

Homing Guide

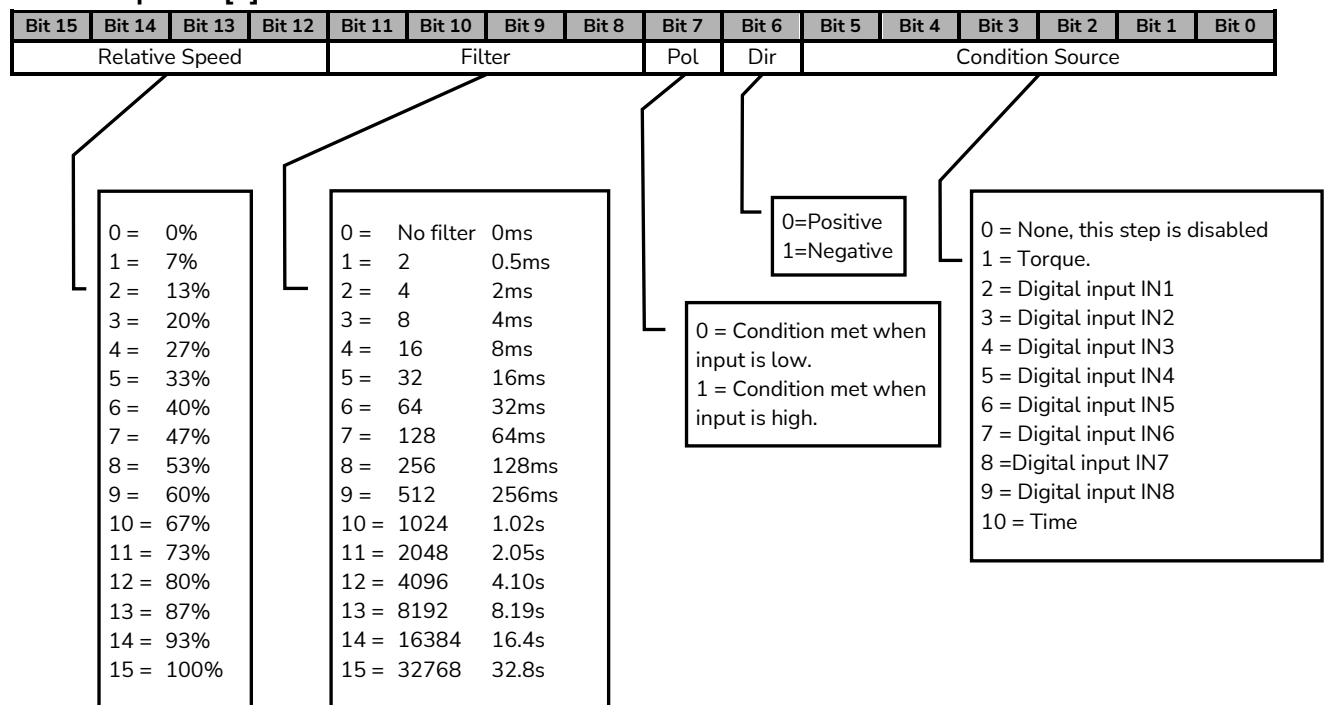
The use of a reference or homing position is important in many applications. The Simplex Motion servomotors come with a built in homing functionality to achieve a repeatable positioning of the system.

The homing can be triggered in two ways, by torque or by external limit switch. To configure the motor for homing, at least the following registers should at least be set:

<480>-<483> HomeSequence1-4

There are four homing sequences available. They can be individually configured and are executed in order from 1 to 4. The HomeSequence parameter is divided into five bitfields: Condition Source, Direction, Polarity, Filter and Relative speed.

HomeSequence[x]



Condition source

This field defines if the homing should trigger on a digital input or torque, run for a certain time or of the sequence is disabled.

Value	Description
0	None, this step is disabled
1	Torque. When Polarity is set to 1, this condition becomes true if motor torque is above HomingTorque register value.
2	Digital input IN1
3	Digital input IN2
4	Digital input IN3
5	Digital input IN4
6	Digital input IN5
7	Digital input IN6
8	Digital input IN7

Value	Description
9	Digital input IN8
10	The sequence runs the motor for the time specified by the 'Filter' bits

Direction

Sets the direction of the homing

Direction	Description
0	Positive direction
1	Negative direction

Polarity

The 'Polarity' bit decides if the condition is met when then input is high or low, or torque is above or below HomingTorque

Polarity	Description
0	Condition met when: -Input is low -Torque below HomingTorque
1	Condition met when: -Input is high -Torque above HomingTorque

Filter

There is a filtering feature if the condition input is noisy. This works by requiring the condition to be true a number of times in a sequence. The 'Filter' entry can be set to 0-15, which selects a number of regulator cycles according to the table below.

