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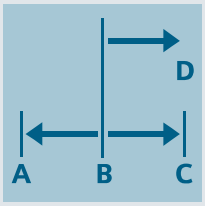
EPos



Function Manual

SINAMICS

SINAMICS G120

Basic positioner (EPos) for CU250-2 Control Units

Edition 04/2018

www.siemens.com/drives

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SINAMICS G120
Basic positioner

Function Manual

Edition 04/2018, firmware V4.7 SP10

04/2018, FW V4.7 SP10
A5E34257659B AF

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

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We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Siemens AG
Division Digital Factory
Postfach 48 48
90026 NÜRNBERG
GERMANY

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℗ 05/2018 Subject to change

Changes in the current edition

Changes with respect to the 09/2017 edition of the Manual

Corrections

- SSI encoders are permissible for both speed control and position control.
  Permissible encoder combinations (Page 15)
- PROFIdrive status word 1, bit 13 corrected.
  Control and status word 1 (Page 21)
  PROFIdrive control word 2, bit 8 corrected.
  PROFIdrive status word 2, bit 7 corrected.
  Control and status word 2 (Page 23)

Revised descriptions

- Only commissioning using the Startdrive PC-based tool is described. Commissioning with STARTER has been removed.
  "Basic positioner" function manual, edition 09/2017 (https://support.industry.siemens.com/cs/ww/en/view/109751321)

Table of contents

Fundamental safety instructions 1

1.1 General safety instructions

WARNING

Danger to life if the safety instructions and residual risks are not observed

If the safety instructions and residual risks in the associated hardware documentation are not observed, accidents involving severe injuries or death can occur.

- Observe the safety instructions given in the hardware documentation.
- Consider the residual risks for the risk evaluation.

WARNING

Malfunctions of the machine as a result of incorrect or changed parameter settings

As a result of incorrect or changed parameterization, machines can malfunction, which in turn can lead to injuries or death.

- Protect the parameterization (parameter assignments) against unauthorized access.
- Handle possible malfunctions by taking suitable measures, e.g. emergency stop or emergency off.

1.2 Warranty and liability for application examples

Application examples are not binding and do not claim to be complete regarding configuration, equipment or any eventuality which may arise. Application examples do not represent specific customer solutions, but are only intended to provide support for typical tasks.

As the user you yourself are responsible for ensuring that the products described are operated correctly. Application examples do not relieve you of your responsibility for safe handling when using, installing, operating and maintaining the equipment.

1.3 Industrial security

Note

Industrial security

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the Internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

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Industrial security (http://www.siemens.com/industrialsecurity)

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To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at:

Industrial security (http://www.siemens.com/industrialsecurity)

Further information is provided on the Internet:

Industrial Security Configuration Manual (https://support.industry.siemens.com/cs/ww/en/view/108862708)

WARNING

Unsafe operating states resulting from software manipulation

Software manipulations (e.g. viruses, trojans, malware or worms) can cause unsafe operating states in your system that may lead to death, serious injury, and property damage.

- Keep the software up to date.
- Incorporate the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation or machine.
- Make sure that you include all installed products into the holistic industrial security concept.
- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.
- Protect the drive against unauthorized changes by activating the "know-how protection" drive function.

Introduction 2

Who requires this manual and why?

This manual addresses machine and plant manufacturers and commissioning engineers. The manual describes the function "basic positioner" of the SINAMICS G120 inverter equipped with the CU250S-2 Control Unit.

What is described in this manual?

This manual covers all the information, procedures and operations required for the following scenarios:

- Controlling the basic positioner via the fieldbus.
- Commissioning the basic positioner.

What other information do you need?

This manual alone is not sufficient for installing or commissioning the standard inverter functions.


Manuals and technical support (Page 93)

What is the meaning of the symbols in the manual?


Reference to further information in the manual


Download from the Internet


DVD that can be ordered

End of a handling instruction.
❒

Basic positioner and position control

3

Overview

Position control means controlling the position of an axis. An "axis" is a machine or system component that comprises the inverter with active position control and the driven mechanical system.

The basic positioner (EPos) calculates the traversing profile for the time-optimized traversing of the axis to the target position.

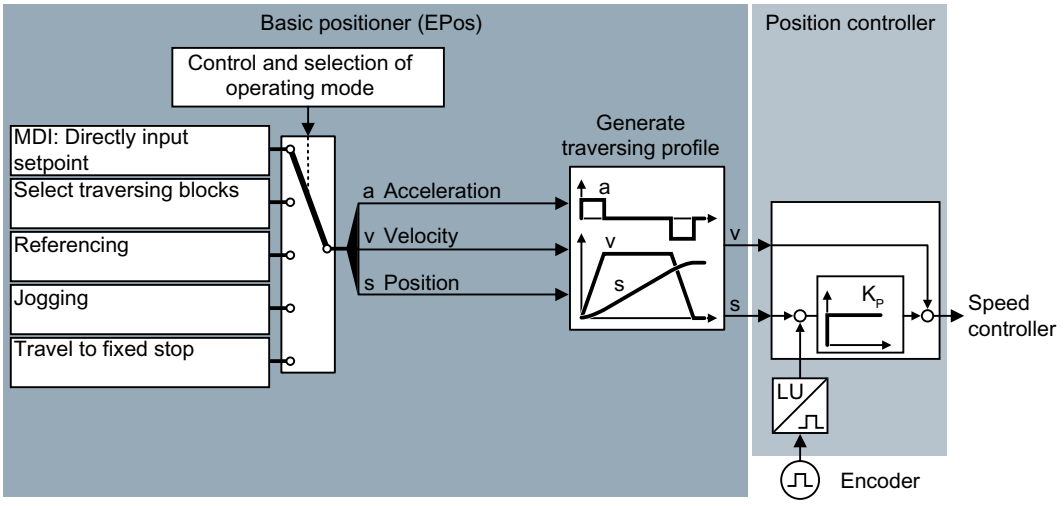


Figure 3-1 Basic positioner and position control

The basic positioner has the following operating modes:

- Direct setpoint input (MDI): The external control specifies the position setpoint for the axis.
- Traversing block selection: Position setpoints are saved in different traversing blocks in the inverter. The external control selects a traversing block.
- Referencing: Referencing establishes the reference of the position measurement in the inverter to the machine.
- Jogging: This function is used to incrementally traverse the axis (Set up).
- Travel to fixed stop: The inverter positions the axis with a defined torque against a mechanical fixed stop.

Permissible encoder combinations

4

Overview

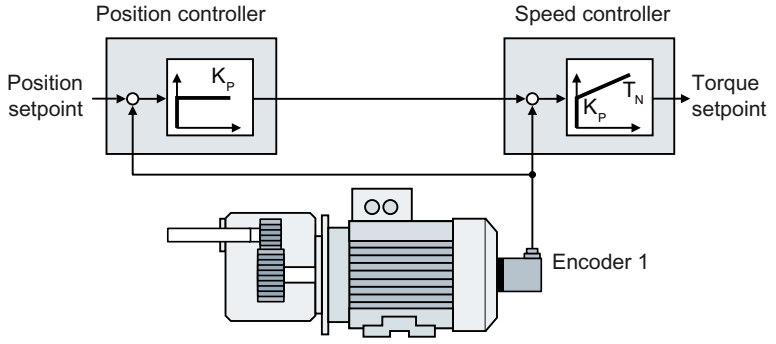
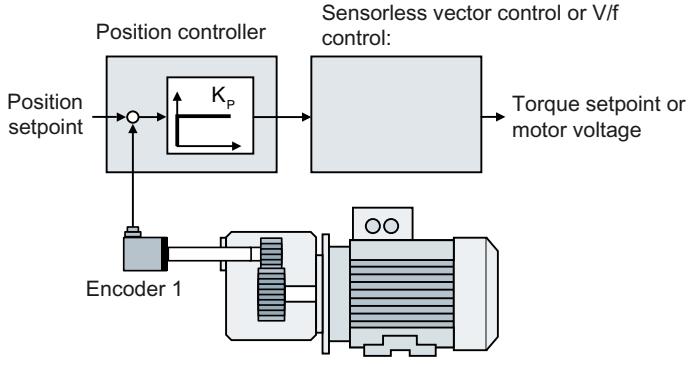
You can connect two encoders to the inverter.

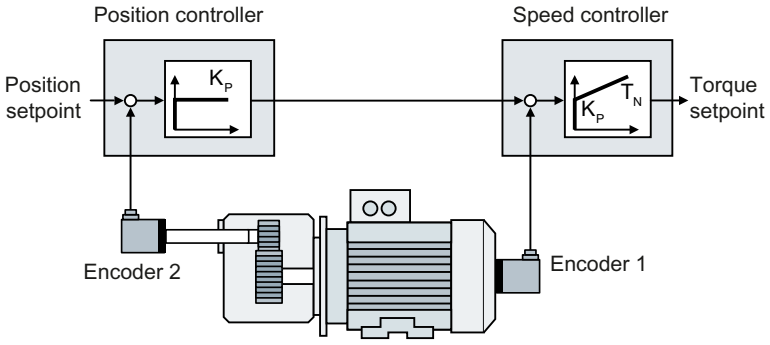
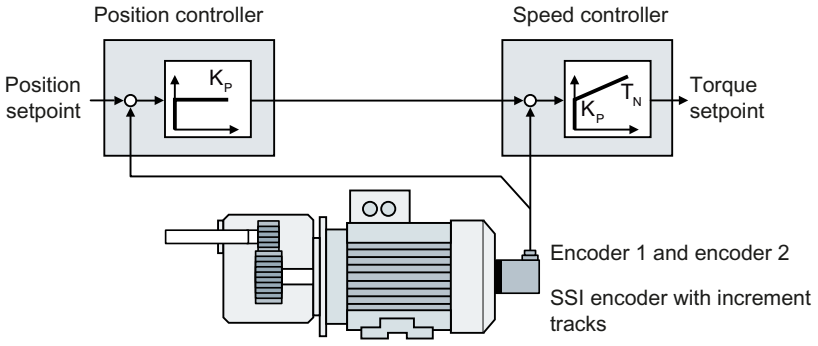
Table 4-1 Encoder combinations

Encoders for the speed controller		Encoders for the position controller					
		D-sub connector -X2100 		Terminal strip -X136 		DRIVE-CLiQ interface -X100 	
		HTL or TTL encoder	SSI encoder	Resolver	HTL encoder	Encoder connection via Sensor Module SMC or SME	DRIVE-CLiQ encoder
	Encoderless	②	②	②	②	②	②
-X2100 	HTL or TTL encoder	①	---	---	③	③	③
	SSI encoder	---	①	---	③	③	③
-X136	Resolver	---	---	①	---	---	---
	HTL encoder	③	③	---	①	③	③
-X100	Encoder connection via SMC or SME	③	③	---	③	①	---
	DRIVE-CLiQ encoder	③	③	---	③	---	①

The symbols ---, ①, ② and ③ are explained in the table below.

Table 4-2 Explanation regarding encoder combinations

---	This combination is not permissible.	
①	Position controllers and speed controllers use the same encoder on the motor shaft.	
		Depending on the gear ratio, restrictions regarding the accuracy of the position control. Not suitable for position control in the case of mechanical slip on the load side
②	The position controller evaluates an encoder on the motor shaft or on the load side. The speed controller operates without an encoder.	
		Restrictions regarding the accuracy and dynamic performance of the position control Not suitable for the position control of hoisting gear The "Travel to fixed stop" EPos function is not possible.

③	Position controller and speed controller use different encoders. The encoder for the speed controller must be mounted on the motor shaft.	
		Compared to the other options of encoder assignment, this configuration provides the best control results.
		Depending on the gear ratio, restrictions regarding the accuracy of the position control. Not suitable for position control in the case of mechanical slip on the load side.

Example

An HTL encoder is connected to terminal strip -X136.

You have the following options in this case:

- You use the HTL encoder for the speed controller and operate the drive without position control.
- You use the HTL encoder both for the speed controller and for the position controller ①.
- You operate the drive with encoderless speed control and use the encoder for the position controller ②.
- You use the HTL encoder at the terminal strip only for the speed controller and a second encoder for the position controller ③.

You can connect the second encoder for the position controller either to the D-sub connector -X2100 or to the DRIVE-CLiQ interface -X100.

PROFIdrive interface

5

The send and receive telegrams of the inverter for cyclic communication are structured as follows:

Telegram 7

PZD01	PZD02
STW1	SATZ ANW
ZSW1	AKT SATZ

Basic positioner with selection of the traversing block

Telegram 9

PZD01	PZD02	PZD03	PZD04	PZD05	PZD06	PZD07	PZD08	PZD09	PZD10
STW1	SATZ ANW	STW2	MDI_TARPOS		MDI_VELOCITY		MDI_ ACC	MDI_ DEC	MDI_ MOD
ZSW1	AKT SATZ	ZSW2	XIST_A						

Basic positioner with direct setpoint input (MDI)

Telegram 110

PZD01	PZD02	PZD03	PZD04	PZD05	PZD06	PZD07	PZD08	PZD09	PZD10	PZD11	PZD12
STW1	SATZ ANW	POS_ STW	STW2	OVER RIDE	MDI_TARPOS		MDI_VELOCITY		MDI_ ACC	MDI_ DEC	MDI_ MOD
ZSW1	AKT SATZ	POS_ ZSW	ZSW2	MELDW	XIST_A						

Basic positioner with direct setpoint input (MDI), override and position actual value

Telegram 111, positioning operation with extended functions

PZD01	PZD02	PZD03	PZD04	PZD05	PZD06	PZD07	PZD08	PZD09	PZD10	PZD11	PZD12
STW1	POS_ STW1	POS_ STW2	STW2	OVER RIDE	MDI_TARPOS		MDI_VELOCITY		MDI_ ACC	MDI_ DEC	Free
ZSW1	POS_ ZSW1	POS_ ZSW2	ZSW2	MELDW	XIST_A		NIST_B		FAULT_ CODE	WARN_ CODE	Free

Basic positioner with direct setpoint input (MDI), override, position actual value and speed actual value

Telegram 999

PZD01	PZD02	PZD03	PZD04	PZD05	PZD06	PZD07	PZD08	PZD09	PZD10	PZD11	PZD12	PZD13 ... PZD17
STW1	Telegram length for the receive data											
ZSW1	Telegram length for the transmit data											

Free interconnection and length

Table 5-1 Explanation of the abbreviations

Abbreviation	Meaning
STW1	Control word 1
ZSW1	Status word 1  Control and status word 1 (Page 21)
STW2	Control word 2
ZSW2	Status word 2, see also:
SATZANW	Selects the traversing block  Control and status word 2 (Page 23)
AKTSATZ	Currently selected traversing block  Control word block selection (Page 30)
MDI_TARPOS	Position setpoint for direct setpoint input (MDI)
XIST_A	Actual position value (32 bits)
OVERRIDE	Speed setpoint
MELDW	Status word for messages  Status word messages (Page 32)
NIST_B	Actual speed value (32 bits)
Free	Freely interconnectable
MDI_VELOCITY	MDI velocity
MDI_ACC	MDI accelerating torque
MDI_DEC	MDI braking torque
MDI_MOD	Selects the positioning mode in the case of direct setpoint input (MDI)  Control word MDI mode (Page 31)
POS_STW	Control word for basic positioner
POS_ZSW	Status word for basic positioner  Control and status word for the positioner (Page 24)
POS_STW1	Control word 1 for basic positioner
POS_ZSW1	Status word 1 for basic positioner  Control and status word 1 for the positioner (Page 26)
POS_STW2	Control word 2 for basic positioner
POS_ZSW2	Status word 2 for basic positioner  Control and status word 2 for the positioner (Page 28)
WARN_CODE	Number of the actual alarm
FAULT_CODE	Number of the actual fault

5.1 Control and status word 1

Control word 1 (STW1)

Table 5-2 Control word 1 for active basic positioner

Bit	Meaning	Comments	P No.
0	0 = OFF1	The motor brakes with the ramp-down time p1121 of the ramp-function generator. The inverter switches off the motor at standstill.	p0840[0] = r2090.0
	0 → 1 = ON	The inverter goes into the "ready" state. If, in addition, bit 3 = 1, the inverter switches on the motor.	
1	0 = OFF2	Switch off motor immediately, then the motor coasts to a standstill.	p0844[0] = r2090.1
	1 = No OFF2	It is possible to switch on the motor (ON command).	
2	0 = Quick stop (OFF3)	Quick stop: the motor brakes with the OFF3 ramp-down time p1135 down to standstill.	p0848[0] = r2090.2
	1 = No quick stop (OFF3)	It is possible to switch on the motor (ON command).	
3	0 = Inhibit operation	Immediately switch-off motor (cancel pulses).	p0852[0] = r2090.3
	1 = Enable operation	Switch-on motor (pulses can be enabled).	
4	0 = Reject traversing job	Axis brakes down to standstill with the maximum deceleration. Inverter rejects the actual traversing block.	p2641 = r2090.4
	1 = Do not reject traversing task	Axis can be started or travel to position setpoint.	
5	0 = Intermediate stop	Axis brakes down to standstill with the specified deceleration override. Inverter remains in the actual traversing block.	p2640 = r2090.5
	1 = No intermediate stop	Axis can be started or continue to travel to position setpoint.	
6	0 → 1: Activate traversing job	The inverter starts axis travel to the setpoint position.	p2631 = r2090.6
	0 → 1: Setpoint transfer MDI		p2650 = r2090.6
7	0 → 1: = Acknowledge faults	Acknowledge fault in the inverter. If the ON command is still active, the inverter switches to "closing lockout" state.	p2103[0] = r2090.7
8	1 = jogging bit 0	Jogging 1	p2589 = r2090.8
9	1 = jogging bit 1	Jogging 2	p2590 = r2090.9
10	0 = No control via PLC	Inverter ignores the process data from the fieldbus.	p0854[0] = r2090.10
	1 = Control via PLC	Control via fieldbus, inverter accepts the process data from the fieldbus.	
11	0 = Stop referencing	---	p2595 = r2090.11
	1 = Start referencing	The inverter does not start referencing.	
12	Reserved		
13	0 → 1: External block change	The axis goes to the next traversing block.	p2633 = r2090.13
14, 15	Reserved		

