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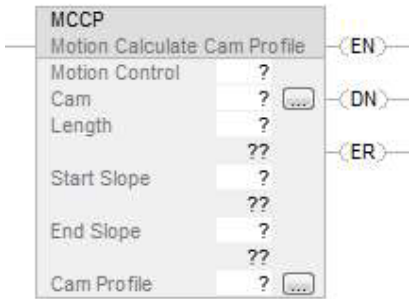
Motion Calculate Cam Profile (MCCP)

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 Calculate Cam Profile (MCCP) instruction calculates a cam profile based on an array of cam points. An array of cam points may be established programmatically or by use of the Cam Profile Editor. Each cam point in the cam array consists of a slave position value, a master position (position cam) or time (time cam) value, and an interpolation type (linear or cubic). The resulting cam profile may be used by a Motion Axis Position Cam (MAPC) instruction or Motion Axis Time Cam (MATC) instruction to govern the motion of a slave axis according to master position or time.

Available Languages

Ladder Diagram



Function Block

This instruction is not available in function block.

Structured Text

```
MCCP(MotionControl,Cam,Length,StartSlope,EndSlope,CamProfile);
```

Operands

Ladder Diagram

Operand	Type	Format	Description
Motion Control	MOTION_INSTRUCTION	Tag	Structure used to access block status parameters.
Cam	CAM	Array	Tag name of the cam array used to compute the cam profile. The numerical array index indicates the starting cam element in the array used in the cam profile calculation. Ellipsis launches Cam Profile Editor.
Length	UINT	Immediate or Tag	Determines the number of cam elements in the array used in the cam profile calculation.
Start Slope	REAL	Immediate or Tag	This is the boundary condition for the initial slope of the profile. It is valid only for a cubic first segment and is used to specify a slope through the first point.

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End Slope	REAL	Immediate or Tag	This is the boundary condition for the ending slope of the profile. It is valid only for a cubic last segment and is used to specify a slope through the last point.
Cam Profile	CAM_PROFILE	Array	Tag name of the calculated cam profile array used as input to MAPC and MATC instructions. Only the zero array element ([0]) is allowed for the Cam Profile array. Ellipsis launches Cam Profile Editor.

Structured Text

Operand	Type	Format	Description
Source	SINT	tag	Initial element to copy Important: the Source and Destination operands should be the same data type, or unexpected results may occur
	INT		
	DINT		
	REAL		
	STRING		
	structure		
Destination	SINT	tag	Initial element to be overwritten by the Source Important: the Source and Destination operands should be the same data type, or unexpected results may occur
	INT		
	DINT		
	REAL		
	STRING		
	LINT structure		
Length	DINT	immediate tag	Number of Destination elements to copy

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

The operands are the same as those for the relay ladder MCCP instruction. For the array operands, you do not have to include the array index. If you do not include the index, the instruction starts with the first element in the array ([0]).

MOTION_INSTRUCTION Structure

Mnemonic	Description
.EN (Enable) Bit 31	The enable bit is set when the rung transitions from false-to-true and stays set until the done bit is set and the rung goes false.
.DN (Done) Bit 29	The done bit is set when the calculate cam instruction has been successfully executed and the Cam Profile array calculated.

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[Motion Axis Gear \(MAG\)](#)

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

[Motion Axis Home \(MAH\)](#)

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

[Motion Axis Jog \(MAJ\)](#)

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.ER (Error) Bit 28	The error bit indicates when the instruction detects an error, such as if the cam array is of an illegal length.

Description

The MCCP instruction computes a cam profile based on a given set of points in a specified cam array. The resultant cam profiles generated by this instruction may be used by subsequent Motion Axis Position Cam (MAPC) or Motion Axis Time Cam (MATC) camming instructions to provide complex motion of a slave axis with respect to either a master axis position or with respect to time.

Since cam profiles can be directly calculated by the Logix Designer Cam Profile Editor, the main purpose of the MCCP instruction is to provide a method for calculating cam profiles in real-time based on programmatic changes to the corresponding cam arrays.

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Specifying a Cam Array

In order to execute an MCCP instruction, a Cam array tag must be created using the RSLogix Tag Editor or the Cam Profile Editor. The figure below illustrates how the Cam array tags are established and used as input to the MCCP instruction.

The Cam array elements consist of slave (yp) and master (xp) point pairs as well as an interpolation type. Since there is no association with a specific axis position or time, the x and y point values are unitless. The interpolation type may be specified for each point as either linear or cubic.

Specifying the Cam Profile Tag

To execute a MAPC instruction, a Cam Profile array tag must also be created. Cam Profile array tags may be created by the Logix Designer tag editor or the MAPC/MATC instructions using the built-in Cam Profile Editor.

The data within the Cam Profile array can be modified at compile time using the Cam Profile Editor, or at run-time with the MCCP instruction. In the case of run-time changes, a Cam array must be created in order to use the MCCP instruction.

The status parameter is used to indicate that the Cam Profile array element has been calculated. If execution of a camming instruction is attempted using any uncalculated elements in a cam profile, the MAPC or MATC instructions error. The type parameter determines the type of interpolation applied between this cam array element and the next cam element.

Cam Profile Array Status Member

The Status member of the first element in the cam profile array is special and used for data integrity checks. For this reason, the MCCP must always specify the cam profile with the starting index set to 0. This first cam profile element Status member can have the following values.

