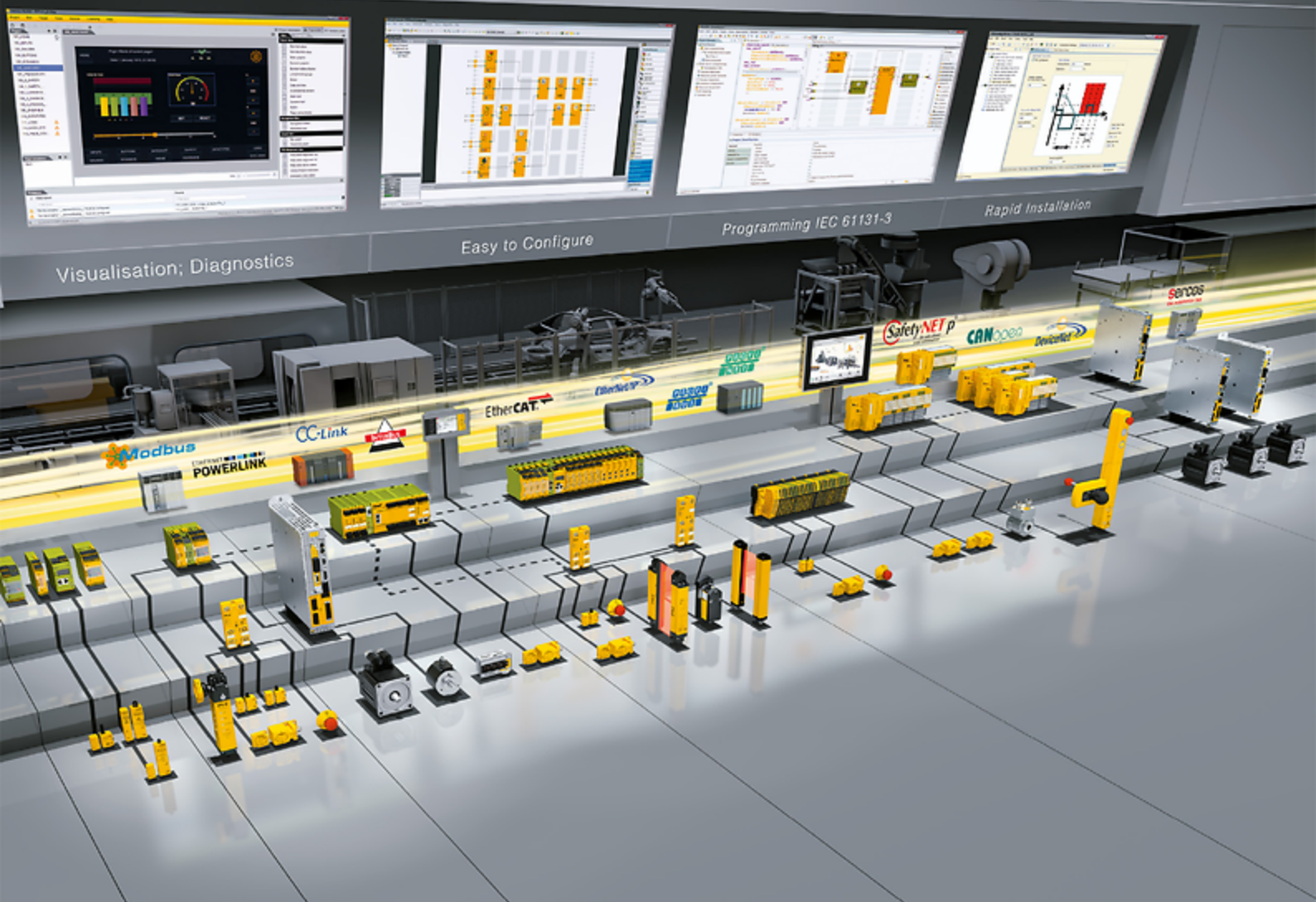


Intern



Motion commands (V 6.5-H or higher)

Pilz

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1 Motion commands of the axis

A motion command is selected using the corresponding application-specific parameter and started with the rising edge by Execute. For most commands, the corresponding set values are taken over once at the start of the command. To change a set value, the command must be triggered again with a rising edge by Execute. However, some commands have set values that are continuously taken over as long as the command is active.

The motion commands that are based on the PLCopen standard (function blocks for motion control) have been supplemented by manufacturer-specific commands from Pilz.

No.	Command	Description
0	MC_DoNothing [ 5]	Manufacturer-specific command for presets
1	MC_MoveAbsolute [ 6]	Axis moves to an absolute set position
2	MC_MoveRelative [ 14]	Axis moves a relative distance; set position is relative to the actual position at the start of the command
3	MC_MoveAdditive [ 21]	Axis moves a relative distance; set position is relative to the set position of the previous motion command
4	MC_MoveVelocity [ 29]	Axis moves without end with set velocity (with position control)
5	MC_Stop [ 36]	Axis is brought to a standstill; next command can be executed after standstill
6	MC_Home [ 42]	Axis is referenced
7	MC_CyclicSpeed [ 49]	Manufacturer-specific command; axis moves without end with set velocity (controller-based motion)
8	MC_MoveSpeed [ 53]	Manufacturer-specific command; axis moves without end with set velocity (velocity control without position control)
9	MC_TorqueControl [ 60]	Axis moves without end with set torque/force
10	MC_CyclicPosition [ 65]	Manufacturer-specific command; axis moves without end with set position (controller-based motion)
11	MC_Halt [ 69]	Axis is stopped; next command can be executed before standstill

Tab. 1: Motion commands of the axis

1.1 MC_DoNothing

The command does not generate any status information and does not switch to the corresponding motion ID.

Control type

Unchanged (corresponds to the control type of the previous command or position control default value).

Applications

The command is used in all applications, e.g. as a default value:

- ▶ CiA 402 in operating mode 0: No mode
- ▶ Drive Based-type applications in all operating modes
- ▶ PROFIdrive in application class 3 with telegram 111 in Program mode (motion block)

Basic settings

Name	Description	Source:				Motion core
		CiA 402	Drive Based ¹	PROFIdrive	Motion control panel ²	
Command	0: MC_DoNothing	A541 = 0	J11/ J40/ D01	M550, bit 15 = 0 + J11	K399/ K402	I401
Motion ID	Use as active motion ID	—	—	—	—	I400

Tab. 2: MC_DoNothing: Basic settings

¹ Specification in the following order: motion block operating mode/command operating mode/velocity, torque/force operating mode

² Specification in the following order: Motion control panel for CiA 402/Motion control panel for Drive Based-type applications and for PROFIdrive

1.2 MC_MoveAbsolute

The axis moves to an absolute set position.

Control type


Position control (velocity feedforward control for the position controller using I25).

Applications

The command is used in the following applications:

- ▶ CiA 402 in operating mode 1: Profile position mode
- ▶ Drive Based-type applications in the motion block and command operating modes
- ▶ PROFIdrive in application class 3 with telegram 111 in Program mode (motion block) and MDI mode (command)

Prerequisites

The axis is referenced (I86 = 1: Active); see motion command [MC_Home](#) [ 42].

Basic settings

Name	Description	Source:				Motion core
		CiA 402	Drive Based ³	PROFIdrive ⁴	Motion control panel ⁵	
Command	1: MC_MoveAbsolute	A541 = 1 + A515, bit 6 = 0	J11/ J40	M550, bit 15 = 0 + J11/ M550, bit 15 = 1 + bit 8 = 1	K399/ K402	I401
Motion ID	Use as active motion ID (I82) in the motion block and command operating modes	—	J300/ J41	J300/ —	—	I400

Tab. 3: MC_MoveAbsolute: Basic settings

³ Specification in the following order: motion block operating mode/command operating mode

⁴ Specification in the following order: Program mode (motion block operating mode)/MDI mode (command operating mode)

⁵ Specification in the following order: Motion control panel for CiA 402/Motion control panel for Drive Based-type applications and for PROFIdrive

1.2.1 Control commands

The 1: MC_MoveAbsolute command includes the control commands described below.

Name	Description	Source:				Motion core
		CiA 402	Drive Based ⁶	PROFIdrive ⁷	Motion control panel	
Execute	Start of motion with rising edge	A515, bit 4	I100	I100	Start button	I402
Position A	Absolute set position	A567	J13/ J42	J13/ M530	K403	I403
Velocity	Specification for the motion profile	A574	J14/ J43 + J49	J14/ M531	K404	I404
Acceleration	Specification for the motion profile	A576	J15/ J44	J15/ M532	K405	I405
Deceleration	Specification for the motion profile	A577	J16/ J45	J16/ M533	K406	I406
Jerk	Specification for the motion profile	A590	J17/ J46	J17/ I16 ⁸	K407	I407
Command Mode	Mode in which the motion block is executed if it is used as a subsequent motion block (cancellation of the ongoing motion block or start at the end of the ongoing motion block)	—	J21/ —	J21/ —	—	I409
Engage brake at the end	Brake engaging at the end of the command in motion block and command operating modes	—	J27/ J53	J27/ — ⁹	—	I410
Movement direction	Direction of motion for absolute positioning if travel range is infinite (I00 = 1: Endless)	A621, bit 6–7	C243 = 0 + C241/ C241	C243 = 0 + C241/ M550, bit 9–10	—	I411
End velocity	Final velocity at which the set position is to be reached in motion block operating mode	—	J18/ —	J18/ —	—	I429

Tab. 4: MC_MoveAbsolute: Control commands

⁶ If parameter not valid for all operating modes, specification in the following order: motion block operating mode/command operating mode

⁷ If parameter not valid for all operating modes, specification in the following order: Program mode (motion block operating mode)/MDI mode (command operating mode)

⁸ Jerk specification is not defined using the profile; therefore, the maximum permitted jerk applies to MDI mode (command)

⁹ Brake control is not defined by the profile; therefore, the brake is controlled on the drive controller side in MDI mode (command) (prerequisite: F00 = 1: Active)

1.2.2 Denial

Possible causes of a command denial include:

- ▶ Set position is not within the software limit switches (I50, I51); only if travel range is limited (I00 = 0: Limited)
- ▶ Travel direction is blocked by permitted direction (I04); only if travel range is infinite (I00 = 1: Endless)
- ▶ Set position is outside of the revolution length (I01); only if travel range is infinite (I00 = 1: Endless)
- ▶ Signal of positive or negative hardware limit switches is active in travel direction (source: I101, I102, signal: I441, I442)
- ▶ Set velocity, acceleration, deceleration or jerk is equal to zero
- ▶ Maximum acceleration and deceleration (I11) or maximum jerk (I16) is equal to zero

1.2.3 Limits

The generated motion profile is subject to the following limitations:

- ▶ Velocity is limited in amount to the maximum velocity (I10)
- ▶ Acceleration is limited in amount to the maximum acceleration (I11)
- ▶ Deceleration is limited in amount to maximum acceleration (I11)
- ▶ Jerk is limited to the maximum jerk (I16)

The following applies to the state of the limits:

- ▶ In case of limited velocity, the velocity limit is active (I190 = 1: Active)
- ▶ If the velocity must be limited to the maximum velocity (I10) due to Overrides > 100%, the cyclical velocity limit is active (I193 = 1: Active)
- ▶ In case of limited acceleration or deceleration or in case of limited jerk, the acceleration/jerk limit is active (I191 = 1: Active)

1.2.4 Start

Start from standstill if travel range is infinite

Prerequisite: I00 = 1: Endless.

The brake is released (prerequisite: F00 = 1: Active).

The state of the motion core (I89) switches to 3: Discrete motion.

The travel direction depends on the direction of motion (directionally optimized, direction retained, positive or negative). Set positions may only be specified within the revolution length (I01) and in the permitted direction (I04).

Behavior when positioning from a standstill:

- ▶ 0: Direction optimized/3: Keep direction
Target is approached following the shortest path
- ▶ 1: Only positive direction
Target is approached following a positive direction if it is outside of the position window (I22); if the target is within the position window, it is approached following the shortest path
- ▶ 2: Only negative direction
Target is approached following a negative direction if it is outside of the position window (I22); if the target is within the position window, it is approached following the shortest path

Start from standstill if travel range is limited

Prerequisite: I00 = 0: Limited.

The brake is released (prerequisite: F00 = 1: Active).

The state of the motion core (I89) switches to 3: Discrete motion.

The travel direction is dependent only on the set position. If the travel range is limited, set positions may only be specified within the positive or negative software limit switches (I50, I51).

Start from motion if travel range is infinite

Prerequisite: I00 = 1: Endless.

The state of the motion core (I89) switches to 3: Discrete motion.

The travel direction depends on the direction of motion (directionally optimized, direction retained, positive or negative). Set positions may only be specified within the revolution length (I01) and in the permitted direction (I04).

Behavior when positioning from an ongoing movement:

- ▶ 0: Direction optimized/3: Keep direction
Target is approached following the currently active direction
- ▶ 1: Only positive direction
Target is approached following a positive direction; if necessary, the process is braked and the direction changed
- ▶ 2: Only negative direction
Target is approached following a negative direction; if necessary, the process is braked and the direction changed

The motion state is continued with limited jerk if all motion variables were defined in advance by the profile generator.



Information

Jerk-free continuation after a preceding MC_TorqueControl command is not guaranteed.

If the set position is in the opposite direction of movement or if braking at the set position is not possible without exceeding deceleration or jerk, an intermediate stop is added.

In case of an intermediate stop, the deceleration is reduced to zero. Afterwards, the acceleration is built up again with limited jerk.

When starting from motion, multiple revolutions can be used to brake at the desired set position.

If the command is denied, motion is stopped by a quick stop.

Start from motion if travel range is limited

Prerequisite: I00 = 0: Limited.

The state of the motion core (I89) switches to 3: Discrete motion.

The travel direction is dependent only on the set position. If the travel range is limited, set positions may only be specified within the positive or negative software limit switches (I50, I51).

The motion state is continued with limited jerk if all motion variables were defined in advance by the profile generator.



Information

Jerk-free continuation after a preceding MC_TorqueControl command is not guaranteed.

If the set position is in the opposite direction of movement or if braking at the set position is not possible without exceeding deceleration or jerk, an intermediate stop is added.

In case of an intermediate stop, the deceleration is reduced to zero. Afterwards, the acceleration is built up again with limited jerk.

When starting from motion, multiple revolutions can be used to brake at the desired set position.

If the command is denied, motion is stopped by a quick stop.

1.2.5 Motion

The axis moves to an absolute set position.

Examples

1. MC_MoveAbsolute to position 1000; then MC_MoveAbsolute with changed velocity to position 2000
2. MC_MoveAbsolute to position 1000; during travel (position 1000 is not yet reached), MC_MoveAbsolute again with changed velocity to position 2000

The end positions of the drive are the same in both cases.

