

# Servo

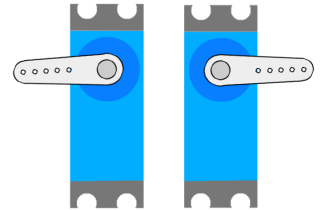
**Goal:** Use of a sensor

**Content:** Function  
 Possible applications  
 Theory  
 Programming



## Function

In contrast to a standard motor, a servo motor does not rotate by 360° but is set to a specific position in a range of 0° to 180°.



A standard servo can mechanically only rotate in a range of 0° to 180° as it is fitted with a limit stop (exception: 360° Continuous Rotation Servo).

Besides the power supply (brown – 0V, red – 5V), a control line (yellow) is in place. The duration of the pulse applied at this line defines the angle of the servos. Every 20ms (0.02s), the servo expects a pulse defining the angle between 1ms [0°] to 2ms [180°].



### Info

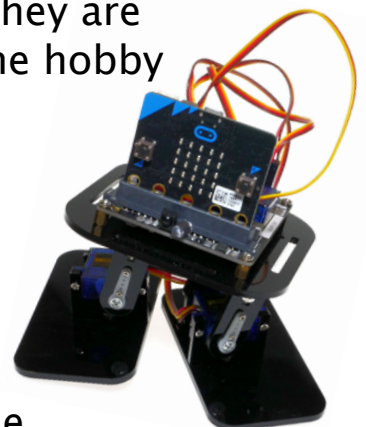
A Servo SG90 can be operated with reduced power directly at the Micro Bit. For use of multiple servos, the designated servo board or an external energy source should be used.

## Possible applications

Servo motors have a very wide range of applications. They are used in industry, mechanical engineering but also in the hobby sector:

- |                      |                           |
|----------------------|---------------------------|
| <u>Industry:</u>     | Robot arm                 |
| <u>Hobby sector:</u> | Model building            |
| <u>Automotive:</u>   | Automatic seat adjustment |
| <u>Sensors:</u>      | Positioning of sensors    |

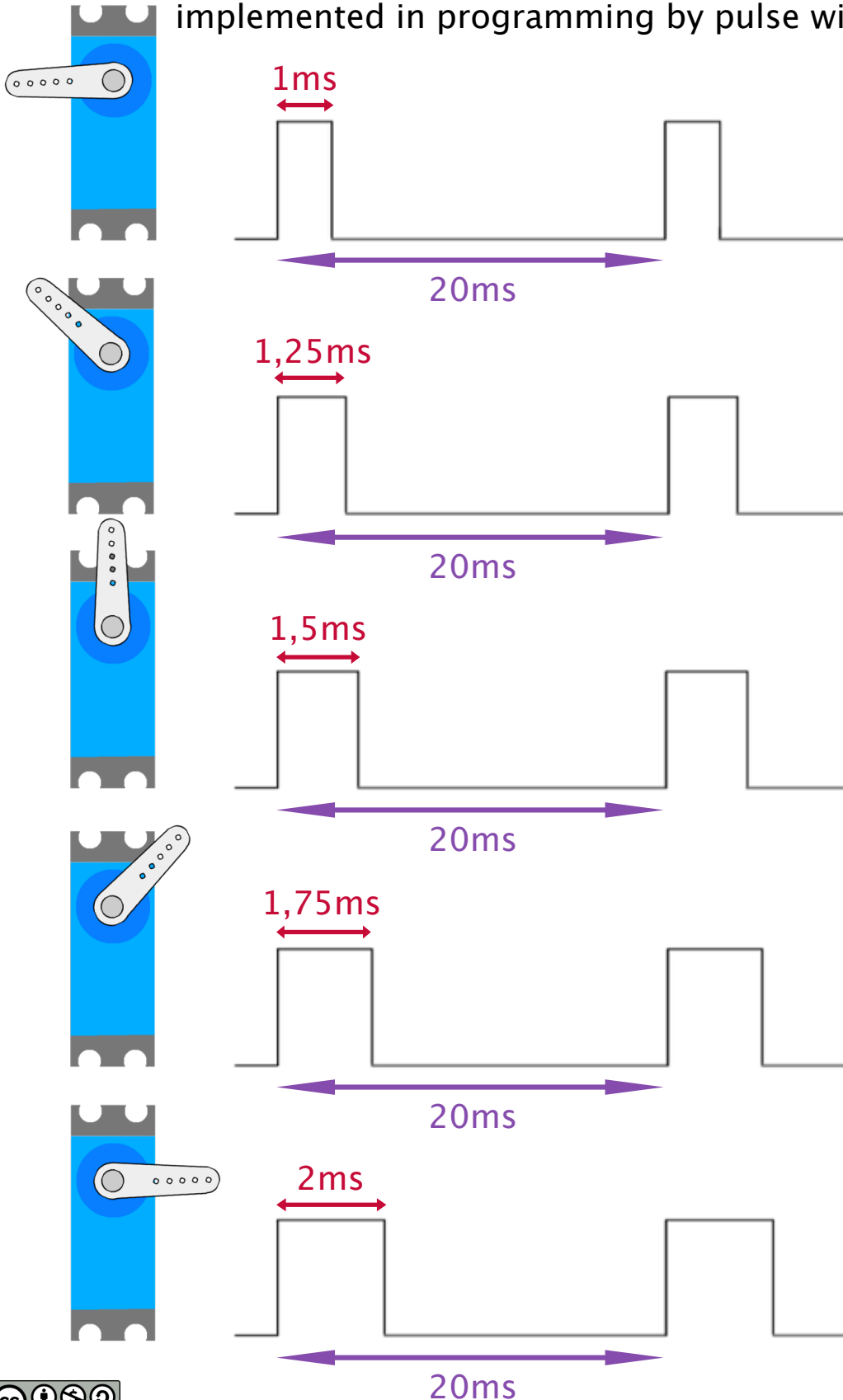
Servo motors are often used if high torques and precise, quick motions are required.



