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Motion Drive Start (MDS)

This information applies to the CompactLogix 5370, ControlLogix 5570, Compact GuardLogix 5370, GuardLogix 5570, Compact GuardLogix 5380, CompactLogix 5380, CompactLogix 5480, ControlLogix 5580, and GuardLogix 5580 controllers.

Use the Motion Drive Start (MDS) instruction to activate the drive control loops for the specified axis and run the motor at the specified speed.

Important:

The MDS instruction is validated if the CIP drive device supports the S ramp attributes, including:

- RampAcceleration
- RampDeceleration
- RampVelocity - Positive
- RampVelocity - Negative
- RampJerk - Control

Available Languages

Ladder Diagram



Function Block

This instruction is not available in function block.

Structured Text

MDS(Axis,MotionControl,Speed,Unitspersec);

Operands

Ladder Diagram and Structured Text

Operand	Type	Type	Format	Description
	CompactLogix 5370, Compact GuardLogix 5370, Compact GuardLogix 5380, CompactLogix 5380, CompactLogix 5480	ControlLogix 5570, GuardLogix 5570, ControlLogix 5580, and GuardLogix 5580 controllers		
Axis	AXIS_CIP_DRIVE	AXIS_CIP_DRIVE	Tag	Motion Axis of data type AXIS_CIP_DRIVE only.
Motion Control	MOTION_INSTRUCTION	MOTION_INSTRUCTION	Tag	Structure used to control execution of the motion instruction.
Speed	SINT INT DINT REAL	SINT INT DINT REAL	Immediate or Tag	Defines the initial speed for the DirectVelocityControlStatus Command attribute.
Speed Units	SINT INT DINT	SINT INT DINT	Immediate	Which units do you want to use for the speed? 0 = % of Maximum 1 = Units per Sec

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[Motion Axis Fault Reset \(MAFR\)](#)

[MAFR Flow Chart \(True\)](#)

[Motion Axis Shutdown \(MASD\)](#)

[MASD Flow Chart \(True\)](#)

See *Structured Text Syntax* for more information on the syntax of expressions within structured text.

MOTION_INSTRUCTION Structure

Mnemonic	Description
.EN (Enable) Bit 31	It is set when the rung makes a false-to-true transition and remains set until the rung makes a true-to-false transition and drive messaging is complete.
.DN (Done) Bit 29	It is set when the drive has been successfully enabled and remains set until the rung makes a false-to-true transition.
.ER (Error) Bit 28	It is set when the instruction encounters an error condition. The error condition can be a direct result of the initial conditions or may result during the instruction’s execution. The bit remains set until the rung makes a false-to-true transition.
.IP (In process) Bit 26	It is set when the instruction has been successfully initiated and remains set until: another MDS instruction supersedes the initial instruction another instruction terminates the initial instruction a drive fault occurs.
STATE	Reflects the state of the instruction. 0 = Sending a request to the drive module to turn the drive on 1 = Waiting for the drive enable and servo action status bits to be set

Description

The MDS instruction:

- Is only valid for the AXIS_CIP_DRIVE axis data type.
- Performs a drive enable if the axis is not in the Running state.
- Applies desired DirectVelocityControlStatus Command attribute and/or the DirectTorqueControlStatus Command attributes.
- Presents the DirectVelocityControlStatus Command attributes and/or the DirectTorqueControlStatus Command attributes.
- Is activated on a Rung False-to-True transition.

The MDS instruction is used to activate the direct control of velocity or torque for a specified axis. The instruction performs an axis enable sequence and then presets the DirectVelocityControlStatus Command attribute and/or the DirectTorqueControlStatus Command attribute if the selected drive supports direct control. The most common usage of the MDS instruction is the flying start application, where the following attributes directly control the motion dynamics:

- RampAcceleration
- RampDeceleration
- RampVelocity - Positive
- RampVelocity - Negative
- RampJerk - Control

The DirectVelocityControlStatus Command attribute is applied by taking the value in the speed field in the instruction configuration and copying it into the DirectVelocityControlStatus Command attribute. The DirectVelocityControlStatus Command attribute is then scaled and summed onto the commanded output to the drive device. The DirectVelocityControlStatus Command attribute value can be modified directly via the MOV instruction.