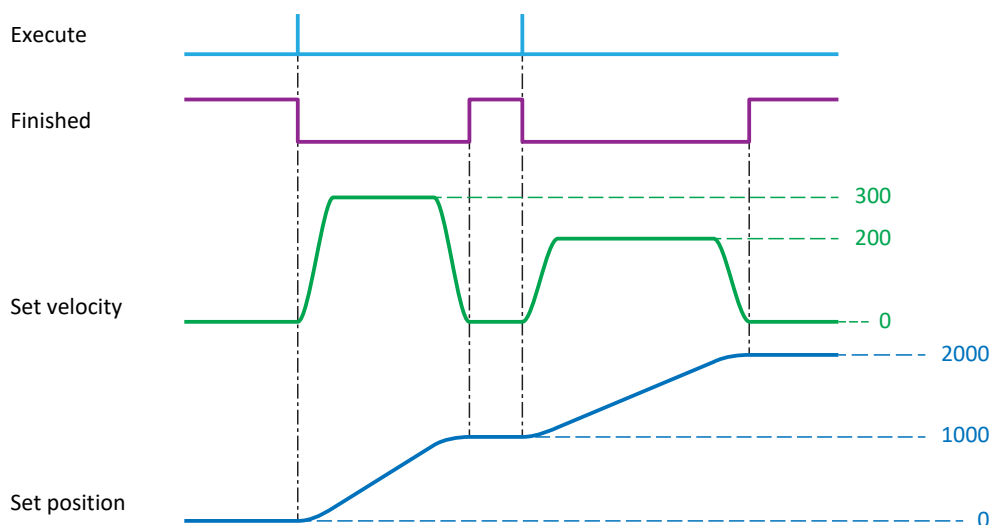


Fig. 1: MC_MoveAbsolute: Motion 1

Intern

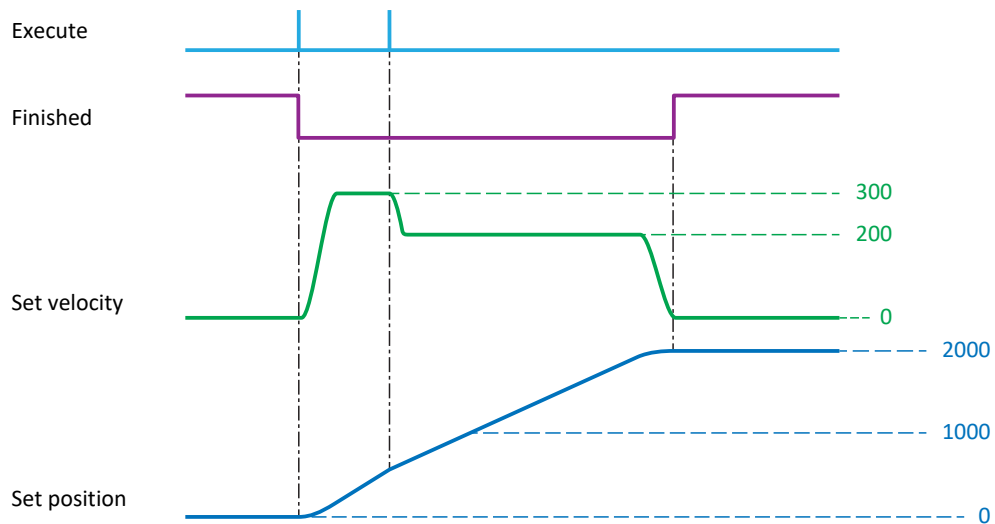


Fig. 2: MC_MoveAbsolute: Motion 2

Conditions

The following conditions apply to the motion:

- ▶ Velocity override is taken into account (I230, source CiA 402: A340, Drive Based: G467/J56, PROFIdrive: M554, control panel: K408)
- ▶ Maximum velocity (I10) cannot be exceeded
- ▶ If the velocity override (I230) is equal to zero, the axis remains stationary; if the velocity override is not equal to zero, it continues to move again
- ▶ If an MC_Stop is sent while the velocity override is equal to zero, the axis remains stationary until a new command starts
- ▶ Jog is taken into account
- ▶ Halt is taken into account

1.2.6 Target

The axis reaches the absolute set position.

The axis stops if the final velocity is equal to zero. If the final velocity is not zero, the set position is passed through with the final velocity.

The following applies to brake engaging at the end:

- ▶ If brake engaging at the end is active, the brake is engaged after the wait time expires (I42)
- ▶ Within the wait time, the axis can be started again without brake engaging by a command

1.2.7 Status information

The 1: MC_MoveAbsolute command includes the status information described below.

Name	Description	Motion core
Speed reached	1: Active: Motion profile of the motion core has reached the set velocity; motion profile is fully calculated (I85) and the actual velocity is within the velocity window around the set velocity (actual velocity: I88, velocity window: C40)	I183
	1: Active → 0: Inactive: Actual velocity has left the window around the set velocity or if the command is canceled by the start of a new command	
	0: Inactive: State even if set velocity is not reached due to parameterization or a travel distance that is too short	
Motion profile done	1: Active: Motion profile is fully calculated and calculated set position has reached the specified set position (I96 = I403)	I85
Actual position in window	1: Active: Actual position is within the position window around the set position at the end of positioning (position window: I22; time: I87)	I180
	1: Active → 0: Inactive: New motion command started or actual position has left the position window around the set position	
Error	1: Active: Motion core has denied or canceled the command	I91
	0: Inactive: State at command start for at least one cycle time (A150), even if the command has been denied (see Denial [8])	
PLCOpen ErrorStop cause	Cause for the cancellation or denial of the command by the motion core (I91 = 1: Active; I89 = 7: Error stop)	I90
	0: Error free: State at command start for at least one cycle time (A150), even if the command has been denied	
Done	1: Active: Motion core has successfully completed the motion command to be executed: Set position of the control and actual position have reached the specified set position and the actual position was within the position window around the set position for the specified time (I85 = 1: Active, I180 = 1: Active for time I87); State for buffered motion blocks only at the end of the subsequent motion block; state before engaging brakes	I92
	0: Inactive: State at command start for at least one cycle time (A150), even if the condition for successfully ending has already been satisfied at command start	
State Motion Command	State of the running motion block and buffered subsequent motion block	I83
PLCOpen state	State of the motion core	I89

Tab. 5: MC_MoveAbsolute: Status information

Intern

Examples

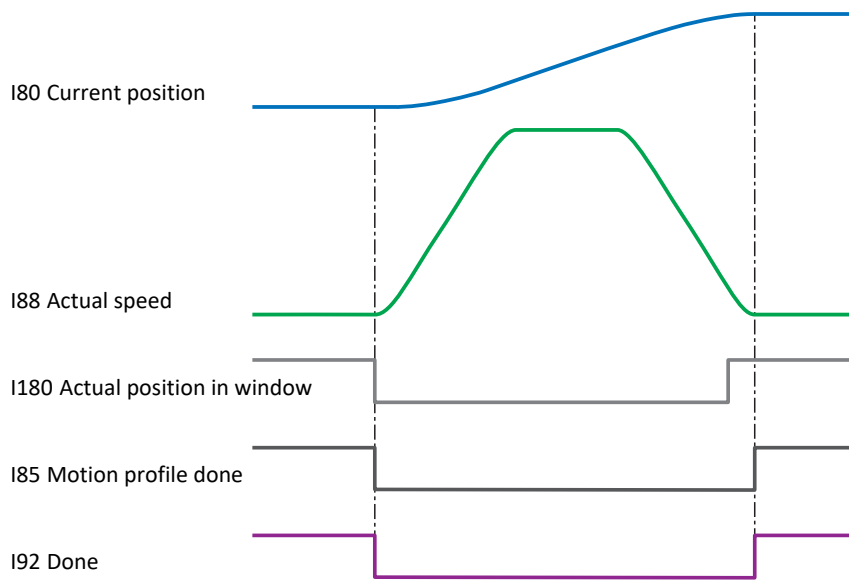


Fig. 3: MC_MoveAbsolute, MC_MoveRelative and MC_MoveAdditive status information: Example 1

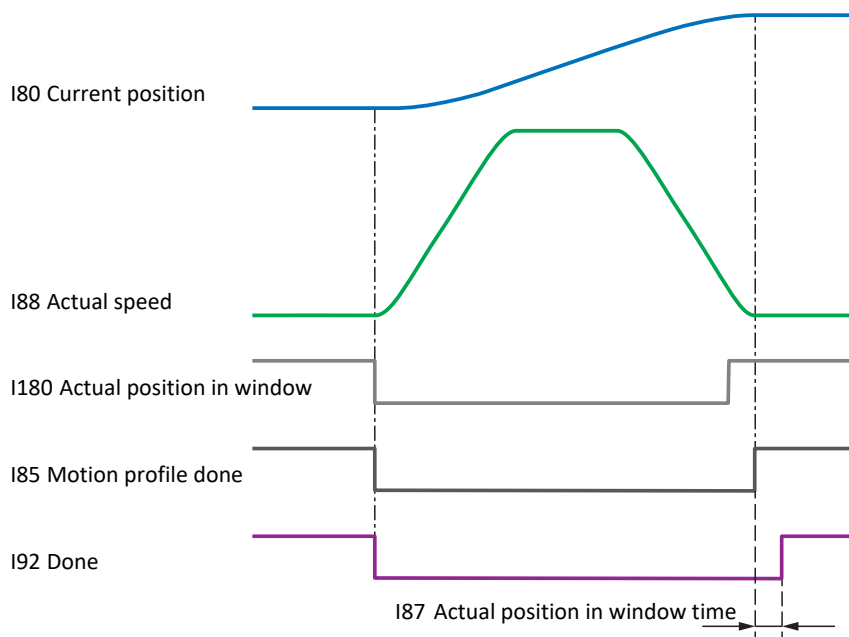


Fig. 4: MC_MoveAbsolute, MC_MoveRelative and MC_MoveAdditive status information: Example 2

The Actual position in window (I180) state is reported first. The axis is still moving at this time.

In the first example, the Done (I92) and Motion profile done (I85) states are reported at the same time.

In the second example, the Motion profile done state is reported first, and the Done state is only reported after the set time has expired (I87).

1.3 MC_MoveRelative

The axis moves a relative distance. The set position is relative to the actual position at the start of the command.

Control type

Position control (velocity feedforward control for the position controller using I25).

Applications

The command is used in the following applications:

- ▶ CiA 402 in operating mode 1: Profile position mode
- ▶ Drive Based-type applications in the motion block and command operating modes
- ▶ PROFIdrive in application class 3 with telegram 111 in Program mode (motion block) and MDI mode (command)

Prerequisites

The command can be executed even if the axis is not referenced. When using software limit switches, the axis must be referenced (I86 = 1: Active), as otherwise the command is denied. For information for referencing, see motion command [MC_Home](#) [📖 42].

Basic settings

Name	Description	Source:				Motion core
		CiA 402	Drive Based ¹⁰	PROFIdrive ¹¹	Motion control panel ¹²	
Command	2: MC_MoveRelative	A541 = 1 + A515, bit 6 = 1 + A621, bit 0 = 0 + bit 1 = 1	J11/ J40	M550, bit 15 = 0 + J11/ M550, bit 15 = 1 + bit 8 = 0	K399/ K402	I401
Motion ID	Use as active motion ID (I82) in the motion block and command operating modes	—	J300/ J41	J300/ —	—	I400

Tab. 6: MC_MoveRelative: Basic settings

¹⁰ Specification in the following order: motion block operating mode/command operating mode

¹¹ Specification in the following order: Program mode (motion block operating mode)/MDI mode (command operating mode)

¹² Specification in the following order: Motion control panel for CiA 402/Motion control panel for Drive Based-type applications and for PROFIdrive

1.3.1 Control commands

The 2: MC_MoveRelative command includes the control commands described below.

Name	Description	Source:				Motion core
		CiA 402	Drive Based ¹³	PROFIdrive ¹⁴	Motion control panel	
Execute	Start of motion with rising edge	A515, bit 4	I100	I100	Start button	I402
Position A	Relative set position (distance relative to actual position at start of command)	A567	J13/ J42	J13/ M530	K403	I403
Velocity	Specification for the motion profile	A574	J14/ J43 + J49	J14/ M531	K404	I404
Acceleration	Specification for the motion profile	A576	J15/ J44	J15/ M532	K405	I405
Deceleration	Specification for the motion profile	A577	J16/ J45	J16/ M533	K406	I406
Jerk	Specification for the motion profile	A590	J17/ J46	J17/ I16 ¹⁵	K407	I407
Command Mode	Mode in which the motion block is executed if it is used as a subsequent motion block (cancellation of the ongoing motion block or start at the end of the ongoing motion block)	—	J21/ —	J21/ —	—	I409
Engage brake at the end	Brake engaging at the end of the command in motion block and command operating modes	—	J27/ J53	J27/ — ¹⁶	—	I410
End velocity	Final velocity at which the set position is to be reached in motion block operating mode	—	J18/ —	J18/ —	—	I429

Tab. 7: MC_MoveRelative: Control commands

¹³ If parameter not valid for all operating modes, specification in the following order: motion block operating mode/command operating mode

¹⁴ If parameter not valid for all operating modes, specification in the following order: Program mode (motion block operating mode)/MDI mode (command operating mode)

¹⁵ Jerk specification is not defined using the profile; therefore, the maximum permitted jerk applies to MDI mode (command)

¹⁶ Brake control is not defined by the profile; therefore, the brake is controlled on the drive controller side in MDI mode (command) (prerequisite: F00 = 1: Active)

1.3.2 Denial

Possible causes of a command denial include:

- ▶ Set position is not within the software limit switches (I50, I51); only if travel range is limited (I00 = 0: Limited)
- ▶ Travel direction is blocked by permitted direction (I04); only if travel range is infinite (I00 = 1: Endless)
- ▶ Signal of positive or negative hardware limit switches is active in travel direction (source: I101, I102, signal: I441, I442)
- ▶ Set velocity, acceleration, deceleration or jerk is equal to zero
- ▶ Maximum acceleration and deceleration (I11) or maximum jerk (I16) is equal to zero

1.3.3 Limits

The generated motion profile is subject to the following limitations:

- ▶ Velocity is limited in amount to the maximum velocity (I10)
- ▶ Acceleration is limited in amount to the maximum acceleration (I11)
- ▶ Deceleration is limited in amount to maximum acceleration (I11)
- ▶ Jerk is limited to the maximum jerk (I16)

The following applies to the state of the limits:

- ▶ In case of limited velocity, the velocity limit is active (I190 = 1: Active)
- ▶ If the velocity must be limited to the maximum velocity (I10) due to Overrides > 100%, the cyclical velocity limit is active (I193 = 1: Active)
- ▶ In case of limited acceleration or deceleration or in case of limited jerk, the acceleration/jerk limit is active (I191 = 1: Active)

1.3.4 Start

Start from standstill

The brake is released (prerequisite: F00 = 1: Active).

The state of the motion core (I89) switches to 3: Discrete motion.

The travel direction is dependent only on the set position (positive or negative sign). If the travel range is limited, set positions may only be specified within the positive or negative software limit switches (I50, I51).

Start from motion

The state of the motion core (I89) switches to 3: Discrete motion.

The travel direction is dependent only on the set position (positive or negative sign). If the travel range is limited, set positions may only be specified within the positive or negative software limit switches (I50, I51).

The motion state is continued with limited jerk if all motion variables were defined in advance by the profile generator.



Information

Jerk-free continuation after a preceding MC_TorqueControl command is not guaranteed.

If the set position is in the opposite direction of movement or if braking at the set position is not possible without exceeding deceleration or jerk, an intermediate stop is added.

In case of an intermediate stop, the deceleration is reduced to zero. Afterwards, the acceleration is built up again with limited jerk.

When starting from motion, multiple revolutions can be used to brake at the desired set position.

If the command is denied, motion is stopped by a quick stop.

1.3.5

Motion

The axis moves a relative distance. The set position is relative to the actual position at the start of the command.

