Application Note #53:
Hard Stop Homing

Functional Description

Skeleton Code Name: Hard Stop Homing with Software Limits

Software: StepSERVO Quick Turner

Hardware: TSM11Q-2RM-002

Hardware Compatibility: StepSERVO and Servo Drives
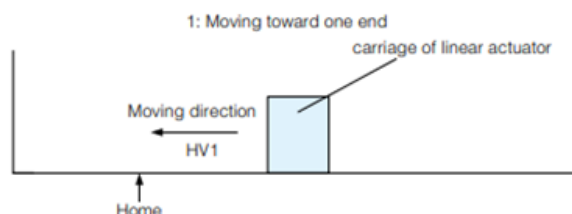
Reference: Host Command Reference Manual

- Commands:
  - o HO – Home Offset
  - o LP – Software Limit CW
  - o LM – Software Limit CCW

Note: Hard Stop Homing is only available with our StepSERVO Systems. Contact our Applications Team to verify whether your system can perform Hard Stop Homing or for alternatives.

Goals

Goal 1: Understand Hard Stop Homing and its Parameters

a. Hard Stop Homing is a useful way to home your system when not using limit/home sensors (ideal with linear screw/actuator systems). Hard Stop Homing requires that the load encounter a point of resistance that peaks the motor past a preset current threshold. This then notifies the driver that the physical limit has been reached, and the driver goes on to execute the remaining homing sequences using the hard limit as a physical point of reference. After hitting the hard limit, the motor can either move to the first index pulse of its encoder output or move a predetermined offset distance (HO Command).

  i. Parameters that require configuration for Hard Stop Homing are the following:
    1. HC – Homing Current Threshold must be set sufficiently low (less than the continuous current), to avoid damaging hardware and to detect the hard limit accurately.
    2. HV1 – Homing Velocity when finding the Hard Stop limit (point of resistance).

1: Moving toward one end

carriage of linear actuator

Moving direction
HV1

Home

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Figure 1: HV1

3. HV2 – Homing Velocity when moving offset distance after finding the Hard Stop limit.
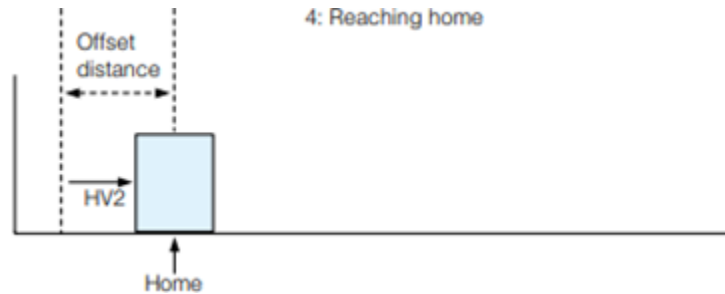

Figure 2: HV2

4. HV3 – Homing Velocity when moving towards first index pulse, instead of performing the offset distance. Moving back to first index pulse is optional.
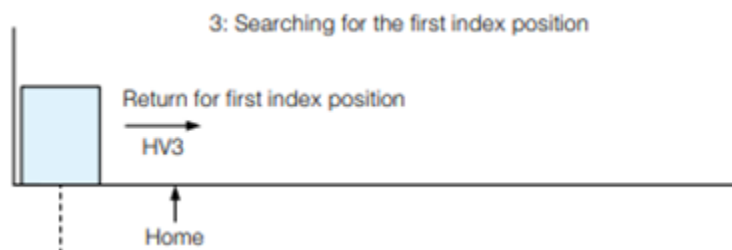