Status word 1 (ZSW1)

Table 5-3 Status word 1 when the basic positioner is active

Bit	Meaning		Comments	P No.
	Telegram 110	Telegram 111		
0	1 = Ready to start		Power supply is switched on; electronics initialized; pulses are inhibited.	p2080[0] = r0899.0
1	1 = Ready		Motor is switched on (ON command = 1); no fault is active. With the command "Enable operation" (STW1.3) the inverter switches on the motor.	p2080[1] = r0899.1
2	1 = Operation enabled		Motor follows setpoint. See control word 1, bit 3.	p2080[2] = r0899.2
3	1 = Fault present		The inverter has a fault. Acknowledge fault using STW1.7.	p2080[3] = r2139.3
4	1 = OFF2 inactive		Coast down to standstill is not active.	p2080[4] = r0899.4
5	1 = OFF3 inactive		Quick stop is not active.	p2080[5] = r0899.5
6	1 = Closing lockout active		It is only possible to switch on the motor after an OFF1 command and an additional ON command.	p2080[6] = r0899.6
7	1 = Alarm present		Motor remains switched on; no acknowledgment necessary.	p2080[7] = r2139.7
8	1 = Following error in tolerance		The actual difference between the actual position and the position setpoint is within the permissible tolerance p2546.	p2080[8] = r2684.8
9	1 = Control requested		The automation system is requested to accept the control from the inverter.	p2080[9] = r0899.9
10	1 = Target position reached		The axis has reached the target position.	p2080[10] = r2684.10
11	1 = Reference point set		The axis is referenced.	p2080[11] = r2684.11
12	0 → 1 = Acknowledgement, traversing block active			p2080[12] = r2684.12
13	1 = Setpoint is stationary			p2080[13] = r2683.2
14	Reserved	1 = Axis accelerates		p2080[14] = r2684.4
15	Reserved	1 = Axis brakes		p2080[15] = r2684.5

5.2 Control and status word 2

Control word 2 (STW2)

Bit	Meaning		Signal interconnection in the inverter
	Telegrams 2, 3 and 4	Telegrams 9, 110 and 111	
0	1 = drive data set selection DDS bit 0		p0820[0] = r2093.0
1	1 = drive data set selection DDS bit 1		p0821[0] = r2093.1
2…6	Reserved		
7	1 = parking axis is selected		p0897 = r2093.7
8	1 = travel to fixed stop active	Reserved	p1545[0] = r2093.8
9…11	Reserved		
12	1 = master sign-of-life bit 0		p2045 = r2050[3]
13	1 = master sign-of-life bit 1		
14	1 = master sign-of-life bit 3		
15	1 = master sign-of-life bit 4		

Status word 2 (ZSW2)

Bit	Meaning	Signal interconnection in the inverter
0	1 = Drive data set DDS effective, bit 0	p2081[0] = r0051.0
1	1 = Drive data set DDS effective, bit 1	p2081[1] = r0051.1
2…4	Reserved	
5	1 = Alarm class bit 0	p2081[5] = r2139.11
6	1 = alarm class bit 1	p2081[6] = r2139.12
7	Reserved	
8	1 = travel to fixed stop active	p2081[8] = r1406.8
9	Reserved	
10	1 = pulses enabled	p2081[10] = r0899.11
11	Reserved	
12	Slave sign-of-life bit 0	Internally interconnected
13	Slave sign of life bit 1	
14	Slave sign of life bit 2	
15	Slave sign of life bit 3	

5.3 Control and status word for the positioner

Positioning control word (POS_STW)

Table 5-4 POS_STW and interconnection with parameters in the inverter

Bit	Meaning	Comments	P No.
0	1 = Follow-up mode	The inverter continuously corrects the position setpoint to follow the position actual value.	p2655[0] = r2092.0
1	1 = Set reference point	The inverter accepts the reference point coordinate in its position actual value and setpoint.	p2596 = r2092.1
2	1 = Reference cam active	The load is currently on the reference cam.	p2612 = r2092.2
3	Reserved	---	---
4			
5	1 = Incremental jogging active	If the jogging command is active, the inverter positions the load by the specified traversing path in a positive or negative direction.	p2591 = r2092.5
	0 = Jogging velocity active	If the jogging command is active, the inverter positions the load with the jog velocity in the direction of the beginning or end of the traversing range.	
6…15	Reserved	---	---

Positioning status word (POS_ZSW)

Table 5-5 POS_ZSW and interconnection with parameters in the inverter

Bit	Meaning	Comments	P No.
0	1 = Follow-up mode active	The inverter is in the follow-up mode.	p2084[0] = r2683.0
1	1 = Velocity limiting is active	The inverter limits the velocity of the axis.	p2084[1] = r2683.1
2	1 = Setpoint is stationary	During a positioning operation, the setpoint no longer changes.	p2084[2] = r2683.2
3	1 = Position setpoint reached	The axis has reached the specified target position.	p2084[3] = r2684.3
4	1 = Axis traverses forwards	The axis traverses in the positive direction.	p2084[4] = r2683.4
	0 = Axis is stationary or traverses backwards	---	
5	1 = Axis traverses backwards	The axis traverses in the negative direction.	p2084[5] = r2683.5
	0 = Axis is stationary or traverses forwards	---	
6	1 = Software limit switch, minus actuated	The load is outside the permitted traversing range.	p2084[6] = r2683.6
7	1 = Software limit switch, plus actuated		p2084[7] = r2683.7

Bit	Meaning	Comments	P No.
8	1 = Position actual value ≤ cam switching position 1	Feedback of the software cams in the inverter.	p2084[8] = r2683.8
	0 = Cam switching position 1 passed		
9	1 = Position actual value ≤ cam switching position 2		p2084[9] = r2683.9
	0 = Cam switching position 2 passed		
10	1 = Direct output 1 active	The inverter sets these signals in the actual traversing block.  Setting the traversing blocks (Page 75)	p2084[10] = r2683.10
11	1 = Direct output 2 active		p2084[11] = r2683.11
12	1 = Fixed stop reached	The axis is at the fixed stop	p2084[12] = r2683.12
13	1 = Fixed stop clamping torque reached	The axis is at the fixed stop and has reached the clamping torque.	p2084[13] = r2683.13
14	1 = Travel to fixed stop active	The inverter moves the axis to a fixed stop.	p2084[14] = r2683.14
15	Reserved	---	---

5.4 Control and status word 1 for the positioner

Positioning control word 1 (POS_STW1)

Table 5-6 POS_STW1 and interconnection in the converter

Bit	Meaning	Comments	P No.
0	Traversing block selection, bit 0	Selecting the traversing block	p2625 = r2091.0
1	Traversing block selection, bit 1		p2626 = r2091.1
2	Traversing block selection, bit 2		p2627 = r2091.2
3	Traversing block selection, bit 3		p2628 = r2091.3
4 to 7	Reserved	---	---
8	0 = Relative positioning is selected	The converter interprets the position setpoint as the position setpoint relative to the start position.	p2648 = r2091.8
	1 = Absolute positioning is selected	The converter interprets the position setpoint as absolute position setpoint relative to machine zero point.	
9	01 = Absolute positioning for rotary axis in the positive direction	Selection of the positioning type for a rotary axis.	p2651 = r2091.9
10	10 = Absolute positioning for rotary axes in negative direction		p2652 = r2091.10
	00, 11 = Absolute positioning for a rotary axis through the shortest distance		
11	Reserved	---	---
12	1 = Continuous acceptance	The converter accepts position setpoint changes immediately.	p2649 = r2091.12
	0 = MDI block change with control word 1, bit 6	The inverter accepts a changed position setpoint with the signal change 0 → 1 of control word 1, bit 6. Control and status word 1 (Page 21)	
13	Reserved	---	---
14	1 = Select Set up	Toggling the axis operating mode between "Set up" and "Positioning". Direct setpoint input (MDI) (Page 87)	p2653 = r2091.14
	0 = Select positioning		
15	1 = Activate MDI	The converter receives its position setpoint from an external control.	p2647 = r2091.15
	0 = Deactivate MDI		

Positioning status word 1 (POS_ZSW1)

Table 5-7 POS_ZSW1 and interconnection in the converter

Bit	Meaning	Comments	P No.
0	Active traversing block bit 0 (2^0)	Number of the currently selected traversing block.	p2083[0] = r2670[0]
1	Active traversing block bit 1 (2^1)		p2083[1] = r2670[1]
2	Active traversing block bit 2 (2^2)		p2083[2] = r2670[2]
3	Active traversing block bit 3 (2^3)		p2083[3] = r2670[3]
4	Active traversing block bit 4 (2^4)		p2083[4] = r2670[4]
5	Active traversing block bit 5 (2^5)		p2083[5] = r2670[5]
6	Reserved	---	---
7			
8	1 = STOP cam minus active	The axis is currently located at a STOP cam.	p2083[08] = r2684[13]
9	1 = STOP cam plus active		p2083[09] = r2684[14]
10	1 = Jogging active	The converter is in the jogging mode.	p2083[10] = r2094[0]
11	1 = Reference point approach active	The converter is presently executing a reference point approach.	p2083[11] = r2094[1]
12	1 = Flying referencing active	The converter references when passing the reference cam.	p2083[12] = r2684[1]
13	1 = Traversing block active	The converter receives its position setpoint from a traversing block.	p2083[13] = r2094[2]
14	1 = Set up active	The axis is in the "Set up" operating mode.	p2083[14] = r2094[4]
15	1 = MDI active	The converter receives its position setpoint from an external control.	p2083[15] = r2670[15]
	0 = MDI inactive		

5.5 Control and status word 2 for the positioner

Positioning control word 2 (POS_STW2)

Table 5-8 POS_STW2 and interconnection with parameters in the converter

Bit	Meaning	Comments	P No.
0	1 = Activate follow-up mode	The converter continuously corrects the position setpoint to follow the position actual value.	p2655[0] = r2092.0
1	1 = Set reference point	The converter accepts the reference point coordinate in its position actual value and setpoint.	p2596 = r2092.1
2	1 = Reference cam active	The axes is currently located at the reference cam.	p2612 = r2092.2
3	Reserved	---	---
4			
5	1 = Incremental jogging active	If the jogging command is active, the converter positions the axis by the specified traversing path in a positive or negative direction.	p2591 = r2092.5
	0 = Jogging velocity active	If the jogging command is active, the converter positions the axis with the jog velocity in the direction of the beginning or end of the traversing range.	
6	Reserved	---	---
7			
8	1 = Selects referencing using flying referencing	Select the referencing type.	p2597 = r2092.8
	0 = Selects referencing via the reference point approach		
9	1 = Starts reference point approach in negative direction	Select the start direction for automatic referencing.	p2604 = r2092.9
	0 = Starts reference point approach in positive direction		
10	1 = Selects probe 2	Edge of the probe input, with which the converter references its actual position value.	p2510[0] = r2092.10
	0 = Selects probe 1		
11	1 = Probe falling edge	Select the edge of the probe input, with which the converter references its actual position value.	p2511[0] = r2092.11
	0 = Probe, rising edge		
12	Reserved	---	---
13			
14	1 = Software limit switch active	The converter evaluates its software limit switch.	p2582 = r2092.14
15	1 = STOP cams active	Converter evaluates the stop cams.	p2568 = r2092.15

Positioning status word 2 (POS_ZSW2)

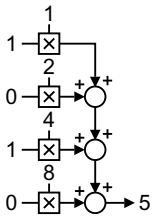
Table 5-9 POS_ZSW2 and interconnection with parameters in the converter

Bit	Meaning	Comments	P No.
0	1 = Follow-up mode active	The converter is in the follow-up mode.	p2084[0] = r2683.0
1	1 = Velocity limiting is active	The converter limits the velocity of the axis.	p2084[1] = r2683.1
2	1 = Setpoint is stationary	During a positioning operation, the setpoint no longer changes.	p2084[2] = r2683.2
3	1 = Print index outside outer window	The discrepancy between the actual position and the reference point was greater than permitted during flying referencing.	p2084[3] = r2684.3
4	1 = Axis traverses forwards	The axis traverses in the positive direction.	p2084[4] = r2683.4
	0 = Axis is stationary or traverses backwards	---	
5	1 = Axis traverses backwards	The axis traverses in the negative direction.	p2084[5] = r2683.5
	0 = Axis is stationary or traverses forwards	---	
6	1 = Software limit switch, minus actuated	The axis is outside the permitted traversing range.	p2084[6] = r2683.6
7	1 = Software limit switch, plus actuated		p2084[7] = r2683.7
8	1 = Position actual value ≤ cam switching position 1	Feedback of the cam sequencer in the converter.	p2084[8] = r2683.8
	0 = Cam switching position 1 passed		
9	1 = Position actual value ≤ cam switching position 2		p2084[9] = r2683.9
	0 = Cam switching position 2 passed		
10	1 = Direct output 1 active	The converter sets these signals in the actual traversing block.  Setting the traversing blocks (Page 75)	p2084[10] = r2683.10
11	1 = Direct output 2 active		p2084[11] = r2683.11
12	1 = Fixed stop reached	The axis is at the fixed stop	p2084[12] = r2683.12
13	1 = Fixed stop clamping torque reached	The axis is at the fixed stop and has reached the clamping torque.	p2084[13] = r2683.13
14	1 = Travel to fixed stop active	The converter moves the axis to a fixed stop.	p2084[14] = r2683.14
15	1 = Traversing command active	Feedback signal indicating as to whether the converter is currently moving the axis.	p2084[15] = r2684.15
	0 = Axis stationary		

5.6 Control word block selection

Block selection

Table 5-10 Block selection and interconnection in the converter

Bit	Meaning	Comments		P No.
0	Block selection, bit 0	Example for selecting traversing block number 5:		p2625 = r2091.0
1	Block selection, bit 1			p2626 = r2091.1
2	Block selection, bit 2			p2627 = r2091.2
3	Block selection, bit 3			p2628 = r2091.3
4…14	Reserved			
15	0 = Deactivate MDI	Switching from traversing blocks to direct setpoint input.		p2647 = r2091.15
	1 = Activate MDI			

Actual traversing block

Table 5-11 Feedback signal of the actual traversing block

Bit	Meaning	Comments	P No.
0	Actual traversing block, bit 0	---	p2081[0] = r2670.0
1	Actual traversing block, bit 1		p2081[1] = r2670.1
2	Actual traversing block, bit 2		p2081[2] = r2670.2
3	Actual traversing block, bit 3		p2081[3] = r2670.3
4…14	Reserved		
15	0 = MDI active	---	p2081[15] = r2670.15
	1 = MDI not active		

5.7 Control word MDI mode

MDI mode

Table 5-12 Selection of the MDI mode and interconnection with parameters in the converter

Bit	Meaning	Comments	P No.
0	0 = Relative positioning is selected	The converter interprets the position setpoint as the position setpoint relative to the start position.	p2648 = r2094.0
	1 = Absolute positioning is selected	The converter interprets the position setpoint as absolute position setpoint relative to machine zero point.	
1	01 = Absolute positioning for rotary axis in the positive direction	Selection of the positioning type for a rotary axis.	p2651 = r2094.1
2	10 = Absolute positioning for rotary axes in negative direction		p2652 = r2094.2
	00, 11 = Absolute positioning for a rotary axis through the shortest distance		
3…15	Reserved		

5.8 Status word messages

Status word messages (MELDW)

Table 5-13 Status word for messages and interconnection with parameters in the converter

Bit	Meaning	Description	P No.
0	0 = Ramp-function generator active	The motor is presently accelerating or braking	p2082[0] = r2199.5
	1 = Ramp-up/ramp-down completed	Speed setpoint and actual speed are the same.	
1	1 = Torque utilization [%] < torque threshold value 2 (p2194)	---	p2082[1] = r2199.11
2	1 = |n_act| < speed threshold value 3 (p2161)	---	p2082[2] = r2199.0
3	1 = |n_act| speed threshold value 2 (p2155)	---	p2082[3] = r2197.1
4, 5	Reserved		
6	1 = No motor overtemperature alarm	The motor temperature is within the permissible range.	p2082[6] = r2135.14
7	1 = No alarm, thermal power unit overload	The converter temperature is within the permissible range.	p2082[7] = r2135.15
8	1 = Speed setpoint - actual value deviation within tolerance t_on	Speed setpoint and actual speed are within the permissible tolerance range p2163.	p2082[8] = r2199.4
9, 10	Reserved		
11	1 = Controller enable	The speed controller is enabled.	p2082[11] = r0899.8
12	1 = Drive ready	The converter is ready to be switched on.	p2082[12] = r0899.7
13	1 = Pulses enabled	The motor is switched on.	p2082[13] = r0899.11
14, 15	Reserved		

5.9 Function block FB283

Overview

The function block FB283 is an interface block that connects an inverter with basic positioner to a SIMATIC S7 controller via PROFIBUS/PROFINET.