Examples

1. MC_MoveRelative with distance 1000; then MC_MoveRelative with changed velocity and distance 1000
2. MC_MoveRelative with distance 1000; during travel at position 570, MC_MoveRelative again with changed velocity and distance 1000

The end positions of the drive are different in the two cases.

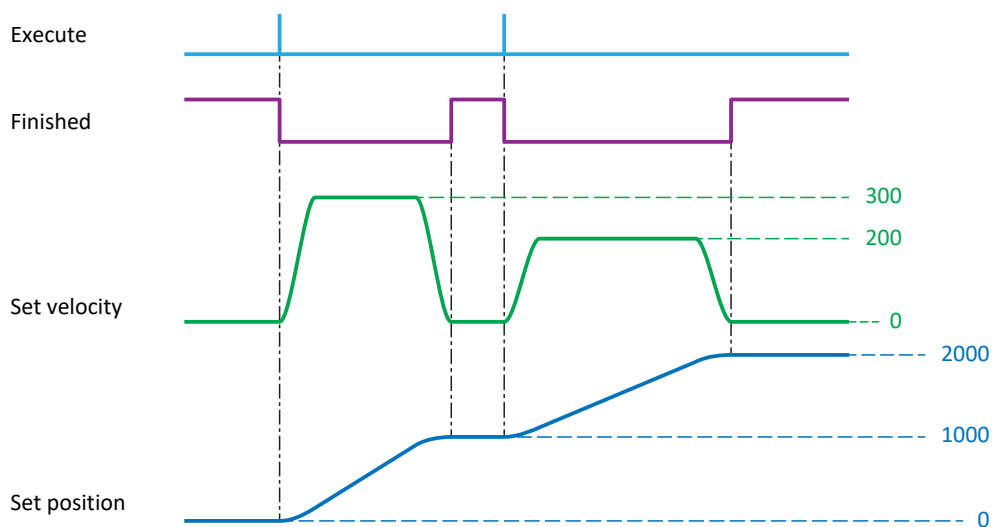


Fig. 5: MC_MoveRelative: Motion 1

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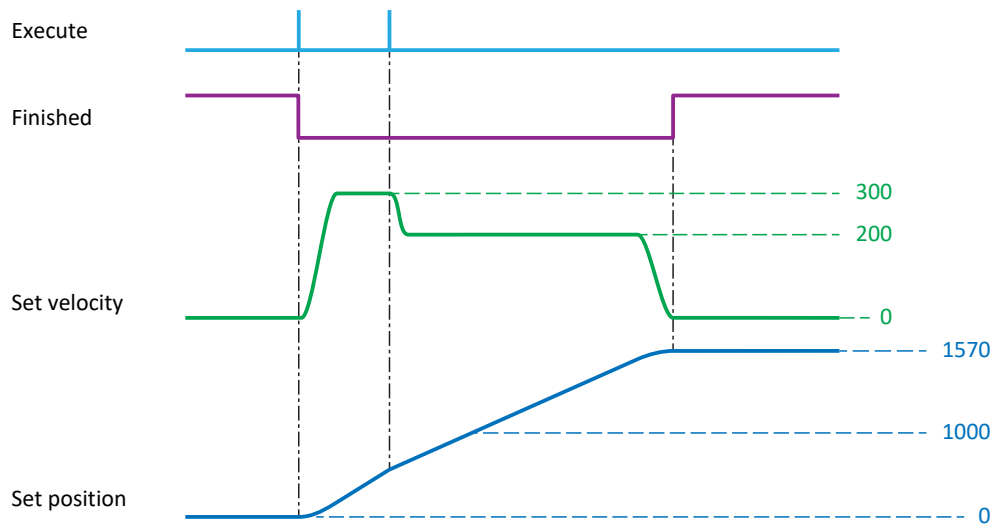


Fig. 6: MC_MoveRelative: Motion 2

Conditions

The following conditions apply to the motion:

- ▶ Velocity override is taken into account (I230, source CiA 402: A340, Drive Based: G467/J56, PROFIdrive: M554, control panel: K408)
- ▶ Maximum velocity (I10) cannot be exceeded
- ▶ If the velocity override (I230) is equal to zero, the axis remains stationary; if the velocity override is not equal to zero, it continues to move again
- ▶ If an MC_Stop is sent while the velocity override is equal to zero, the axis remains stationary until a new command starts
- ▶ Jog is taken into account
- ▶ Halt is taken into account

1.3.6 Target

The axis reaches the set position. The set position is relative to the actual position at the start of the command.

The axis stops if the final velocity is equal to zero. If the final velocity is not zero, the set position is passed through with the final velocity.

The following applies to brake engaging at the end:

- ▶ If brake engaging at the end is active, the brake is engaged after the wait time expires (I42)
- ▶ Within the wait time, the axis can be started again without brake engaging by a command

1.3.7 Status information

The 2: MC_MoveRelative command includes the status information described below.

Name	Description	Motion core
Speed reached	1: Active: Motion profile of the motion core has reached the set velocity; motion profile is fully calculated (I85) and the actual velocity is within the velocity window around the set velocity (actual velocity: I88, velocity window: C40)	I183
	1: Active → 0: Inactive: Actual velocity has left the window around the set velocity or if the command is canceled by the start of a new command	
	0: Inactive: State even if set velocity is not reached due to parameterization or a travel distance that is too short	
Motion profile done	1: Active: Calculated set position has reached the specified set position (I96 = I403 + I80 at the start of the command)	I85
Actual position in window	1: Active: Actual position is within the position window around the set position at the end of positioning (position window: I22; time: I87)	I180
	1: Active → 0: Inactive: New motion command started or actual position has left the position window around the set position	
Error	1: Active: Motion core has denied or canceled the command	I91
	0: Inactive: State at command start for at least one cycle time (A150), even if the command has been denied (see Denial [16])	
PLCOpen ErrorStop cause	Cause for the cancellation or denial of the command by the motion core (I91 = 1: Active; I89 = 7: Error stop)	I90
	0: Error free: State at command start for at least one cycle time (A150), even if the command has been denied	
Done	1: Active: Motion core has successfully completed the motion command to be executed: Set position of the control and actual position have reached the specified set position and the actual position was within the position window around the set position for the specified time (I85 = 1: Active, I180 = 1: Active for time I87); State for buffered motion blocks only at the end of the subsequent motion block; state before engaging brakes	I92
	0: Inactive: State at command start for at least one cycle time (A150), even if the condition for successfully ending has already been satisfied at command start	
State Motion Command	State of the running motion block and buffered subsequent motion block	I83
PLCOpen state	State of the motion core	I89

Tab. 8: MC_MoveRelative: Status information

Intern

Examples

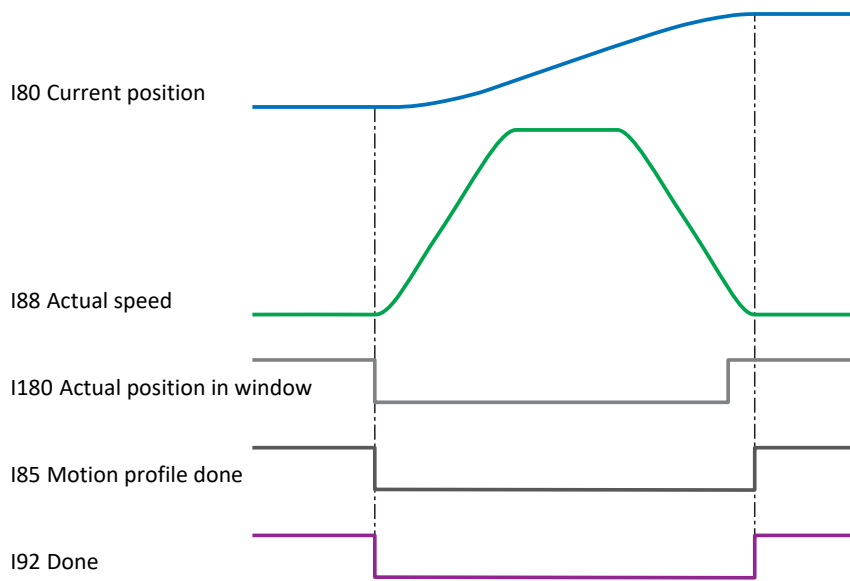


Fig. 7: MC_MoveAbsolute, MC_MoveRelative and MC_MoveAdditive status information: Example 1

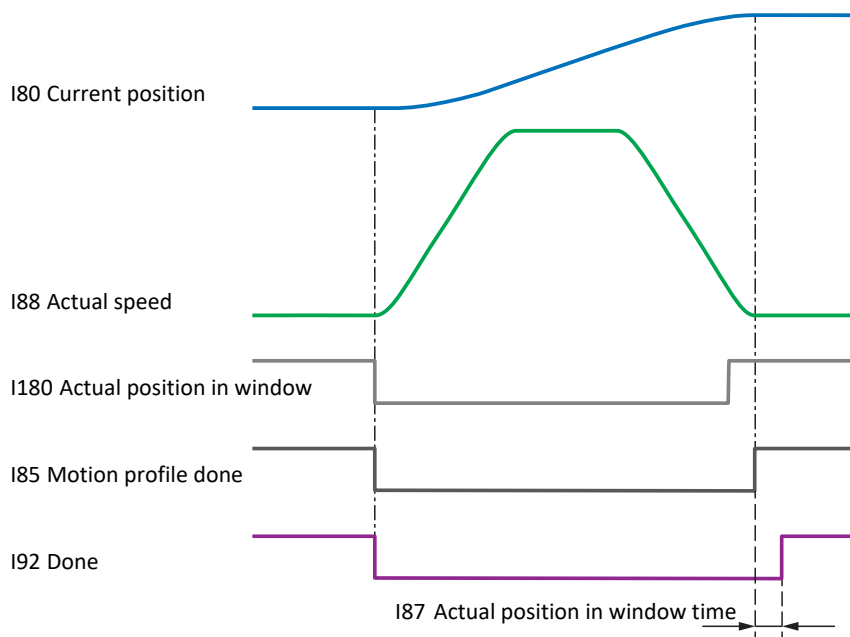


Fig. 8: MC_MoveAbsolute, MC_MoveRelative and MC_MoveAdditive status information: Example 2

The Actual position in window (I180) state is reported first. The axis is still moving at this time.

In the first example, the Done (I92) and Motion profile done (I85) states are reported at the same time.

In the second example, the Motion profile done state is reported first, and the Done state is only reported after the set time has expired (I87).

1.4 MC_MoveAdditive

The axis moves a relative distance. The set position is relative to the set position of the previous motion command.

Control type

Position control (velocity feedforward control for the position controller using I25).

Applications

The command is used in the following applications:

- ▶ CiA 402 in operating mode 1: Profile position mode
- ▶ Drive Based-type applications in the motion block and command operating modes
- ▶ PROFIdrive in application class 3 with telegram 111 in Program mode (motion block)

Prerequisites

The command can be executed even if the axis is not referenced. When using software limit switches, the axis must be referenced (I86 = 1: Active), as otherwise the command is denied. For information for referencing, see motion command [MC_Home](#) [📖 42].

Basic settings

Name	Description	Source:				Motion core
		CiA 402	Drive Based ¹⁷	PROFIdrive	Motion control panel ¹⁸	
Command	3: MC_MoveAdditive	A541 = 1 + A515, bit 6 = 1 + A621, bit 0 = 0 + bit 1 = 0	J11/ J40	M550, bit 15 = 0 + J11	K399/ K402	I401
Motion ID	Use as active motion ID (I82) in the motion block and command operating modes	—	J300/ J41	J300	—	I400

Tab. 9: MC_MoveAdditive: Basic settings

¹⁷ Specification in the following order: motion block operating mode/command operating mode

¹⁸ Specification in the following order: Motion control panel for CiA 402/Motion control panel for Drive Based-type applications and for PROFIdrive

1.4.1 Control commands

The 3: MC_MoveAdditive command includes the control commands described below.

Name	Description	Source:				Motion core
		CiA 402	Drive Based ¹⁹	PROFIdrive	Motion control panel	
Execute	Start of motion with rising edge	A515, bit 4	I100	I100	Start button	I402
Position A	Relative set position (distance relative to internal set position)	A567	J13/ J42	J13	K403	I403
Velocity	Specification for the motion profile	A574	J14/ J43 + J49	J14	K404	I404
Acceleration	Specification for the motion profile	A576	J15/ J44	J15	K405	I405
Deceleration	Specification for the motion profile	A577	J16/ J45	J16	K406	I406
Jerk	Specification for the motion profile	A590	J17/ J46	J17	K407	I407
Command Mode	Mode in which the motion block is executed if it is used as a subsequent motion block (cancellation of the ongoing motion block or start at the end of the ongoing motion block)	—	J21/ —	J21	—	I409
Engage brake at the end	Brake engaging at the end of the command in motion block and command operating modes	—	J27/ J53	J27	—	I410
End velocity	Final velocity at which the set position is to be reached in motion block operating mode	—	J18/ —	J18	—	I429

Tab. 10: MC_MoveAdditive: Control commands

¹⁹ If parameter not valid for all operating modes, specification in the following order: motion block operating mode/command operating mode

1.4.2 Denial

Possible causes of a command denial include:

- ▶ Set position is not within the software limit switches (I50, I51); only if travel range is limited (I00 = 0: Limited)
- ▶ Travel direction is blocked by permitted direction (I04); only if travel range is infinite (I00 = 1: Endless)
- ▶ Signal of positive or negative hardware limit switches is active in travel direction (source: I101, I102, signal: I441, I442)
- ▶ Set velocity, acceleration, deceleration or jerk is equal to zero
- ▶ Maximum acceleration and deceleration (I11) or maximum jerk (I16) is equal to zero

1.4.3 Limits

The generated motion profile is subject to the following limitations:

- ▶ Velocity is limited in amount to the maximum velocity (I10)
- ▶ Acceleration is limited in amount to the maximum acceleration (I11)
- ▶ Deceleration is limited in amount to maximum acceleration (I11)
- ▶ Jerk is limited to the maximum jerk (I16)

The following applies to the state of the limits:

- ▶ In case of limited velocity, the velocity limit is active (I190 = 1: Active)
- ▶ If the velocity must be limited to the maximum velocity (I10) due to Overrides > 100%, the cyclical velocity limit is active (I193 = 1: Active)
- ▶ In case of limited acceleration or deceleration or in case of limited jerk, the acceleration/jerk limit is active (I191 = 1: Active)

1.4.4 Start

Start from standstill

The brake is released (prerequisite: F00 = 1: Active).

The state of the motion core (I89) switches to 3: Discrete motion.

The travel direction is dependent only on the set position (positive or negative sign). If the travel range is limited, set positions may only be specified within the positive or negative software limit switches (I50, I51).

Start from motion

The state of the motion core (I89) switches to 3: Discrete motion.

The travel direction is dependent only on the set position (positive or negative sign). If the travel range is limited, set positions may only be specified within the positive or negative software limit switches (I50, I51).

The motion state is continued with limited jerk if all motion variables were defined in advance by the profile generator.



Information

Jerk-free continuation after a preceding MC_TorqueControl command is not guaranteed.

If the set position is in the opposite direction of movement or if braking at the set position is not possible without exceeding deceleration or jerk, an intermediate stop is added.

In case of an intermediate stop, the deceleration is reduced to zero. Afterwards, the acceleration is built up again with limited jerk.

When starting from motion, multiple revolutions can be used to brake at the desired set position.

If the command is denied, motion is stopped by a quick stop.

