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Motion Homing Configuration Attributes

Use Homing functionality to establish a machine reference position or Home Position for the associated axis. Homing configuration attributes are often only applicable when there is an associated position feedback device. If the drive is configured for Encoderless or Sensorless operation, the homing function is not applicable.

Home Mode

Usage	Access	Data Type	Default	Min	Max	Semantics of Values
Required - E	Set/SSV	USINT	1	-	-	Enumeration 0 = Passive 1 = Active (!N) 2-55 = Reserved

The Home Mode attribute determines if homing actively moves the axis to generate the homing event or if the axis is to be moved by some external agent to generate the homing event.

There Motion axis supports active and passive homing modes. Active homing is the most common homing procedure for physical servo axes but does not apply when Axis Configuration is Feedback Only since it requires active control of the axis.

Homing Mode	Description
Active	<p>After selecting the active homing mode, select the desired homing sequence specifying if a home limit switch, a specified torque level, and/or the encoder marker is used for this axis. Active homing sequences use the trapezoidal velocity profile with dynamics defined by Home Speed, Home Return Speed, Home Acceleration, and Home Deceleration. The Home Sequence attribute section describes the available active homing sequences.</p> <p>If the configured feedback type does not support a marker signal, the <i>marker</i>, <i>switch then marker</i>, and <i>home to torque</i> then marker homing sequences are not applicable.</p>
Passive	<p>Passive homing redefines the current absolute position of the axis on when a home switch, encoder marker, or home to torque event triggers. Passive homing is often used to calibrate uncontrolled axes. It is also used with controlled axes to create a custom homing sequence.</p> <p>Passive homing operates similarly to the corresponding active homing sequence for a given home sequence. No motion is commanded-the controller just waits for the switch, marker, or torque events to occur. If the configured feedback type does not support a marker signal, the marker and switch then marker, and home to torque then marker homing sequences are not applicable.</p>

Home Direction

Usage	Access	Data Type	Default	Min	Max	Semantics of Values
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Required - E	Set/SSV	USINT	1	-	-	Enumeration
PV Only						0 = Unidirectional forward
						1 = Bidirectional forward
						2 = Unidirectional reverse
						3 = Bidirectional reverse
						4-255 = Reserved

The Home Direction attribute is the starting direction of a Homing Sequence when configured for active Home Mode.

This attribute is only valid for position and velocity control.

Home Sequence

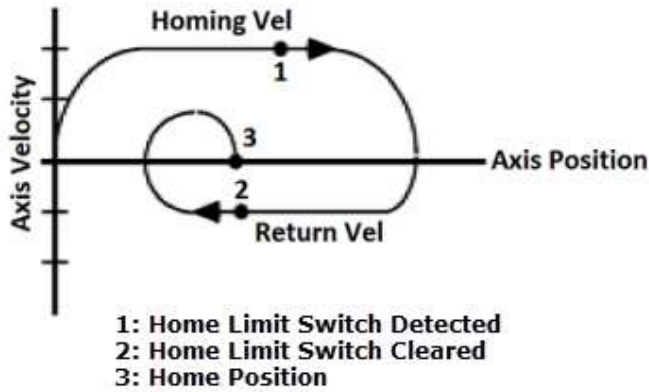
Usage	Access	Data Type	Default	Min	Max	Semantics of Values
Required - E	Set/SSV	USINT	0	-	-	Enumeration
						0 = Immediate (default)
						1 = Home to switch (O)
						2 = Home to marker (O)
						3 = Home to switch then marker (O)
						4 = Home to torque (O)
						5 = Home to torque then marker (O)
						6-255 = Reserved

Determines the motion sequencing used to trigger the desired homing events. Filtering of optional enumerations based on available hardware support and feedback interface hardware.

Home Sequence Descriptions

Homing Sequence Types	Description
Active Immediate Home	This is the simplest active homing sequence type. The axis actual position and command positions are updated based on the configured Home Position.