The block FB283 transfers all of the required process data to and from the drive. It is suitable for both controlling the basic positioner and for a pure speed-controlled drive.

The FB283 additionally provides the following functions:

- Reading and writing parameters in the inverter.
- Reading out the fault buffer of the inverter.
- Transferring up to 16 traversing blocks when a function is initiated.
- Reading or writing a maximum of any 10 parameters with one job, e.g. for product adaptation.

You can find additional information about FB283 in the Internet:

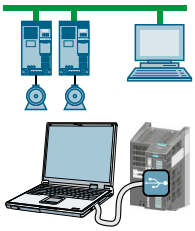
FB283 (http://support.automation.siemens.com/WW/view/en/25166781)

Commissioning 6

6.1 Commissioning sequence

We recommend that you commission the basic positioner using a PC tool.

PC tools



STARTER and **Startdrive** are PC tools that are used to commission, troubleshoot and control the inverter, as well as to back up and transfer the inverter settings. You can connect the PC with the inverter via USB or via the PROFIBUS / PROFINET fieldbus.

Connecting cable (3 m) between PC and inverter: Article number 6SL3255-0AA00-2CA0

STARTER DVD: Article number 6SL3072-0AA00-0AG0

Startdrive DVD: Article number 6SL3072-4CA02-1XG0

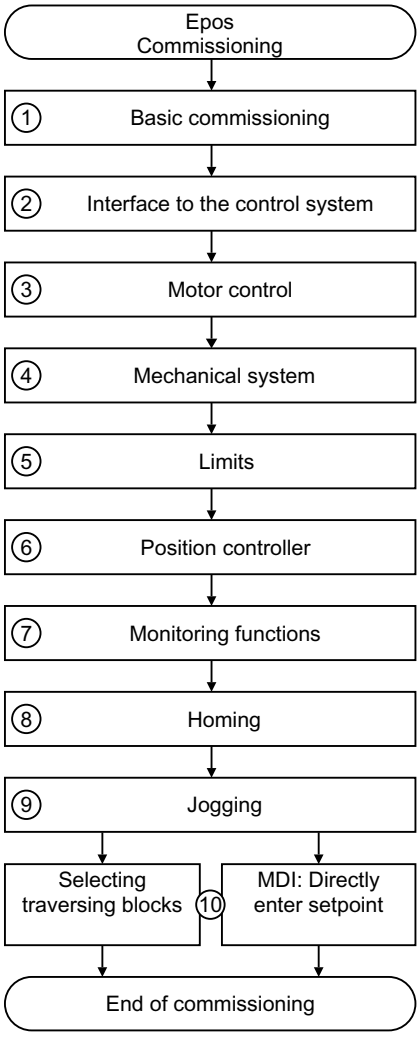
Startdrive, system requirements and download (https://support.industry.siemens.com/cs/ww/en/view/109752254)

STARTER, system requirements and download (http://support.automation.siemens.com/WW/view/en/26233208)

Startdrive tutorial (http://support.automation.siemens.com/WW/view/en/73598459)

STARTER videos (http://www.automation.siemens.com/mcms/mc-drives/en/low-voltage-inverter/sinamics-g120/videos/Pages/videos.aspx)

The screen forms to commission the basic positioner in Startdrive and STARTER essentially have the same structure. Commissioning using Startdrive is described in this manual.



① Assign encoders to the axes.
→ Operating instructions

② Set the communication via the fieldbus.
PROFIdrive interface (Page 19)

③ Optimize the speed control
→ Operating instructions

④ Normalizing the encoder signal (Page 37)

⑤ Limiting the positioning range (Page 43)

⑥ Setting the position controller (Page 46)

⑦ Setting the monitoring functions (Page 51)

⑧ Referencing (Page 55)

⑨ Jogging (Page 69)

⑩ Traversing blocks (Page 73)
or
Direct setpoint input (MDI) (Page 87)

6.2 Normalizing the encoder signal

6.2.1 Define the resolution

Distance unit (LU): the resolution of the position actual value in the inverter

The inverter calculates the position actual value of the axis using the neutral position unit LU (Length Unit). The distance unit LU is independent of whether the inverter controls e.g. the position of an elevating platform or the angle of rotary table.

Firstly, for your application define the required resolution. In other words: Which distance or angle corresponds to the length unit (LU)?

The following rules apply when selecting the distance unit LU:

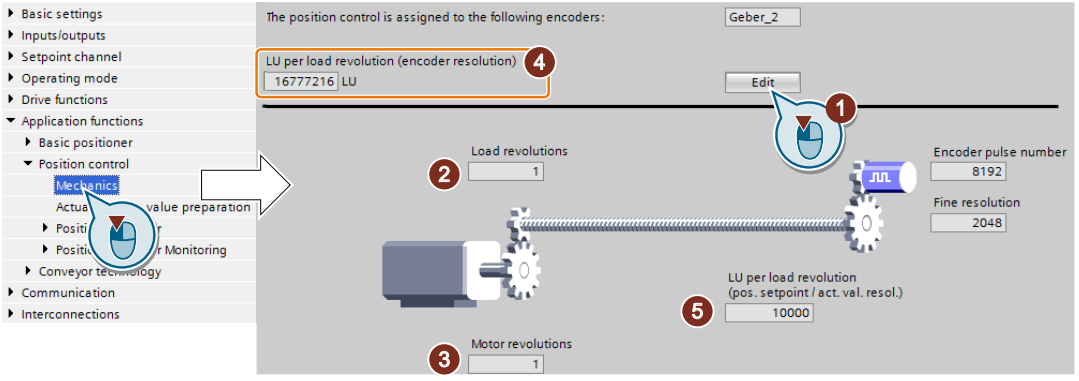
1. The higher the resolution of the distance unit LU, the higher the accuracy of the position control.
2. If you select a resolution that is too high, then the inverter cannot represent the position actual value over the complete axis traversing range. The inverter responds with a fault in the case of an overflow when representing the number.
3. The resolution of the distance unit LU should be less than the maximum resolution that is obtained from the resolution of the distance-encoder.

Normalize the encoder signal

Requirements

- You are online with Startdrive.
- You have selected the "Mechanical system" screen.
- You have defined the required resolution for your particular application, e.g. 1 LU ≙ 1 µm or 1 LU ≙ 1/1000° (1 millidegree).

Procedure



1. Enable the settings so they can be edited.
2. Enter the gear ratio of the axis: Load revolutions.

3. Motor revolutions
   Unknown gear ratio
   If you do not know the gear ratio, then you must measure the ratio, for example by manually rotating the motor and counting the load revolutions.
   Example: After 5 motor revolutions, the load has turned through 37 °. The ratio is therefore 37 ° / (5 × 360 °). You must then enter the following values into Startdrive:
   - ② 37 [load revolution]
   - ③ 1800 [motor revolution]
4. Check the maximum resolution based on your encoder data.
5. Calculate:
   Value = 360 ° / required resolution, e.g. 360 °/ 0.1 ° = 3600.
   Enter the calculated value into Startdrive.

You have normalized the encoder signal.
❒

Parameter	Meaning	
p2502	**Encoder assignment**	
	0	No encoder
	1	Encoder 1
	2	Encoder 2
p2503	**Length unit LU per 10 mm**	
p2504	**Motor/load motor revolutions**	
p2505	**Motor/load load revolutions**	
p2506	**Length unit LU per load revolution**	

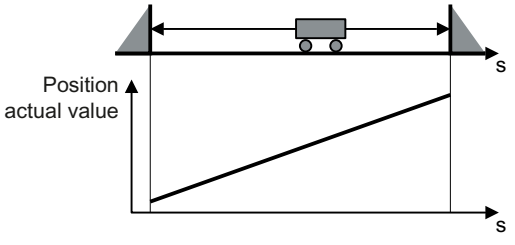
6.2.2 Modulo range setting

Description

Linear axis

A linear axis is an axis whose traversing range is limited in both motor directions of rotation by the mechanical system of the machine, e.g.:

- Stacker crane
- Elevating platform
- Tilting station
- Gate/door drive

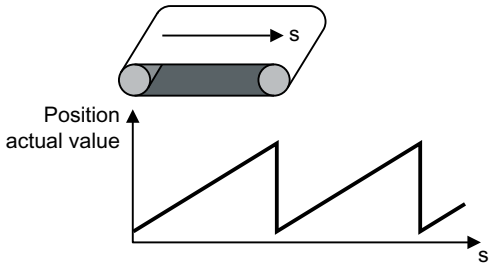


The inverter maps the complete traversing range to the position actual value.

Modulo axis

A modulo axis is an axis with an infinite traversing range, e.g.:

- Rotary table
- Conveyor belt
- Roller conveyor



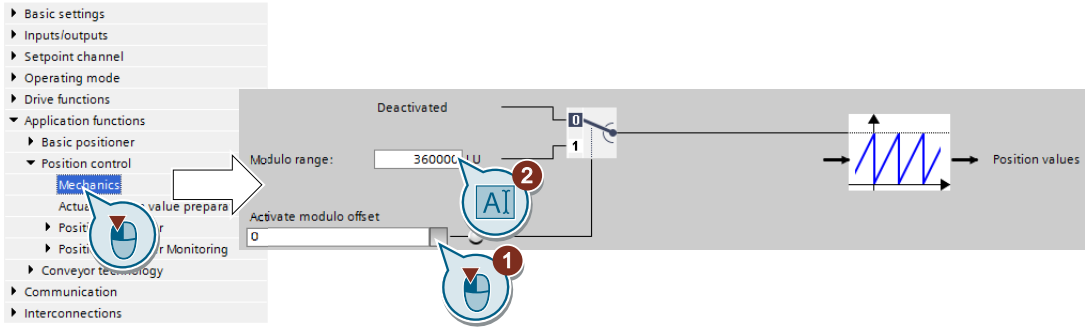
The inverter maps the modulo range on the position actual value. If the load position leaves the modulo range, then the value range of the position actual value repeats in the inverter.

Setting the modulo range

Requirements

- You are online with Startdrive.
- You have selected the "Mechanical system" screen.

Procedure



1. Enable the modulo correction.
2. Define the modulo range.
   Example 1: In the case of a rotary table, one load revolution corresponds to 3600 LU. In this case, the modulo correction is also 3600.
   Example 2: For a roller conveyor, 100 motor revolutions corresponds to one production cycle. For a resolution of 3600 LU per motor revolution, the modulo range is 360000 LU.

You have now set the modulo range.
❒

Parameter	Meaning
p2576	**Modulo offset, modulo range**
p2577	**Modulo correction activation (signal = 1)**
r2685	**Offset value**

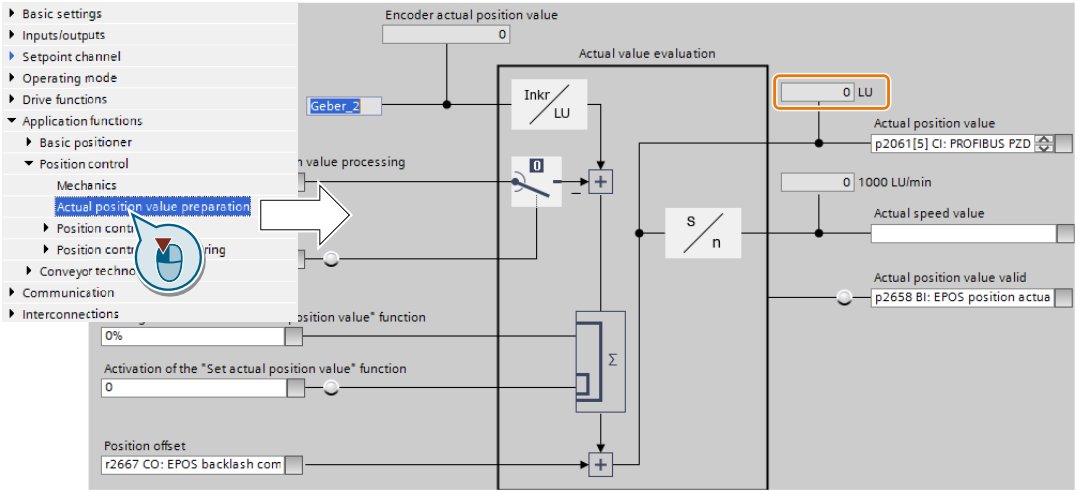
6.2.3 Checking the actual position value

After normalization of the encoder signal you should check the actual position value.

Requirements

- You are online with Startdrive.
- You have selected the "Position actual value processing" screen.

Procedure



- There must be no overflow of the actual position value in the entire traverse range. The inverter can show as a maximum the value range of -2147483648 … 2147483647. If this maximum value is exceeded, the inverter reports fault F07493.
- If you have defined a modulo range, the inverter resets the actual position value after passing through the range.

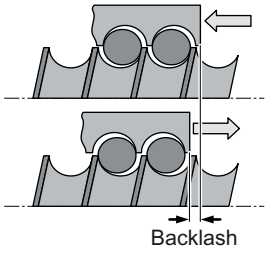
You have now checked the calculation for the actual position value.
❒

Parameter	Meaning
r2521[0]	Position actual value for position control

6.2.4 Setting the backlash

Description

Backlash (also called play, dead travel on reversing etc.) is the distance or the angle that a motor must travel through when the direction of rotation reverses until the axis actually moves in the other direction.



Backlash in a spindle

With the appropriate setting, the inverter corrects the positioning error caused by the backlash when reversing.

The inverter corrects the backlash under the following condition:

- For an incremental encoder, the axis must be referenced.
  Referencing (Page 55)
- For an absolute encoder, the axis must be adjusted.
  Absolute encoder adjustment (Page 67)

Measuring backlash

Procedure

1. Move the axis to position A in the machine. Mark this position in the machine and note down the actual position value in the inverter.
   Checking the actual position value (Page 40)
2. Move the axis a little bit more in the same direction.
3. Move the axis in the opposite direction until the actual position value in the inverter shows the same value as at position A. Due to the backlash when reversing, the axis is now at position B.
4. Measure the position difference Δ = A - B in the machine.

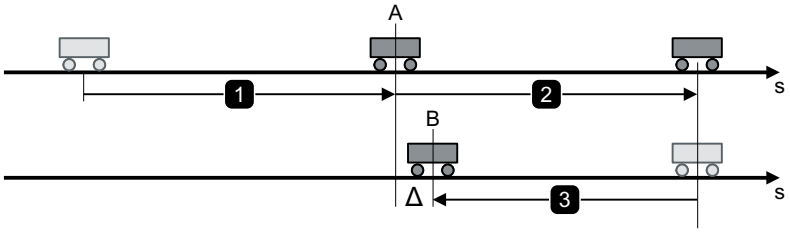


Figure 6-1 Measuring backlash

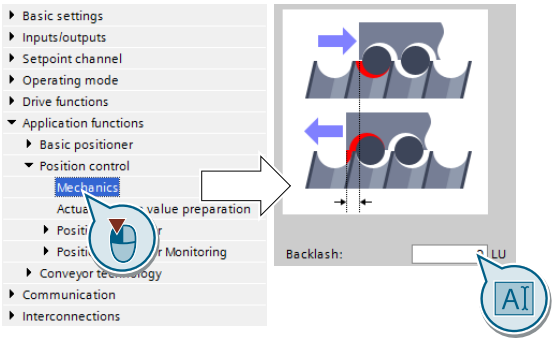
You have measured the backlash.
❒

Correcting backlash

Requirement

You have selected the "Mechanical system" screen.

Procedure



- If the axis has not traveled far enough, then set a positive backlash.
- If the axis has traveled too far, then set a negative backlash.

You have corrected the backlash.
❒

Parameter	Meaning
p2583	**Backlash compensation**
r2685	**Offset value**

6.3 Limiting the positioning range

Description

Positioning range for linear axes

The inverter limits the positioning range of a linear axis using a software limit switch. The inverter only accepts position setpoints that lie within the software limit switches.

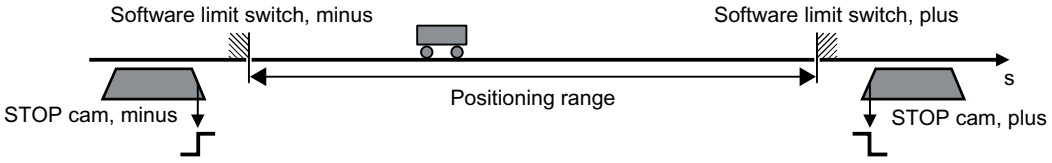


Figure 6-2 Limiting the positioning range of a linear axis

In addition, using its digital inputs, the inverter evaluates signals from stop cams. When passing a STOP cam, the inverter responds – depending on the setting – either with a fault or an alarm.