1.4.5 Motion

The axis moves a relative distance. The set position is relative to the set position of the previous motion command.

Examples

1. MC_MoveAdditive with distance 1000; then MC_MoveAdditive with changed velocity and distance 1000
2. MC_MoveAdditive with distance 1000; during travel (still within first distance), MC_MoveAdditive again with changed velocity and distance 1000

The end positions of the drive are the same in both cases.

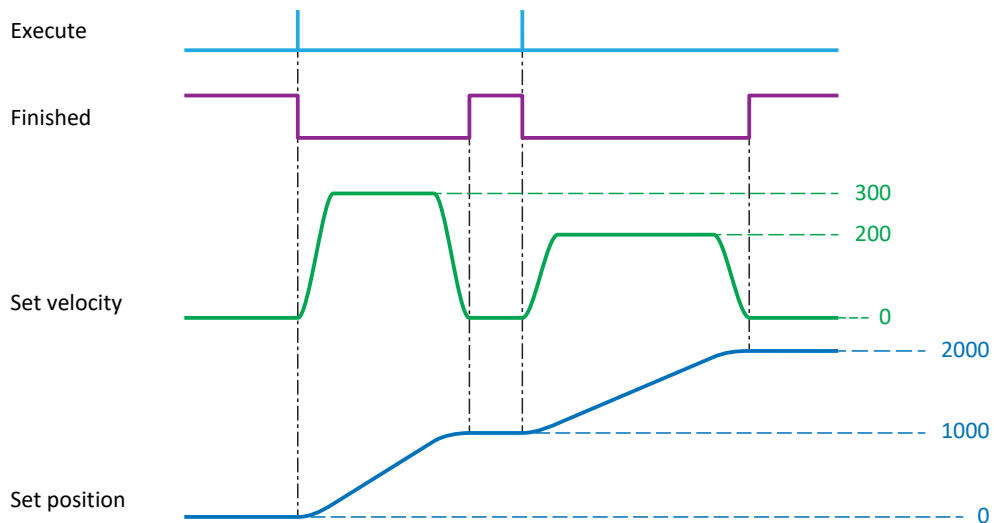


Fig. 9: MC_MoveAdditive: Motion 1

Intern

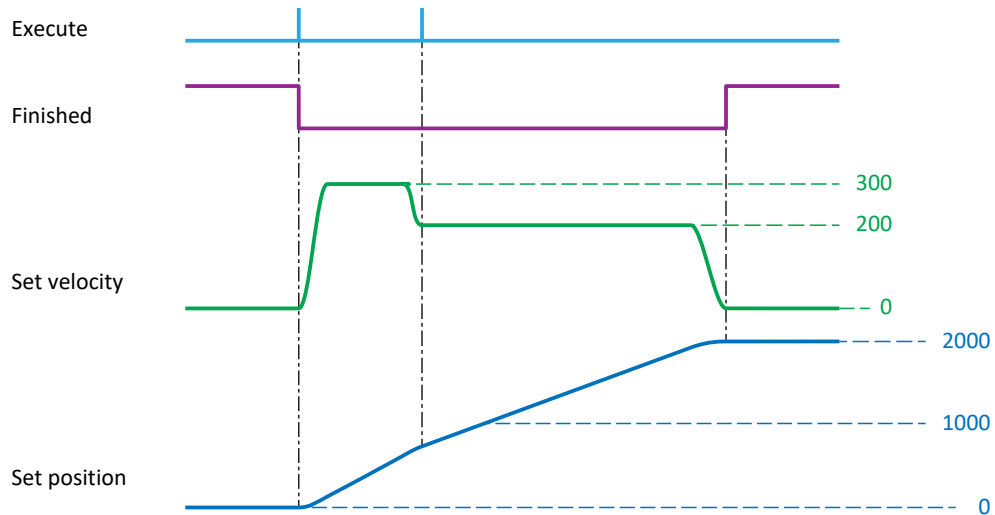


Fig. 10: MC_MoveAdditive: Motion 2

Conditions

The following conditions apply to the motion:

- ▶ Velocity override is taken into account (I230, source CiA 402: A340, Drive Based: G467/J56, PROFIdrive: M554, control panel: K408)
- ▶ Maximum velocity (I10) cannot be exceeded
- ▶ If the velocity override (I230) is equal to zero, the axis remains stationary; if the velocity override is not equal to zero, it continues to move again
- ▶ If an MC_Stop is sent while the velocity override is equal to zero, the axis remains stationary until a new command starts
- ▶ Jog is taken into account
- ▶ Halt is taken into account

1.4.6 Calculating the set position

The starting point for the calculation of a new set position is the last valid set position.

If there is no known set position, the actual position is used as the starting point.

A valid set position can only be generated by the MC_MoveAbsolute, MC_MoveRelative or MC_MoveAdditive commands. For the MC_Stop or MC_Halt commands, the last set position remains valid.

If the enable signal is deactivated, the following applies to the starting point, depending on the position window (I22):

- ▶ The actual position is used as the starting point if the axis does not reach the position window
- ▶ The actual position is used as the starting point if the axis reaches the position window but then exits it again
- ▶ The set position is used as the starting point if the axis reaches the position window and stays there

Start position	Commands	End position
0	MC_MoveAbsolute to position 1000; then MC_MoveAdditive with distance 200	1200
0	MC_MoveAbsolute to position 1000; MC_Stop during travel; then MC_MoveAdditive with distance 200	1200
0	MC_MoveAbsolute to position 1000; Enable-off and Enable-on at position 578.9 during travel; then MC_MoveAdditive with distance 200	778.9
0	MC_MoveAdditive with distance 200; then MC_MoveAdditive with distance 200	400
0	MC_MoveAdditive with distance 200; MC_Stop during travel; then MC_MoveAdditive with distance 200	400
0	MC_MoveAdditive with distance 200; Enable-off and Enable-on at position 91.2 during travel; then MC_MoveAdditive with distance 200	291.2
9.5	MC_MoveRelative with distance 200; then MC_MoveAdditive with distance 200	409.5
9.5	MC_MoveRelative with distance 200; MC_Stop during travel; then MC_MoveAdditive with distance 200	409.5
9.5	MC_MoveRelative with distance 200; Enable-off and Enable-on at position 91.2 during travel; then MC_MoveAdditive with distance 200	291.2

Tab. 11: MC_MoveAdditive: Examples of calculation

1.4.7 Target

The axis reaches the set position. The set position is relative to the set position of the previous motion command.


The axis stops if the final velocity is equal to zero. If the final velocity is not zero, the set position is passed through with the final velocity.

The following applies to brake engaging at the end:

- ▶ If brake engaging at the end is active, the brake is engaged after the wait time expires (142)
- ▶ Within the wait time, the axis can be started again without brake engaging by a command

1.4.8 Status information

The 3: MC_MoveAdditive command includes the status information described below.

Name	Description	Motion core
Speed reached	1: Active: Motion profile of the motion core has reached the set velocity; motion profile is fully calculated (I85) and the actual velocity is within the velocity window around the set velocity (actual velocity: I88, velocity window: C40)	I183
	1: Active → 0: Inactive: Actual velocity has left the window around the set velocity or if the command is canceled by the start of a new command	
	0: Inactive: State even if set velocity is not reached due to parameterization or a travel distance that is too short	
Motion profile done	1: Active: Calculated set position has reached the specified set position (I96 = I403 + I96 at the start of the command)	I85
Actual position in window	1: Active: Actual position is within the position window around the set position at the end of positioning (position window: I22; time: I87)	I180
	1: Active → 0: Inactive: New motion command started or actual position has left the position window around the set position	
Error	1: Active: Motion core has denied or canceled the command	I91
	0: Inactive: State at command start for at least one cycle time (A150), even if the command has been denied (see Denial [ 23])	
PLCOpen ErrorStop cause	Cause for the cancellation or denial of the command by the motion core (I91 = 1: Active; I89 = 7: Error stop)	I90
	0: Error free: State at command start for at least one cycle time (A150), even if the command has been denied	
Done	1: Active: Motion core has successfully completed the motion command to be executed: Set position of the control and actual position have reached the specified set position and the actual position was within the position window around the set position for the specified time (I85 = 1: Active, I180 = 1: Active for time I87); State for buffered motion blocks only at the end of the subsequent motion block; state before engaging brakes	I92
	0: Inactive: State at command start for at least one cycle time (A150), even if the condition for successfully ending has already been satisfied at command start	
State Motion Command	State of the running motion block and buffered subsequent motion block	I83
PLCOpen state	State of the motion core	I89

Tab. 12: MC_MoveAdditive: Status information

Intern

Examples

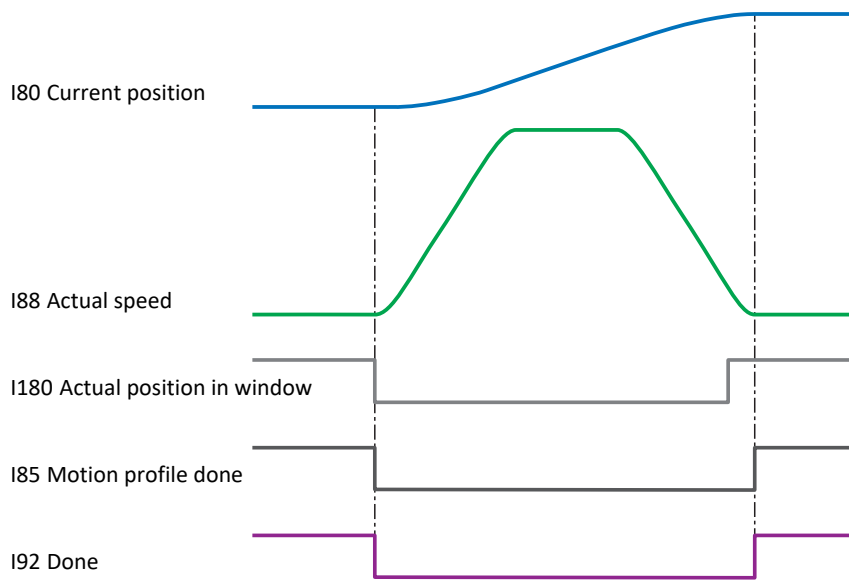


Fig. 11: MC_MoveAbsolute, MC_MoveRelative and MC_MoveAdditive status information: Example 1

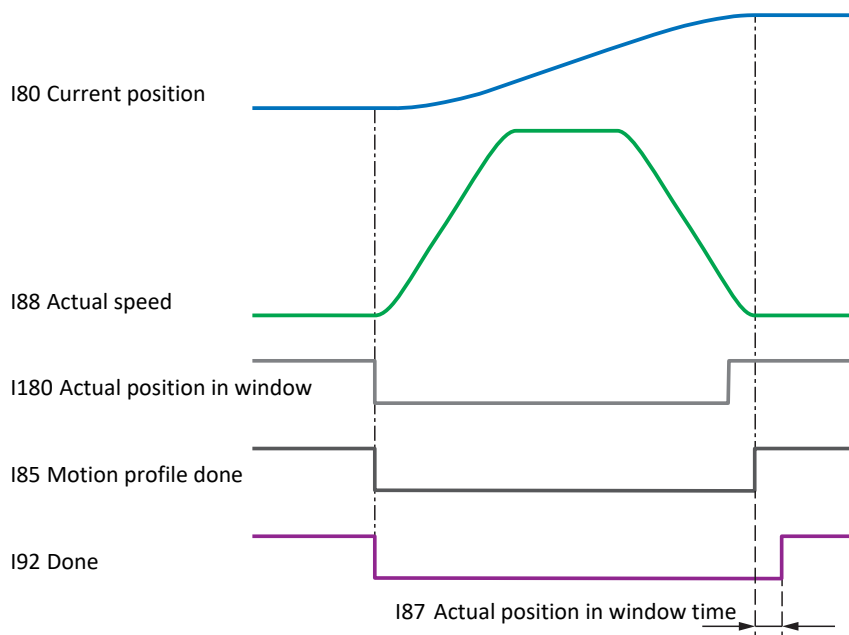


Fig. 12: MC_MoveAbsolute, MC_MoveRelative and MC_MoveAdditive status information: Example 2

The Actual position in window (I180) state is reported first. The axis is still moving at this time.

In the first example, the Done (I92) and Motion profile done (I85) states are reported at the same time.

In the second example, the Motion profile done state is reported first, and the Done state is only reported after the set time has expired (I87).

1.5 MC_MoveVelocity

The axis moves without end with set velocity (with position control).

Control type

Position control (velocity feedforward control for the position controller using I25).

Applications

The command is used in the following applications:

- ▶ Drive Based-type applications in all operating modes
- ▶ PROFIdrive in application class 3 with telegram 111 in Program mode (motion block) and MDI mode (command)

Basic settings

Name	Description	Source:				Motion core
		CiA 402	Drive Based ²⁰	PROFIdrive ²¹	Motion control panel	
Command	4: MC_MoveVelocity	—	J11/ J40/ D01	M550, bit 15 = 0 + J11/ M550, bit 14 = 1 + bit 15 = 1	K402	I401
Motion ID	Use as active motion ID (I82) in the motion block and command operating modes	—	J300/ J41/ —	J300 —	—	I400

Tab. 13: MC_MoveVelocity: Basic settings

²⁰ Specification in the following order: motion block operating mode/command operating mode/velocity, torque/force operating mode

²¹ Specification in the following order: Program mode (motion block operating mode)/MDI mode (command operating mode)

1.5.1 Control commands

The 4: MC_MoveVelocity command includes the control commands described below.

Name	Description	Source:				Motion core
		CiA 402	Drive Based ²²	PROFIdrive ²³	Motion control panel	
Execute	Start of motion with rising edge; behavior in case of set value changes adjustable using I113	—	I100	I100	Start button	I402
Velocity	Set velocity	—	J14/ J43 + J49/ D12, D13	J14/ M531	K404	I404
Acceleration	Specification for the motion profile	—	J15/ J44/ D14, D15	J15/ M532	K405	I405
Deceleration	Specification for the motion profile	—	J16/ J45/ D16, D17	J16/ M533	K406	I406
Jerk	Specification for the motion profile	—	J17/ J46/ D18, D19	J17/ I16 ²⁴	K407	I407
Command Mode	Mode in which the motion block is executed if it is used as a subsequent motion block (cancellation of the ongoing motion block or start at the end of the ongoing motion block)	—	J21/ —/ —	J21/ —	—	I409
MC_MoveVelocity mode	Behavior in case of changes to the set velocity for the motion command (takeover only at start of command by default or alternatively cyclical takeover)	—	I113	I113	—	I424

Tab. 14: MC_MoveVelocity: Control commands

²² If parameter not valid for all operating modes, specification in the following order: motion block operating mode/command operating mode/velocity, torque/force operating mode (fixed value, control byte)

²³ If parameter not valid for all operating modes, specification in the following order: Program mode (motion block operating mode)/MDI mode (command operating mode)

²⁴ Jerk specification is not defined using the profile; therefore, the maximum permitted jerk applies to MDI mode (command)

Intern



Information

By default, the set velocity is taken over only at the start of the command. In case of a change to the setting for cyclical takeover of set value changes, the specifications for the limiting the acceleration, deceleration and jerk are ignored. In this case, make sure that the controller supplies suitable specifications in order to prevent set value jumps.



Information

There is no specification for the direction of rotation or travel. The travel direction is dependent only on the set velocity (positive or negative sign).

