Motion Coordinated Stop (MCS)

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.

The Motion Coordinated Stop (MCS) instruction initiates a controlled stop of coordinated motion. Any pending motion profiles are canceled.

Important: Tags used for the motion control attribute of instructions should only be used once. Re-use of the motion control tag in other instructions can cause unintended operation. This may result in damage to equipment or personal injury.

Important: Risk of Velocity and/or End Position Overshoot

If you change move parameters dynamically by any method, that is by changing move dynamics (MCD or MCCD) or by starting a new instruction before the last one has completed, be aware of the risk of velocity and/or end position overshoot.

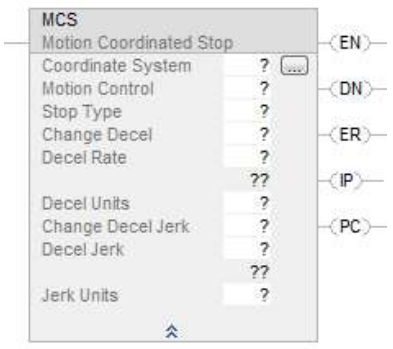
A Trapezoidal velocity profile can overshoot if maximum deceleration is decreased while the move is decelerating or is close to the deceleration point.

An S-curve velocity profile can overshoot if:

- maximum deceleration is decreased while the move is decelerating or close to the deceleration point; or
- maximum acceleration jerk is decreased and the axis is accelerating. Keep in mind, however, that jerk can be changed indirectly if it is specified in % of time.

Available Languages

Ladder Diagram



Function Block

This instruction is not available in function block.

Structured Text

MCS(CoordinateSystem, MotionControl,StopType, ChangeDecel, DecelRate,DecelUnits, ChangeDecelJerk,DecelJerk, JerkUnits);

Operands

There are data conversion rules for mixed data types within an instruction. See Data Conversion.

Ladder Diagram and Structured Text

Operand	Type	Format	Description	
Coordinate System	COORDINATE_SYSTEM	Tag	Name of the coordinate system.	
Motion Control	MOTION_INSTRUCTION	Tag	Control tag for the instruction.	
Stop Type	DINT	Immediate	**If you want to**	**Choose this Stop Type**

			Stop all motion for the axes of the coordinate system and stop any transform that the coordinate system is a part of.	All (0) - For each axis, all motion generators, including the coordinated motion, are taken into account when computing the initial dynamics (i.e., acceleration rate and velocity) to be used in the Decel. Every axis in the coordinated system is stopped independently using the computed initial dynamics.
			Stop only coordinated moves.	Coordinated Move (2)
			Cancel any transform that the coordinate system is a part of.	Coordinated Transform (3)
Change Decel(1)	DINT	Immediate	If you want to	Then Choose
			Use the maximum deceleration rate of the coordinate system.	No (0)
			Specify the deceleration rate.	Yes (1)
Decel Rate	REAL	Immediate or Tag	**Important:** An axis could overshoot its target position if you reduce the deceleration while a move is in process. Deceleration along the path of the coordinated move. The instruction uses this value: • Only if Change Decel is Yes. • Only for coordinated moves. Enter a value greater than 0.	
Decel Units	DINT	Immediate	0 = Units per Sec^2 1 = % of Maximum Only "% of Maximum" is allowed on Cartesian geometries with coordinate definition = XYZRxRyRz. % of Cartesian max is used for XYZ and "% of orientation max" is used for Rx, Ry and Rz.	
Change Decel Jerk	SINT, INT, or DINT	Immediate	0 = No 1 = Yes	
Decel Jerk	SINT, INT, DINT, or REAL	Immediate or Tag	You must always enter a value for the Decel Jerk operand. This instruction only uses the value if the Profile is configured as S-curve. Decel Jerk is the deceleration jerk rate for the coordinate system. Use these values to get started. • Decel Jerk = 100 (% of Time) • Jerk Units = 2	

Jerk Units	SINT, INT, or DINT	Immediate	0 = Units per sec^3 1 = % of Maximum 2 = % of Time (use this value to get started) Only "% of Time" is allowed on Cartesian geometries with coordinate definition = XYZRxRyRz.

(1) Overshoot may occur if MCS is executed close to or beyond the deceleration point and the deceleration limit is decreased. Keep in mind that deceleration may be decreased indirectly by setting ChageDecel to NO if configured maximum deceleration rate is less than the active deceleration rate.

Structured Text

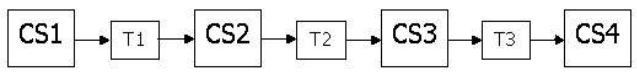
Enter the stop type and decel units without spaces.

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

For example, enter the Coordinate System operand as CoordinateSystem.

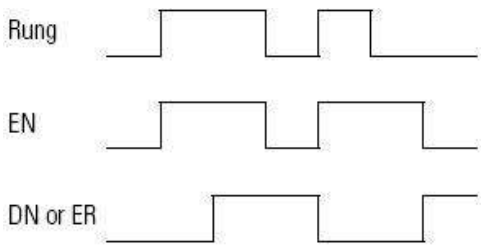
How Stop Types Affect Transforms

The following table describes how the stop types affect coordinate systems that are a part of a transform.