Figure 3: HV3

5. HA1/HA2/HA3 – Acceleration rates for each of the three homing stages mentioned above.
6. HL1/HL2/HL3 – Deceleration rates for each of the three homing stages mentioned above.
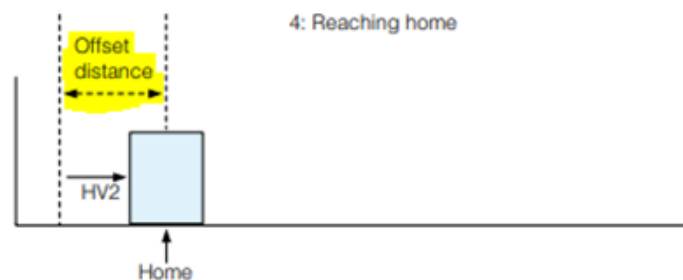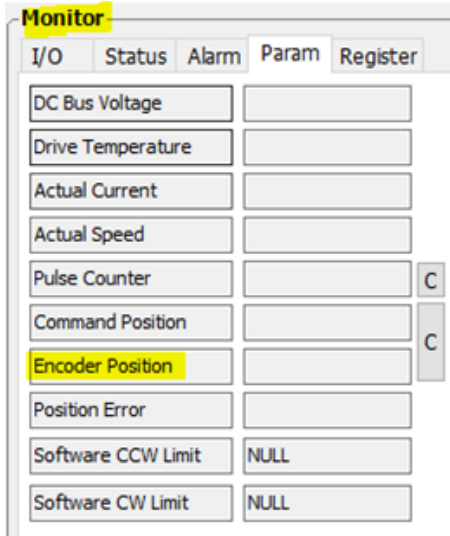7. HO – Homing Offset refers to the distance the motors/actuator will move after hitting the hard limit.

Figure 4: Homing Offset Distance

Goal 2: Understand the usage of software limits (LP/LM)

a. If a customer's machine design is using a hard stop homing sequence, chances are the main reason for that is to avoid using physical limit sensors/switches or there are no sensors/switches on hand. Otherwise, we would be using a different homing method to begin with. Since there are no physical limit sensors/switches, then we must come up with a way to prevent out linear slide/screw from constantly hitting the physical limits of our linear actuator's stroke at full speeds. To do so, we use our software limits.

b. Software limits are used for the same purpose as physical ones except we must store on the driver the position (in counts) past which we would like to avoid further motion. Though before using them, it's important to realize to take that into account and test the correct limit positions (these will be slightly before you actual desired stop position). Writing the limit positions must be done on *every* power up since these limits are written to volatile memory. You can either program those limits via Q program or stream them via SCL before your system begins operation. The driver will handle the rest.

c. CW Software Limit is set via our LP Command. We cannot set LP to '0' since the default value is '0.' If we do so, the CW limit will not stop motion past that position.

d. CCW Software Limit is set via our LM Command. We cannot set LM to '0' for the same reason that we cannot set LP to '0.'

e. We can figure out what we would like our software limits to be by first powering on the motor and then zeroing its position (EP0 and SP0) where we want our home position to be. Then, we simply jog the moto to the limits with Home as reference or calculate beforehand simply through our knowledge of our system. Designers often know after how many rotations or after how much linear displacement they would like to prevent motion. Jogging the motor to said positions is a way to test those calculations.

f. As the desired limits, we make a note of what the counts are by looking at the monitor tab:

Figure 5: Monitor Tab on StepSERVO Quick Tuner

Goal 3: Write and execute a program that sets home and software limits with the Hard Stop Homing method

a. The following code segment (Figure 6) configures our hard stop homing scenario. EG sets our gearing ratio but is not mandatory. EG was set for additions capabilities not covered in this Application Note.

b. Note that I have allowed my motor to hit the hard limit first by executing HS before setting my software limits LP/LM. Setting software limits prior to Hard Stop home could impede that process by alarming out.

Segment 1

Line	Label	Cmd	Param1	Param2
1		VE	10	
2		EG	12000	
3		HC	0.5	
4		HA	1	50
5		HA	2	50
6		HV	1	1
7		HV	2	1
8		HO	-1000	
9		HS	0	
10		EP	0	
11		SP	0	
12		LP	84000	
13		LM	-1	

Figure 6: Demo Program

[Click here for the Sample Code.](#)

Try it out today!
If you have questions about this or any other application, please reach out to our Apps Engineering Group for any assistance at 1-800-525-1609 or support@applied-motion.com.