Velocity Loop Configuration Attributes

These are the velocity loop configuration attributes associated with a Motion Control Axis.

Velocity Offset

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Required - PV	Set/SSV		REAL	0	-maxspd	maxspd	Velocity Units

The Velocity Offset attribute can be used to provide a velocity bias when performing velocity control. This value is summed together with the Velocity Trim value that can be sent synchronously to the drive every Coarse Update Period. Since the Velocity Trim value is available as a templated value, real time velocity corrections can be done using the Velocity Trim attribute.

Acceleration Feedforward Gain

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Required - PV	Set/SSV		REAL	0	0	∞	%

The Acceleration Feedforward Gain attribute is a value that multiplies the Acceleration Fine Command signal to form the Acceleration Feedforward Command that is applied to the acceleration loop summing junction. 100% Acceleration Feedforward applies the full Acceleration Fine Command signal to the output of the velocity loop.

Velocity Loop Bandwidth

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Required - PV	Set/SSV	T	REAL	260 FD	0	∞	Loop Bandwidth Units

The Velocity Loop Bandwidth attribute is a value that determines the proportional gain, Kvp, of the velocity loop that multiplies the Velocity Error signal. This value represents the unity gain bandwidth of the velocity loop.

Velocity Integrator Bandwidth

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Required - PV	Set/SSV	T	REAL	0 FD	0	∞	Loop Bandwidth Units

The Velocity Integrator Bandwidth attribute determines the velocity loop integral gain, Kvi, which together with the Kvp, multiplies the integrated Velocity Error signal. This value represents the bandwidth of the velocity integrator beyond which the integrator is ineffective. A value of 0 for this attribute disables the integrator.

Velocity Negative Feedforward Gain

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Optional - PV	Set/SSV		REAL	0	0	∞	%

The Velocity Negative Feedforward Gain attribute is a value that reduces or eliminates velocity overshoot by subtracting a portion of the velocity reference signal from the velocity error.

Velocity Droop

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Optional - FPV	Set/SSV		REAL	0	0	∞	Velocity Units / Sec / % Rated

Velocity Droop value that provides compliance to the velocity integrator by subtracting a portion of the velocity loop effort from the velocity error input to the velocity integrator. The presence of the Torque/Force scaling gain, Kj, in the droop signal path lets Velocity Droop to be specified in velocity units per % rated torque output. This parameter is also valid for V/Hz devices and its behavior is nearly identical, but instead of % rated being related to torque, % rated is related to current.

Velocity Error Tolerance

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Optional - PV	Set/SSV		REAL	0 FD	0	∞	Velocity Units

The Velocity Error Tolerance attribute determines the absolute maximum Velocity Error value that can be tolerated without causing a Excessive Velocity Error exception.

Velocity Error Tolerance Time

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Optional - PV	Set/SSV		REAL	0.01	0	∞	Seconds

The Velocity Error Tolerance Time attribute determines the maximum amount of time that the Velocity Error Tolerance can be exceeded without generating an exception.

Velocity Integrator Control

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Required - PV	Set/SSV		BYTE	0 0:0 1:0	-	-	Bitmap 0 = Integrator Hold Enable (R) 1 = Auto-Preset (O) 2-7 = Reserved

The Velocity Integrator Control attribute controls the behavior of the velocity loop

integrator while commanding motion through the controller. When the integrator hold enable bit is set, the integrator is held while motion is being commanded with a non-zero velocity. When clear, the integrator runs without qualification. When the auto-preset bit is set, the integrator preload value is automatically loaded with the current torque command when there is a control mode change between torque control and velocity control. If clear, the integrator is loaded with the configured velocity integrator preload value.

Velocity Integrator Preload

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Optional - PV	Set/SSV		REAL	0	0	∞	Accel Units

The Velocity Integrator Preload attribute is a value assigned to the velocity integrator when the velocity control loop is enabled.

