Motion Control Configuration Attributes

These are the basic motion control configuration attributes associated with a motion control axis. These attributes govern the overall behavior of the motion control axis.

Axis features

Usage	Access	Data Type	Default	Min	Max	Value Description
Required - All	Set/ GSV	DWORD	0	-	-	Bitmap 0 = Fine Interpolation (O) 1 = Registration Auto-rearm (O) 2 = Alarm Log (O) 3 = Marker (O) 4 = Home Switch (O) 5 = Hookup Test (O) 6 = Commutation Test (O) 7 = Motor Test (O) 8 = Inertia Test (O) 9 = Sensorless Control (O) 10 = Drive Scaling (O) 11 = Extended Event Block (O) 12 = Integer Command Position (O) 13 = Ext. Motor Test (O) 14 = Control Mode Change (O) 15 = Feedback Model Change (O) 16 = Pass Bus Status (O) 17 = Pass Bus Unload (O) 18 = Ext. Speed for SPM (O) 19 = Ext. Speed for IPM (O) 20 = Ext. Pos. Feedback (O) 21 = Ext. Sub Code Format (O) 22-31 = Reserved

The following table provides descriptions of the bit specified Axis feature attribute values.

Bit	Motion Status	Description

0	Fine Interpolation (O)	Indicates that the axis supports fine interpolation of command data based on command target time. Fine interpolation is used to provide smoother command reference signals when the drive update period is smaller than the controller update period.
1	Registration Auto-rearm (O)	Indicates that the axis supports the automatic re-arming mechanism for registration inputs. This feature is required for windowed registration support.
2	Alarm Log (O)	Indicates that this axis supports the Alarm Log feature. Alarm Log data is received from the drive using the Alarm bit of the Status Data Set and updates the Alarm Log of the controller.
3	Marker (O)	Indicates that the axis position feedback device supports a marker function. This functionality is required for Homing Sequences that employ the marker signal and for the marker Hookup Test.
4	Home Switch (O)	Indicates that the axis supports a home switch input. This functionality is required for Homing Sequences that employ the home switch input signal.
5	Hookup Test (O)	The axis supports a Hookup Test service. This service is required to perform a Hookup Test (MRHD) to check wiring to the motor and feedback components.
6	Commutation Test (O)	The axis supports a Commutation Test as part of the Hookup Test service. This service is required to perform a Hookup Test (MRHD) to check commutation wiring and determine the Commutation Offset.
7	Motor Test (O)	The axis supports a Motor Test service. This service is required to perform a Motor Test (MRMT) to measure motor model parameters.
8	Inertia Test (O)	The axis supports an Inertia Test service. This service is used as part of the Auto Tune (MRAT) that measures inertia.
9	Sensorless Control (O)	The axis supports sensorless control operation letting the drive run in velocity loop mode without an external feedback device.
10	Drive Scaling (O)	The device supports Drive Scaling functionality where the device is able to scale feedback counts to planner counts and manage absolute position.
11	Extended Event Block (O)	The device supports the extended Event Data Block format. This format supports additional features generally associated with Drive Scaling functionality, such as Watch Position events and Windowed Registration.
12	Integer Command Position (O)	The device requires Command Position Format to be a DINT (32-bit signed integer) data type. If not set, the device supports the standard LREAL (64-bit floating point) Command Position data type.
13	Ext. Motor Text (O)	The device supports the extended motor data format for the Motor Test service. This format supports transfer of vendor specific motor parameters and is required for the Motor Test service to support IPM motors.

