

## Speed Control Guide

A common use of servo motors is to have them controlling the exact speed of a shaft, an actuator, an axle, or some other mechanical device. This comprehensive guide highlights the basic settings needed to get custom speed control in place and includes examples of common use cases.

There are several speed control modes available:

- Speed
- SpeedRamp
- SpeedLow
- SpeedLowRamp

### Speed vs SpeedRamp

The difference between the Speed and SpeedRamp is that Speed tries to reach the new speed setting instantaneously and SpeedRamp uses acceleration and deceleration parameters. The ramping feature should be used in all applications, except when there is an external control system that takes care of the ramping.

### SpeedLow vs SpeedLowRamp

The SpeedLow and SpeedLowRamp modes makes it possible to fine tune the speed and run at very low speed. The resolution of the speed is increased by 256 in these modes. This means that the speed can be set in steps of 0,0009 rpm instead of 0,23 rpm.

To configure the motor for speed mode, the following registers should at least be set:

#### <400> Mode

The mode register is where the operating mode of the motor is set.

0 = idle

32 = Speed

33 = SpeedRamp

34 = SpeedLow

35 = SpeedLowRamp

#### <351> RampSpeedMax

Sets maximum speed of the motor. The motor can be run at any speed up to the set value. The register unit is positions / second / 16. Convert an RPM value to the register value using the following formula:

$$\text{Register value} = \text{rpm} * 4096 \text{ (positions in one revolution of the motor)} / 16 \text{ (factor)} / 60 \text{ (seconds)}$$

### <353> RampAccMax

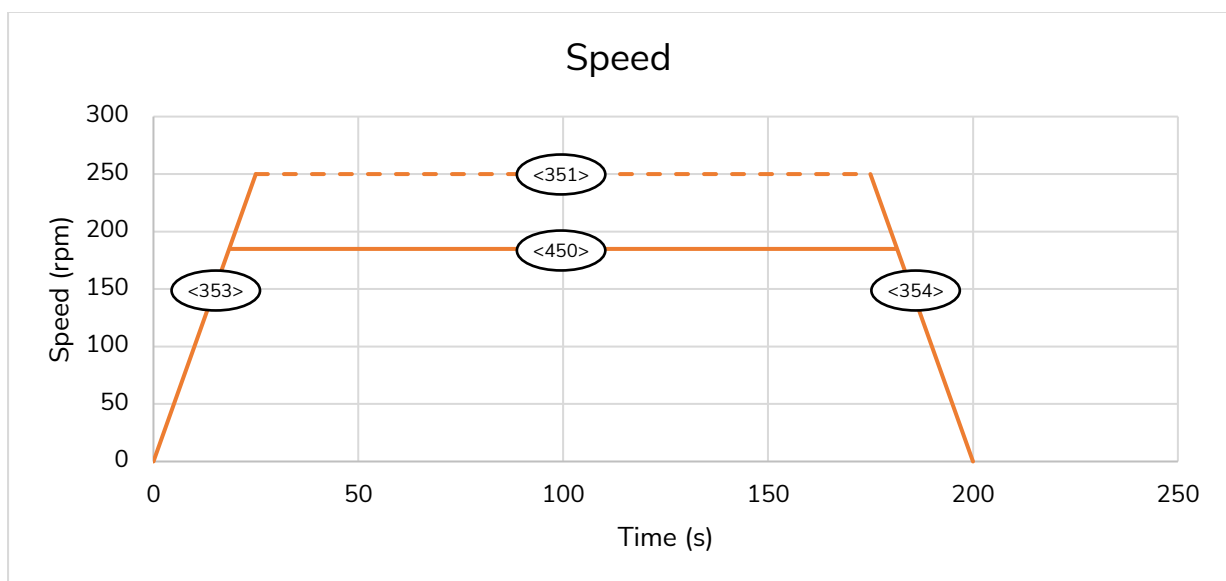
Sets how fast the motor should accelerate to a set speed. The register unit is positions/second<sup>2</sup> / 256. Convert an RPM/s value to the register value using the following formula:

$$\text{Register value} = \text{rpm/s} * 4096 \text{ (positions in one revolution of the motor)} / 256 \text{ (factor)} / 60 \text{ (seconds)}$$