Fault when passing over a STOP cam

When passing the STOP cam, the inverter brakes the axis with the OFF3 ramp-down time, switches the motor off and outputs fault F07491 or F07492.

To switch the motor on again, you must do the following:

1. Switch the motor off (OFF1).
2. Acknowledge the fault.
3. Traverse the axis away from the STOP cam, e.g. using the jogging function.

Alarm when passing over a STOP cam

The following happens when the STOP cam is passed:

1. The inverter brakes the axis with maximum deceleration.
   Limiting the traversing profile (Page 49)
2. The inverter maintains the axis in closed-loop control and reports alarm A07491 or A07492.

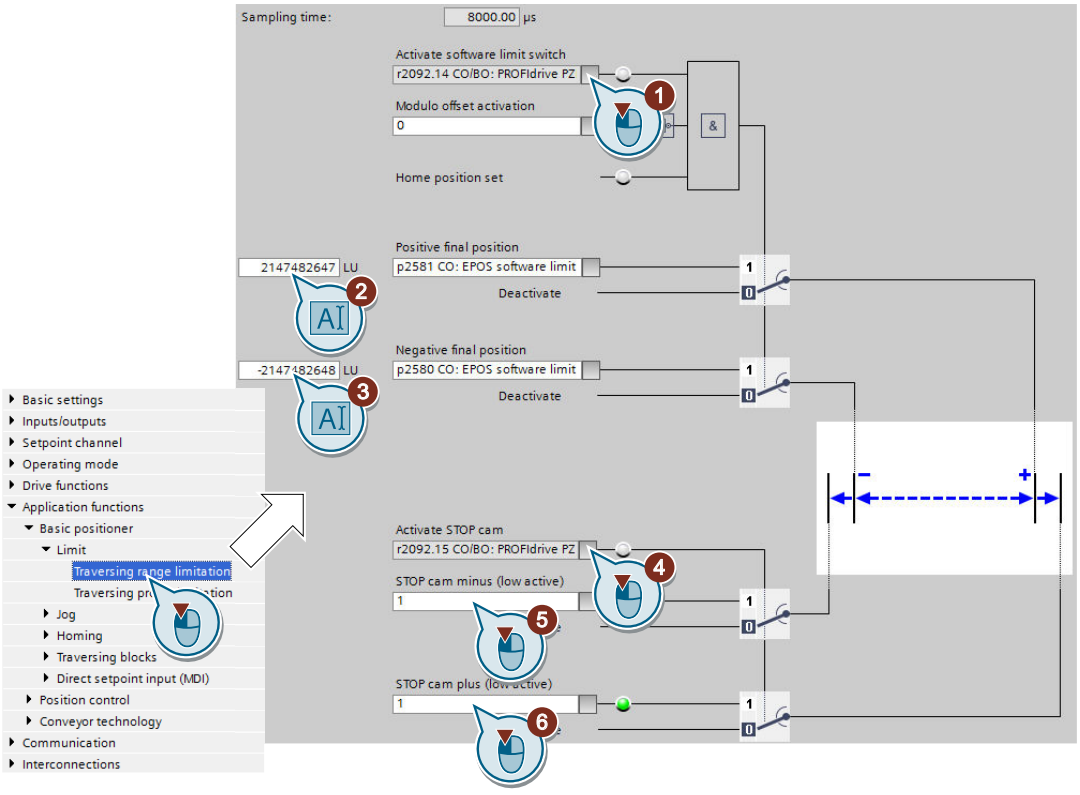
In order to bring the axis back into the valid traversing range, you must move the axis away from the STOP cam, e.g. using the jogging function.

Setting the limits of the positioning range

Requirement

You have selected the "Limit" screen.

Procedure



1. Enable the software limit switch.
2. Move the axis to the positive limit position in your machine. Set the position of the software limit switches to the actual position value.
3. Move the axis to the negative limit position in your machine. Set the position of the software limit switches to the actual position value.
4. Enable the STOP cams.
5. Interconnect the signal of the STOP cam minus with the corresponding signal of your machine.
   Signal = 0 means an active STOP cam.
6. Interconnect the signal of the STOP cam plus with the corresponding signal of your machine.

You have now set the limits of the positioning range.
❒

Parameter	Meaning
p2568	**STOP cam activation**
p2569	**STOP cam, minus**
p2570	**STOP cam, plus**
p2578	**Software limit switch, minus signal source**
p2579	**Software limit switch, plus signal source**
p2580	**Software limit switch, minus**
p2581	**Software limit switch, plus**

Parameter	Meaning
p2582	**Software limit switch activation**
r2683.6	**Software limit switch, minus actuated**
r2683.7	**Software limit switch, plus actuated**
r2684.13	**STOP cam minus active**
r2684.14	**STOP cam plus active**

6.4 Setting the position controller

6.4.1 Precontrol and gain

Preconditions and constraints

Before you optimize the position controller, the closed-loop drive speed control must be optimally set.

Dynamic response and accuracy of the closed-loop position control depend heavily on the lower-level closed-loop or open-loop control or the motor speed:

- Position control in connection with an optimally set vector control with speed encoder provides the best results.
- Position control with encoderless vector control (sensorless vector control, SLVC) provides satisfactory results for most applications. Hoisting/lifting applications require a speed controller.
- If you operate the position control with the U/f control of drive, then you must take into account some significant reduction in closed-loop control performance and precision.

Position controllers in hoisting gear

U/f control is not suitable for vertical axes, such as elevating platforms or hoisting gear used in high-bay racking units, as the axis generally cannot reach the target position as a result of the limited precision of the U/f control.

Description

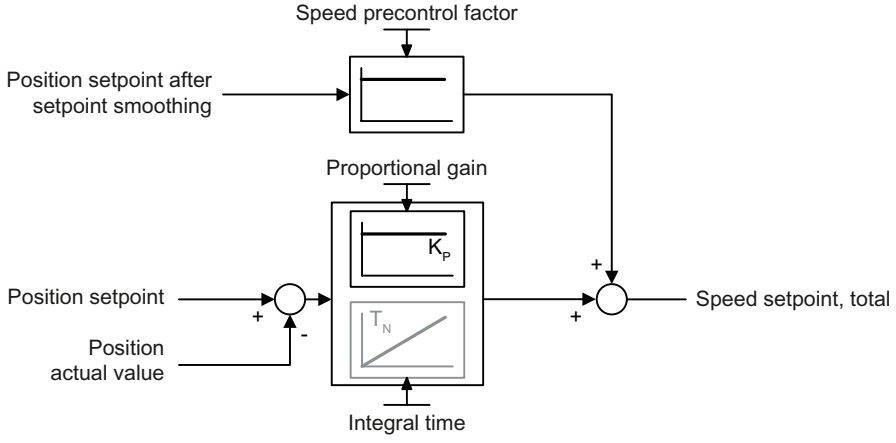


Figure 6-3 Position controller with precontrol

If the speed control of the converter has an encoder to feedback the actual speed, then deactivate the integral component T_N of the position controller.

If you use the position control together with the encoderless vector control (SLVC, SensorLess Vector Control), the positioning accuracy may be inadequate. With active integral time, positioning accuracy improves.

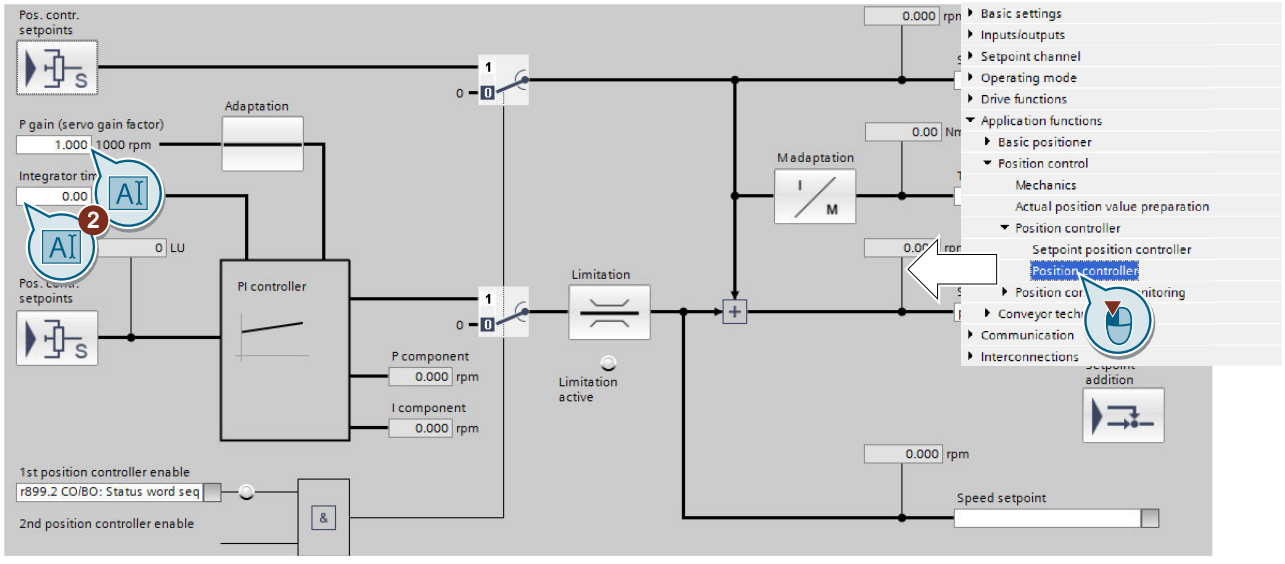
6.4.2 Optimizing the position controller

To assess the control performance of the position controller, you must move the axis with the position control and assess the control performance e.g. via the timing of the following error.

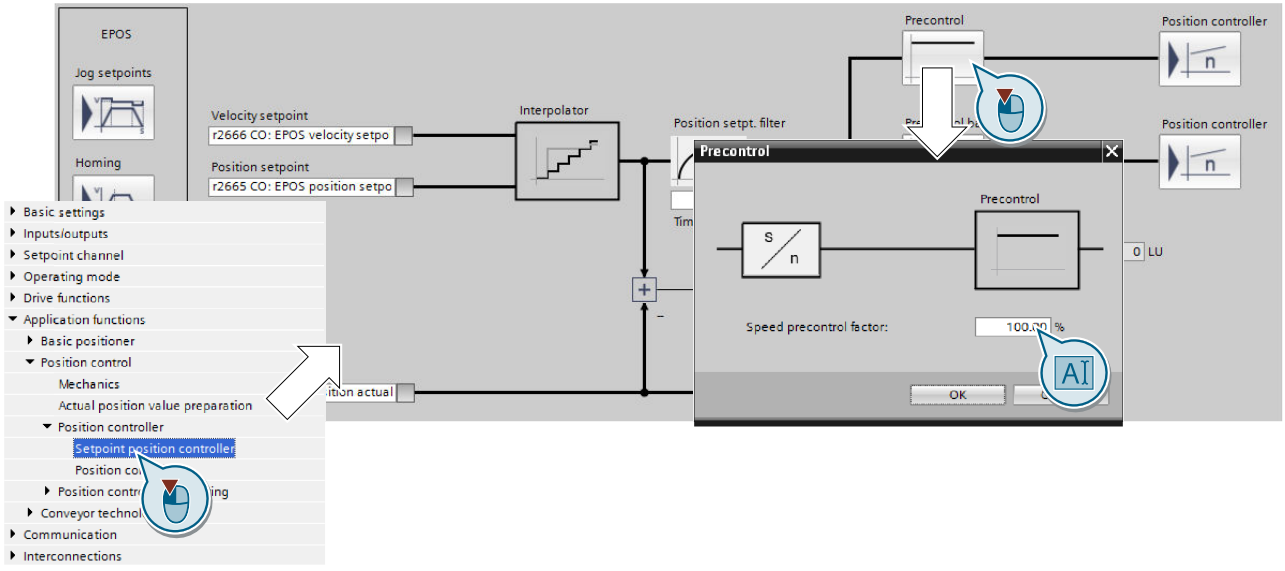
Optimizing the position controller

Procedure

1. Adjust the proportional gain.
2. Adjust the integral time.



3. Set the precontrol of the position controller to 100 %.



You have optimized the position controller.
❒

Parameter	Meaning
p2534	Speed precontrol factor
p2538	Proportional gain / Kp
p2539	Integral time / Tn
p2731	Signal = 0: activate position controller

Advanced settings

If you permanently activate the integral time of the position controller, the characteristics of the position control change as follows:

- The following error during positioning goes to zero.
- When positioning the axis, it tends to overshoot. This means that the axis briefly moves beyond the target position.

6.4.3 Limiting the traversing profile

Description

The traversing profile is the acceleration, velocity and position characteristics of an axis when being positioned.

You can influence the traversing profile by limiting velocity, acceleration or jerk (= change of the acceleration over time).

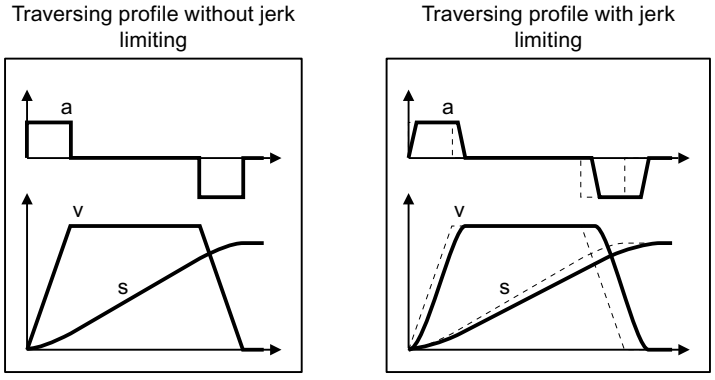


Figure 6-4 Example: Effect of jerk limiting

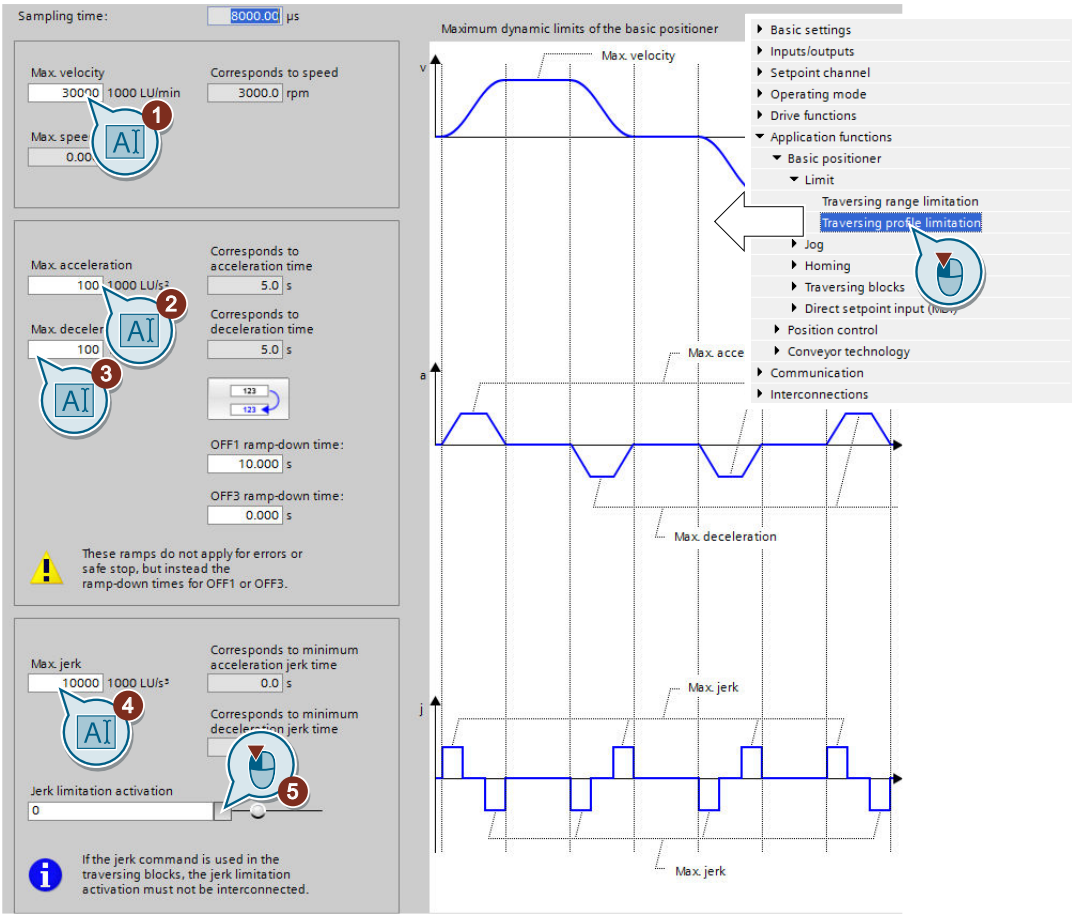
If the axis must traverse more slowly or must accelerate at a lower rate or "softly", then you must set the relevant limits to lower values. The lower that one of the limits is, the longer the inverter needs to position the axis.

Setting the traversing profile limitation

Requirement

You have selected the "Limit" screen and the "Traversing profile limitation" tab.