1.5.2 Denial

Possible causes of a command denial include:

- ▶ Travel direction is blocked by permitted direction (I04); only if travel range is infinite (I00 = 1: Endless)
- ▶ Signal of positive or negative hardware limit switches is active in travel direction (source: I101, I102, signal: I441, I442)
- ▶ Acceleration, deceleration or jerk is zero
- ▶ Maximum acceleration and deceleration (I11) or maximum jerk (I16) is equal to zero

1.5.3 Limits

The generated motion profile is subject to the following limitations:

- ▶ Velocity is limited to the maximum velocity (I10)
- ▶ Acceleration is limited in amount to the maximum acceleration (I11)
- ▶ Deceleration is limited in amount to maximum acceleration (I11)
- ▶ Jerk is limited to the maximum jerk (I16)

The following applies to the state of the limits:

- ▶ In case of limited velocity, the velocity limit is active (I190 = 1: Active)
- ▶ If the velocity must be limited to the maximum velocity (I10) due to Overrides > 100%, the cyclical velocity limit is active (I193 = 1: Active)
- ▶ In case of limited acceleration or deceleration or in case of limited jerk, the acceleration/jerk limit is active (I191 = 1: Active)

1.5.4 Start

Start from standstill

The brake is released (prerequisite: F00 = 1: Active).

The state of the motion core (I89) switches to 4: Continuous motion.

The travel direction is dependent only on the set velocity (positive or negative sign).

Start from motion

The state of the motion core (I89) switches to 4: Continuous motion.

The travel direction is dependent only on the set velocity (positive or negative sign).

The motion state is continued with limited jerk if all motion variables were defined in advance by the profile generator.



Information

Jerk-free continuation after a preceding MC_TorqueControl command is not guaranteed.

If the set velocity is in the opposite direction of motion, an intermediate stop is added.

In case of an intermediate stop, the deceleration is reduced to zero. Afterwards, the acceleration is built up again with limited jerk.

1.5.5 Motion

The axis moves without end with set velocity (with position control).

Example

MC_MoveVelocity with velocity 300; then MC_MoveVelocity with velocity 200; then MC_MoveVelocity with velocity 400

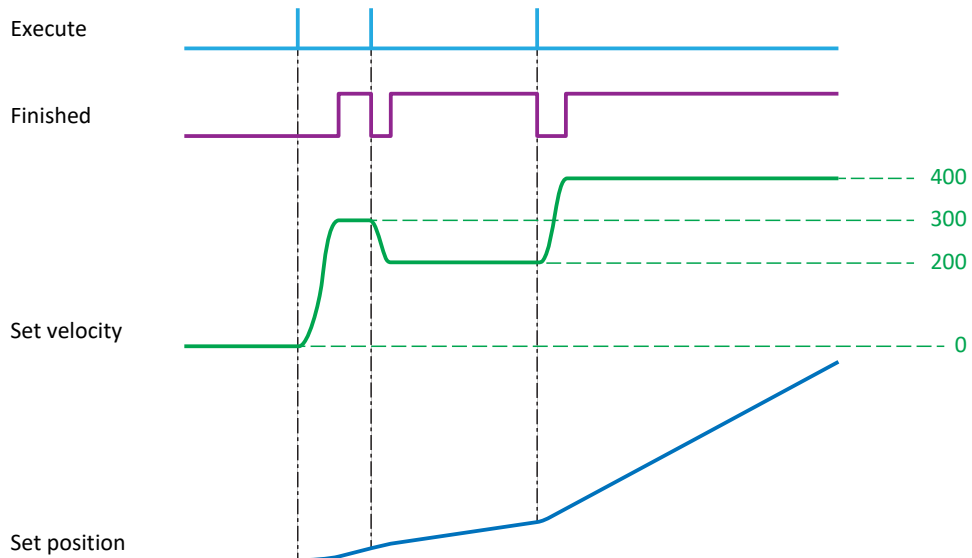


Fig. 13: MC_MoveVelocity: Motion

Conditions

The following conditions apply to the motion:

- ▶ Velocity override is taken into account (I230, source Drive Based: G467/J56, PROFIdrive: M554, control panel: K408)
- ▶ Maximum velocity (I10) cannot be exceeded
- ▶ If the velocity override (I230) is equal to zero, the axis remains stationary; if the velocity override is not equal to zero, it continues to move again
- ▶ If an MC_Stop is sent while the velocity override is equal to zero, the axis remains stationary until a new command starts
- ▶ Jog is taken into account
- ▶ Halt is taken into account

1.5.6 Target

The axis reaches the set velocity. This is followed without end until a new command starts or until the PLCopen state switches (I89).

1.5.7 Status information

The 4: MC_MoveVelocity command includes the status information described below.

Name	Description	Motion core
Speed reached	1: Active: Motion profile of the motion core has reached the set velocity; motion profile is fully calculated (I85) and the actual velocity is within the velocity window around the set velocity (actual velocity: I88, velocity window: C40)	I183
	1: Active → 0: Inactive: Actual velocity has left the window around the set velocity or if the command is canceled by the start of a new command	
	0: Inactive: State even if set velocity is not reached due to parameterization or a travel distance that is too short	
Motion profile done	1: Active: Calculated set velocity has reached the specified set velocity (E07 = I404)	I85
Error	1: Active: Motion core has denied or canceled the command	I91
	0: Inactive: State at command start for at least one cycle time (A150), even if the command has been denied (see Denial [32])	
PLCOpen ErrorStop cause	Cause for the cancellation or denial of the command by the motion core (I91 = 1: Active; I89 = 7: Error stop)	I90
	0: Error free: State at command start for at least one cycle time (A150), even if the command has been denied	
Done	1: Active: Motion core has successfully ended the motion command to be traveled: Set velocity of the control and actual velocity have reached the specified set velocity (I85 = 1: Active, I183 = 1: Active); State for buffered motion blocks only at the end of the subsequent motion block	I92
	0: Inactive: State at command start for at least one cycle time (A150), even if the condition for successfully ending has already been satisfied at command start	
State Motion Command	State of the running motion block and buffered subsequent motion block	I83
PLCOpen state	State of the motion core	I89

Tab. 15: MC_MoveVelocity: Status information

Intern

Example

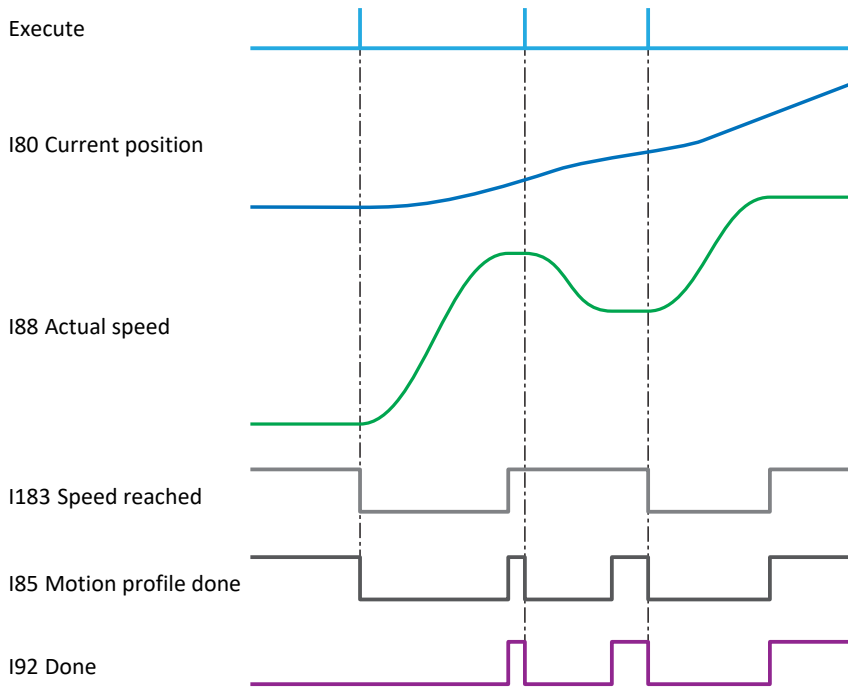


Fig. 14: MC_MoveVelocity status information: Example

In the example, the Speed reached (I183), Motion profile done (I85) and Done (I92) states are reported at the same time after the start of the first command, as soon as the set velocity is reached. With the second Execute, a new command starts with a lower set velocity. The Speed reached state remains active. The Motion profile done and Done states are only reported as soon as the new set velocity is reached. With the third Execute, another command starts that has a higher set velocity again. All three states are reported again at the same time as soon as the higher set velocity is reached.

1.6 MC_Stop

The axis is brought to a standstill. The next command can be executed after the axis standstill.

Control type

Unchanged (corresponds to the control type of the previous command or position control default value).

Applications

The command is used in the following applications:

- ▶ Drive Based-type applications in the motion block and command operating modes
- ▶ PROFIdrive in application class 3 with telegram 111 in Program mode (motion block)

Basic settings

Name	Description	Source:				Motion core
		CiA 402	Drive Based ²⁵	PROFIdrive	Motion control panel	
Command	5: MC_Stop	—	J11/ J40	M550, bit 15 = 0 + J11	K402	I401
Motion ID	Use as active motion ID (I82) in the motion block and command operating modes	—	J300/ J41	J300	—	I400

Tab. 16: MC_Stop: Basic settings

²⁵ Specification in the following order: motion block operating mode/command operating mode

1.6.1 Control commands

The 5: MC_Stop command includes the control commands described below.

Name	Description	Source:				Motion core
		CiA 402	Drive Based ²⁶	PROFIdrive	Motion control panel	
Execute	Start of motion with rising edge	—	I100	I100	Start button	I402
Deceleration	Specification for the motion profile	—	J16/ J45	J16	K406	I406
Jerk	Specification for the motion profile	—	J17/ J46	J17	K407	I407
Engage brake at the end	Brake engaging at the end of the command in motion block and command operating modes	—	J27/ J53	J27	—	I410

Tab. 17: MC_Stop: Control commands

²⁶ If parameter not valid for all operating modes, specification in the following order: motion block operating mode/command operating mode

1.6.2 Denial

Possible causes of a command denial include:

- ▶ Deceleration or jerk is equal to zero; exception: axis is already stationary (I89 = 2: Standstill)
- ▶ Maximum acceleration and deceleration (I11) or maximum jerk (I16) is equal to zero

1.6.3 Limits

The generated motion profile is subject to the following limitations:

- ▶ Deceleration is limited in amount to maximum acceleration (I11)
- ▶ Jerk is limited to the maximum jerk (I16)

The following applies to the state of the limits:

- ▶ In case of limited acceleration or deceleration or in case of limited jerk, the acceleration/jerk limit is active (I191 = 1: Active)

1.6.4 Start

Start from standstill

The brake is actuated according to the setting for brake engaging.

The state of the motion core (I89) switches to 6: Stopping and stays there until the Execute signal becomes inactive.

Start from motion

The state of the motion core (I89) switches to 6: Stopping until the standstill is reached and the Execute signal becomes inactive.

The motion state is continued with limited jerk if all motion variables were defined in advance by the profile generator.



Information

Jerk-free continuation after a preceding MC_TorqueControl command is not guaranteed.

1.6.5 Motion

The axis is brought to a standstill. The next command can be executed after the axis standstill.

The standstill is reached if the motion profile is fully calculated and the actual velocity is within the velocity window around the set velocity of zero (actual velocity: I88, velocity window: C40).

Example

MC_Stop while previous command (e.g. MC_MoveVelocity) is active; commands that are started during an active MC_Stop are denied

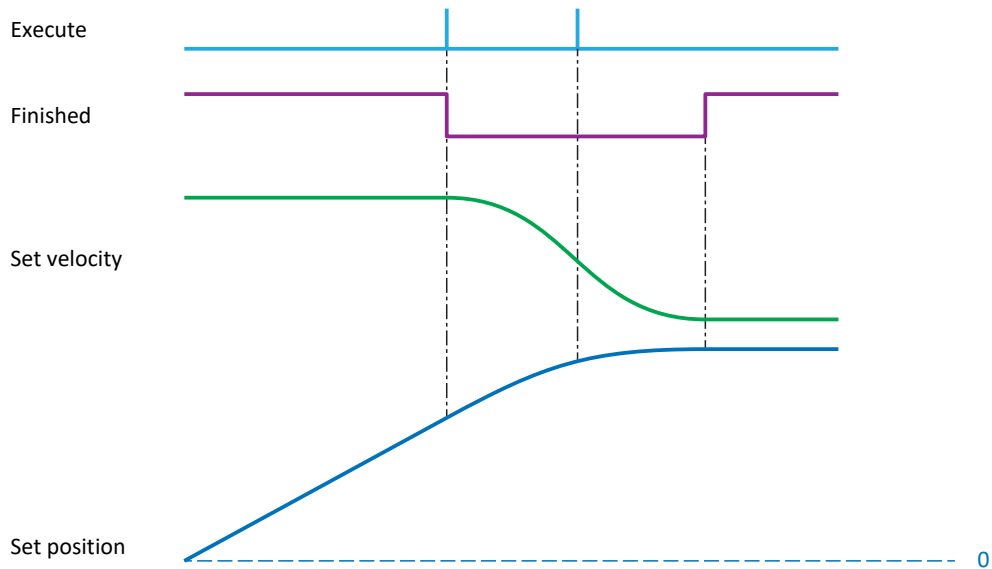


Fig. 15: MC_Stop: Motion

Conditions

The following conditions apply to the motion:

- ▶ Velocity override (I230) is not taken into account

1.6.6 Target

The axis is stationary.

The following applies to brake engaging at the end:

- ▶ If brake engaging at the end is active, the brake is engaged after the wait time expires (I42)
- ▶ Within the wait time, the axis can be started again without brake engaging by a command

1.6.7 Status information

The 5: MC_Stop command includes the status information described below.

Name	Description	Motion core
Speed reached	1: Active: Motion profile of the motion core has reached the set velocity; motion profile is fully calculated (I85) and the actual velocity is within the velocity window around the set velocity = 0 (actual velocity: I88, velocity window: C40)	I183
	1: Active → 0: Inactive: Actual velocity has left the window around the set velocity	
	0: Inactive: State even if set velocity is not reached due to parameterization or a travel distance that is too short	
Motion profile done	1: Active: Motion profile is fully calculated and calculated set velocity has reached the value zero (E07 = 0)	I85
Error	1: Active: Motion core has denied or canceled the command	I91
	0: Inactive: State at command start for at least one cycle time (A150), even if the command has been denied (see Denial [38])	
PLCOpen ErrorStop cause	Cause for the cancellation or denial of the command by the motion core (I91 = 1: Active; I89 = 7: Error stop)	I90
	0: Error free: State at command start for at least one cycle time (A150), even if the command has been denied	
Done	1: Active: Motion core has successfully ended the motion command to be run: Set and actual velocities have reached zero (I85 = 1: Active, I199 = 1: Active); State for buffered motion blocks only at the end of the subsequent motion block; state before engaging the brakes	I92
	0: Inactive: State at command start for at least one cycle time (A150), even if the condition for successfully ending has already been satisfied at command start	
State Motion Command	State of the running motion block and buffered subsequent motion block	I83
PLCOpen state	State of the motion core	I89

Tab. 18: MC_Stop: Status information



Information

If the command is denied at a standstill, the state for successful ending is reported instead of an error (I91 = 0: Inactive, I92 = 1: Active).