Velocity Low Pass Filter Bandwidth

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Optional - PV	Set/SSV	T	REAL	0	0	10^4	Filter Frequency Units

The Velocity Low Pass Filter Bandwidth attribute controls the bandwidth of the Low Pass Filter applied to the Velocity Error signal. Recommended implementation is a two pole IIR filter. A value of 0 for this attribute disables this feature.

Velocity Threshold

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Optional - ED	Set/SSV		REAL	0 FD	0	∞	Velocity Units

The Velocity Threshold attribute defines a minimum absolute velocity. If the magnitude of the Velocity Feedback signal is less than this value, the Velocity Threshold status bit is set. If the axis is configured for Frequency Control, the Velocity Feedback signal is derived from the Velocity Reference signal.

Velocity Lock Tolerance

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Optional - PV	Set/SSV		REAL	1 FD	0	∞	Velocity Units

The Velocity Lock Tolerance attribute establishes a window around the unlimited velocity reference signal. When the Velocity Feedback signal is within this window the Velocity Lock status bit is set. When Velocity Feedback signals falls outside this window, the Velocity Lock status bit is cleared.

Velocity Standstill Window

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Required - ED	Set/SSV		REAL	1 FD	0	∞	Velocity Units

The Velocity Standstill Window attribute establishes a window around zero speed. When the Velocity Feedback signal is within this window the Velocity Standstill status bit is set. When Velocity Feedback signal falls outside this window, the Velocity Standstill status bit is cleared. If the axis is configured for Frequency Control, the Velocity Feedback signal is derived from the Velocity Reference signal.

Velocity Limit - Positive

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Optional - FPV	Set/SSV		REAL	0 FD	0	∞	Velocity Units

The Velocity Limit - Positive attribute defines the most positive velocity reference value into the velocity summing junction. If the signal entering the velocity limiter exceeds this velocity limit value, the device responds by clamping the velocity reference to this limit and sets the Velocity Limit status bit.

Velocity Limit - Negative

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Optional - FPV	Set/SSV		REAL	0 FD	-∞	0	Velocity Units

The Velocity Limit - Negative attribute is a negative value that defines the most negative velocity reference value allowed into the velocity summing junction. If the signal entering the velocity limiter exceeds this velocity limit value, the device responds by clamping the velocity reference to this limit and sets the Velocity Limit status bit.

Slat Configuration

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Optional - V	Set/SSV		BYTE	0	-	-	0 = SLAT Disabled 1 = SLAT Min Speed/Torque 2 = SLAT Max Speed/Torque

The Slat Configuration attribute configures the Speed Limited Adjustable Torque feature. The SLAT Configuration enumeration determines how the drive controls torque for this axis instance. In order to support applications that require Speed Limited Adjustable Torque (SLAT) control, the Min/Max torque control enumerations provide a feature to automatically switch to and from speed control under certain conditions. In either SLAT mode the drive will operate in one of two min/max states - speed control off or on.

Bit	Name	Description
0	SLAT Disabled	SLAT function is disabled. Normal Velocity Loop operation.
1	SLAT Min Speed/Torque	Drive will automatically switch from torque control to speed control if Velocity Error < 0 and switch back to torque control if

		Velocity Error > SLAT Setpoint for SLAT Time.
2	SLAT Max Speed/Torque	Drive will automatically switch from torque control to speed control if Velocity Error > 0 and switch back to torque control if Velocity Error < -SLAT Set Point for SLAT Time

SLAT Set Point

Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Optional - V	Set/SSV		REAL	0	0		Velocity Units

Speed Error level to switch from Speed control to Min/ Max control.

SLAT Time Delay

Time delay after SLAT Set Point is reached to switch from Speed control to Min/ Max control.