Procedure



1. Set the maximum velocity with which the inverter may position the axis.
2. Set the maximum acceleration.
3. Set the maximum delay.
   The "override" in the traversing blocks or for the direct setpoint input refers to the values ② and ③.
4. Reduce the maximum jerk, if you require softer acceleration and braking.
5. For permanent jerk limiting, set this signal to 1.

You have now set the limitation of the traversing profile.
❒

Parameter	Meaning
p2571	**Maximum velocity**
p2572	**Maximum acceleration**
p2573	**Maximum deceleration**
p2574	**Jerk limiting**
p2575	**Activating jerk limiting** 1 signal: Jerk limiting is active

6.5 Setting the monitoring functions

6.5.1 Standstill and positioning monitoring

Description

As soon as the setpoint for the position within a positioning operation no longer changes, then the inverter sets the "Setpoint stationary" signal to 1. With this signal, the inverter starts to monitor the position actual value:

- As soon as the axis has reached the positioning window, the inverter signals that the target has been reached, and maintains the axis in closed-loop control.
- If the axis does not come to a standstill within the standstill monitoring time, the inverter reports fault F07450.
- If the axis does not enter the positioning window within the positioning monitoring time, the inverter reports fault F07451.

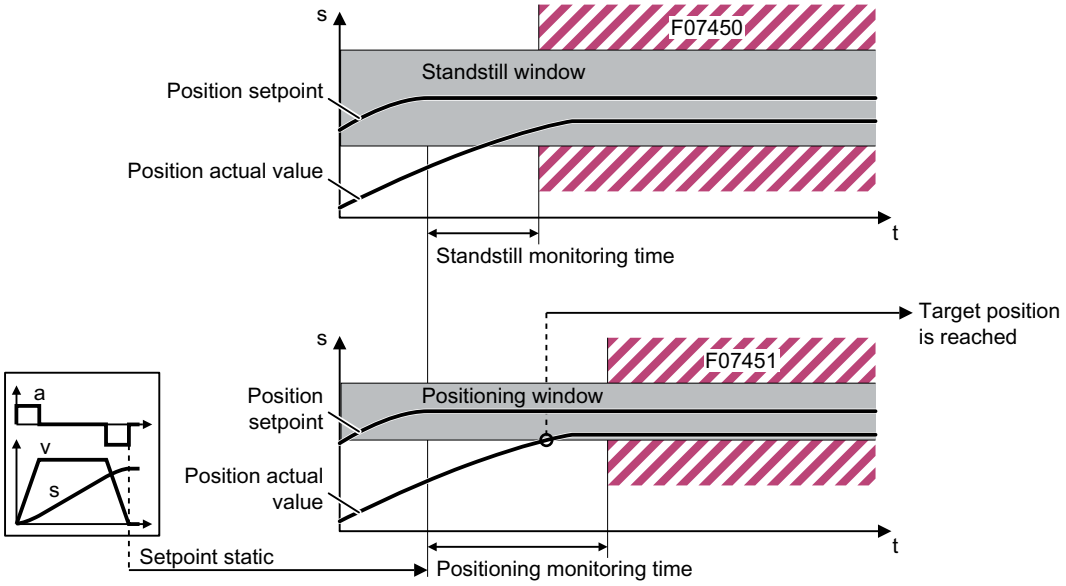


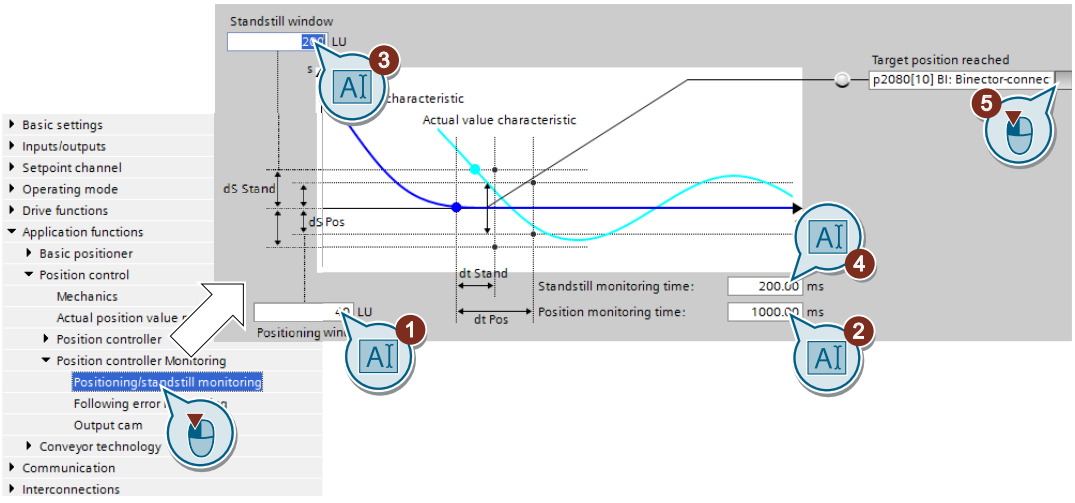
Figure 6-5 Standstill monitoring and positioning monitoring

Setting standstill monitoring and positioning monitoring

Requirement

You have selected the "Monitoring" screen and the "Position monitoring" tab.

Procedure



1. Set the required positioning accuracy.
2. Set the time within which the axis must be positioned.
3. Set the required standstill window.
   The standstill window must be larger than the positioning window.
4. Set the time within which the axis must be at standstill.
5. Define the signal "Target position reached" as a message to a higher-level control.

You have now set the standstill and position monitoring.
❒

Parameter	Meaning
p2542	**Standstill window (target position ±p2542)**
p2543	**Standstill monitoring time**
p2544	**Positioning window (target position ±p2544)**
p2545	**Positioning monitoring time**

6.5.2 Following error monitoring

Description

The following error is the deviation between the position setpoint and the position actual value while the converter is positioning the axis.

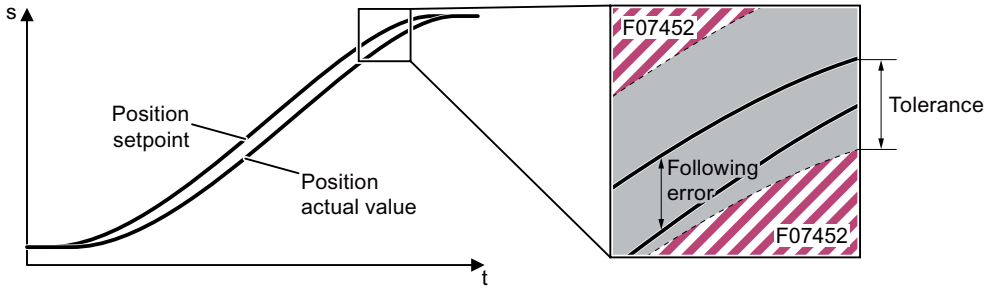


Figure 6-6 Monitoring the following error

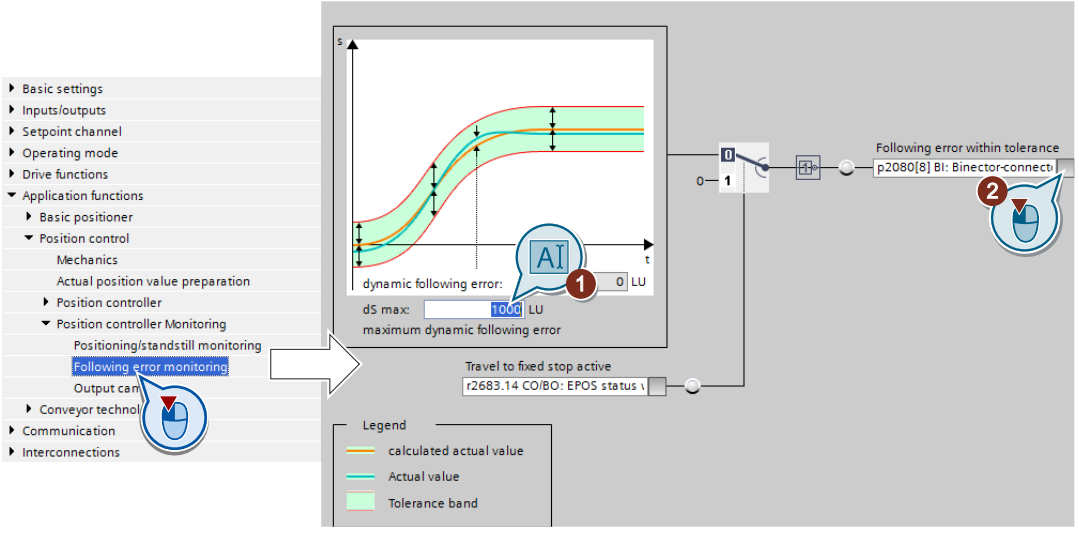
The converter reports fault F07452 if the following error is too high. If you set the tolerance to 0, monitoring is deactivated.

Setting following error monitoring

Requirement

You have selected the "Monitoring" screen and the "Following error monitoring" tab.

Procedure



1. Set the monitoring window.
   Start with the factory setting value.
   Test your setting by positioning the axis at maximum velocity, e.g. from the control panel.
   If the converter stops the travel with fault F07452 , you will need to either increase the monitoring window or increase the dynamics of the position controller.
2. If you want to evaluate the message in your higher-level control, interconnect this signal with, for example, a status bit in the fieldbus telegram.

You have now set the monitoring of the following error.
❒

Parameter	Meaning
p2546	**Dynamic following error monitoring tolerance**
r2563	**Following error, dynamic model**

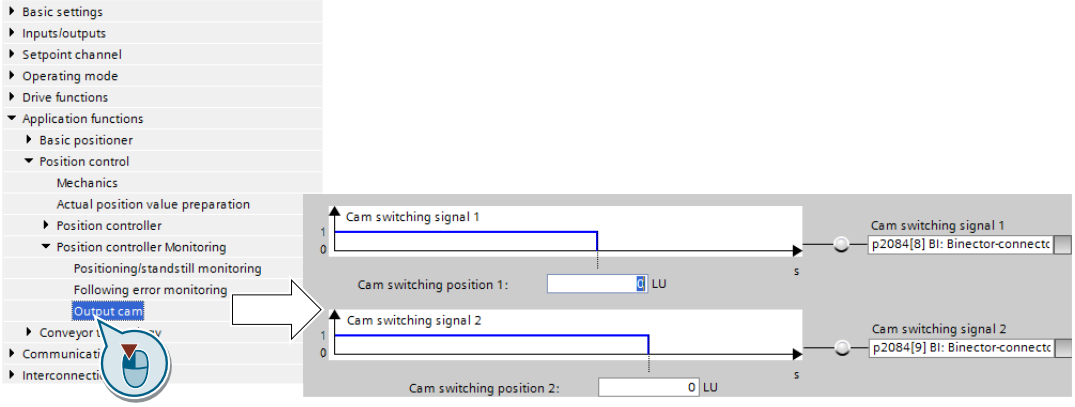
6.5.3 Cam sequencer

Description

The converter compares the position actual value with two different positions and therefore simulates two independent cam switching signals.

Setting the cam sequencer

Procedure



Set the cam switching position to match your particular application and interconnect the cam switching signal appropriately.

Parameter	Meaning
p2547	**Cam switching position 1**
p2548	**Cam switching position 2**
r2683.8	**Position actual value <= cam switching position 1**
r2683.9	**Position actual value <= cam switching position 2**

6.6 Referencing

6.6.1 Referencing methods

Overview

If you are using an incremental encoder for the position actual value, after the supply voltage is switched off, the inverter loses its valid position actual value. After the supply voltage is switched on again, the inverter no longer knows the reference of the axis position to the machine.

Referencing re-establishes the reference between the zero point of the position calculated in the inverter and the machine zero point.

Absolute encoders retain their position information, even after the supply has been switched off.

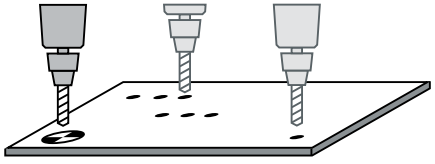
The inverter offers various ways of referencing the axis:

- Reference point approach - only with incremental encoders
- Flying referencing - with all encoder types
- Set reference point - with all encoder types
- Absolute encoder adjustment - with absolute encoders

Reference point approach

The inverter automatically traverses the axis to a defined reference point.

Example: A workpiece must be positioned at a starting point before machining starts.



Flying referencing

The inverter corrects its position actual value while traversing and reduces errors, e.g. caused by wheel slip or a gear ratio that has not been precisely set.

Example: A pallet on a roller conveyor must be stopped at a specific position. However, the exact position of the pallet on the conveyor is only known when a sensor is passed.

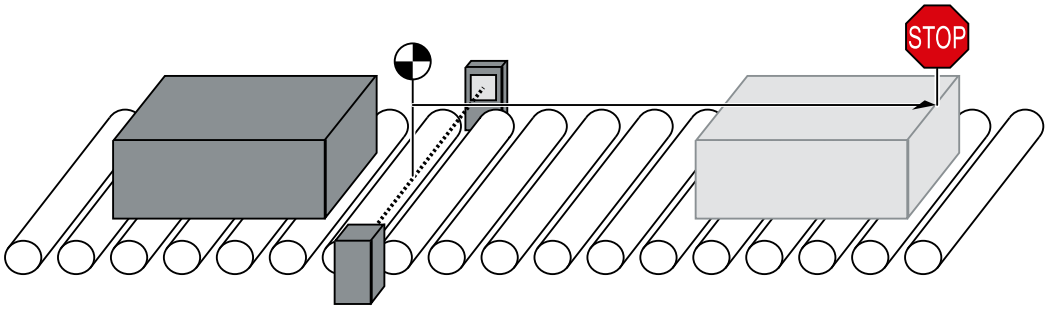


Figure 6-7 Positioning an item to be transported on a roller conveyor

Set the reference point and adjust the absolute encoder

The inverter takes the reference point coordinate as the new axis position.

6.6.2 Setting the reference point approach

Description

A reference point approach generally consists of the following three steps:

1. Travel to reference cam.
   When it receives a signal, the axis searches for the reference cam in a specified direction.
2. Travel to zero mark.
   Once the reference cam is reached, the axis changes the traversing direction and evaluates the zero mark of the encoder.
3. Travel to reference point.
   Once the zero mark is reached, the axis traverses to the reference point and synchronizes the actual position value in the inverter with the machine.

Step 1: Travel to reference cam

The converter accelerates the axis in the start direction to the "Approach velocity". Once the axis has reached the reference cam, in step 2, the converter switches to the reference point approach.

Reversing cams make sense if the reference cam does not extend up to the end of the traversing range. After reaching a reversing cam, the converter continues to search for the reference cam in the opposite direction.

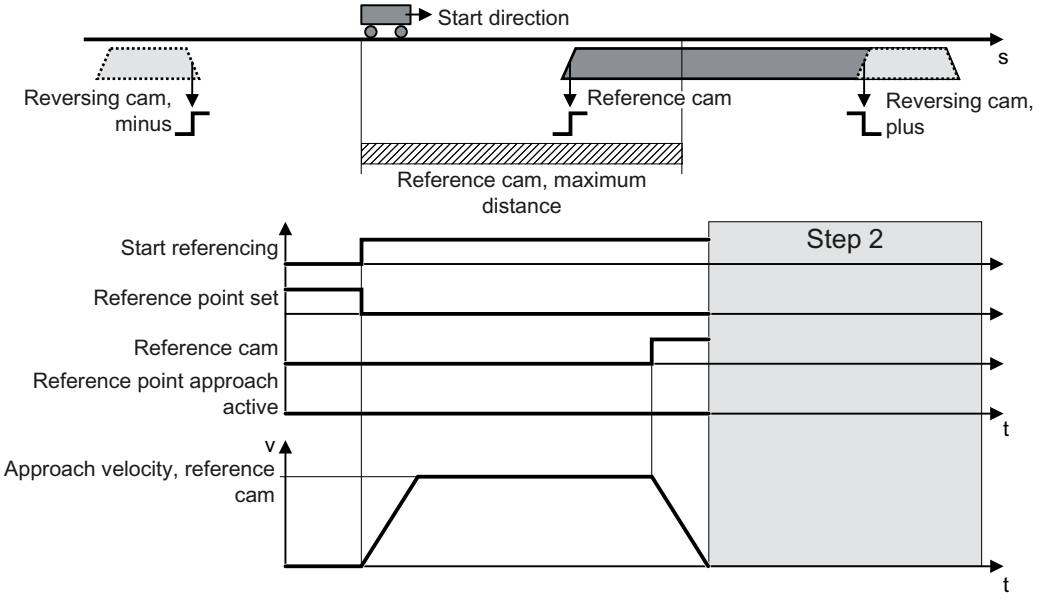


Figure 6-8 Step 1: Travel to reference cam

Under one of the following conditions, the converter skips the first step and starts with step 2:

- The axis is already at the reference cam.
- There is no reference cam available.

Step 2: Travel to zero mark

The behavior of the axis in step 2 depends on whether a reference cam is available:

- Reference cam available: When the converter reaches the reference cam, the axis accelerates *in the opposite direction to the start direction*, to the "approach velocity zero mark".
- No reference cam is available: The converter accelerates the axis *in the start direction* to the "approach velocity zero mark".