This Operand	Description
All	This stop type: • stops the axes in the specified coordinate system. It also stops the axes of any coordinate system that shares axes with this coordinate system. • cancels any transforms that the coordinate system is a part of.
Coordinate Move	This stop type stops only the coordinated moves. Any transforms stay active.
Coordinated Transform	This stop type cancels the transforms associated with the specified coordinate system. All transform-related motion stops on all associated target coordinate systems. However, source coordinate axes will continue to move as instructed. Example If four coordinate systems are linked via three transforms. And the first coordinate system (CS1) is the source and is processing commanded motion.  Executing an MCS instruction on CS2 and using a stop type of coordinated transform results in: • Transforms T1 and T2 are canceled. • Transform T3 stays active. • the axes in CS1 stay in motion. • the axes in Coordinate Systems CS2 and CS3 stop via the deceleration rate selected in the MCS instruction or the maximum coordinate deceleration rate. • the axes in CS4 follow the respective CS3 axes. In an Motion Axis Stop (MAS) instruction, a stop type of all also cancels transforms.

MOTION_INSTRUCTION Data Type

To see if	Check if this bit is on	Data Type	Notes

The rung is true	EN	BOOL	Sometimes the EN bit stays on even if the rung goes false. This happens if the rung goes false before the instruction is done or an error has occurred. 
The stop was successfully initiated	DN	BOOL	
An error happened	ER	BOOL	
The axis is stopping	IP	BOOL	Any of these actions ends the MCS instruction and turns off the IP bit: • The coordinate system is stopped. • Another MCS instruction supersedes this MCS instruction. • Shutdown instruction. • Fault Action.
The axis is stopped	PC	BOOL	The PC bit stays on until the rung makes a false-to-true transition.

Master Driven Speed Control (MDSC) and the MCS Instruction

If an MCS is issued when in Master Driven Mode, a switch is made to Time Driven Mode and the axes are stopped in Time Driven Mode. MCS All resets the IP bit of the Master Driven Coordinate Control (MDCC) instruction. Other stop types do not reset the IP bit.

The MCS All instruction clears the pending Master Axis for all future coordinated motion instructions. However, MCS ALL on the Master axis does not break the MDSC link.

The AC bit of the MDCC instruction is reset when the axis is stopped.

The instruction queue is cleared when an MCS All or MCS Coordinated is executed (goes IP).

The status bit CalculatedDataAvailable in an active motion instruction status word for an MCLM or MCCM instruction clears when an MCS is executed (goes IP). The CalculatedData is not recomputed.

Note that if a stop is issued very close to the programmed endpoint, the actual stop may be beyond the programmed endpoint, especially if run in Master Driven Mode.

MCS 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, .ER, and .IP bits are cleared to false.
Rung-condition-in is false	The .EN bit is cleared to false if either the .DN or .ER bit is true.

Rung-condition-in is true	The .EN bit is set to true and the instruction executes.
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

See Extended Error Codes for Motion Instructions. It has information about how to use the extended error codes. See Motion Error Codes (.ERR) for motion instructions.

Changes to Status Bits

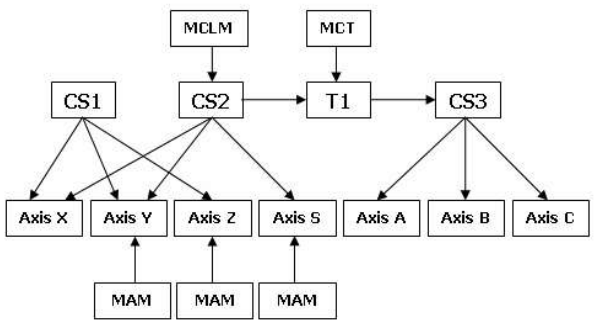
The instruction changes these status bits when it executes.

In the tag for the	**This bit**	**When the stop type is**	**Turns**
Axis	CoordinatedMotionStatus	→	Off when the coordinated move stops
	TransformStatus	Coordinated Move	Unchanged
		• All • Coordinated Transform	Off
	ControlledByTransformStatus	Coordinated Move	Off when the axes stop and the PC bit of the MCS instruction turns on
		• All • Coordinated Transform	Off
Coordinate System	MotionStatus	→	Off when the coordinated move stops
	AccelStatus	→	Off
	DecelStatus	→	On during the stop and then off when the stop completes
	StoppingStatus	→	On during the stop and then off when the PC bit turns on
	MoveStatus	→	Off
	MoveTransitionStatus	→	Off
	TransformSourceStatus	Coordinated Move	Unchanged

		• All • Coordinated Transform	Off
	TransformTargetStatus	Coordinated Move	Unchanged
		• All • Coordinated Transform	Off

How Stop Types Affect Transforms an Axis Motion Example

Suppose you have this situation.