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Active Bidirectional Home to Switch	<p>This active homing sequence is useful when an encoder marker is not available. When this sequence is performed, the axis moves in the specified Home Direction at the specified Home Speed and Home Acceleration until the home limit switch is detected. The axis then decelerates to a stop at the specified Home Deceleration and then moves in the opposite direction at the specified Home Return Speed and Home Acceleration until the home limit switch is cleared.</p> <p>When the home limit switch is cleared, axis position is immediately redefined to be equal to the Home Position and the axis decelerates to a stop at the specified Home Direction.</p> <p>If Home Offset is non-zero, then the Home Position will be offset from the point where the home switch is cleared by this value. Once the axis decelerates to a stop at the specified Home Deceleration, the controller then moves the axis back to the Home Position at the Home Return Speed and Home Acceleration using a trapezoidal move profile.</p> <p>If the axis is configured in Cyclic Travel Mode, the move back to the Home Position takes the shortest path, for example, no more than ½ revolution. The axis behavior for this active homing sequence is depicted in the following diagram:</p> <div><p>The diagram shows a graph of Axis Velocity versus Axis Position. The velocity curve starts at a positive value, decelerates to zero at point 1 (Home Limit Switch Detected), then reverses direction and decelerates to zero at point 2 (Home Limit Switch Cleared). From point 2, it moves back to point 3 (Home Position) at a lower velocity (Return Vel). The initial forward velocity is labeled Homing Vel. The legend below the graph states: 1: Home Limit Switch Detected, 2: Home Limit Switch Cleared, 3: Home Position.</p></div> <p>If the controller detects that the state of the home switch at the start of the homing sequence is active, the controller immediately reverses the homing direction and begins the return leg of the homing sequence.</p> <p>Neglecting the mechanical uncertainty of the home limit switch, the accuracy of this homing sequence depends on the time uncertainty in detecting the home limit switch transitions. The position uncertainty of the home position is the product of the maximum time for the control to detect the home limit switch (~10 milliseconds) and the specified Home Return Speed. For this reason, the Home Return Speed is often made significantly slower than the Home Speed.</p> <p>For example, if a Home Return Speed of 0.1 inches per second (6 IPM) is specified, the uncertainty of the home position is calculated as shown below:</p> <p>Uncertainty = 0.1 Inch/Sec * 0.01 Sec = 0.001 Inch.</p>
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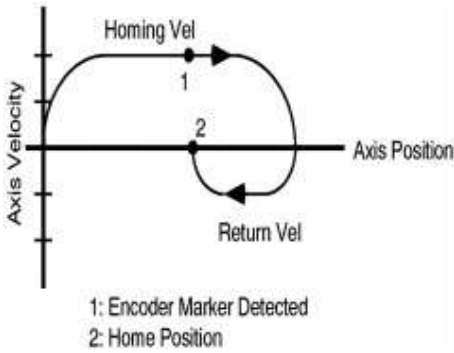
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Active Bidirectional Home to Marker	<p>This active homing sequence is useful for single turn rotary and linear encoder applications since these have only one encoder marker for full axis travel. When this sequence is performed, the axis moves in the specified Home Direction at the specified Home Speed and Home Acceleration until the marker is detected. The Home Position is then assigned to the axis position corresponding to the marker location, and the axis decelerates to a stop at the specified Home Deceleration.</p> <p>If Home Offset is non-zero, then the Home Position will be offset from the point where the marker is detected by this value. The controller then moves the axis back to the Home Position at the specified Home Return Speed and Home Acceleration using a trapezoidal move profile. If the axis is configured as a Cyclic Travel Mode, the move back to the Home Position takes the shortest path (for example, no more than ½ revolution). The axis behavior for this homing sequence is depicted in the following diagram:</p>  <p>The accuracy of this homing sequence depends only on the time delay in detecting the marker transition. The position uncertainty of the home position is the product of the maximum delay for the control to detect the marker pulse (~1 microsecond) and the specified Home Speed.</p> <p>For example, if a Home Speed of 1 inches per second (60 IPM) is specified, the uncertainty of the home position is calculated as shown below:</p> <p>Uncertainty = 1 Inch/Sec * 0.000001 Sec = 0.000001 Inch.</p>