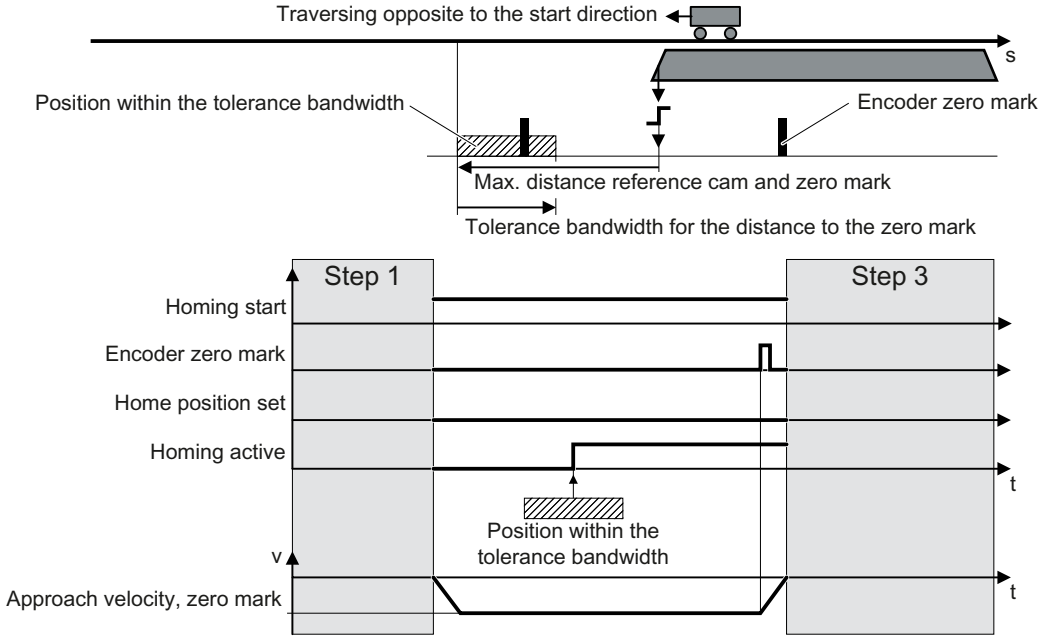


Figure 6-9 Step 2: Travel to zero mark if a reference cam is available

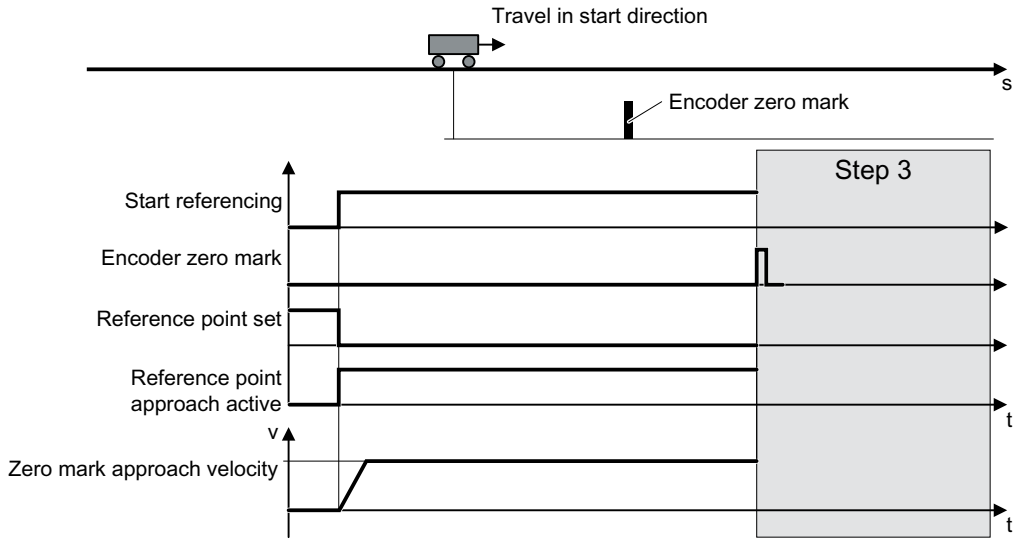


Figure 6-10 Travel to the zero mark if a reference cam is not available

Step 3: Travel to reference point

After the converter has detected a zero mark, the axis moves with the "approach velocity reference point" to the reference point coordinate.

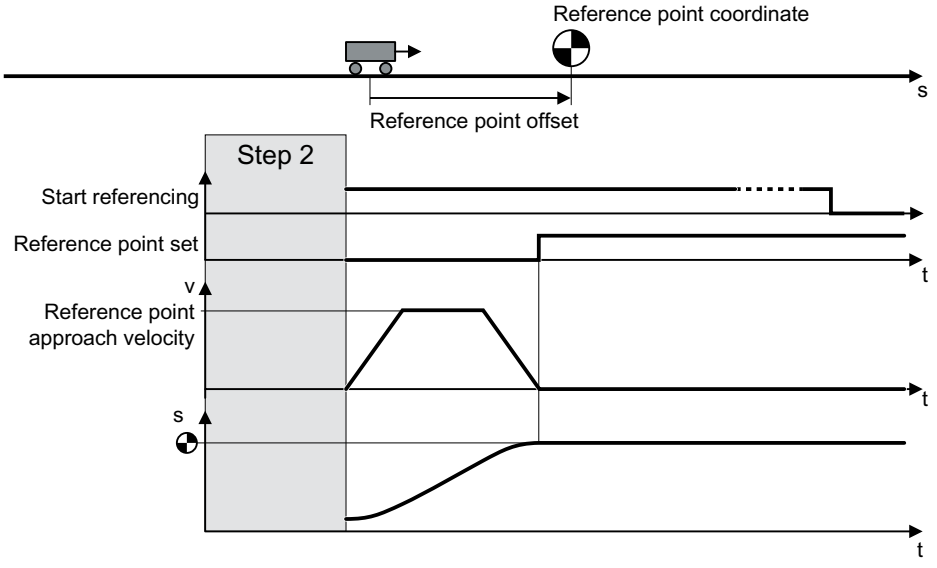


Figure 6-11 Step 3: Travel to reference point

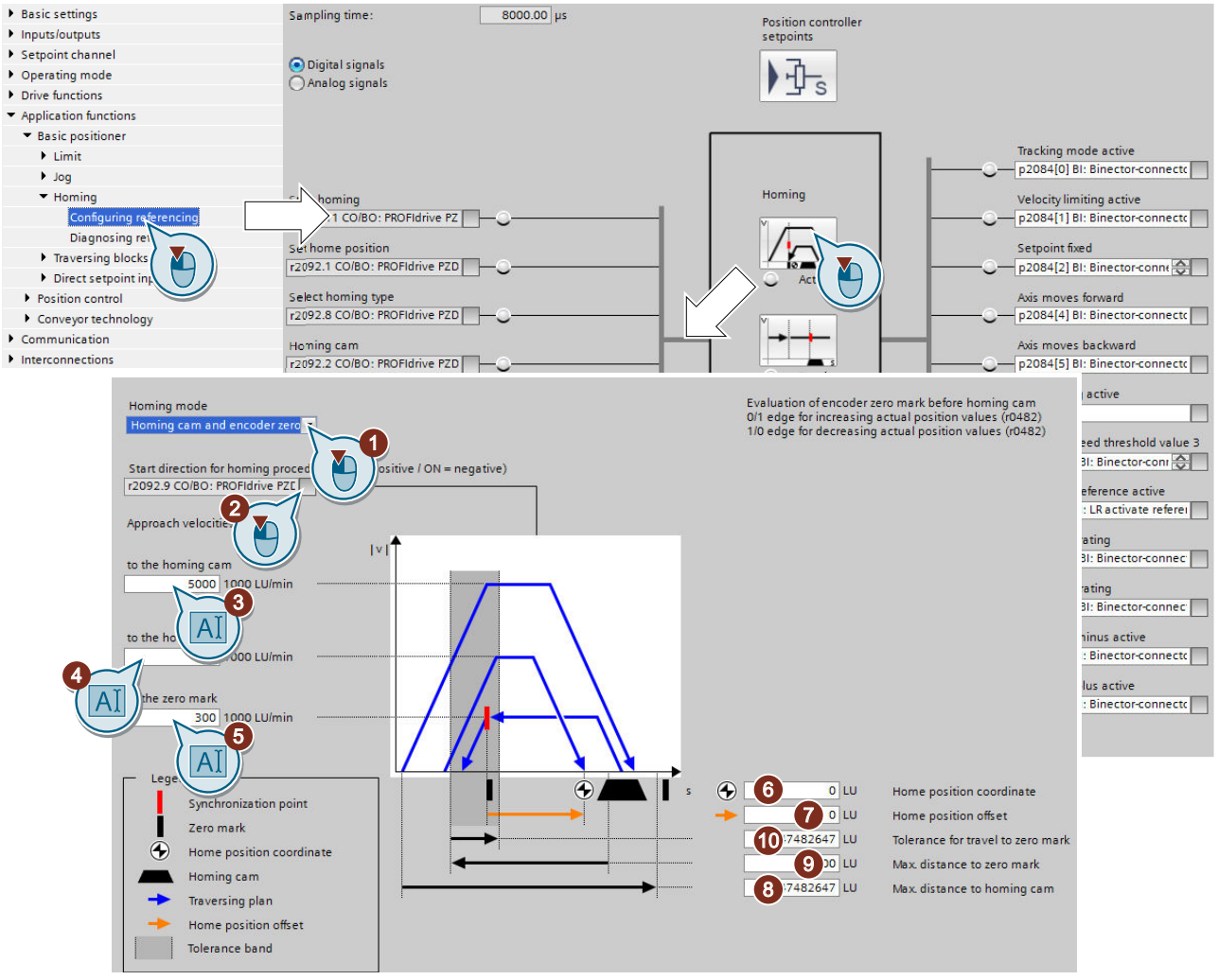
After the load has reached the reference point coordinate, the converter sets its position setpoint and actual value to this value.

Setting the reference point approach

Requirements

1. You have selected the "Homing" screen.
2. You have come to the settings via the button on the screen.
3. You have selected "Active homing".

Procedure



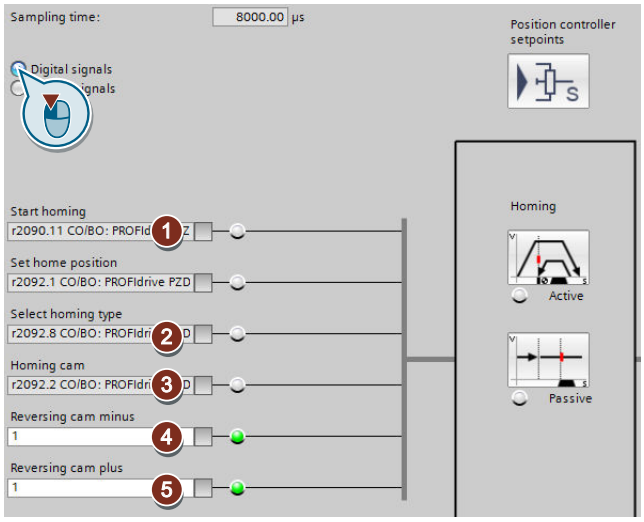
1. You specify the referencing mode:
   - Only using the encoder zero mark
   - With external zero mark
   - With reference cam and encoder zero mark
2. Specify the start direction.
3. Set the approach velocity to the reference cam.

4. Set the approach velocity to the reference point.
5. Set the approach velocity to the zero mark.
6. Specify the reference point coordinate.
7. Specify the reference point offset.
8. Specify the max. permissible distance to the reference cam in step 1 of active referencing.
9. If a reference cam is available: Define the maximum permitted distance to the zero mark.
10. If no reference cam is available: Define the tolerance for travel to the zero mark.
11. Close the screen form.

You have set the USB reference point approach.
❒

Defining the digital signals for controlling referencing

Procedure

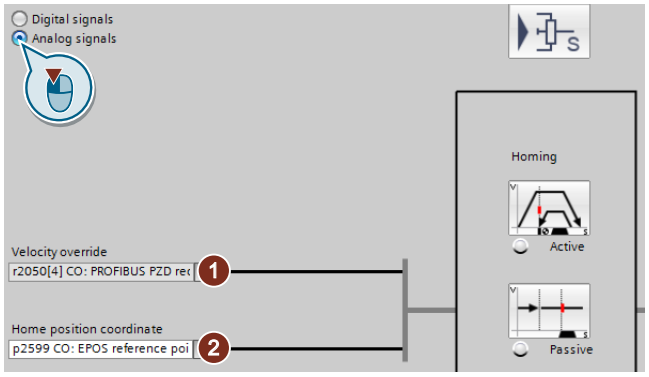


1. This signal starts the reference point approach.
2. This signal must be 0 for the reference point approach.
3. Interconnect the signal of the reference cam with the corresponding signal of your machine.
4. If you use the reversing cam minus, interconnect the reversing cam with the corresponding signal, e.g. with the fieldbus.
   0 = Reversing cams active.
5. If you use the reversing cam plus, interconnect the reversing cam with the corresponding signal, e.g. with the fieldbus.
   0 = Reversing cams active.

You have now defined the digital signals for controlling.
❒

Defining the analog signals for controlling referencing

Procedure



1. Define the signal source for the velocity override.
   Direct setpoint input (MDI) (Page 87)
2. Change the source for the reference point coordinate, if necessary.

You have now defined the analog signals for controlling.
❒

Parameter	Meaning
p2595	Start referencing
p2598	Reference point coordinate, signal source
p2599	Reference point coordinate value
p2600	Reference point approach, reference point offset
p2604	Reference point approach, start direction
p2605	Reference point approach, approach velocity, reference cam
p2606	Reference point approach reference cam, maximum distance
p2607	Reference point approach reference cam available
p2608	Reference point approach, approach velocity, zero mark
p2609	Reference point approach, max distance reference cam and zero mark
p2610	Reference point approach, tolerance band for the distance to the zero mark
p2611	Reference point approach, approach velocity, reference point
p2612	Reference point approach, reference cam
p2613	Reference point approach reversing cam, minus
p2614	Reference point approach reversing cam, plus
r2684.0	Reference point approach active
r2684.11	Reference point set

6.6.3 Setting the flying referencing

Description

During motion, the load passes a reference cam. The inverter evaluates the reference cam signal via a suitable fast digital input, and corrects its calculated position during travel. The fast digital inputs of the inverter used for flying referencing are also called probe inputs.

For flying referencing, the inverter corrects the position setpoint and actual value simultaneously.

If the position actual value correction means that the axis has already passed the point where it should start braking, then the axis travels beyond the target and approaches the target from the opposite direction.