The DirectTorqueControlStatus Command attribute is applied by taking the value in speed field in the instruction configuration and copying it into the DirectTorqueControlStatus Command attribute. The DirectTorqueControlStatus Command attribute is then sent directly to the drive via the placeholder in the CIP Controller to Drive Connection.

A combination of the DirectVelocityControlStatus Command attribute and the DirectTorqueControlStatus Command attribute can be applied in applications that require Speed-limited Adjustable Torque (SLAT) modes. SLAT operation mode provides automatic speed control under certain conditions.

[Motion Axis Shutdown Reset \(MASR\)](#)

[MASR Flow Chart \(True\)](#)

[Motion Direct Drive Off \(MDF\)](#)

[MDF Flow Chart \(True\)](#)

[Motion Direct Drive On \(MDO\)](#)

[MDO Flow Chart \(True\)](#)

[Motion Drive Start \(MDS\)](#)

[Motion Servo Off \(MSF\)](#)

[MSF Flow Chart \(True\)](#)

[Motion Servo On \(MSO\)](#)

[MSO Flow Chart \(True\)](#)

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The SLAT Configuration is an enumerated attribute that determines how the drive controls torque for this axis instance. To support applications that require 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 operates in one of the states described in the following table.

Enumeration	Mode	Description
0	SLAT disabled	SLAT function is disabled. This is the normal Velocity Loop operation.
1	SLAT Min Speed/Torque	Drive automatically switches from torque control to speed control if Velocity Error > SLAT set point and switches back to torque control if Speed Error < 0.
2	SLAT Max Speed Torque	Drive automatically switches from torque control to speed control if Velocity Error < -SLAT set point and switches back to torque control if Speed Error > 0.

When you execute the MDS instruction and the drive is configured for velocity control, the acceleration and deceleration ramp to the specified speed is controlled by the drives based on the Acceleration Limit and Deceleration Limit attributes. The Motion Planner takes the value from the Direct Command Velocity attribute and sums it into the axis output before sending the command to the drive. The most common use of this instruction is to perform a Drive Start application into a spinning motor, also known as a Flying Start application.

The axis remains in DirectVelocityControlStatus Command attribute or DirectTorqueControlStatus Command attribute modes until canceled by one of the following instructions:

- Motion Axis Stop (MAS)
- Motion Axis Shutdown (MASD)
- Motion Coordinated Shutdown (MCSD)
- Motion Group Shutdown (MGSD)
- Motion Servo Off (MSF)

Depending on how the fault action is configured, an axis fault can also cancel the MDS instruction.

Execution of the MDS instruction has no effect on motion group or coordinate system objects. However, the instruction affects axis objects as follows:

When the MDS instruction is initiated without errors, the DirectVelocityControlStatus bit of the MotionStatus axis attribute is set, indicating the DirectVelocityControlStatus bit is active on the axis.

The DirectVelocityControlStatus bit remains set until it is made inactive via an MAS or MASR instruction, or via an axis fault.

Also, when the MDS instruction is initiated without errors, the DirectTorqueControlStatus bit attribute of the MotionStatus axis attribute is set, indicating the DirectTorqueControlStatus Command attribute is active on the axis.

The DirectTorqueControlStatus bit remains set until it is made inactive via an MAS or MASR instruction, or via an axis fault.

Some fault actions impact the execution of the MDS instruction.

Fault Action	Description
Ignore	Ignore instructs the device to completely ignore the exception condition. For some exceptions that are fundamental to the operation of the axis, it may not be possible to Ignore the condition.
Alarm	Alarm action instructs the device to set the associated bit in the Axis Alarm word but to otherwise not affect axis behavior. For some exceptions that are fundamental to the operation of the device, it may not be possible to select this action or any other action that leaves device operation unaffected.
Fault Status Only	Fault Status Only instructs the device to set the associated bit in the Axis Faults word but to otherwise not affect axis behavior. It is up to the controller to programmatically bring the axis to a stop in this condition. For some exceptions that are fundamental to the operation of the device, it may not be possible to select this action or any other action that leaves device operation unaffected.