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Active Bidirectional Home to Switch then Marker	<p>This is the most precise active homing sequence available. When this sequence is performed, the axis moves in the specified Home Direction at the specified Home Speed and Home Acceleration until the home limit switch is detected. The axis then decelerates to a stop at the specified Home Deceleration and moves in the opposite direction at the specified Home Return Speed and Home Acceleration until the home limit switch is cleared. After clearing the home limit switch, the axis continues in the same direction at the Home Return Speed until the first encoder marker is detected.</p> <p>The Home Position is assigned to the axis position at the moment that the marker is detected, and the axis then decelerates to a stop at the specified Home Deceleration. If Home Offset is non-zero, then the Home Position will be offset from the point where the marker is detected by this value. The controller then moves the axis back to the Home Position at the specified Home Return Speed and Home Acceleration using a trapezoidal move profile.</p> <p>If the axis is configured in Cyclic Travel Mode, the move back to the Home Position takes the shortest path (for example, no more than ½ revolution). Axis behavior for this active homing sequence is depicted in the following diagram:</p> <p>1: Home Limit Switch Detected 2: Home Limit Switch Cleared 3: Encoder Marker Detected 4: Home Position</p> <p>If the controller detects that the state of the home switch at the start of the homing sequence is active, the controller immediately reverses the homing direction and begins the return leg of the homing sequence.</p>
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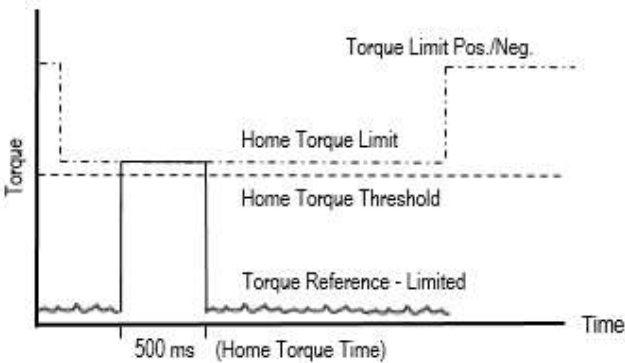
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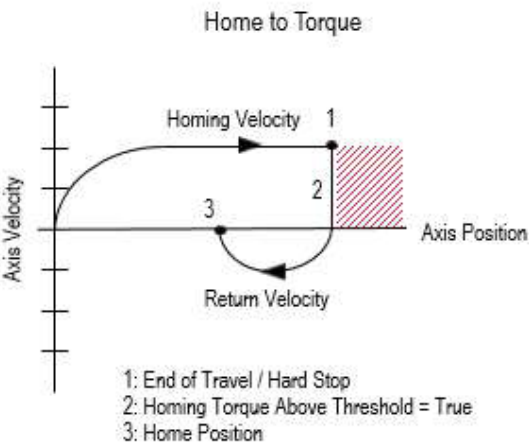
Active Unidirectional Home to Switch	<p>Unidirectional home is usually used when the physical axis cannot change directions.</p> <p>This active homing sequence is useful when an encoder marker is not available and either unidirectional motion is required or proximity switch is being used.</p> <p>When this sequence is performed in the Active Homing Mode, the axis moves in the specified Home Direction at the specified Home Speed and Home Acceleration until the home switch is detected. If the Home Offset is zero, the Home Position is assigned to the axis position at the moment that the limit switch is detected and the axis decelerates to a stop at the specified Home Deceleration.</p> <p>If Home Offset is non-zero, then the Home Position will be offset from the point where the switch is detected by this value. The controller then continues to move the axis to the Home Position at the specified Home Speed and Home Acceleration using a trapezoidal move profile.</p> <p>By setting a Home Offset greater than the deceleration distance, unidirectional motion to the Home Position is insured. However, if the Home Offset value is less than the deceleration distance, then the axis is simply decelerated to a stop at the specified Home Deceleration. The axis does not reverse direction to move to the Home Position. In this case, the PC-bit leg of the associated MAH instruction is not set when the IP-bit leg is cleared.</p> <p>In the case where this homing sequence is performed on a cyclic axis and the Home Offset value is less than the deceleration distance when the home event is detected, the control automatically adds one or more revolutions to the move distance. This guarantees the resulting move to the Home Position is unidirectional.</p>
Active Unidirectional Home to Marker	<p>This active homing sequence is useful for single turn rotary and linear encoder applications when unidirectional motion is required.</p> <p>When this sequence is performed in the Active Homing Mode, the axis moves in the specified Home Direction at the specified Home Speed and Home Acceleration until the marker is detected. If the Home Offset is zero, the Home Position is assigned to the axis position at the moment that the marker is detected and the axis decelerates to a stop at the specified Home Deceleration.</p> <p>If Home Offset is non-zero, then the Home Position will be offset from the point where the marker was detected by this value. The controller then continues to move the axis to the Home Position at the specified Home Speed and Home Acceleration using a trapezoidal move profile.</p> <p>The axis position is updated based on the Home Position and Home Offset. Even if the Home Offset is zero, the position is updated. Zero is a valid number.</p> <p>By setting a Home Offset greater than the deceleration distance, unidirectional motion to the Home Position is insured. However, if the Home Offset value is less than the deceleration distance, then the axis is simply decelerated to a stop at the specified Home Deceleration. The axis does not reverse direction to move to the Home Position. In this case, the PC-bit leg of the associated MAH instruction is not set when the IP-bit leg is cleared.</p> <p>In the case where this homing sequence is performed on a cyclic axis and the Home Offset value is less than the deceleration distance when the home event is detected, the control automatically adds one or more revolutions to the move distance. This guarantees the resulting move to the Home Position is unidirectional.</p>