Intern

Example

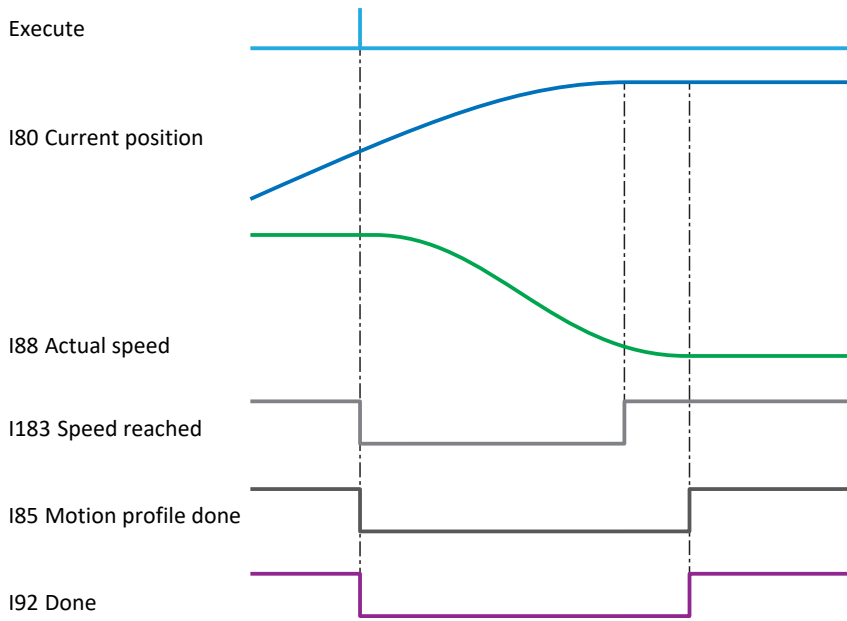


Fig. 16: MC_Stop status information: Example

In the example, the Speed reached (I183) state is reported first after the start of the command, as soon as the actual velocity is within the velocity window around the set velocity of zero. The Motion profile done (I85) and Done (I92) states are only reported if the set and actual velocities have reached the value zero.

1.7 MC_Home

The axis is referenced.

Control type

The control type depends on the selected referencing type (Drive Based/PROFIdrive) or the selected Homing method (CiA 402)

Control type	Referencing type (Drive Based/PROFIdrive)	Homing method (CiA 402)
Position control (velocity feedforward control for the position controller using I25)	I30 = 1: Reference input, 2: Limit switch or 3: Zero pulse	A586 = 1, 2, 3, 5, 7, 11, 17, 18, 19, 21, 23, 27, 33 or 34
Velocity control	I30 = 4: Torque/force stopper	A586 = -1, -2, -3 or -4
Unchanged (corresponds to the control type of the previous command or position control default value)	I30 = 5: Define home	A586 = 35, 37

Tab. 19: MC_Home: Control type

Applications

The command is used in the following applications:

- ▶ CiA 402 in operating mode 6: Homing mode
- ▶ Drive Based-type applications in the motion block and command operating modes
- ▶ PROFIdrive in application class 3 with telegram 111 in Program mode (motion block) and MDI mode (command)

Basic settings

Name	Description	Source:				Motion core
		CiA 402	Drive Based ²⁷	PROFIdrive ²⁸	Motion control panel ²⁹	
Command	6: MC_Home	A541 = 6	J11/ J40	M550, bit 15 = 0 + J11/ M550, bit 15 = 1	K399/ K402	I401
Motion ID	Use as active motion ID (I82) in the motion block and command operating modes	—	J300/ J41	J300 —	—	I400

Tab. 20: MC_Home: Basic settings

²⁷ Specification in the following order: motion block operating mode/command operating mode

²⁸ Specification in the following order: Program mode (motion block operating mode)/MDI mode (command operating mode)

²⁹ Specification in the following order: Motion control panel for CiA 402/Motion control panel for Drive Based-type applications and for PROFIdrive

1.7.1 Control commands

The 6: MC_Home command includes the control commands described below.

Name	Description	Source:				Motion core
		CiA 402	Drive Based	PROFIdrive	Motion control panel ³⁰	
Execute	Start of motion with rising edge	A515, bit 4	I100	M515, bit 11	Start button	I402
Homing torque/force limit	Torque/force limit of the torque/force stop while referencing the axis	I28	I28	I28	I28	I28
Time homing torque/force limit	Time that the actual torque/force must be greater than the torque/force limit before the reference is set	I29	I29	I29	I29	I29
Referencing type	CiA 402: Set referencing method; Drive Based/PROFIdrive: By combining the referencing type, direction specification (I31) and zero pulse search (I35), different referencing methods can be implemented	A586	I30	I30	A586/ I30	I30
Referencing direction	Direction for the initial movement of the reference search	—	I31	I31	—/ I31	I31
Referencing speed fast	Specification for the motion profile	A587[0]	I32	I32	A587[0]/ I32	I32
Referencing speed slow	Specification for the motion profile	A587[1]	I33	I33	A587[1]/ I33	I33
Reference position	Set position when referencing the axis	A569	I34	I34	A569/ I34	I34
Referencing with zero pulse	Referencing with subsequent evaluation of the zero pulse	—	I35	I35	—/ I35	I35
Continuous referencing	Continuous referencing based on reference marks arranged over the travel range with equal spacing (spacing: I41); for an initial reference point, normal referencing must be carried out first	I36	I36	I36	I36	I36

Intern

Name	Description	Source:				Motion core
		CiA 402	Drive Based	PROFIdrive	Motion control panel ³⁰	
Index search distance	Distance moved during the search for the zero pulse; if the search distance moved is very small and the zero pulse is very close to a bouncing reference switch, the start of the search can be shifted by a distance (I53)	I37	I37	I37	I37	I37
Referencing acceleration	Specification of the acceleration and deceleration for the motion profile	A588	I39	I39	A588/ I39	I39
Reference management	Management of the reference of several logical axes and master encoder	I40	I40	I40	I40	I40
Distance reference mark	Spacing of the reference marks in continuous referencing	I41	I41	I41	I41	I41
Move to reference position	Move to reference position after referencing	I43	I43	I43	I43	I43
Referencing jerk	Specification for the motion profile	I44	I44	I44	I44	I44
Source positive /limit switch	Source of the digital signal used to evaluate a limit switch at the positive end of the travel range	I101	I101	I101	I101	I101
Source negative /limit switch	Source of the digital signal used to evaluate a limit switch at the negative end of the travel range	I102	I102	I102	I102	I102
Source reference switch	Source of the digital signal used to evaluate a reference switch during the reference search	I103	I103	I103	I103	I103

Tab. 21: MC_Home: Control commands

³⁰ If parameter not valid for all applications, specification in the following order: Motion control panel for CiA 402/Motion control panel for Drive Based-type applications and for PROFIdrive

1.7.2 Denial

Possible causes of a command denial include:

- ▶ Motion core is not ready for the motion command (I89 ≠ 2: Standstill)
- ▶ Referencing type is inactive (CiA 402: A586 = 0: Inactive, Drive Based/PROFIdrive: I30 = 0: Inactive)



Information

The command is not denied if the slow or fast referencing velocity, the referencing acceleration or referencing jerk is equal to zero.

1.7.3 Limits

The generated motion profile is subject to the following limitations:

- ▶ Velocity is limited in amount to the maximum velocity (I10)
- ▶ Acceleration is limited in amount to the maximum acceleration (I11)
- ▶ Deceleration is limited in amount to maximum acceleration (I11)
- ▶ Jerk is limited to the maximum jerk (I16)

The following applies to the state of the limits:

- ▶ In case of limited velocity, the velocity limit remains inactive (I190 = 0: Inactive)
- ▶ In case of limited acceleration or deceleration or in case of limited jerk, the acceleration/jerk limit remains inactive (I191 = 0: Inactive)

1.7.4 Start

Start from standstill

The brake is released (prerequisite: F00 = 1: Active).

The state of the motion core (I89) depends on the selected referencing type (Drive Based/PROFIdrive) or the selected Homing method (CiA 402):

- ▶ When setting the reference, the state of the motion core stays in 2: Standstill
- ▶ The state of the motion core switches to 8: Homing during referencing and back to 2: Standstill at the end of referencing

Start from motion

The state of the motion core (I89) depends on the selected referencing type (Drive Based/PROFIdrive) or the selected Homing method (CiA 402):

- ▶ When setting the reference, the state of the motion core remains unchanged
- ▶ The state of the motion core switches to 8: Homing during referencing and to 2: Standstill at the end of referencing

1.7.5 Motion

The axis is referenced.

Referencing depends on the selected referencing method, which is implemented differently depending on the application.

Conditions

The following conditions apply to the motion:

- ▶ Velocity override is taken into account (I230, source CiA 402: A340, Drive Based: G467/J56, PROFIdrive: M554, control panel: K408)
- ▶ Maximum velocity (I10) cannot be exceeded
- ▶ If the velocity override (I230) is equal to zero, the axis remains stationary; if the velocity override is not equal to zero, it continues to move again
- ▶ If an MC_Stop is sent while the velocity override is equal to zero, the axis remains stationary until a new command starts
- ▶ Jog is not possible
- ▶ Halt is taken into account

1.7.5.1 Referencing methods

In the CiA 402 application, travel depends on the selected referencing method (A586).

In Drive Based applications and in PROFIdrive, the referencing method is implemented by combining Referencing type (I30), direction specification (I31) and zero pulse search (I35).

Detailed information on referencing and the individual referencing methods can be found in the respective application manual (see Further information).

The following table shows an overview of the possible referencing methods.

Abbreviation	Meaning
S	Switch
M/F	Torque or force

Intern

	Method	Initial movement	Zero pulse	Feature
	A	Negative	Yes	Negative limit switch
	B	Negative	Yes	Negatively positioned reference switch
	C	Negative	–	Negative limit switch
	D	Negative	–	Negatively positioned reference switch
	E	Positive	Yes	Positive limit switch
	F	Positive	Yes	Positively positioned reference switch
	G	Positive	–	Positive limit switch
	H	Positive	–	Positively positioned reference switch
	I	Positive	Yes	Centrally positioned reference switch
	J	Positive	–	Centrally positioned reference switch
	K	Negative	Yes	Centrally positioned reference switch
	L	Negative	–	Centrally positioned reference switch
	M	Negative	Yes	Zero pulse
	N	Positive	Yes	Zero pulse
	O	–	–	Setting the reference
	P	Positive	–	Torque/force stop
	Q	Positive	Yes	Torque/force stop
	R	Negative	–	Torque/force stop
	S	Negative	Yes	Torque/force stop


Tab. 22: Referencing methods

1.7.6 Target

The reference location is reached (at the reference switch or limit switch, at the zero pulse of the position encoder or at the torque/force limit). The actual position is set to the reference position there. The drive comes to a standstill. Alternatively, in Drive Based-type applications or in PROFIdrive, it is possible to travel back to the reference position.

1.7.7 Status information

The 6: MC_Home command includes the status information described below.

Name	Description	Motion core
In reference	1: Active: Axis is referenced; absolute positioning is possible	I86
Error	1: Active: Motion core has denied or canceled the command	I91
	0: Inactive: State at command start for at least one cycle time (A150), even if the command has been denied (see Denial [ 45])	
PLCOpen ErrorStop cause	Cause for the cancellation or denial of the command by the motion core (I91 = 1: Active; I89 = 7: Error stop)	I90
	0: Error free: State at command start for at least one cycle time (A150), even if the command has been denied	
Done	1: Active: Motion core has successfully ended the motion command to be executed: Referencing is completed	I92
	0: Inactive: State at command start for at least one cycle time (A150), even if the condition for successfully ending has already been satisfied at command start	
State Motion Command	State of the running motion block and buffered subsequent motion block	I83
PLCOpen state	State of the motion core	I89

Tab. 23: MC_Home: Status information



Information

The Speed reached (I183) and Motion profile done (I85) status information is not used and remains inactive.

1.8 MC_CyclicSpeed

The axis moves without end with set velocity (controller-based motion).



Information

The switch to cyclical set values (cyclical set velocity) takes place immediately.



Information

When using the command, make sure that the controller supplies suitable specifications for limiting the acceleration, deceleration and jerk in order to prevent set value jumps.

Control type

Velocity control.

Applications

The command is used in the CiA 402 application in operating mode 9: Cyclic synchronous velocity mode.

Basic settings

Name	Description	Source:				Motion core
		CiA 402	Drive Based	PROFIdrive	Motion control panel	
Command	7: MC_CyclicSpeed	A541 = 9	—	—	—	I401
Motion ID	Use as active motion ID	—	—	—	—	I400

Tab. 24: MC_CyclicSpeed: Basic settings

1.8.1 Control commands

The 7: MC_CyclicSpeed command includes the control commands described below.

Name	Description	Source:				Motion core
		CiA 402	Drive Based	PROFIdrive	Motion control panel	
Execute	Start of motion with rising edge; behavior in case of set value changes adjustable using I119	A515, bit 4	—	—	—	I402
Cyclic reference speed	Cyclical set velocity	A592 + A638	—	—	—	I426
Disable v-set at command change	Behavior in case of changes to the set velocity for the motion command (cyclical takeover by default or alternatively takeover only at start of command)	I119	—	—	—	I426

Tab. 25: MC_CyclicSpeed: Control commands



Information

The cyclical set values are interpolated linearly by the fine interpolator. During the extrapolation time adjustable in parameter I423, other set values can be extrapolated by the fine interpolator for the control, starting from the last received set value. After the time has expired, the extrapolation ends and event 78: Position limit cyclic with cause 3 is triggered. The extrapolation time is used to compensate for fluctuations in the cycle of the controller (A291) or the absence of set values.



Information

There is no specification for the direction of rotation or travel. The travel direction is dependent only on the cyclical set velocity (positive or negative sign).

1.8.2 Denial

The motion command is never denied.

1.8.3 Limits

The following limits apply:

- ▶ Velocity is limited to the maximum velocity (I10)
- ▶ Torque or force is limited to the maximum torque or maximum force (E65, E66)
- ▶ Upon reaching a limit switch, a quick stop is executed by limit switch fault; then, set values in the direction of the limit switch are no longer taken into account for the calculation of the motion profile
- ▶ Set values in an impermissible direction (I04) are not taken into account for the calculation of the motion profile

The following applies to the state of the limits:

- ▶ The cyclical velocity limit is active in case of an impermissible direction (I193 = 1: Active)

1.8.4 Start

Start from standstill

The brake is released (prerequisite: F00 = 1: Active).

The state of the motion core (I89) switches to 11: Cyclic Motion.

The travel direction is dependent only on the cyclical set velocity (positive or negative sign).

Start from motion

The start of the command from motion is not useful and should be avoided.

The state of the motion core (I89) switches to 11: Cyclic Motion.

The travel direction is dependent only on the cyclical set velocity (positive or negative sign).

The cyclical set values determine the motion behavior. The internal set velocity value switches to the cyclical set velocity within the cycle time (A291). The controller is responsible for supplying useful specifications for motion.

1.8.5 Motion

The axis moves without end with set velocity (controller-based motion).

Conditions

The following conditions apply to the motion:

- ▶ Velocity override (I230) is not taken into account
- ▶ In case of a limit switch fault, internal set values in the direction of the limit switch are set to zero so that the axis comes to a standstill
- ▶ In case of set values in an impermissible direction (I04), the internal set values are set to zero
- ▶ Jog is taken into account
- ▶ Halt is taken into account

1.8.6 Target

The axis reaches the set velocity. This is followed without end until a new command starts or until the PLCOpen state switches (I89).