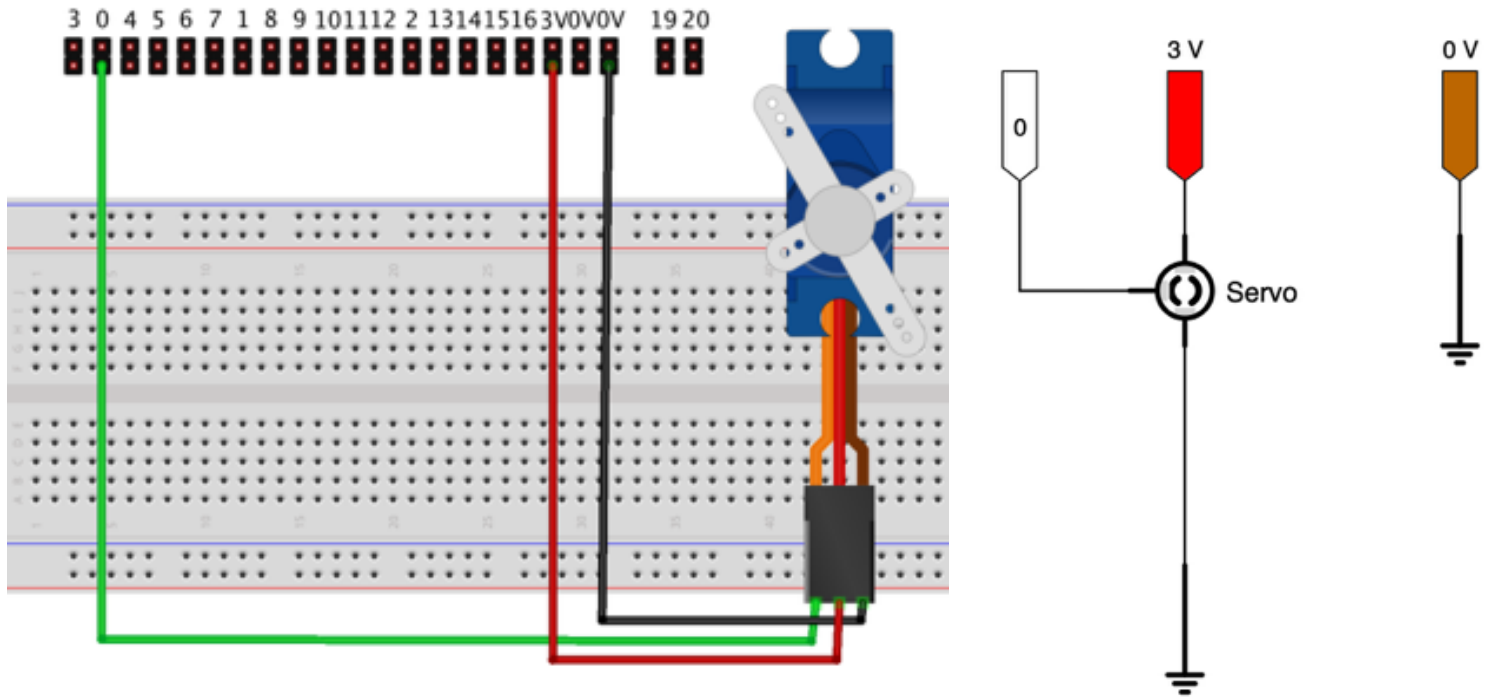
# Theory

Within a period duration of 20ms, the pulse width of the control signal specifies the angular position of the servo. At a pulse width of 1ms, the servo is set at an angle of 0° (fully on the left) and moves to 180° (fully on the right) during increase to 2ms. This values are for reference only and must be taken from the data sheet.

Timing is realised by the microcontroller (Micro Bit) and implemented in programming by pulse width modulation.



# Circuit set-up



- Servo cabling: Use the green cable to route the connection on the left (control line) to pin 1 of the Micro Bit.
- With the **red cable**, the centre connection is connected to the **3V pin**.
- In the end, the Gnd of the servo is connected to the 0V pin of the

## Info

In most cases, a servo requires more power than the Micro Bit can supply. If this is the case (servo not moving or "vibrating"), a suitable power source must be connected. The external ground (minus pole) must be connected to the 0V pin of the Micro Bit.

# Programming

```
on button A ▼ pressed
  servo write pin P0 ▼ to 15
```

```
on button B ▼ pressed
  servo write pin P0 ▼ to 165
```

```
on button A+B ▼ pressed
  servo write pin P0 ▼ to 90
```

## Possible extension of the assignment

Add a potentiometer (rotary controller) to the circuit to understand the angular position of the servo.

HINT: As the potentiometer is read via the 10bit ADC (analogue digital converter) with 1024 stages, while the servo only offers 180 stages (from 0° to 180°), this application can be realised with the **map function** from the [pins category](#).

[see the worksheet on the map function](#)

# Information on block code

If button A is pressed the servo arm moves to angular position 15° (left)

on button **A** ▼ pressed

servo write pin **P0** ▼ to **15**

If button B pressed the servo arm moves to centre position 90°

on button **B** ▼ pressed

servo write pin **P0** ▼ to **165**

If buttons A+B are pressed the servo arm moves to angular position 15° (left)

on button **A+B** ▼ pressed

servo write pin **P0** ▼ to **90**