Stop Planner	Stop Motion instructs the device to set the associated bit in the Axis Faults word and instructs the Motion Planner to perform a controlled stop of all planned motion at the configured Max Decel rate but otherwise not affect axis behavior. This allows the axis to be subsequently moved via the Motion Planner without first clearing the fault. For some exceptions that are fundamental to the operation of the device, it may not be possible to select this action or any other action that leaves device enabled.
Stop Drive	<p>The Stop Drive action results in the device both setting the associated bit in the Axis Faults word and bringing the axis to a stop based on the factory set "best" available stopping method. This "best" stopping method includes both the method of decelerating the motor to a stop and the final state of the axis given the expected level of control still available. The level of axis control available depends on the specific exception condition and on the configured control mode.</p> <p>The available deceleration methods are defined by the Stopping Mode attribute. Standard stopping modes, listed in decreasing levels of deceleration control, are as follows:</p> <p>Ramp Decel</p> <p>Current Limit Decel</p> <p>Coast</p> <p>In general, the "best" stopping mode is the most controlled deceleration method still available given the exception condition.</p> <p>The final state of the axis in response to the Major Fault exception action can be any one of the following states that are listed in decreasing levels of control functionality:</p> <p>Hold (Stopped state with Holding Torque)</p> <p>Disable (Stopped state with Power Structure Disabled)</p> <p>Shutdown (DC Bus Power Disabled)</p> <p>The "best" final state of the axis is the state with the most control functionality still available given the exception condition. But in all these final states a fault reset must be executed before the axis can be restored to enabled operation and commanded to move.</p> <p>If the application requires exception action that is a more severe stopping action than the factory set "best" method, the controller must initiate that action.</p> <p>If the application requires exception action that is less severe than the factory set "best" method, the controller must configure the device axis instance for a Minor Fault exception action and handle the fault directly. This may put device and motor components at risk and should only be allowed by the device when there is an opportunity, albeit temporal, for the device to remain operational. This is important in applications where the value of the product is higher than the value of the motor or device.</p> <p>When multiple major faults occur with different stopping actions, the most severe of the associated stopping actions is applied, i.e. the stopping action that requires the lowest level of control functionality. This rule also applies to the stopping action associated with the Stopping Mode associated with a Disable Request.</p>
Shutdown	Shutdown forces the axis into the Shutdown state, immediately disabling the drive's power structure. If Shutdown Action is configured to do so, this action also drops DC Bus power to the drive's power structure. Therefore, the Shutdown action overrides the drive's best stopping method. An explicit Shutdown Reset is required to restore the drive to an operational state

This is a transitional instruction:

- In relay ladder, toggle the Rung-condition-in from false to true each time the instruction should execute.
- In structured text, condition the instruction so that it only executes on a transition.

Affects Math Status Flags

No

Major/Minor Faults

None specific to this instruction. See *Common Attributes* for operand-related faults.

Execution

Ladder Diagram

Condition/State	Action Taken
Prescan	The .EN, .DN, and .ER are cleared to false.
Rung-condition-in is false	The .EN bit is cleared to false if the .DN or .ER bit is true.
Rung-condition-in is true	The .EN bit is set to true and the instruction executes. If the EN bit is set to false, there is no action taken,
Postscan	N/A

Structured Text

Condition/State	Action Taken
Prescan	See Prescan in the Ladder Diagram table
Normal execution	See Rung-condition-in is false, followed by rung is true in the Ladder Diagram table.
Postscan	See Postscan in the Ladder Diagram table.

Error Codes

See *Motion Error Codes (.ERR)* for Motion Instructions.

Extended Error Codes

Extended Error Codes provide additional instruction specific information for the Error Codes that are generic to many instructions. See *Motion Error Codes (.ERR)* for Motion Instructions.

MDS Changes to Status Bits

Axis Status Bits

Bit Name	State	Meaning
DriveVelocityControlStatus	FALSE	Axis is not under Direct Velocity Control.
DirectTorqueControlStatus	FALSE	Axis is not under Direct Torque Control.

Examples

Example 1

The Speed operand is a REAL tag and Speed Units is "Units per sec"

Ladder Diagram



Structured Text

MDS(myAxis,myMotionControl,mySpeed_REAL,Unitspersec);

Example 2

The Speed operand is a DINT tag and Speed Units is % of Maximum

Ladder Diagram



Structured Text

MDS(myAxis,myMotionControl,mySpeed_DINT,%ofMaximum);

See also

[Motion State Instructions](#)

[Motion Error Codes \(.ERR\)](#)

[Structured Text Syntax](#)

[Common Attributes](#)