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Active Unidirectional Home to Switch then Marker	<p>This active homing sequence is useful for multi-turn rotary applications when unidirectional motion is required.</p> <p>When this sequence is performed in the Active Homing Mode, the axis moves in the specified Home Direction at the specified Home Speed and Home Acceleration until the home switch is detected. The axis continues in the same direction at the Home Speed until the first marker event is detected. If the Home Offset is zero, the Home Position is assigned to the axis position at the precise position where the marker was detected, and the axis decelerates to a stop at the specified Home Deceleration. The axis position is updated based on the Home Position and Home Offset.</p> <p>If Home Offset is non-zero, then the Home Position will be offset from the point where the marker was detected by this value. The controller then continues to move the axis to the Home Position at the specified Home Speed and Home Acceleration using a trapezoidal move profile.</p> <p>By setting a Home Offset greater than the deceleration distance, unidirectional motion to the Home Position is insured. However, if the Home Offset value is less than the deceleration distance, then the axis is simply decelerated to a stop at the specified Home Deceleration. The axis does not reverse direction to move to the Home Position. In this case, the PC-bit leg of the associated MAH instruction is not set when the IP-bit leg is cleared.</p> <p>In the case where this homing sequence is performed on a cyclic axis and the Home Offset value is less than the deceleration distance when the home event is detected, the control automatically adds one or more revolutions to the move distance. This guarantees the resulting move to the Home Position is unidirectional.</p> <p>If the controller detects that the state of the home switch at the start of the homing sequence is active, the controller immediately establishes the Home Position based on the current axis position, and if allowed by the unidirectional motion constraint, begins to move to the Home Position.</p>
Active Home to Torque	<p>The Home to Torque sequence is applicable when a hard stop is used to establish the home position, as is a common practice for a linear actuator. The occurrence of the hard stop is detected by the drive when the output torque to the motor reaches or exceeds the Home Torque Threshold for the specified Home Torque Time. Since the Home to Torque sequence relies on the mechanical end of travel for operation, Unidirectional homing will not be possible so only Forward Bidirectional and Reverse Bidirectional are allowed. A delay filter is implemented in the drive to reduce any false/nuisance triggers when there is a spike in the torque feedback upon enabling or jobbing the motor under the load.</p> <p>At the start of the Home to Torque sequences, the controller overrides the Torque Limit Positive/Negative attribute values in the drive with the Home Torque Level value and overrides the Position and Velocity Error Tolerances, saving the original values. The drive then begins monitoring the torque reference signal, waiting for it to exceed the Home Torque Threshold. The torque level must exceed the Home Torque Threshold for an interval given by Home Torque Time to avoid false/nuisance trips due to the torque disturbances that can occur while moving the motor under load. The following timing diagram depicts the Torque Limit adjustments, Home Torque Limit, and Home Torque Threshold behavior during the Home to Torque sequence:</p>



