes

Stator coils

Rotor

CNC Stepping Motor

Advantages / Disadvantages

Advantages:-

- Low cost for control achieved

- Ruggedness

- Simplicity of construction

- Can operate in an open loop control system

- Low maintenance

- Less likely to stall or slip
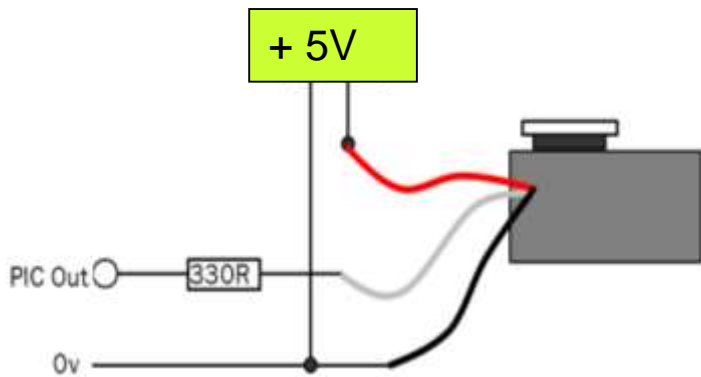
- Will work in any environment

Disadvantages:-

- Require a dedicated control circuit

- Use more current than D.C. motors

- High torque output achieved at low speeds

Control sequence to turn a stepper motor

CW

CCW

Step 1	**0**	**0**	**1**	**1**
Step 2	**1**	**0**	**1**	**0**
Step 3	**1**	**1**	**0**	**0**
Step 4	**0**	**1**	**0**	**1**
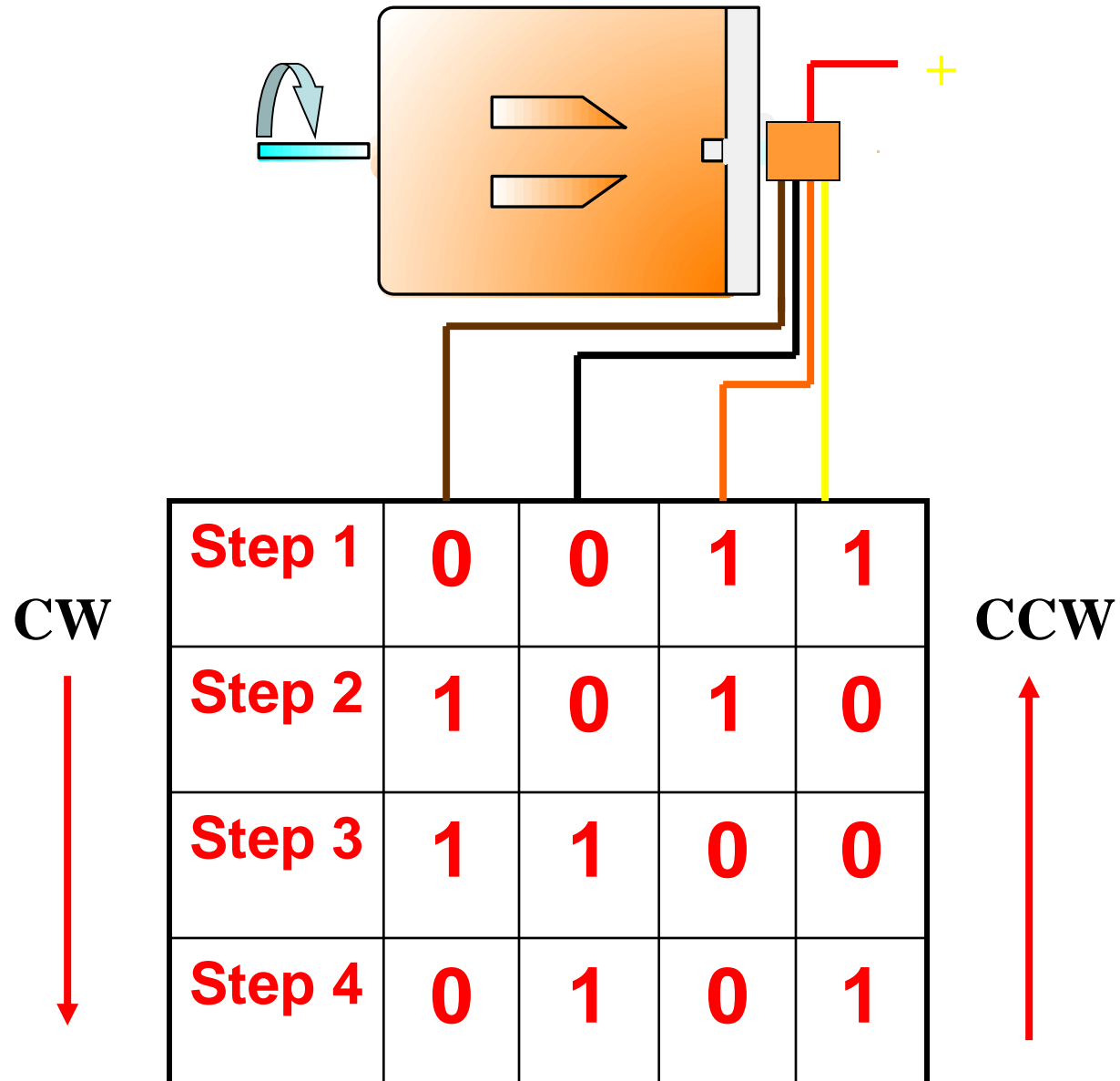
Servo Motor Detail

Actuator

Reduction gear

Position feedback

Potentiometer

(closed loop system)

Small electric DC motor

+ 5V

PIC Out
330R
0v