Status Variables	Description
0	Cam profile element has not been calculated.
1	Cam profile element is being calculated.

- ▷ [Sequential Function Chart \(SFC\) Instructions](#)
- ▷ [Statistical Instructions](#)
- ▷ [Safety Instructions](#)
- ▷ [Studio 5000 Logix Designer Glossary](#)

2	Cam profile element has been calculated.
n	Cam profile element has been calculated and is currently being used by (n-2) or MATC instructions.

Linear and Cubic Spline Interpolation

The resultant calculated cam profiles are fully interpolated. This means that if the current master position or time does not correspond exactly with a point in the cam array used to generate the cam profile, the slave axis position is determined by linear or cubic interpolation between adjacent points. In this way, the smoothest possible slave motion is provided. The MCCP instruction accomplishes this by calculating coefficients to a polynomial equation that determines slave position as a function of master position or time.

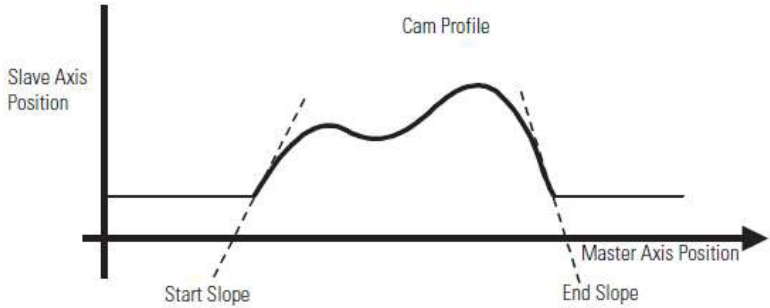
Calculating the Cam Profile

Before calculating a cam profile on a specified axis, the MCCP instructions first checks if the cam profile array has been calculated by checking the value of the first cam profile element's Status member. If the Status value is either 0 or 2, the MCCP proceeds with the calculation of the cam profile. When the cam profile array has been completely calculated, the MCCP instruction sets the first cam profile element's Status value to being calculated, or 1, and then sets the Status value of all other cam profile elements to being calculated. As the calculation proceeds, individual cam profile members' Status values are set to calculated, or 2. When all elements in the cam profile array have been calculated, the first cam profile element's Status value is also set to calculated.

However, if an MCCP instruction is executed with an initial cam profile Status value of 1, then the cam profile is currently being calculated by another MCCP instruction, and the MCCP instruction errors. If the Status value is >2, then the cam profile is being actively used by an MAPC or MATC instruction process, and the MCCP instruction errs.

Start Slope and End Slope

To facilitate a smooth entry into and exit from a cubic cam profile, slope control is provided. The Start Slope and End Slope parameters determine the initial rate of change of the slave relative to the master. These values are used in the cubic spline calculations performed on the cam array. The diagram below the master slave slope relationship.



The default values for Start Slope and End Slope are 0 to facilitate a smooth start and end to the cam profile from rest. However, if the axis is already camming, an appropriate non-zero Start Slope can be specified to match the End Slope of the currently executing cam, to seamlessly blend the two cam profiles together.

The Start Slope and End Slope values are not applicable when starting or ending the cam profile with linear interpolation.

Important: The MCCP instruction execution completes in a single scan. This instructions should therefore be placed in a separate task to avoid impacting user program scan time.

This is a transitional instruction:

- In relay ladder, toggle 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.

Extended Error Codes

Extended Error Codes provide additional instruction specific information for the Error Codes that are not specific enough to help pinpoint the problem. When the MCCP instruction receives an Illegal Cam Length (26) error message to let it know that the length input parameter does not correspond to what the instruction expects, the corresponding Extended Error code provides the number of cams in the Cam Tag provided to the instruction. When the MCCP instruction receives an Illegal Cam Profile Length (27) error message to let it know that the length input parameter does not correspond to what the instruction expects, the corresponding Extended Error code provides the number of cam points the instruction is attempting to generate. See Error Codes (ERR) for Motion Instructions.

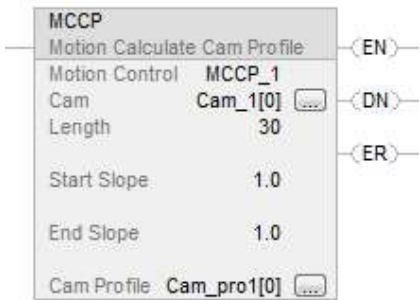
MCCP Changes to Status Bits

No

Examples

Example 1

Ladder Diagram

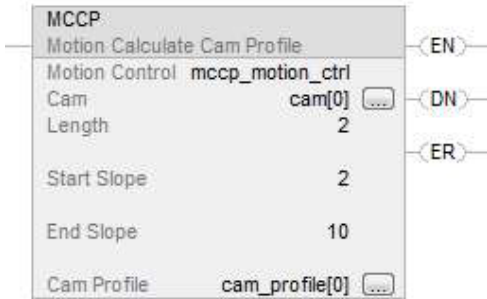


Structured Text

MCCP(MCCP_1,Cam_1[0],30,1.0,1.0,Cam_pro1[0]);

Example 2

Ladder Diagram



Structured Text

MCCP(mccp_motion_ctrl,cam[0],2,2,10,cam_profile[0]);

See also

[Motion Move Instructions](#)

[Structured Text Syntax](#)

[Common Attributes](#)

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