Attributes

Converter Current Control Configuration Attributes

Converter Current Control Signal Attributes

Converter Current Reference Configuration Attributes

Converter Current Reference Signal Attributes

Converter Output Attributes

Converter Reactive Power Control Attributes

Converter Types

Current Control Signal Attributes

Current Control Configuration Attributes

Cyclic Read and Cyclic Write

DC Bus Condition Attributes

Device Function Codes

Device Commissioning Attributes

Drive General Purpose I/O Attributes

Drive Output Attributes

Drive Parameters

Event Capture Attributes

Exception Factory Limit Info Attributes

Exception User Limit Configuration Attributes

Exception, Fault and Alarm Attributes

Exceptions

Fault and Alarm Behavior

Feedback Interface Types

Feedback Configuration Attributes

Frequency Control Configuration Attributes

Frequency Control Signal Attribute

General Feedback Info Attributes

General Feedback Signal Attributes

General Linear Motor Attributes

General Motor Attributes

General Permanent Magnet Motor Attributes

General Rotary Motor

14	Control Mode Change (O)	The device supports changes to the Control Mode while in the Running state without generating large motion disturbances (bumpless). An example of such a mode change would be to switch from Position Control to Torque Control using an SSV instruction. If a particular Control Mode change is not supported by the device, a Configuration Fault will be generated.
15	Feedback Mode Change (O)	The device supports the ability to change the Feedback Mode while in the Running state without generating large motion disturbances (bumpless). An example of such a mode change would be to switch from Load Feedback to Motor Feedback using an SSV instruction. If a particular Feedback Mode change is not supported by the device, a Configuration Fault will be generated.
16	Pass Bus Status (O)	The device supports passing Converter Status bits, Bus Up and AC Power Loss, in the Control Status element of the C2D Connection's Axis Instance header when configured for DC Bus Sharing. The states of these Bus Status bits are determined by the controller based on the Bus Up and AC Power Loss bits passed in the Axis Status element of the D2C Connection's Cyclic Data of Converters or Drives (Bus Masters) that also support the Pass Bus Status feature. If clear, the associated device does not support Bus Up and AC Power Loss bits in the C2D Connection. Furthermore, if clear, the Bus Up and AC Power Loss status bits received by the controller in the device's D2C connection are not passed on to any other devices.
17	Pass Bus Unload (O)	The associated device is capable of generating a Bus Sharing exception based on Bus Unload request bit passed in the Control Status element of the C2D Connection's Axis Instance header. In this case, the controller passes a Bus Unload request to the device if any Converter or Drive (Bus Masters) in its Bus Sharing Group requests a Bus Unload. If clear, the controller is responsible for generating a Bus Sharing exception for this device axis in response to a Bus Unload request from any Converter or Drive (Bus Masters) in its Bus Sharing group.
18	Ext. Speed for SPM (O)	The device supports extending the speed range of an SPM motor through field weakening to speeds that require methods to protect drives from destructive DC Bus Overvoltage conditions. To manage that risk, the Extended Speed feature provides additional PM motor attributes including a PM Motor Extended Speed Permissive attribute.
19	Ext. Speed for IPM (O)	The device supports extending the speed range of an IPM motor through field weakening to speeds that require methods to protect drives from destructive DC Bus Overvoltage conditions. To manage that risk, the Extended Speed feature provides additional PM motor attributes including a PM Motor Extended Speed Permissive attribute.
20	Ext. Position Feedback (O)	The device supports passing Actual Position as a 64-bit LINT element in the Cyclic Data Block of the D2C Connection. If this bit is clear, the device only supports passing Actual Position as a 32-bit DINT.
21	Ext. Sub Code Format (O)	The device supports the Extended Sub Code Format as defined in the Motion Device Axis Object. The extended format uses the most significant bit of the Sub Code to select one of two bit field formats for the remaining 7-bits.

Axis configuration

Axis Configuration

Usage	Access	Data Type	Default	Min	Max	Value Description
Required - All	Set/GSV	USINT	AOP*	0	5	Enumeration 0 = Feedback Only (O) 1 = Frequency Control (O) 2 = Position Loop (O) 3 = Velocity Loop (O) 4 = Torque Loop (O) 5 = Non-Regenerative AC/DC Converter (O) 6 = Regenerative AC/DC Converter (O) 7 = Low Harmonic AC/DC Converter (O) 8 = DC/DC Converter (O) 9-15 = Reserved

* The default value can be specified by the specific drive profile (AOP).

The axis configuration attribute determines the general dynamic control behavior of the motion device axis instance.

This attribute is used to set both the Control Mode and Control Method attributes according to the following table:

Axis Config	Control Mode	Control Method
Regenerative AC/DC Converter	No Control	No Control
Non-Regenerative AC/DC Converter	No Control	No Control
Low Harmonic AC/DC Converter	No Control	No Control
DC/DC Converter	No Control	No Control
Position Loop	Position Control	PI Vector Control
Velocity Loop	Velocity Control	PI Vector Control
Torque Loop	Torque Control	PI Vector Control

The axis configuration attribute is an enumerated value that determines the general dynamic control behavior of the motion device axis instance. This attribute is used by the controller to set the Control Mode attribute that is sent to the drive as part of the cycle connection, and also determines Control Method attribute configuration. So, when axis configuration is set by configuration software, control mode and control method are also updated.

The following table provides descriptions of the Axis configuration attribute values:

Enumeration	Usage	Name	Description

0	R/E O/C	Feedback Only	Provides an axis interface to a specific feedback device as a master feedback source. The Control Mode and Control Method are set to No Control in this configuration, indicating that there is no dynamic control capability associated with this axis.
1	R/F	Frequency Control	Selects the Frequency Control Method that applies voltage to the motor, generally in proportion to the commanded frequency or speed. Accordingly, the Control Mode attribute is set to Velocity Control.
2	R/P	Position Loop	Selects the PI Vector Control Method that applies feedback to provide closed loop cascaded PI control of motor position, velocity, and torque, and includes closed loop control of Iq and Id components of the motor current vector. Accordingly, the Control Mode attribute is set to Position Control.
3	R/V O/P	Velocity Loop	Selects the PI Vector Control Method that applies feedback to provide closed loop cascaded PI control of motor velocity, and torque, and includes closed loop control of Iq and Id components of the motor current vector. Accordingly, the Control Mode attribute is set to Velocity Control.
4	R/T O/PV	Torque Loop	Selects the PI Vector Control Method that applies feedback to provide closed loop PI control of motor torque through control of Iq and Id components of the motor current vector. Accordingly, the Control Mode attribute is set to Torque Control.
5	O/ND	Non-Regenerative AC/DC Converter	Provides an axis interface to a standalone non-regenerative power converter device. Both the Control Mode and Control Method are set to No Control in this configuration, indicating that there is no dynamic control capability associated with this axis.
6	O/G	Regenerative AC/DC Converter	Provides an axis interface to a standalone regenerative power converter device or the regenerative converter function of an integrated regenerative drive device. Both the Control Mode and Control Method are set to No Control in the configuration, indicating that there is no dynamic control capability associated with this axis.
7	O/G	Low Harmonic AC/DC Converter	Provides an axis interface to a standalone AC/DC low harmonic converter device, or the AC/DC converter function of an integrated low harmonic drive device that utilizes active electronics to that regulate power flow from the AC source to the DC bus. Both the Control Mode and Control Method are set to No Control in this configuration, indicating that there is no dynamic motor control capability associated with this axis.

8	O/N	DC/DC Converter	Provides an axis interface to a class of devices that convert power between two DC sources using active electronics, or simply distribute primary DC input power to secondary DC buses. DC/DC converters with active electronics are capable of transferring energy between a primary DC bus and one or more secondary DC buses, each with different voltage levels. Both the Control Mode and Control Method are set to No Control in this configuration, indicating that there is no motor dynamic control capability associated with this axis.
9-255		(Reserved)	-

Control Mode

Usage	Access	Data Type	Default	Min	Max	Value Description
Required - All Derived from Axis Configuration	Get/ SSV(1)	BYTE	0	0	4	Enumeration 0 = No Control 1 = Position Control 2 = Velocity Control 3 = Acceleration Control 4 = Torque Control 5-15 = Reserved Bits 4-7 Reserved

(1) SSV - These configuration attributes cannot be changed online or using an SSV instruction if the axis is in the Running state, for example the Tracking Command bit of the CIP Axis Status attribute.

The Control Mode attribute determines the general dynamic control behavior of the drive device axis instance and consists of a 4-bit enumeration. This value is derived from the axis configuration attribute value during initialization. This attribute is transferred to the device as part of the Cyclic data block.

When modified programmatically, using SSV, the Control Mode value cannot be set to an enumeration that the current Axis Configuration cannot support. For example if the axis configuration is set for Velocity Loop, the Control Mode cannot be changed to Position Loop since position loop attributes have not been configured. This table provides a list of valid Control Modes for a given axis configuration:

Axis Configuration	Valid Control Modes
Non-Regenerative AC/DC Converter	No Control

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

Regenerative AC/DC Converter	No Control
Low Harmonic AC/DC Converter	No Control
DC/DC Converter	No Control
Feedback Only	No Control
Frequency Control	Velocity Control
Position Loop	Position Control Velocity Control Torque Control
Velocity Loop	Velocity Control Torque Control
Torque Loop	Torque Control

The Control Mode attribute is a 4-bit enumeration that determines the specific dynamic behavior of the motor that the device is to control for this axis instance. The following table provides descriptions of valid Control Modes.

Enumeration	Usage	Name	Description
0	R/BE	No Control	No motor control is provided in this mode.
1	R/P	Position Control	Controls the position, or orientation, of the motor.
2	R/PV	Velocity Control	Controls the velocity of the motor.
3	O/PVT	Acceleration Control	Controls the acceleration of the motor.
4	R/C	Torque Control	Controls the torque output of the motor.
5-15		Reserved	-

Control Method

The Control Method (derived from axis configuration) attribute is an 8-bit enumerated code that determines the basic control algorithm applied by the device to control the dynamic behavior of the motor.

Usage	Access	Data Type	Default	Min	Max	Value Description
Required - All Derived from Axis Configuration	Get/ GSV	USINT	0	0	2	Enumeration 0 = No Control 1 = Frequency Control 2 = PI Vector Control 3-255 =

						Reserved

This value is sent to the drive during initialization and cannot be changed during operation.

Enumeration	Usage	Name	Description
0	R/BE	No Control	Associated with a Control Mode of No Control where there is no explicit motor control provided by the device for this axis instance.
1	R/F	Frequency Control	An open loop control method that applies voltage to the motor, generally in proportion to the commanded frequency or speed. This control method is associated with Variable Frequency Drives (VFDs) or so called Volts/Hertz drives.
2	R/C	PI Vector Control	A closed loop control method that uses actual or estimated feedback for closed loop cascaded PI control of motor dynamics, for example, position, velocity, acceleration, and torque, and always includes independent closed loop PI control of Iq and Id components of the motor current vector.
3-127		Reserved	-
128-255		Vendor Specific	-

See also

Interpreting the Attribute Tables

Motion Control Modes

Control Mode Attributes