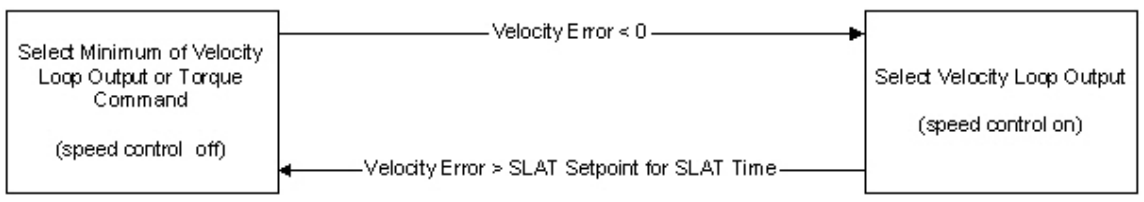
Usage	Access	T	Data Type	Default	Min	Max	Semantics of Values
Optional - V	Set/SSV		REAL	0	0		Seconds

Time delay after SLAT Set Point is reached to switch from Speed control to Min/ Max control.

SLAT Min Speed/Torque Mode

In SLAT Min Speed/Torque mode (SLAT Configuration = 1) the drive defaults to the state with speed control off (leftmost state) shown in the figure below. In this state, the torque reference is the minimum, or Min function, of the Velocity Loop Output or the Torque Command.

Min Mode



When used for SLAT control, an application dependent Velocity Command is applied to the drive. When the motor's speed is mechanically limited, this reference is at a level that results in saturation of the velocity loop output. In this state, the 'Min' select operation selects the smaller Torque Command value. The Velocity Error is positive in value equal to the Velocity Command.

If the mechanical speed limitation is removed (example web break), the motor accelerates and the Velocity Error becomes negative when the motor speed exceeds the Velocity Command. At this time, an automatic transition to speed control occurs and the Velocity Loop Output is selected as the Torque Reference, regardless of the value of the Torque Command. Coincident with the transition into speed control, a preset operation will occur within the velocity loop. This preset will force the velocity loop integrator to match the internal torque reference value, at the time of the mode transition.

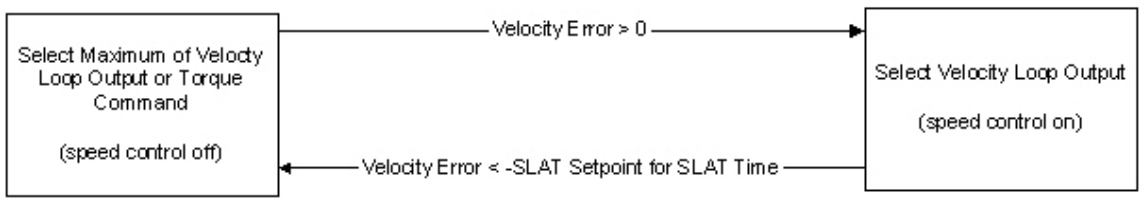
In Min mode the drive remains in speed control until the Velocity Error exceeds the configured SLAT Set-point attribute value for a period of time given by the SLAT Time Delay attribute. When these two conditions are met, speed control is turned off and the 'Min' select operation becomes active. This condition would occur if the mechanical constraint was restored.

SLAT Max Speed/Torque Mode

▷ Select/Limit Instructions
▷ Sequential Function Chart (SFC) Instructions
▷ Statistical Instructions
▷ Safety Instructions
▷ Studio 5000 Logix Designer Glossary

For SLAT Max Speed/Torque mode (SLAT Configuration = 2) the SLAT control operates similar to SLAT Min Speed/Torque mode, except that the signs have changed to allow the feature to work in the negative direction.

Max Mode



The active 'Max' select function will select the larger, or Max function, of the Velocity Loop Output or the Torque Command. The Velocity Command value is a negative quantity and so when the motor speed is mechanically limited, the Velocity Error is a negative value, and the Velocity Loop Output is a saturated (limited) to a negative value. The Torque Command is also negative, but smaller in magnitude, so it becomes selected by the 'Max' operation.

The forced transition to speed control occurs when the Velocity Error value becomes positive such as when the mechanical limitation is removed. A preset of the velocity loop's integral term occurs, as before.

When, by restoring the mechanical constraint, the Velocity Error becomes negative again and less than the negated SLAT Set-point parameter value for a SLAT Time delay, speed control is turned off and the 'Max' select operation becomes active.

See also

Position Loop Attributes

Position Loop Configuration Attributes

Velocity Loop Attributes

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