1.8.7 Status information

The 7: MC_CyclicSpeed command includes the status information described below.

Name	Description	Motion core
Error	1: Active: Motion core has canceled the command	I91
	0: Inactive: State at command start for at least one cycle time (A150)	
PLCOpen ErrorStop cause	Cause for the cancellation of the command by the motion core (I91 = 1: Active; I89 = 7: Error stop)	I90
	0: Error free: State at command start for at least one cycle time (A150)	
Done	1: Active: State after the second cycle time (A150) after command start	I92
	0: Inactive: State at command start for at least one cycle time (A150)	
PLCOpen state	State of the motion core	I89

Tab. 26: MC_CyclicSpeed: Status information



Information

The Speed reached (I183) and Motion profile done (I85) status information is not used and remains inactive.

1.9 MC_MoveSpeed

The axis moves without end with set velocity (velocity control without position control).



Information

The switch to cyclical set values (cyclical set velocity) takes place immediately.



Information

Unlike command MC_CyclicSpeed, with MC_MoveSpeed, the specifications for limiting the acceleration, deceleration and jerk are taken into account for the calculation of the motion profile.

Control type

Velocity control.

Applications

The command is used in the following applications:

- ▶ CiA 402 in operating mode 3: Profile velocity mode
- ▶ Drive Based-type applications in all operating modes
- ▶ PROFIdrive in application class 3 with telegram 111 in Program mode (motion block)

Basic settings

Name	Description	Source:				Motion core
		CiA 402	Drive Based ³¹	PROFIdrive	Motion control panel ³²	
Command	8: MC_MoveSpeed	A541 = 3	J11/ J40/ D01	M550, bit 15 = 0 + J11	K399/ K402	I401
Motion ID	Use as active motion ID (I82) in the motion block and command operating modes	—	J300/ J41/ —	J300	—	I400

Tab. 27: MC_MoveSpeed: Basic settings

³¹ Specification in the following order: motion block operating mode/command operating mode/velocity, torque/force operating mode

³² Specification in the following order: Motion control panel for CiA 402/Motion control panel for Drive Based-type applications and for PROFIdrive

1.9.1 Control commands

The 8: MC_MoveSpeed command includes the control commands described below.

Name	Description	Source:				Motion core
		CiA 402	Drive Based ³³	PROFIdrive	Motion control panel	
Execute	Start of motion with rising edge; behavior in case of set value changes adjustable using I119	A515, bit 4	I100/ I100/ — ³⁴	I100	Start button	I402
Cyclic reference speed	Cyclical set velocity	A592 + A638	J14/ J43 + J49/ D12, D13	J14	K404	I426
Cyclic acceleration	Specification for the motion profile	A576	J15/ J44/ D14, D15	J15	K405	I216
Cyclic deceleration	Specification for the motion profile	A577	J16/ J45/ D16, D17	J16	K406	I217
Jerk	Specification for the motion profile	A590	J17/ J46/ D18, D19	J17	K407	I407
Command Mode	Mode in which the motion block is executed if it is used as a subsequent motion block (cancellation of the ongoing motion block or start at the end of the ongoing motion block)	—	J21/ —/ —	J21	—	I409
Disable v-set at command change	Behavior in case of changes to the set velocity for the motion command (cyclical takeover or takeover only at start of command)	I119	I119	I119	—	I426

Tab. 28: MC_MoveSpeed: Control commands

³³ If parameter not valid for all operating modes, specification in the following order: motion block operating mode/command operating mode/velocity, torque/force operating mode (fixed value, control byte)

³⁴ Start of the command by Enable-on

Intern



Information

By default, changes to the set velocity are taken over cyclically after the start of the command. In case of a change to the setting for takeover only at command start, check the specifications for limiting the acceleration and deceleration. Cyclical acceleration and deceleration are ignored in this case.



Information

There is no specification for the direction of rotation or travel. The travel direction is dependent only on the cyclical set velocity (positive or negative sign).

1.9.2 Denial

Possible causes of a command denial include:

- ▶ Jerk is zero
- ▶ Maximum jerk (I16) is zero



Information

If the cyclical acceleration or deceleration is equal to zero, the last value is retained.

1.9.3 Limits

The generated motion profile is subject to the following limitations:

- ▶ Velocity is limited to the maximum velocity (I10)
- ▶ Acceleration is limited to the maximum acceleration (I11)
- ▶ Deceleration is limited in amount to maximum acceleration (I11)
- ▶ Jerk is limited to the maximum jerk (I16)
- ▶ Upon reaching a limit switch, a quick stop is executed by limit switch fault; then, set values in the direction of the limit switch are no longer taken into account for the calculation of the motion profile
- ▶ Set values in an impermissible direction (I04) are not taken into account for the calculation of the motion profile

The following applies to the state of the limits:

- ▶ The cyclical velocity limit is active in case of limited velocity or impermissible direction (I193 = 1: Active)
- ▶ The cyclical acceleration limit is active in case of limited acceleration or deceleration (I195 = 1: Active)
- ▶ If acceleration or deceleration is equal to zero, the last value is retained
- ▶ In case of limited jerk, the acceleration/jerk limit is active (I191 = 1: Active)

1.9.4 Start

Start from standstill

The brake is released (prerequisite: F00 = 1: Active).

The state of the motion core (I89) switches to 4: Continuous motion.

The travel direction is dependent only on the cyclical set velocity (positive or negative sign).

Start from motion

The state of the motion core (I89) switches to 4: Continuous motion.

The travel direction is dependent only on the cyclical set velocity (positive or negative sign).

The motion state is continued with limited jerk if all motion variables were defined in advance by the profile generator.



Information

Jerk-free continuation after a preceding MC_TorqueControl command is not guaranteed.

If the cyclical set velocity is in the opposite direction of motion, an intermediate stop is added.

In case of an intermediate stop, the cyclical deceleration is reduced to zero. Afterwards, the cyclical acceleration is built up again with limited jerk.

1.9.5

Motion

The axis moves without end with set velocity (velocity control without position control).

Conditions

The following conditions apply to the motion:

- ▶ Velocity override is taken into account (I230, source Drive Based: G467/J56, PROFIdrive: M554, control panel: K408)
- ▶ Maximum velocity (I10) cannot be exceeded
- ▶ If the velocity override (I230) is equal to zero, the axis remains stationary; if the velocity override is not equal to zero, it continues to move again
- ▶ If an MC_Stop is sent while the velocity override is equal to zero, the axis remains stationary until a new command starts
- ▶ In case of a limit switch fault, internal set values in the direction of the limit switch are set to zero so that the axis comes to a standstill
- ▶ In case of set values in an impermissible direction (I04), the internal set values are set to zero
- ▶ Jog is taken into account
- ▶ Halt is taken into account

1.9.6

Target

The axis reaches the set velocity. This is followed without end until a new command starts or until the PLCopen state switches (I89).

1.9.7 Status information

The 8: MC_MoveSpeed command includes the status information described below.

Name	Description	Motion core
Speed reached	1: Active: Motion profile of the motion core has reached the set velocity; motion profile is fully calculated (I85) and the actual velocity is within the velocity window around the set velocity (actual velocity: I88, velocity window: C40)	I183
	1: Active → 0: Inactive: Actual velocity has left the window around the set velocity or if the command is canceled by the start of a new command	
	0: Inactive: State even if set velocity is not reached due to parameterization or a travel distance that is too short	
Motion profile done	1: Active: Calculated set velocity has reached the specified set velocity (E07 = I426)	I85
Error	1: Active: Motion core has denied or canceled the command	I91
	0: Inactive: State at command start for at least one cycle time (A150), even if the command has been denied (see Denial [57])	
PLCOpen ErrorStop cause	Cause for the cancellation or denial of the command by the motion core (I91 = 1: Active; I89 = 7: Error stop)	I90
	0: Error free: State at command start for at least one cycle time (A150), even if the command has been denied	
Done	1: Active: Motion core has successfully ended the motion command to be traveled: Set velocity of the control and actual velocity have reached the specified set velocity (I85 = 1: Active, I183 = 1: Active); State for buffered motion blocks only at the end of the subsequent motion block	I92
	0: Inactive: State at command start for at least one cycle time (A150), even if the condition for successfully ending has already been satisfied at command start	
State Motion Command	State of the running motion block and buffered subsequent motion block	I83
PLCOpen state	State of the motion core	I89

Tab. 29: MC_MoveSpeed: Status information

1.10 MC_TorqueControl

The axis moves without end with set torque/force.



Information

The switch to cyclical set values (cyclical set torque or cyclical set force) takes place immediately.



Information

When using the command, make sure that the controller supplies suitable specifications for limiting the acceleration, deceleration and jerk in order to prevent set value jumps.

Control type

Torque/force control

Applications

The command is used in the following applications:

- ▶ CiA 402 in operating modes 4: Profile torque mode and 10: Cyclic synchronous torque mode
- ▶ Drive Based-type applications in all operating modes
- ▶ PROFIdrive in application class 3 with telegram 111 in Program mode (motion block)

Basic settings

Name	Description	Source:				Motion core
		CiA 402 ³⁵	Drive Based ³⁶	PROFIdrive	Motion control panel ³⁷	
Command	9: MC_TorqueControl	A541 = 4/ A541 = 10	J11/ J40/ D01	M550, bit 15 = 0 + J11	K399/ K402	I401
Motion ID	Use as active motion ID (I82) in the motion block and command operating modes	—	J300/ J41/ —	J300	—	I400

Tab. 30: MC_TorqueControl: Basic settings

³⁵ Specification in the following order: Profile torque mode/Cyclic synchronous torque mode

³⁶ Specification in the following order: motion block operating mode/command operating mode/velocity, torque/force operating mode

³⁷ Specification in the following order: Motion control panel for CiA 402/Motion control panel for Drive Based-type applications and for PROFIdrive

1.10.1 Control commands

The 9: MC_TorqueControl command includes the control commands described below.

Name	Description	Source:				Motion core
		CiA 402 ³⁸	Drive Based ³⁹	PROFIdrive	Motion control panel	
Execute	Start of motion with rising edge; cyclical set value takeover	A515, bit 4	I100/ I100/ — ⁴⁰	I100	Start button	I402
Cyclic reference torque/force	Cyclical set torque or cyclical set force	A558/ A558 + A593	G469	G469	K415	I428
Torque/force ramp up	Specification for the motion profile	A561/ —	G500	G500	—	I430
Torque/force ramp down	Specification for the motion profile	A561/ —	G501	G501	—	I431
Command Mode	Mode in which the motion block is executed if it is used as a subsequent motion block (cancellation of the ongoing motion block or start at the end of the ongoing motion block)	—	J21	J21	—	I409

Tab. 31: MC_TorqueControl: Control commands



Information

There is no specification for the direction of rotation or travel. The travel direction is dependent only on the cyclical set velocity (positive or negative sign).

³⁸ If parameter not valid for all operating modes, specification in the following order: Profile torque mode/Cyclic synchronous torque mode

³⁹ If parameter not valid for all operating modes, specification in the following order: motion block operating mode/command operating mode/velocity, torque/force operating mode (fixed value, control byte)

⁴⁰ Start of the command by Enable-on

1.10.2 Denial

The motion command is never denied.

1.10.3 Limits

The following limits apply:

- ▶ Torque or force is limited to the maximum torque or maximum force (E65, E66)
- ▶ Upon reaching a limit switch, a quick stop is executed by limit switch fault; then, set values in the direction of the limit switch are no longer taken into account for the calculation of the motion profile
- ▶ Set values in an impermissible direction (I04) are not taken into account for the calculation of the motion profile

The following applies to the state of the limits:

- ▶ In case of limited torque or limited force, the cyclical torque/force limit is active (I194 = I194)

1.10.4 Start

Start from standstill

The brake is released (prerequisite: F00 = 1: Active).

The state of the motion core (I89) switches to 4: Continuous motion.

The travel direction is dependent only on the cyclical set torque or cyclical set force (positive or negative sign).

Start from motion

The state of the motion core (I89) switches to 4: Continuous motion.

The travel direction is dependent only on the cyclical set torque or cyclical set force (positive or negative sign).

The load determines the motion behavior (acceleration, velocity, position). The motion can be slower or faster.

1.10.5 Motion

The axis moves without end with set torque/force.

Conditions

The following conditions apply to the motion:

- ▶ Velocity override (I230) is not taken into account
- ▶ Maximum velocity (I10) cannot be exceeded
- ▶ In case of a limit switch fault, internal set values in the direction of the limit switch are set to zero so that the axis comes to a standstill
- ▶ In case of set values in an impermissible direction (I04), the internal set values are set to zero
- ▶ Jog is taken into account
- ▶ Halt is taken into account

1.10.6 Target

The axis reaches the set torque or set force. This is followed without end until a new command starts or until the PLCOpen state switches (I89).

1.10.7 Status information

The 9: MC_TorqueControl command includes the status information described below.

Name	Description	Motion core
Done	1: Active: State after the second cycle time (A150) after command start	I92
	0: Inactive: State at command start for at least one cycle time (A150)	
State Motion Command	State of the running motion block and buffered subsequent motion block	I83
PLCOpen state	State of the motion core	I89

Tab. 32: MC_TorqueControl: Status information



Information

The Speed reached (I183), Motion profile done (I85) and Error (I91) status information is not used and remains inactive.

1.11 MC_CyclicPosition

The axis moves without end with set position (controller-based motion)



Information

The switch to cyclical set values (cyclical set velocity) takes place immediately.



Information

When using the command, make sure that the controller supplies suitable specifications for limiting the acceleration, deceleration and jerk in order to prevent set value jumps.

Control type

Position control (velocity feedforward control for the position controller using I25).

Using I425, both the source of the velocity feedforward control of the position controller as well as the interpolation type for velocity and position can be defined.

Applications

The command is used in the CiA 402 application in operating modes 7: Interpolated position mode and 8: Cyclic synchronous position mode.

Basic settings

Name	Description	Source:				Motion core
		CiA 402 ⁴¹	Drive Based	PROFIdrive	Motion control panel	
Command	10: MC_CyclicPosition	A541 = 7/ A541 = 8	—	—	—	I401
Motion ID	Use as active motion ID	—	—	—	—	I400

Tab. 33: MC_CyclicPosition: Basic settings

⁴¹Specification in the following order: Interpolated position mode/Cyclic synchronous position mode

1.11.1 Control commands

The 10: MC_CyclicPosition command includes the control commands described below.

Name	Description	Source:				Motion core
		CiA 402 ⁴²	Drive Based	PROFIdrive	Motion control panel	
Execute	Start of motion with rising edge; behavior in case of set value changes adjustable using I119	A515, bit 4	—	—	—	I402
Cyclic position reference value	Cyclical set position	A601/ A567	—	—	—	I421
Cyclic reference speed	Specification for the motion profile	A592/ A592 + A638	—	—	—	I426
Disable v-set at command change	Behavior in case of changes to the set velocity for the motion command (cyclical takeover by default or alternatively takeover only at start of command)	—/ I119	—	—	—	I426

Tab. 34: MC_CyclicPosition: Control commands



Information

For rotary axes (I00 = 1: Endless), the cyclical set position must be between zero and the revolution length I01. Otherwise, event 78: Position limit cyclic with cause 2 is triggered. The revolutions needed for infinite rotation are counted internally.



