

Position Control Guide

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

There are two basic position control modes available:

- Position
- PositionRamp

Position vs PositionRamp

The difference between the Position and PositionRamp is that Position tries to reach the new position instantaneously and PositionRamp 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 (eg Step Direction).

To configure the motor for position 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

20 = Position

21 = PositionRamp

<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

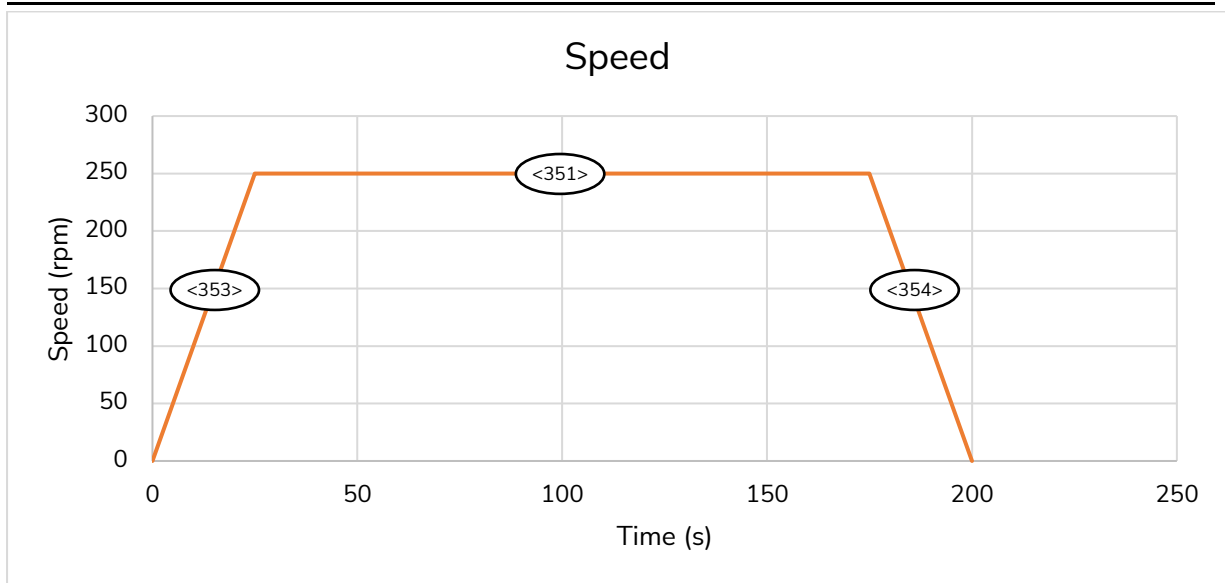
Sets how fast the motor should accelerate to a set speed. The register unit is positions/second² / 256. Convert an RPM/s value to the register value using the following formula:

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

<354> RampDecMax

Sets how fast the motor should decelerate to a set speed. The register unit is positions/second² / 256. Convert an RPM/s value to the register value using the following formula:

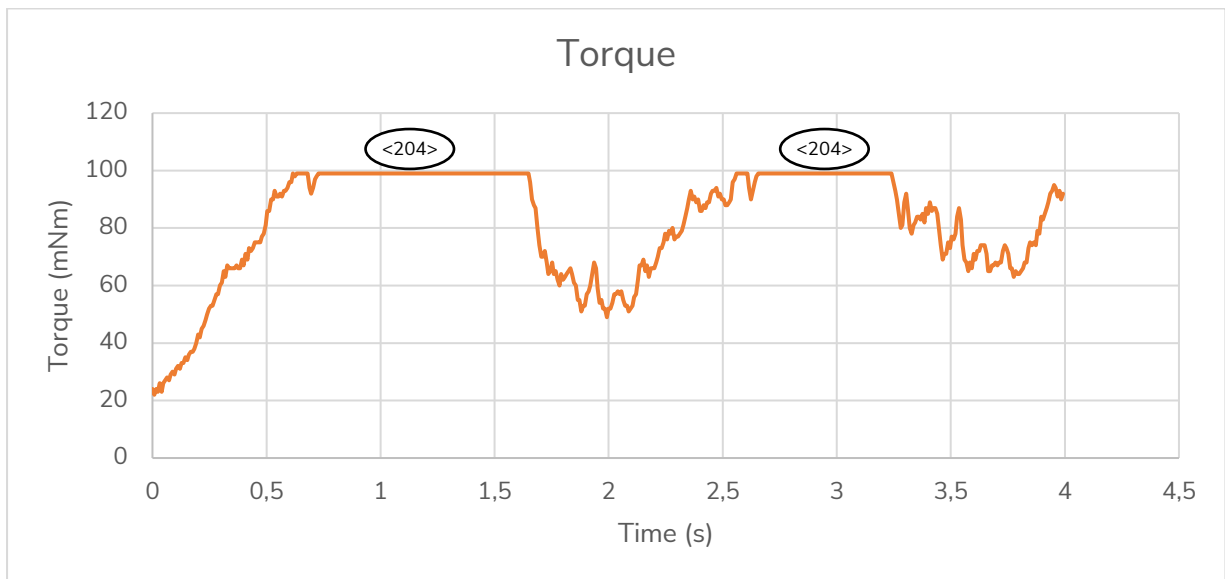
$$\text{Register value} = \text{rpm/s} * 4096 / 256 / 60$$



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 position 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, and there are 4096 position / turn. Convert number of turns or degrees to the register value using the following formula:

$$\text{Register value} = \text{turns} * 4096$$

$$\text{Register value} = \text{degrees} * 4096 / 360$$

<448> TargetRelative

Used to make a relative change to the position. The value entered can be positive or negative and is added to the <450> TargetInput register. The register unit is positions, and there are 4096 position / turn. Convert number of turns or degrees to the register value using the following formula:

$$\begin{aligned}\text{Register value} &= \text{turns} * 4096 \\ \text{Register value} &= \text{degrees} * 4096 / 360\end{aligned}$$

Example

The motor shall rotate 2,5 turns from the 0 position in positive direction, 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 = 21
- <450> TargetInput = 10240 (2,5 turns * 4096)