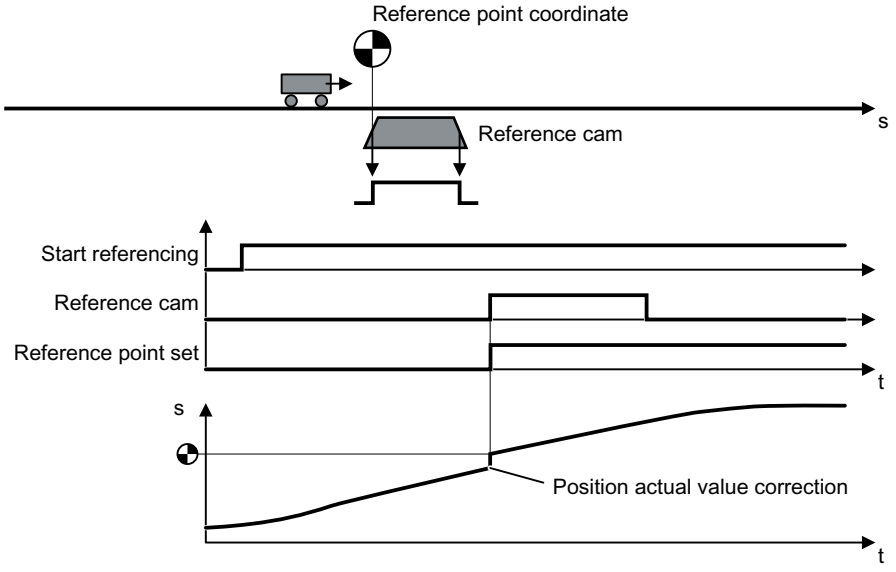


Figure 6-12 Flying referencing

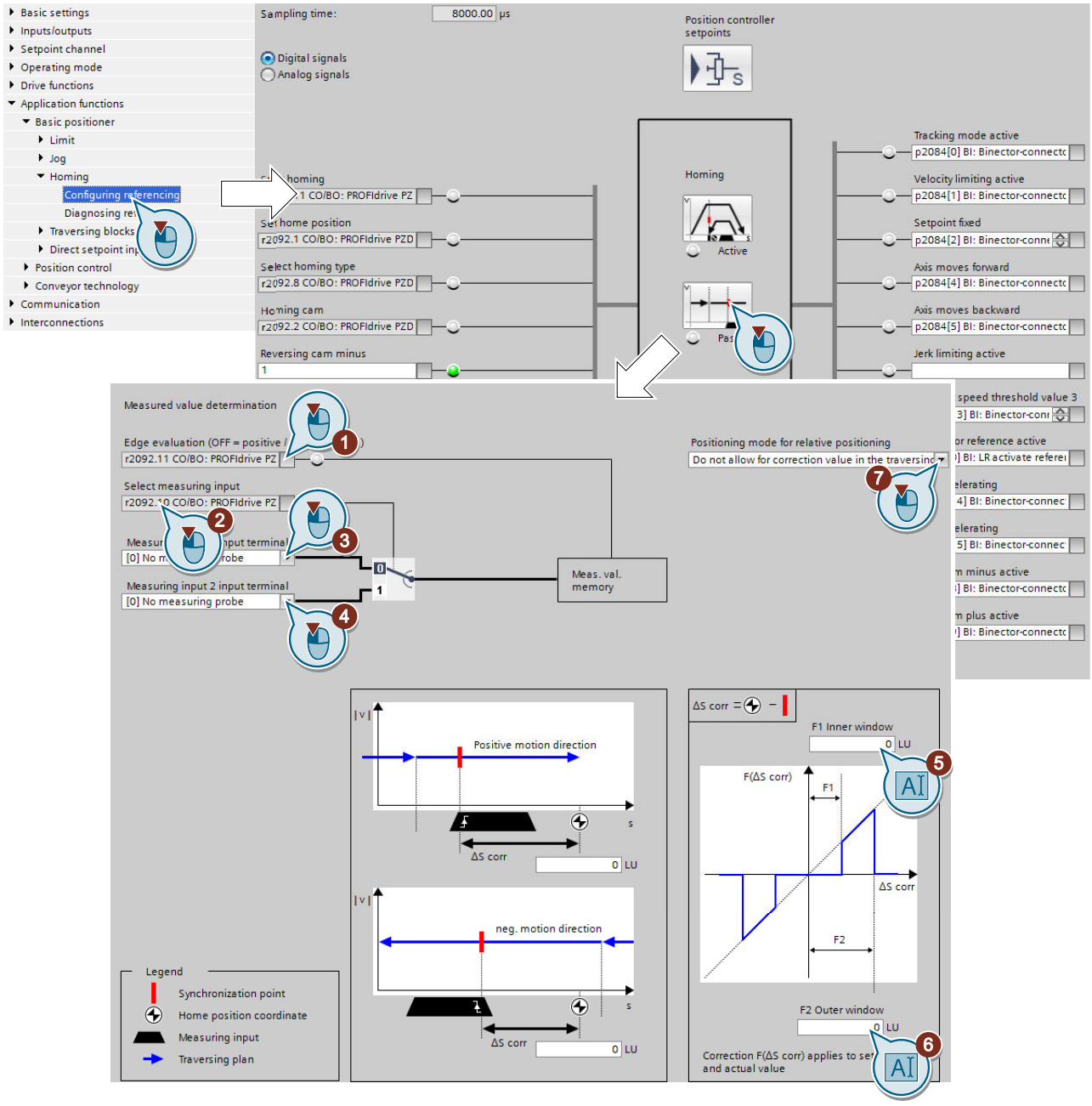
The inverter sets the "Reference point set" signal back to zero after its supply voltage is switched off and switched on again. The inverter only corrects its position actual value for a 1 signal from "Start referencing". In this way, you can define, for example, the direction of travel when the inverter is referencing.

Setting flying referencing

Requirement

1. You have selected the "Homing" screen.
2. You have come to the settings via the button on the screen.
3. You have selected the "Passive referencing" screen.

Procedure



1. Set the edge of the reference cam signal the inverter should use to reference its actual position value:
   0: Rising edge
   1: Falling edge
2. Interconnect the switchover of reference cams 1 and 2 with a signal of your choice.
3. Select the digital input with which reference cam 1 is interconnected.

4. Select the digital input with which reference cam 2 is interconnected.
   Several reference points:
   If you require several reference points for an axis, then you must do the following:
   - Assign the corresponding digital input to the respective reference point.
   - Change the reference point coordinate during operation, e.g. using the non-cyclic communication of the fieldbus.
5. Set the inner window for referencing. You deactivate the inner window with the value 0.
6. Set the outer window for referencing. You deactivate the outer window with the value 0.
   Referencing can be suppressed depending on the deviation of the actual position value:
   Inner window: For excessively small deviations, the inverter does not correct its position actual value.
   Outer window: The inverter signals an excessive deviation, but does not correct its position actual value.

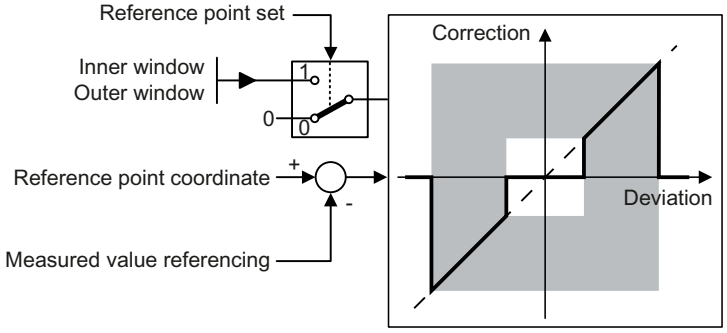


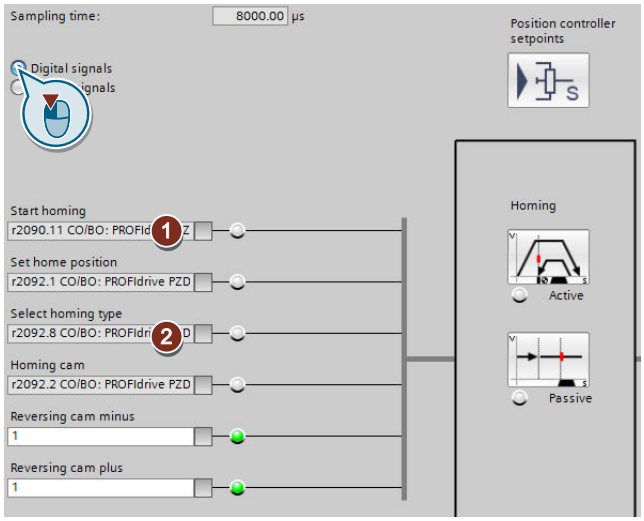
Figure 6-13 Outer and inner window for flying referencing

7. Specify the following:
   - Taking into account the offset in traversing distance: The inverter corrects both the actual position as well as the setpoint. The relative traversing distance is shorter or longer by the value of the correction.
     Example: 500 LU is the axis start position. The axis should travel relatively through 1000 LU. The inverter corrects the reference point during travel by 2 LU, and travels to the corrected target position 1498 LU.
   - Not taking into account the correction in the traversing distance: The inverter corrects both the actual position as well as the setpoint. The relative travel distance remains unchanged.
     Example: 500 LU is the axis start position. The axis should travel relatively through 1000 LU. The inverter corrects the reference point during travel by 2 LU, however, moves to the old target position 1500 LU.
8. Set the reference point coordinate p2599 via the parameter view in Startdrive.
9. Close the screen form.

You have set flying referencing.
❒

Defining the digital signals for controlling referencing

Procedure

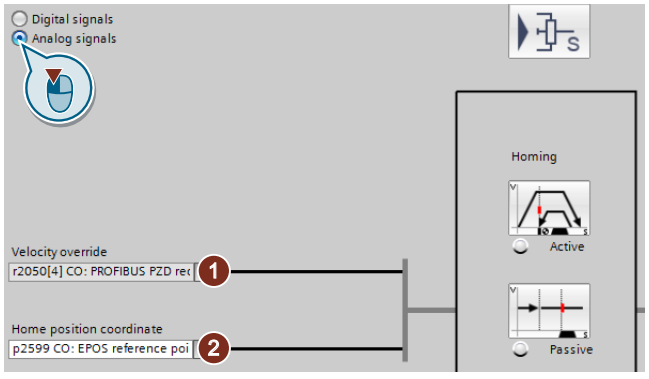


1. This signal starts flying referencing.
2. For flying referencing, this signal must be 1.
   The other signals are of no significance for flying referencing.

You have now defined the digital signals for controlling.
❒

Defining the analog signals for controlling referencing

Procedure



1. Define the signal source for the velocity override.
   Direct setpoint input (MDI) (Page 87)
2. Change the source for the reference point coordinate, if necessary.

You have now defined the analog signals for controlling.
❒

Parameter	Meaning
p2595	Start referencing
p2598	Reference point coordinate, signal source
p2599	Reference point coordinate value
p2601	Flying referencing, inner window
p2602	Flying referencing, outer window
p2603	Flying referencing, relative positioning mode
p2612	Reference point approach, reference cam
r2684.11	Reference point set
p2660	Measured value referencing

6.6.4 Set reference point

Description

Position the load, e.g. using the "jog" function, at the reference position in the machine.

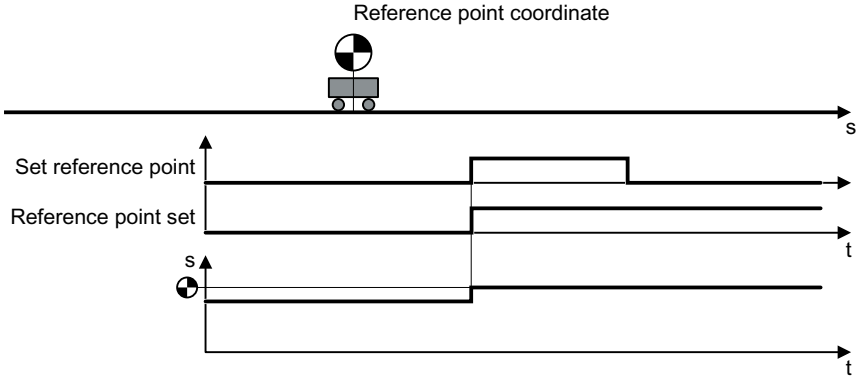


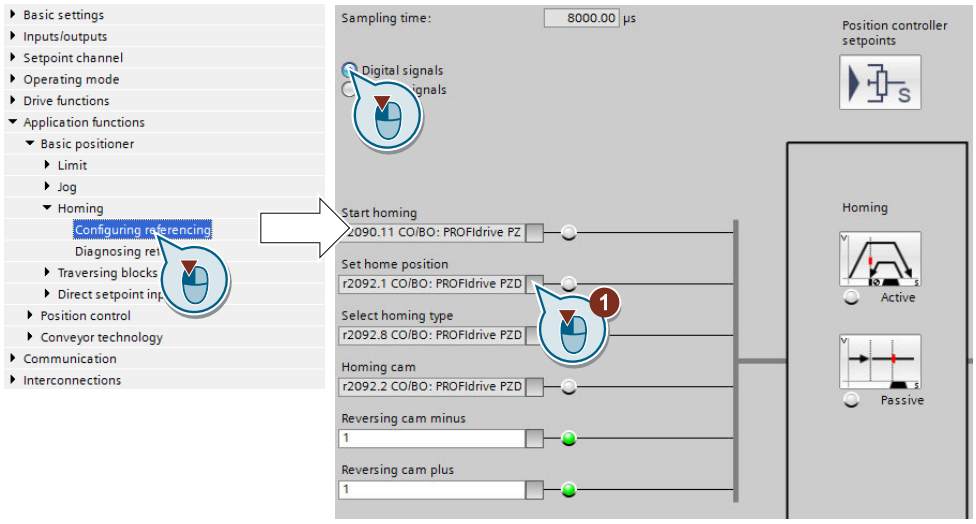
Figure 6-14 Set reference point

Activate 'set home position'

Requirement

You have selected the "Homing" screen.

Procedure



1. Interconnect this bit with the corresponding signal of your machine.
   If the axis is stationary, with the signal change 0 → 1, the inverter sets its actual position value to the reference point coordinate.
   For this function, all of the other signals are of no significance.
2. In Startdrive, proceed to the parameter view and set p2599 = reference point coordinate.

You have now activated 'set home position'.
❒

Parameter	Meaning
p2596	**Set reference point**
p2598	**Reference point coordinate, signal source**
p2599	**Reference point coordinate value**
r2684.11	**Reference point set**

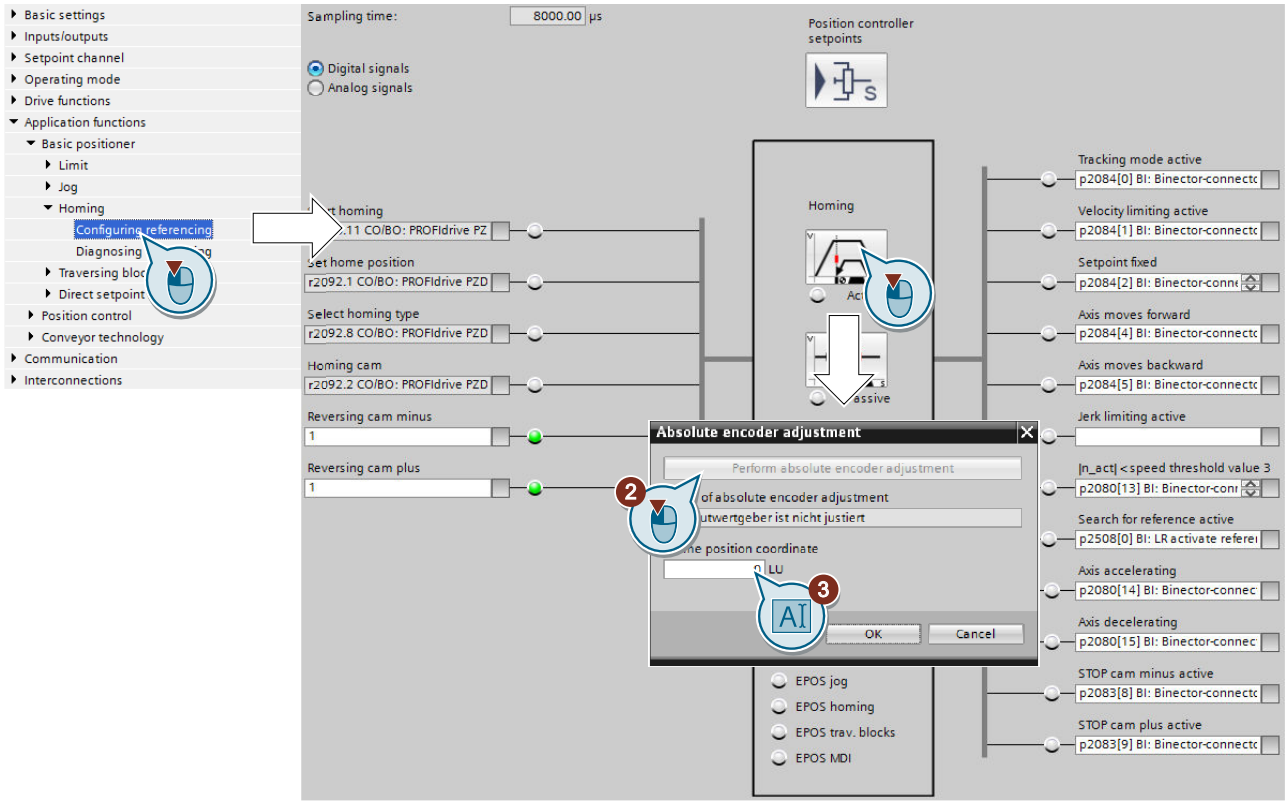
6.6.5 Absolute encoder adjustment

Absolute encoder adjustment

Requirement

1. You have positioned the axis (e.g. using the "jog" function) to the reference position in the machine.
2. You can use an absolute encoder for the position control.

Procedure



1. Specify the reference point coordinate.
2. Accept the reference point coordinate in the position actual value.

You have now adjusted the absolute encoder.
❒

Parameter	Meaning	
p2598	**Reference point coordinate, signal source**	
p2599	**Reference point coordinate value**	
p2507	**Absolute encoder adjustment status**	
	0	Error has occurred in the adjustment
	1	Absolute encoder was not adjusted
	2	Absolute encoder was not adjusted and encoder adjustment was initiated
	3	Absolute encoder adjusted

6.7 Jogging

6.7.1 Jog velocity

Description

Only input a setpoint velocity for the converter for velocity jog. With the signal "Jogging 1" or "Jogging 2", the converter accelerates the axis to the relevant setpoint velocity. The converter stops the axis when the respective "Jog" signal returns to zero.