The Home to Torque sequence is similar to Home to Switch, with the exception that the torque level is used instead of the home switch input. When this sequence is performed, the axis moves in the specified Home Direction at the specified Home Speed and Home Acceleration until a hard stop is detected, such as when motor torque has exceeded the Home Torque Threshold for a period equal to Home Torque Time. At this point, Home Position is calculated. The axis then decelerates to a stop at the specified Home Deceleration. If Home Offset is non-zero and would not place the Home Position of the axis further into the hard stop, the axis moves to the Home Position at the Home Return Speed and Home Acceleration and Home Deceleration using a trapezoidal move profile. Finally, the controller restores overridden drive attributes to their saved original values. Axis behavior for this homing sequence is depicted in the following diagram:



<p>Active Home to Torque then Marker</p>	<p>Like the Home to Torque sequence, the Home to Torque then Marker sequence is applicable when a hard stop is used as the home position, as is common for a linear actuator, and the feedback device is equipped with an encoder marker signal. The occurrence of the hard stop is detected when the commanded torque applied to the motor reaches or exceeds the user specified torque level. Since the Home to Torque sequence relies on the mechanical end of travel for operation, Uni-directional homing will not be possible so only Forward Bi-directional and Reverse Bi-directional are allowed. A delay filter is implemented in the drive to reduce any false/nuisance triggers when there is a spike in the torque feedback upon enabling or jogging the motor under load.</p> <p>By including the encoder marker in the homing sequence this is the most precise homing operation available for torque level based homing. When this sequence is performed, the axis moves in the specified Home Direction at the specified Home Speed and Home Acceleration until a hard stop is detected, such as when the Home Torque Threshold is exceeded for a period equal to Home Torque Time. The axis then reverses direction, first decelerating at the Home Deceleration rate, then moving away from the hard stop using the Home Acceleration to reach the Home Return Speed, until the first encoder marker is detected. Once the marker has been detected, the Home Position is calculated. The axis then decelerates to a stop at the specified Home Deceleration and the controller restores overridden drive attributes to their saved original values. If the calculated Home Position is not beyond the hard stop, the axis moves to the Home Position at the Home Return Speed and Home Acceleration and Home Deceleration using a trapezoidal move profile. Axis behavior for this homing sequence is depicted in the following diagram:</p> <div data-bbox="358 1563 1036 2169"><p>Torque Level - Marker Homing</p><p>1: End of Travel / Hard Stop 2: Homing Torque Above Threshold = TRUE 3: Homing Torque Above Threshold = FALSE and Arm Registration for Encoder Marker 4: Encoder Marker Detected 5: Home Position</p></div>
<p>Passive Immediate Home</p>	<p>This is the simplest passive homing sequence type. When this sequence is performed, the controller immediately assigns the Home Position to the current axis actual position. This homing sequence produces no axis motion.</p>
<p>Passive Home with Switch</p>	<p>This passive homing sequence is useful when an encoder marker is not available or a proximity switch is being used.</p> <p>When this sequence is performed in the Passive Homing Mode, an external agent moves the axis until the home switch is detected. The Home Position is assigned to the axis position at the moment that the limit switch is detected. If Home Offset is non-zero, then the Home Position will be offset from the point where the switch is detected by this value.</p>

Passive Home with Marker	<p>This passive homing sequence is useful for single turn rotary and linear encoder applications.</p> <p>When this sequence is performed in the Passive Homing Mode, an external agent moves the axis until the marker is detected. The home position is assigned to the axis position at the precise position where the marker was detected. If Home Offset is non-zero, then the Home Position will be offset from the point where the switch is detected by this value.</p>
Passive Home with Switch then Marker	<p>This passive homing sequence is useful for multi-turn rotary applications.</p> <p>When this sequence is performed in the Passive Homing Mode, an external agent moves the axis until the home switch and then the first encoder marker is detected. The home position is assigned to the axis position at the precise position where the marker was detected. If Home Offset is non-zero, then the Home Position will be offset from the point where the switch is detected by this value.</p>

Home Configuration Bits

Usage	Access	Data Type	Default	Min	Max	Semantics of Values
Required - E	Set/SSV	DWORD	0x00	-	-	Bitmap 0 = Reserved 1 = Home Switch Normally Closed 2-31 = Reserved

The Home Configuration Bits attribute determines homing related behavior such as the sense of the home switch contacts.