Information

The cyclical set values are interpolated linearly by the fine interpolator. During the extrapolation time adjustable in parameter I423, other set values can be extrapolated by the fine interpolator for the control, starting from the last received set value. After the time has expired, the extrapolation ends and event 78: Position limit cyclic with cause 3 is triggered. The extrapolation time is used to compensate for fluctuations in the cycle of the controller (A291) or the absence of set values.

⁴² If parameter not valid for all operating modes, specification in the following order: Interpolated position mode/Cyclic synchronous position mode

1.11.2 Denial

The motion command is never denied.

1.11.3 Limits

The following limits apply:

- ▶ Velocity is limited to the maximum velocity (I10)
- ▶ Torque or force is limited to the maximum torque or maximum force (E65, E66)
- ▶ Upon reaching a limit switch, a quick stop is executed by limit switch fault; then, set values in the direction of the limit switch are no longer taken into account for the calculation of the motion profile
- ▶ Set values in an impermissible direction (I04) are not taken into account for the calculation of the motion profile

The following applies to the state of the limits:

- ▶ In case of an impermissible direction, cyclical position limiting and the cyclical velocity limit are active (I192 = 1: Active and I193 = 1: Active)

1.11.4 Start

Start from standstill

The brake is released (prerequisite: F00 = 1: Active).

The state of the motion core (I89) switches to 11: Cyclic Motion.

Start from motion

The start of the command from motion is not useful and should be avoided.

The state of the motion core (I89) switches to 11: Cyclic Motion.

The cyclical set values determine the motion behavior. Within the cycle time (A291), the internal set position switches to the cyclical set velocity and the internal set velocity switches to the cyclical set velocity. The controller is responsible for supplying useful specifications for motion.

1.11.5 Motion

The axis moves without end with set position (controller-based motion)

Velocity feedforward control for the position controller

The feedforward control lessens the work for the position controller and reduces following error (feedforward control: I25, source: I425).

Detailed information on the feedforward control and the individual options (controller-generated external feedforward control, drive-generated internal feedforward control or without feedforward control) can be found in the manual for the CiA 402 application (see Further information).

Conditions

The following conditions apply to the motion:

- ▶ Velocity override (I230) is not taken into account
- ▶ In case of a limit switch fault, internal set values in the direction of the limit switch are set to zero so that the axis comes to a standstill
- ▶ In case of set values in an impermissible direction (I04), the internal set values are set to zero
- ▶ Jog is taken into account
- ▶ Halt is taken into account

1.11.6 Target

The axis reaches the set velocity and set position. These specifications are followed without end until a new command starts or until the PLCOpen state switches (I89).

1.11.7 Status information

The 10: MC_CyclicPosition command includes the status information described below.

Name	Description	Motion core
Error	1: Active: Motion core has canceled the command	I91
	0: Inactive: State at command start for at least one cycle time (A150)	
PLCOpen ErrorStop cause	Cause for the cancellation of the command by the motion core (I91 = 1: Active; I89 = 7: Error stop)	I90
	0: Error free: State at command start for at least one cycle time (A150)	
Done	1: Active: State after the second cycle time (A150) after command start	I92
	0: Inactive: State at command start for at least one cycle time (A150)	
PLCOpen state	State of the motion core	I89

Tab. 35: MC_CyclicPosition: Status information



Information

The Speed reached (I183) and Motion profile done (I85) status information is not used and remains inactive.

1.12 MC_Halt

The axis is brought to a standstill. The next command can be executed before the axis standstill.

Control type

Unchanged (corresponds to the control type of the previous command or position control default value).

Applications

The command is used in the following applications:

- ▶ Drive Based-type applications in the motion block and command operating modes
- ▶ PROFIdrive in application class 3 with telegram 111 in Program mode (motion block)

Basic settings

Name	Description	Source:				Motion core
		CiA 402	Drive Based ⁴³	PROFIdrive	Motion control panel	
Command	11: MC_Halt	—	J11/ J40	M550, bit 15 = 0 + J11	K402	I401
Motion ID	Use as active motion ID (I82) in the motion block and command operating modes	—	J300/ J41	J300	—	I400

Tab. 36: MC_Halt: Basic settings

⁴³ Specification in the following order: motion block operating mode/command operating mode

1.12.1 Control commands

The 11: MC_Halt command includes the control commands described below.

Name	Description	Source:				Motion core
		CiA 402	Drive Based ⁴⁴	PROFIdrive	Motion control panel	
Execute	Start of motion with rising edge	—	I100	I100	Start button	I402
Deceleration	Specification for the motion profile	—	J16/ J45	J16	K406	I406
Jerk	Specification for the motion profile	—	J17/ J46	J17	K407	I407
Engage brake at the end	Brake engaging at the end of the command in motion block and command operating modes	—	J27/ J53	J27	—	I410

Tab. 37: MC_Halt: Control commands

⁴⁴ If parameter not valid for all operating modes, specification in the following order: motion block operating mode/command operating mode

1.12.2 Denial

Possible causes of a command denial include:

- ▶ Deceleration or jerk is equal to zero; exception: axis is already stationary (I89 = 2: Standstill)
- ▶ Maximum acceleration and deceleration (I11) or maximum jerk (I16) is equal to zero

1.12.3 Limits

The generated motion profile is subject to the following limitations:

- ▶ Deceleration is limited in amount to maximum acceleration (I11)
- ▶ Jerk is limited to the maximum jerk (I16)

The following applies to the state of the limits:

- ▶ In case of limited acceleration or deceleration or in case of limited jerk, the acceleration/jerk limit is active (I191 = 1: Active)

1.12.4 Start

Start from standstill

The brake is actuated according to the setting for brake engaging.

The state of the motion core (I89) switches to 3: Discrete motion and stays there until the Execute signal becomes inactive.

Start from motion

The state of the motion core (I89) switches to 3: Discrete motion until the standstill is reached and the Execute signal becomes inactive.

The motion state is continued with limited jerk if all motion variables were defined in advance by the profile generator.



Information

Jerk-free continuation after a preceding MC_TorqueControl command is not guaranteed.

1.12.5 Motion

The axis is brought to a standstill. The next command can be executed before the axis standstill.

The standstill is reached if the motion profile is fully calculated and the actual velocity is within the velocity window around the set velocity of zero (actual velocity: I88, velocity window: C40).

Example

MC_Halt while the previous command (e.g. MC_MoveVelocity) is active; after the axis standstill, the canceled command is started again by a second Execute

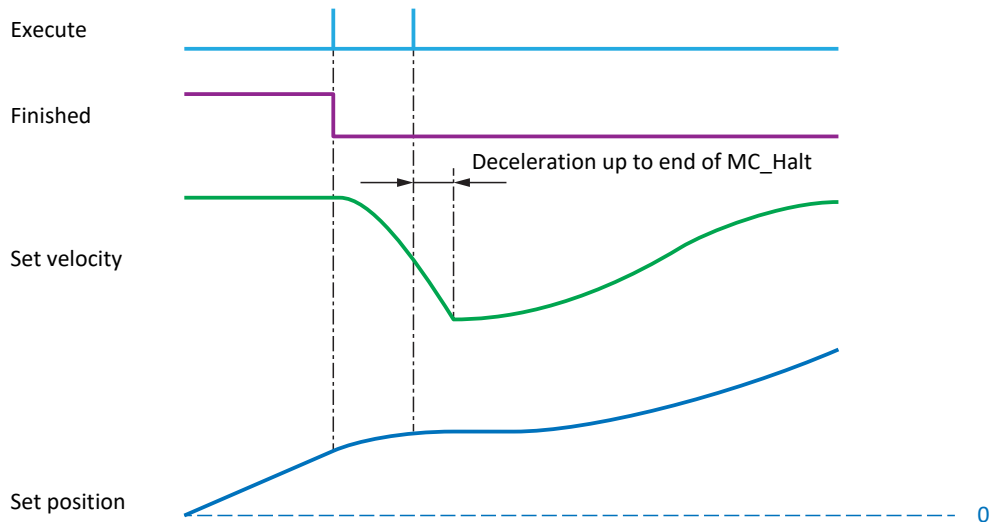


Fig. 17: MC_Halt: Motion

Conditions

The following conditions apply to the motion:

- ▶ Velocity override (I230) is not taken into account

1.12.6 Target

The axis is stationary.

The following applies to brake engaging at the end:

- ▶ If brake engaging at the end is active, the brake is engaged after the wait time expires (I42)
- ▶ Within the wait time, the axis can be started again without brake engaging by a command

1.12.7 Status information

The 11: MC_Halt command includes the status information described below.

Name	Description	Motion core
Speed reached	1: Active: Motion profile of the motion core has reached the set velocity; motion profile is fully calculated (I85) and the actual velocity is within the velocity window around the set velocity = 0 (actual velocity: I88, velocity window: C40)	I183
	1: Active → 0: Inactive: Actual velocity has left the window around the set velocity or if the command is canceled by the start of a new command	
	0: Inactive: State even if set velocity is not reached due to parameterization or a travel distance that is too short	
Motion profile done	1: Active: Motion profile is fully calculated and calculated set velocity has reached the value zero (E07 = 0)	I85
Error	1: Active: Motion core has denied or canceled the command	I91
	0: Inactive: State at command start for at least one cycle time (A150), even if the command has been denied (see Denial [71])	
PLCOpen ErrorStop cause	Cause for the cancellation or denial of the command by the motion core (I91 = 1: Active; I89 = 7: Error stop)	I90
	0: Error free: State at command start for at least one cycle time (A150), even if the command has been denied	
Done	1: Active: Motion core has successfully ended the motion command to be run: Set and actual velocities have reached zero (I85 = 1: Active, I199 = 1: Active); State for buffered motion blocks only at the end of the subsequent motion block; state before engaging the brakes	I92
	0: Inactive: State at command start for at least one cycle time (A150), even if the condition for successfully ending has already been satisfied at command start	
State Motion Command	State of the running motion block and buffered subsequent motion block	I83
PLCOpen state	State of the motion core	I89

Tab. 38: MC_Halt: Status information



Information

If the command is denied at a standstill, the state for successful ending is reported instead of an error (I91 = 0: Inactive, I92 = 1: Active).

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Example

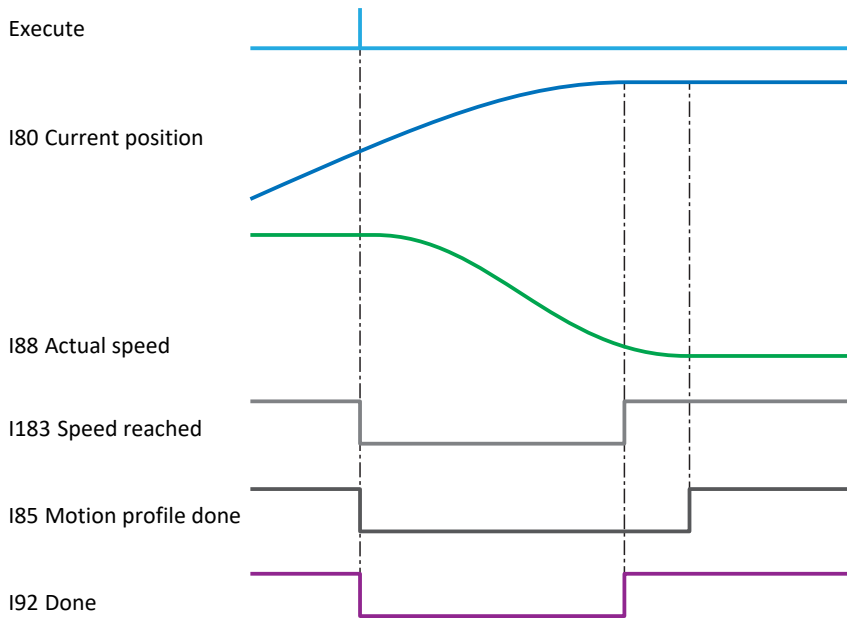


Fig. 18: MC_Halt status information: Example

In the example, the Speed reached (I183) and Done (I92) states are reported at the same time as soon as the actual velocity is within the velocity window around the set velocity of zero. The Motion profile done (I85) state is only reported if the calculated set velocity has reached the value zero.

2 Further information

The documentation listed below provides you with further relevant information on applications for the 6th Pilz drive controller generation. The current status of the documentation can be found in our download center at:

<https://www.pilz.com/en-INT>.

Enter the ID of the documentation in the search field.

Title	Documentation	Contents	ID
PROFIdrive application – PMC SC6, PMC SI6	Manual	Project configuration, configuration, parameterization, function test, detailed information	1006911
CiA 402 application – PMC SC6, PMC SI6	Manual	Project planning, configuration, parameterization, function test, detailed information	1005347
Drive Based application (DB) – PMC SC6, PMC SI6	Manual	Project configuration, configuration, parameterization, function test, detailed information	1006906
Drive Based Synchronous application (DBS) – PMC SC6, PMC SI6	Manual	Project configuration, configuration, parameterization, function test, detailed information	1006908
Drive Based Center Winder application (DBCW) – PMC SC6, PMC SI6	Manual	Project configuration, configuration, parameterization, function test, detailed information	1006912

Application class (AC)

Standardized drive functions according to the PROFIdrive device profile. In view of its wide range of possible applications, six classes specified according to functionality have been defined for PROFIdrive. A drive can cover one or more classes.

Control type

Method of controlling a physical variable, such as the position, velocity, torque, force, current or voltage.

Feedforward control

Element of control system design where a manipulated variable is loaded with a value that is independent from the states of the controlled section and the resulting measurements. Feedforward control makes it possible to take into account the manipulated variable requirement to be expected based on the set value profile.

Fine interpolator

Part of the motion core that calculates appropriate intermediate values for control in controller-based motion profiles, as this is faster than specifying set values. It sits between the profile calculation and control cascade.

Jog

Step-by-step movement that can be used to move the drive incrementally and independently of the controller, such as during commissioning, in emergency operation or during setup and repair work. Also: Name of a CiA 402 application operating mode.

Motion command

Command that determines the basic movement of the axis, i.e. in which control type (position, velocity, torque/force) and with which set value (set position, set velocity, set torque/force) the axis is moved. It determines which movement variables need to be configured (e.g. acceleration, velocity, jerk) to enable the motion profile to be calculated from them.

Motion core

The part upstream in the control cascade that is composed of the fine interpolator, profile generator and logic for its use. It supplies the set values for the control cascade.

Operating mode

Application-specific command sets for the configuration of individual motion profiles.

Override

Manual control function, which makes it possible to change specified values such as the velocity during operation.

Position controller

Controller that is part of the control cascade and makes sure the deviation between the set and actual position is small. To do so, it calculates a set velocity from the deviation and passes it to the velocity controller.

Referencing

When commissioning a system with a position measurement system, the relation of a measured axis to an actual axis position must be determined. As a rule, a defined starting position is identified through either a reference search or a reference setting. The associated process is referred to as referencing. Absolute movements can be performed only in a referenced state.

Referencing

When commissioning a system with a position measurement system, the relation of a measured axis to an actual axis position must be determined. Usually, a defined initial position is identified either by a reference search or by a reference setting. The associated process is referred to as referencing. Absolute movements can be performed only in a referenced state.

Velocity controller

Controller that is part of the control cascade and makes sure the deviation between the set and actual velocity is small. In addition, it uses the deviation to calculate a value for the set torque/force and transfers this to the current controller.

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► Support

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