When using mode 10 to run the motor for a certain time, the Filter bitfield is used to set the time.

Setting	Cycles	Running Time
0	No filter	
1	2	0.5ms
2	4	2ms
3	8	4ms
4	16	8ms
5	32	16ms
6	64	32ms
7	128	64ms
8	256	128ms
9	512	256ms
10	1024	1.02s
11	2048	2.05s
12	4096	4.10s
13	8192	8.19s
14	16384	16.4s
15	32768	32.8s

Relative speed

To allow different speeds for the homing sequence steps there is also a 4-bit 'Relative speed' entry. The value 0-15 is interpreted as relative speed 0-100% of the <HomeSpeed> register value.

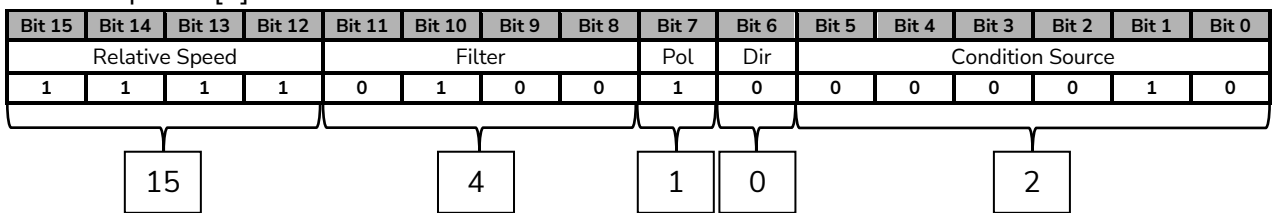
Setting	Relative speed
0	0%
1	7%
2	13%
3	20%
4	27%

Setting	Relative speed
5	33%
6	40%
7	47%
8	53%
9	60%
10	67%
11	73%
12	80%
13	87%
14	93%
15	100%

Example 1:

Homing in positive direction, triggering on an external switch
 Condition source = 2, limit switch is connected to input 1
 Direction = 0, homing in positive direction
 Polarity = 1, the condition is met when the input indicates 1
 Filter = 4, a filter in case of disturbances from the switch signal
 Relative speed = 15, Using 100% of the set speed in HomeSpeed

HomeSequence[1]

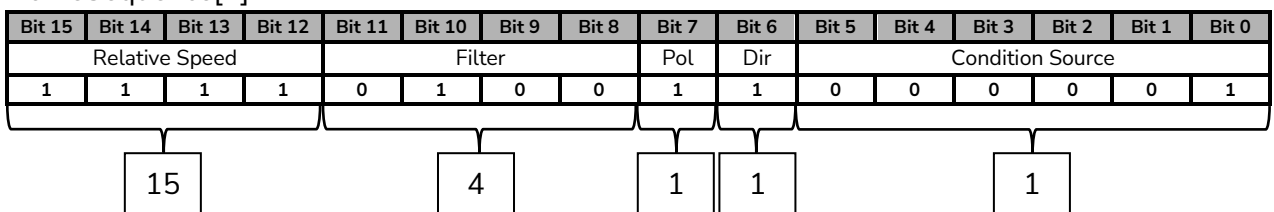


Converting the binary number 1111 0100 1000 0010 to decimal, equals 62594, which is written into the HomeSequence1 register.

Example 2:

Homing in negative direction, triggering on torque
 Condition source = 1, triggers on torque
 Direction = 1, homing in positive direction
 Polarity = 1, the condition is met when the measured torque reaches the HomeTorque value
 Filter = 4, a filter in case of noisy torque measurement in the application
 Relative speed = 15, Using 100% of the set speed in HomeSpeed

HomeSequence[1]



Converting the binary number 1111 0100 1100 0001 to decimal, equals 62657, which is written into the HomeSequence1 register.