The Home Switch Normally Closed bit attribute determines the normal state of the home limit switch used by the homing sequence. The normal state of the switch is its state prior to being engaged by the axis during the homing sequence. For example, if the Home Switch Normally Closed bit is set (true) then the condition of the switch prior to homing is closed. When the switch is engaged by the axis during the homing sequence, the switch is opened, which constitutes a homing event.

Home Position

Usage	Access	Data Type	Default	Min	Max	Semantics of Values
Required - E	Set/SSV	REAL	0	- maxpos	maxpos	Position Units

If Travel Mode is Cyclic: 0 <= home pos < unwind

The Home Position is the desired absolute position for the axis after the specified homing sequence has been completed. After an active homing sequence has completed, the axis is left at the specified Home Position.

- If bidirectional homing, then the axis is left at the Home Position.
- If unidirectional homing and TravelMode=Cyclic, then the axis is left at the Home Position

Otherwise, the axis is not at the home position and the axis position is based on the Home Position.

In most cases, Home Position is set to zero, although any value, within the Maximum Positive and Negative Travel limits of the axis (if enabled), may also be used. (A description of the Maximum Positive and Negative Travel configuration attributes may be found in the Servo and Drive Axis Object specifications.) For a cyclic axis, the Home Position is constrained to be a positive number less than the Position Unwind value divided by the Conversion Constant.

Home Offset

Usage	Access	Data Type	Default	Min	Max	Semantics of Values
Required - E	Set/SSV	REAL	0	- maxpos	maxpos	Position Units

When applied to an active or passive Homing Mode, using a non-immediate Home Sequence, the Home Offset is the desired position offset of the axis Home Position from the position at which the home event occurred. The Home Offset is applied at the end of the specified homing sequence before the axis moves to the Home Position. In most cases, Home Offset is set to zero.

After an active bidirectional homing sequence has completed, the axis is left at the specified Home Position. If the Home Offset is non-zero, the axis will then be offset from the marker or home switch event point by the Home Offset value. If the Home Offset is zero, the axis will sit right on top of the marker or home switch point.

This is not valid for immediate Home Sequence.

Home Speed

Usage	Access	Data Type	Default	Min	Max	Semantics of Values
Required - E PV Only	Set/SSV	REAL	0	0	maxspd	Position Units / Sec

The Home Speed attribute controls the speed of the jog profile used in the first leg of an active homing sequence as described in the above discussion of the Home Sequence Type attribute.

This is valid for non-immediate cases of active Home Mode. Only valid for position and velocity control.

Home Return Speed

Usage	Access	Data Type	Default	Min	Max	Semantics of Values
Required - E PV Only	Set/SSV	REAL	0	0	maxspd	Position Units / Sec

The Home Return Speed attribute controls the speed of the jog profile used after the first leg of an active bidirectional homing sequence as described in the above discussion of the Home Sequence Type attribute.

This is valid for non-immediate cases of active Home Mode. Only valid for position and velocity control.

Home Acceleration

Usage	Access	Data Type	Default	Min	Max	Semantics of Values
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Optional - E PV Only	Set/SSV	REAL	0	0	maxacc	Position Units / Sec ²
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The Home Acceleration attribute controls the acceleration of the velocity profile used in an active Home Sequence attribute.

Home Deceleration

Usage	Access	Data Type	Default	Min	Max	Semantics of Values
Optional - E PV Only	Set/ SSV	REAL	0	0	maxacc	Position Units / Sec ²

The Home Deceleration attribute controls the deceleration of the axis as it comes to a stop in an active homing sequence as described in the Home Sequence attribute.

Home Torque Limit

Usage	Access	Data Type	Default	Min	Max	Semantics of Values
Optional - E PV Only	Set/ SSV	REAL	0	0	100	Position Units / Sec ²

The Home Deceleration attribute controls the deceleration of the axis as it comes to a stop in an active homing sequence as described in the Home Sequence attribute.

See also

[Motion Control Configuration Attributes](#)

[Motion Control Status Attributes](#)