### <354> RampDecMax

Sets how fast the motor should decelerate to a set speed. The register unit is positions/second<sup>2</sup> / 256. Convert an RPM/s value to the register value using the following formula:

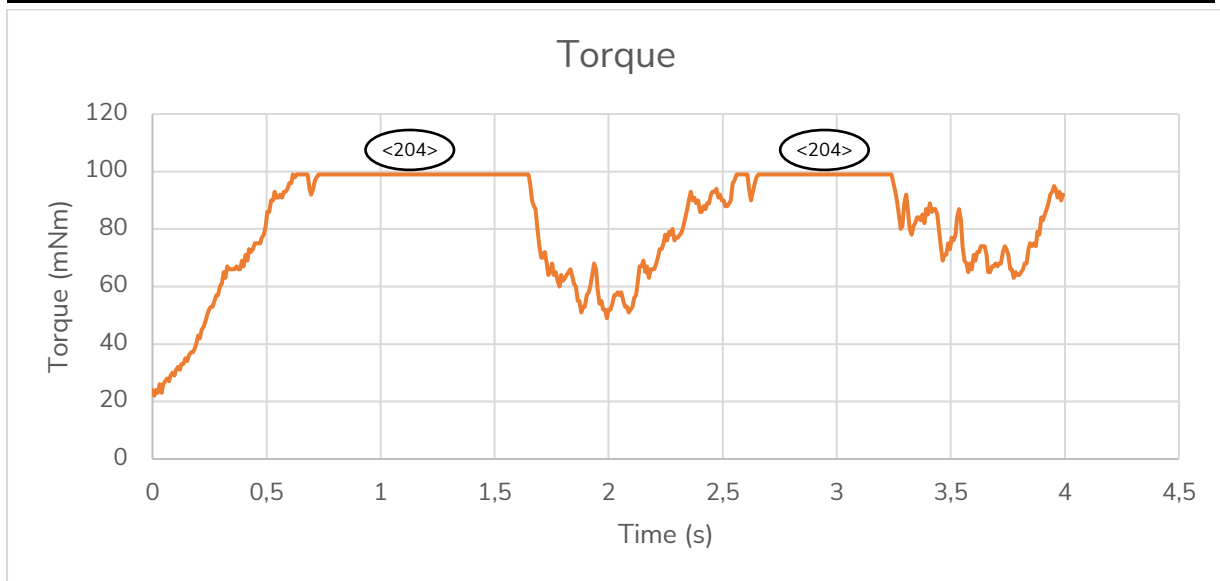
$$\text{Register value} = \text{rpm/s} * 4096 / 256 / 60$$



Graph showing speed, acceleration and deceleration ramps

### <204> MotorTorqueMax

Limits the maximum torque of the motor. The motor uses as much torque as it needs to achieve the set target. Depending on the design and application the maximum torque might have to be limited. Unit is in mNm.



Graph showing torque limit

### <450> TargetInput

Sets current target speed of the motor. The motor will accelerate or decelerate to this speed using the values in <353> and <354>. The speed of the motor will never be higher than the RampSpeedMax value. The register unit is positions / second / 16. Convert an RPM value to the register value using the following formula:

$$\text{Register value} = \text{rpm} * 4096 \text{ (positions in one revolution of the motor)} / 16 \text{ (factor)} / 60 \text{ (seconds)}$$

### <448> TargetRelative

Used to make a relative change to the speed. The value entered can be positive or negative and is added to the <450> TargetInput register. The register unit is positions / second / 16. Convert an RPM value to the register value using the following formula:

$$\text{Register value} = \text{rpm} * 4096 \text{ (positions in one revolution of the motor)} / 16 \text{ (factor)} / 60 \text{ (seconds)}$$

### Example

The motor shall run at maximum 250 rpm with an acceleration and deceleration of 10 rpm/s and a maximum torque of 0,2 Nm

- <204> MotorTorqueMax = 200 (0,2 Nm equals 200 mNm )
- <351> RampSpeedMax = 1067 (250 \* 4096 / 16 / 60)
- <353> RampAccMax = 296 (10 \* 4096 / 256 / 60)
- <354> RampDecMax = 296 (10 \* 4096 / 256 / 60)
- <400> Mode = 33 (SpeedRamp)
- <450> TargetInput = -1067 to 1067 (-250 to 250 rpm)