<490> HomeOffset16

New position value the homing position should have in relation to the 0-position. Only used for legacy reasons. Use HomeOffset32 instead

<491> HomeSpeed

Reference speed to use for homing. The register unit is positions / second / 16. Convert an RPM value to the register value using the following formula:

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

<492> HomeAcc

Homing acceleration. The register unit is positions/second² / 256. Convert an RPM/s value to the register value using the following formula:

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

<493> HomeTorque

Torque limit to use by hard stop homing. Unit is mNm.

<494> HomeDoneMode

Mode to switch to when homing sequence is finished. This value is then written to register 400.

<495> HomeChange

The amount of position change after a completed homing. Useful for debugging and basically shows how much repetitive homings deviate.

496/497 HomeOffset32

New position value the homing position should have in relation to the 0-position. Allows the 0 position to be placed at an offset from the homing position.

Example 3:

A common homing sequence, to achieve precision and accuracy in a system, is to trigger a limit switch, and then slowly move backwards until the limit switch is released again. In this example the second movement will be done at 50% of the initial speed. In addition, the reference point will be 15 mm from the limit switch.

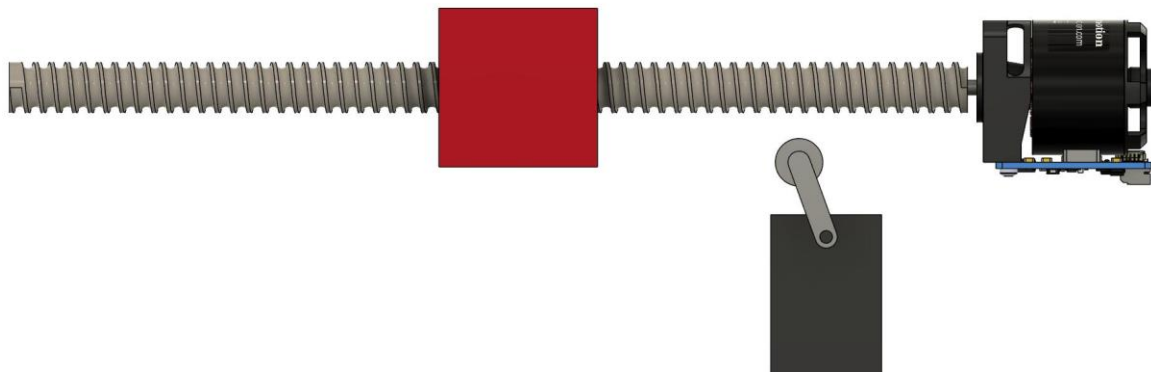


Figure 1, Example setup with motor, ball screw, red moving box and a limit switch

First sequence:

Condition source = 2, limit switch is connected to input 1

Direction = 1, homing in negative direction

Polarity = 1, the condition is met when the input indicates 1

Filter = 0, no filtering of the limit switch

Relative speed = 15, Using 100% of the set speed in HomeSpeed

HomeSequence[1]

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Relative Speed				Filter				Pol	Dir	Condition Source					
1	1	1	1	0	0	0	0	1	1	0	0	0	0	1	0
15				0				1	1	2					

Converting the binary number 1111 0000 1100 0010 to decimal, equals 61634, which is written into the HomeSequence1 register.

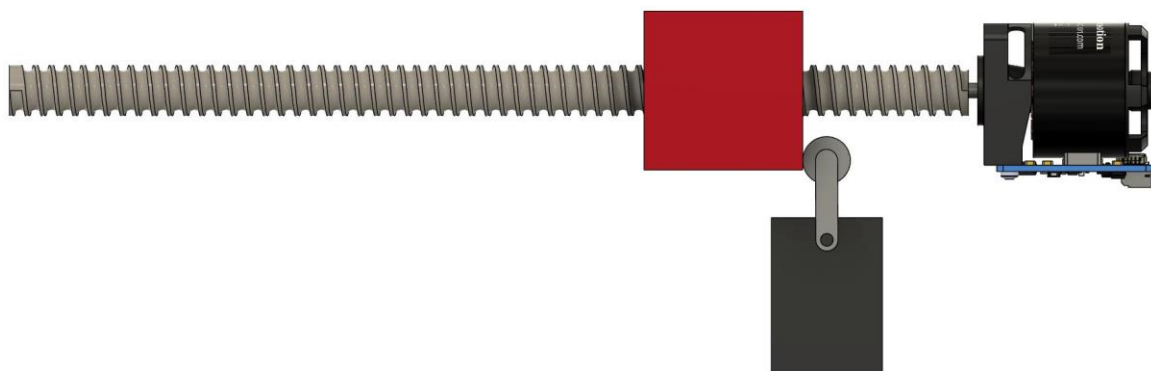


Figure 2, Limit switch triggered

Second sequence:

Condition source = 2, limit switch is connected to input 1

Direction = 0, homing in positive direction
 Polarity = 0, the condition is met when the input indicates 0
 Filter = 0, no filtering of the limit switch
 Relative speed = 7, Using 47% of the set speed in HomeSpeed

HomeSequence[2]

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Relative Speed				Filter				Pol	Dir	Condition Source						
0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	

7	0	0	0	2
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Converting the binary number 0111 0000 0000 0010 to decimal, equals 28674, which is written into the HomeSequence2 register.

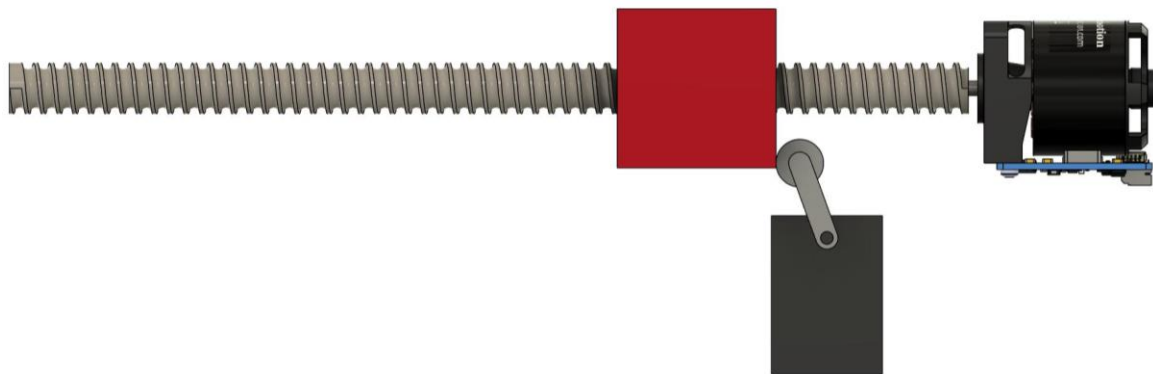


Figure 3, Limit switch released

When the second homing sequence is done, the 0-position is defined using the HomeOffset32 parameter. It defines the distance from the 0-position to the homing position, i.e. at what position is the homing position in relation to the 0-position.

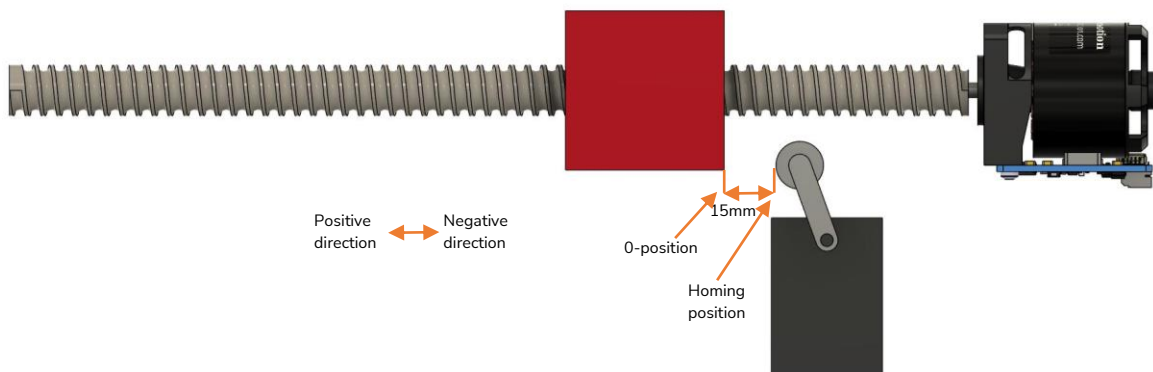


Figure 4, 0-position 15mm offset from homing position

The pitch of the screw is 5mm/turn, so a 15mm offset is 3 turns. Each turn is 4096 motor positions, which equals 12288 positions.
 In this case the homing position is on the negative side of the 0-position, which means that the HomeOffset32 value is -12288.