Where:

- Coordinate system 1 (CS1) contains the X, Y, and Z axes.
- Coordinate system 2 (CS2) contains the Y, Z, and S axes.
- Coordinate system 3 (CS3) contains the A, B, and C axes.
- Transform (T1) links source coordinate CS2 to target CS3.
- CS2 (XYS) axes are mapped to CS3 (ABC) axes.
- MAM instructions executed on the Y, Z, and S axes.
- MCLM instruction executed on CS2.
- MCT instruction executed with CS2 as the source and CS3 as the target.
- No coordinate instructions were executed on CS2 or CS3.

This table shows the results of executing various MCS and MAS instructions with different stop types.

Instruction	**Stop Type**	**Result**
MCS on CS1	All	The MCLM instruction on CS2 will stop.
		The MAM on Y will stop.
		The MAM on Z will stop.
		The MAM on S will continue.
		T1 is canceled.
		Axes ABC will stop due to canceling the transform.
MCS on CS2	All	The MCLM instruction on CS2 will stop.
		The MAM on Y will stop.
		The MAM on S will stop.
		The MAM on Z will continue.
		T1 is canceled.
		Axes ABC will stop due to canceling the transform.

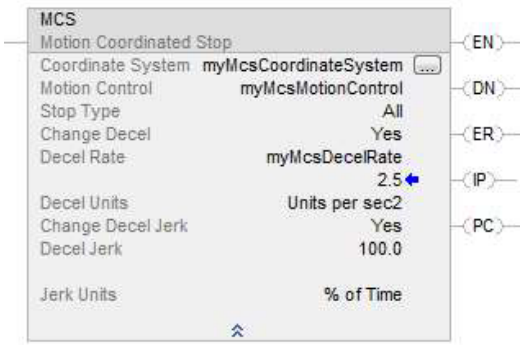
MCS on CS3	All	The MCLM instruction on CS2 will continue.
		The MAM on Y will continue.
		The MAM on S will continue.
		The MAM on Z will continue.
		T1 is canceled.
		Axes ABC will stop due to canceling the transform.
MCS on CS1	Coordinated Move	The MCLM instruction on CS2 will continue.
		The MAM on Y will continue.
		The MAM on S will continue.
		The MAM on Z will continue.
		T1 stays active.
		Axes ABC will follow the respective CS2 axes.
MCS on CS2	Coordinated Move	The MCLM instruction on CS2 will stop.
		The MAM on Y will continue.
		The MAM on S will continue.
		The MAM on Z will continue.
		T1 stays active.
		Axes ABC will follow the respective CS2 axes.
MCS on CS3	Coordinated Move	The MCLM instruction on CS3 will stop.
		The MAM on Y will continue.
		The MAM on S will continue.
		The MAM on Z will continue.
		T1 stays active.
		Axes ABC will follow the respective CS2 axes.
MAS on Y	All	The MCLM instruction on CS2 will stop.
		The MAM on Y will stop.
		The MAM on S will continue.
		The MAM on Z will continue.
		T1 is canceled.
		Axes ABC will stop due to canceling the transform.
MAS on Y	Move	The MCLM instruction on CS2 will continue.

		The MAM on Y will stop.
		The MAM on S will continue.
		The MAM on Z will continue.
		T1 stays active.
		Axes ABC will follow the respective CS2 axes.
MAS on Z	All	The MCLM instruction on CS2 will continue.
		The MAM on Y will continue.
		The MAM on S will continue.
		The MAM on Z will stop.
		T1 stays active.
		Axes ABC will follow the respective CS2 axes.
MAS on Z	Move	The MCLM instruction on CS2 will continue.
		The MAM on Y will continue.
		The MAM on S will continue.
		The MAM on Z will stop.
		T1 stays active.
		Axes ABC will follow the respective CS2 axes.
MCS on CS1	Coordinated Transform	The MCLM instruction on CS2 will continue
		The MAM on Y will continue.
		The MAM on S will continue.
		The MAM on Z will continue.
		T1 stays active.
		Axes ABC will follow the respective CS2 axes.
MCS on CS2	Coordinated Transform	T1 is canceled.
		The MCLM instruction on CS2 will continue.
		The MAM on Y will continue.
		The MAM on S will continue.
		The MAM on Z will continue.
		Axes ABC will stop due to canceling the transform.
MCS on CS3	Coordinated Transform	T1 is canceled.
		The MCLM instruction on CS2 will continue.

		The MAM on Y will continue.
		The MAM on S will continue.
		The MAM on Z will continue.
		Axes ABC will stop due to canceling the transform.

Example

Ladder Diagram



Structured Text

```
MCS(myMcsCoordinateSystem,myMcsMotionControl,All,Yes,myMcsDecelRate,Unitspersec2,Yes,100.0,%ofTime);
```

See also

Motion Error Codes (.ERR)

Multi-Axis Coordinated Motion Instructions

Common Attributes

Data Conversions

Structured Text Syntax