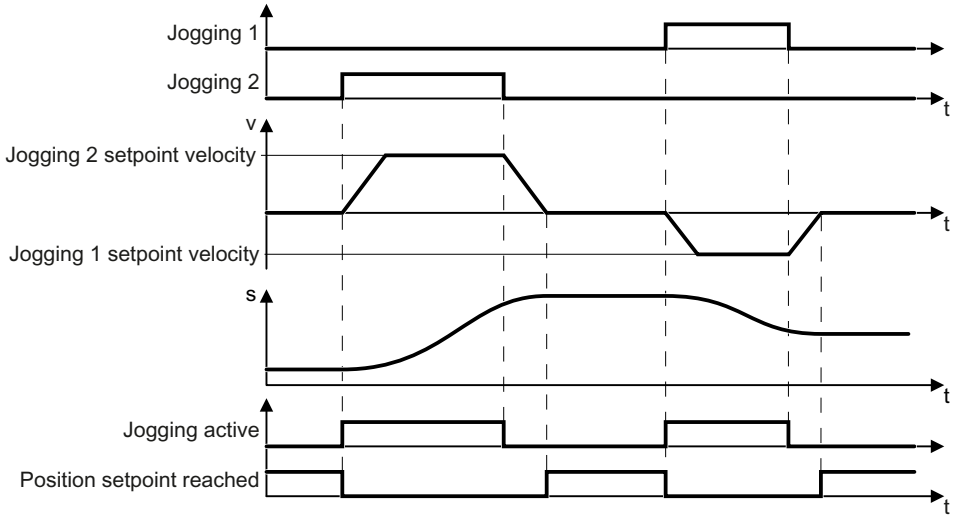


Figure 6-15 Jog velocity

6.7.2 Incremental jogging

Description

In the case of incremental jogging, input a relative traversing distance and a velocity setpoint into the converter. With the signals "Jogging 1" or "Jogging 2" the converter positions the axis by the respective travel path.

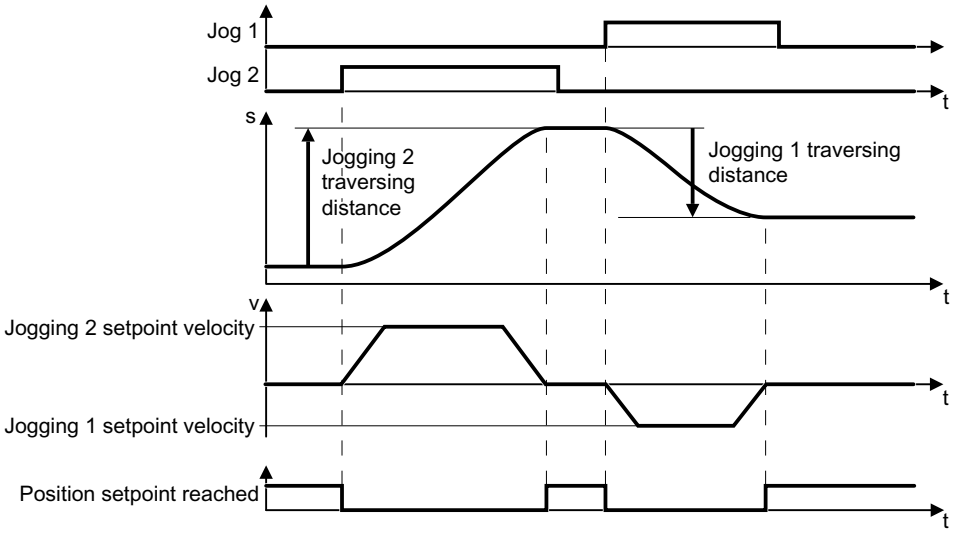


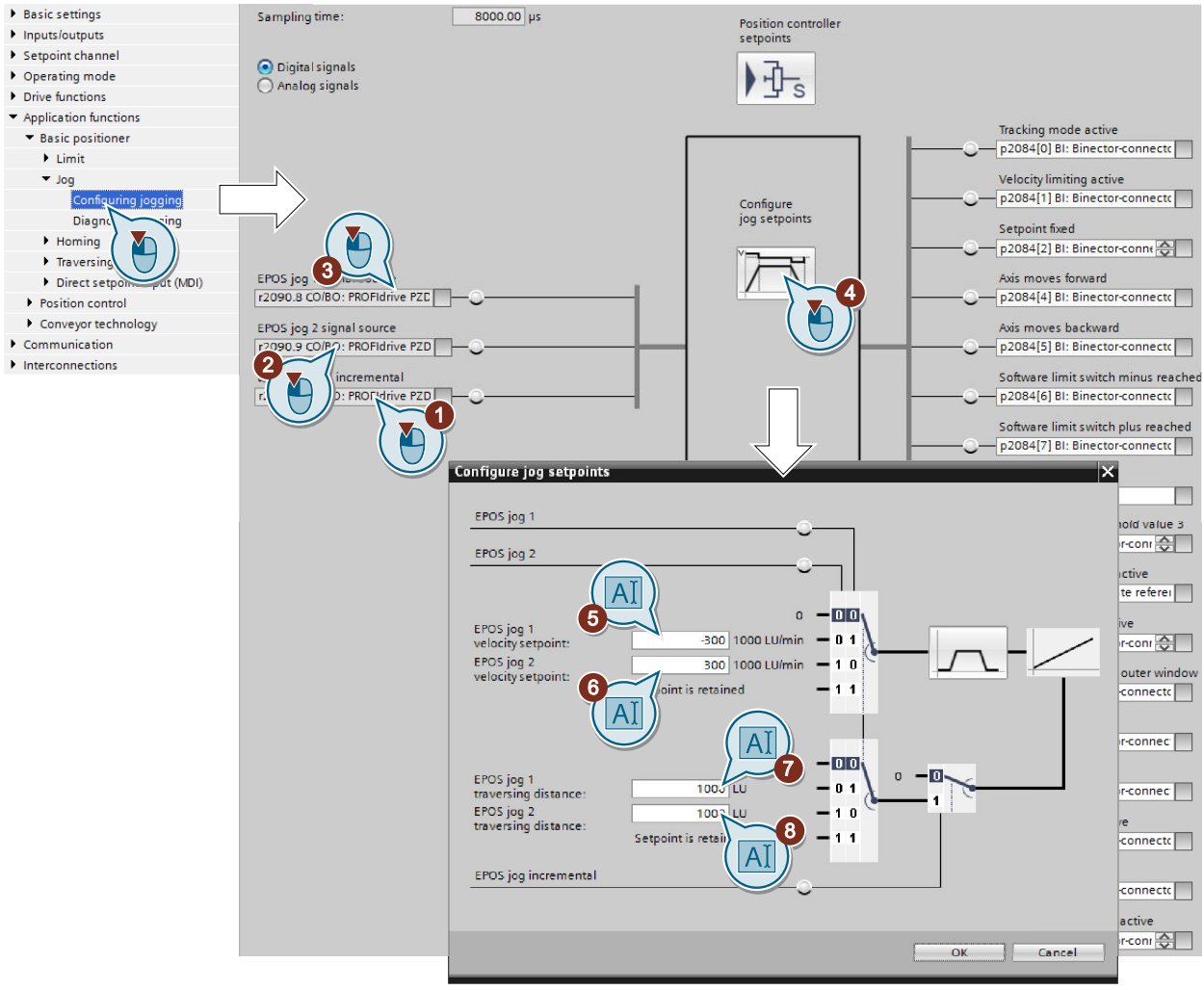
Figure 6-16 Incremental jogging

6.7.3 Setting jogging

Requirement

You have selected the "Jog" screen.

Procedure



1. Interconnect the signal that defines the mode for the "jog" function.
   0: Velocity jogging
   1: Incremental jogging
2. Interconnect the signal for jogging 1
3. Interconnect the signal for jogging 2.
4. Select the button for the other settings.
5. Set the velocities for the "jogging 1" function.
6. Set the velocities for the "jogging 2" function.
7. If you use the incremental jog, set the relative position setpoint for the "jogging 1" function. This value has no significance for velocity jogging.
8. If you use the incremental jog, set the relative position setpoint for the "jogging 2" function. This value has no significance for velocity jogging.

You have set the "jog" function.
❒

Parameter	Meaning
p2585	Jogging 1 setpoint velocity
p2586	Jogging 2 setpoint velocity
p2587	Jogging 1 traversing distance
p2588	Jogging 2 traversing distance
p2589	Jogging 1 signal source
p2590	Jogging 2 signal source
p2591	Incremental jogging

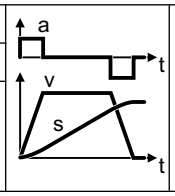
6.8 Traversing blocks

Description

A traversing block describes a positioning instruction for the drive.

The converter saves 16 different traversing blocks, which it normally executes one after the other. However, you can also directly select a specific traversing block or skip traversing blocks.

Table 6-1 Components of a traversing block

Element	Meaning		
Number	With this number in the range 0 to 15, every traversing block can be selected using binary-coded control signals.		
Job	Positioning command: You can give the converter various commands. For some jobs, you must also specify a parameter. See the table below.		
Parameter			
Mode	Positioning mode: Positioning relative to the start position or absolute to the machine zero point.		
Position	Target position		
Velocity	v		Setpoints for the traversing profile.
Acceleration	a		
Braking	-a		
Advance	Jump condition to the next traversing block. See the table below.		

Job and parameters

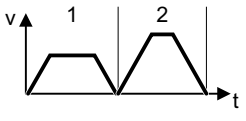
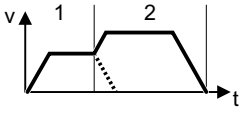
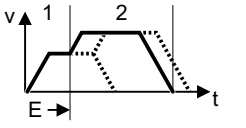
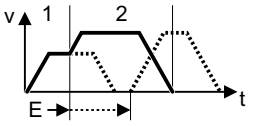
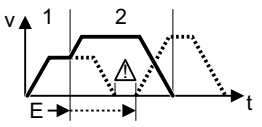
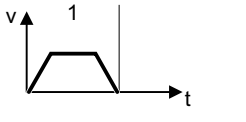
Table 6-2 Job and parameters

Job	Parameter	Meaning
Positioning	---	• Axis absolute or relative positioning. • Rotary axis with modulo correction in a positive or negative direction, absolute positioning.
Travel to fixed stop	Force [N] or torque [0.01 Nm]	Traverse axis to a fixed stop: • Linear axis with reduced force. • Rotary axis with reduced torque. Travel to fixed stop (Page 80)
Endless travel	---	Traverse the axis at the specified velocity to the positive or negative end of the traversing range.
Wait	Time [ms]	Wait the specified time.
Go to	Number	The converter then executes the next traversing block with the specified number.

Job	Parameter		Meaning
Set, reset	1	Set output 1	Set or reset internal signals in the converter: • Output 1: r2683.10 • Output 2: r2683.11 You can interconnect the signals with digital outputs of the converter or with bit 10 and 11 of the positioning status word of the fieldbus. Control and status word for the positioner (Page 24) Control and status word 2 for the positioner (Page 28)
	2	Set output 2	
	3	Set outputs 1 and 2	
Jerk	0	Inactive	Activate or deactivate jerk limiting. Limiting the traversing profile (Page 49)
	1	active	

Conditions for advance

Table 6-3 Advance: Jump condition to the next traversing block

Condition	Meaning			Traversing block
CONTINUE WITH STOP	If the axis has reached the setpoint position and has come to a standstill, the converter executes the next traversing block.			
CONTINUE FLYING	The converter goes to next traversing block at the braking instant.			
CONTINUE EXTERNAL	At the external E signal, the converter goes to the next traversing block.	If the E signal is not present, the drive behaves just the same as for "CONTINUE FLYING".		
CONTINUE EXTERNAL WAIT		If the E signal is not present, the converter exits the actual traversing block and continues to wait for the signal.	---	
CONTINUE EXTERNAL ALARM			As long as the axis is at a standstill, the converter signals alarm A07463.	
END	The converter exits the actual traversing block if the target position has been reached. The converter does not go to the next traversing block.			

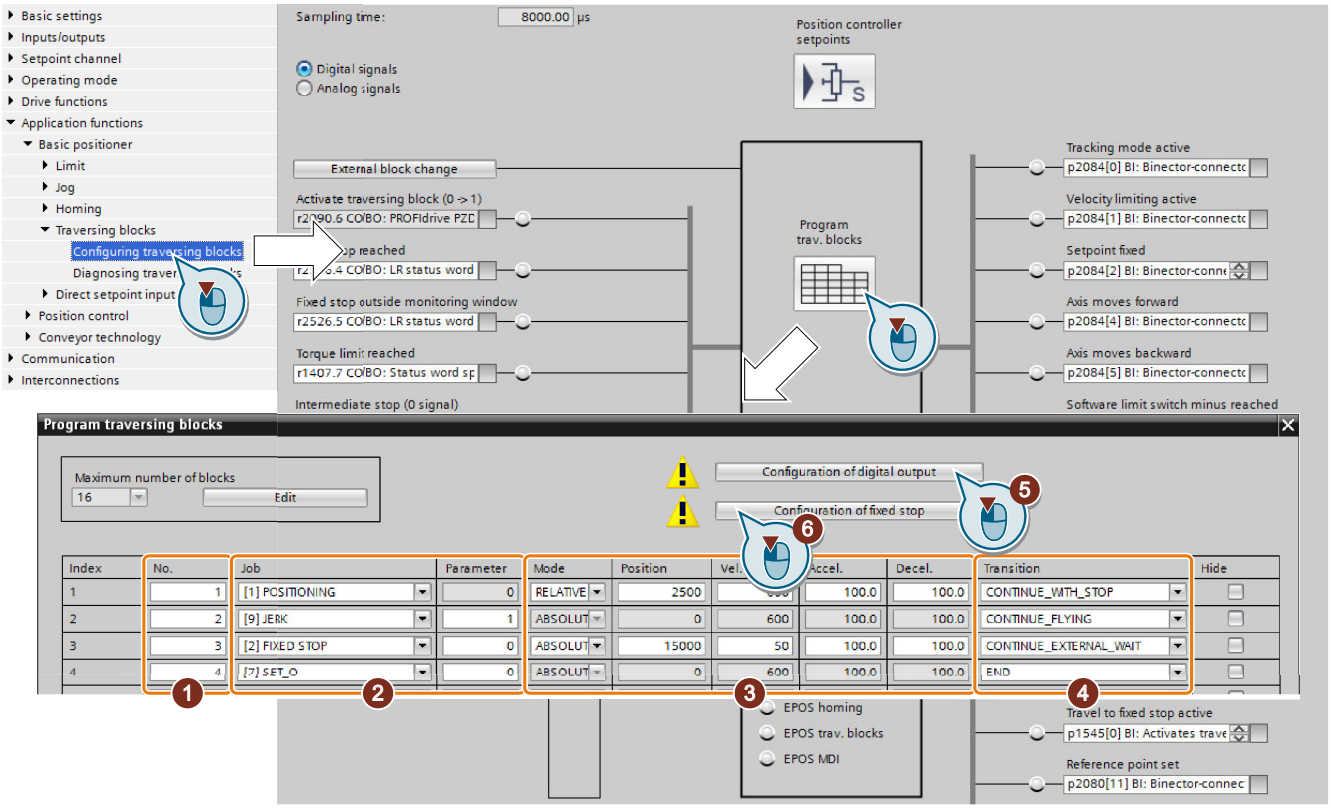
6.8.1 Setting the traversing blocks

Programming traversing blocks

Requirement

1. You have selected the "Traversing blocks" screen.
2. You select the "Program traversing blocks" button.

Procedure

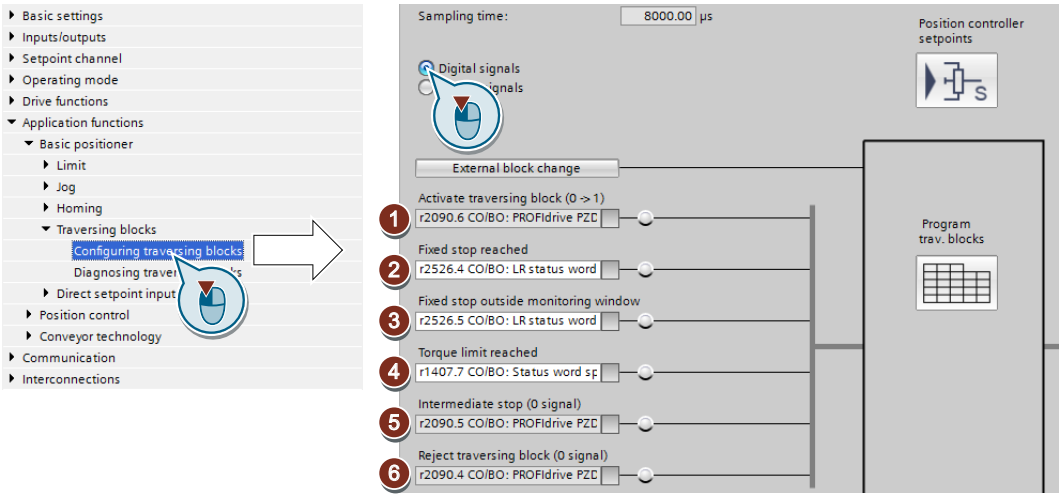


1. Assign a unique number for each traversing block.
2. Define the command and the corresponding parameters.
3. Set the job-specific values.
4. Define the step enabling condition for the next job.
5. Click this button to interconnect the status signals of the traversing blocks, for example, with bit 10 and 11 of the positioner status word with the fieldbus.
6. If you travel to a fixed stop, a button appears to make additional settings for this function.
   Travel to fixed stop (Page 80)
7. When you have programmed all traversing blocks, close the screen.

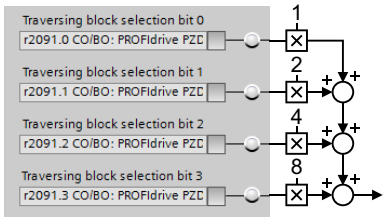
You have programmed the traversing blocks.
❒

Define digital signals for controlling

Procedure



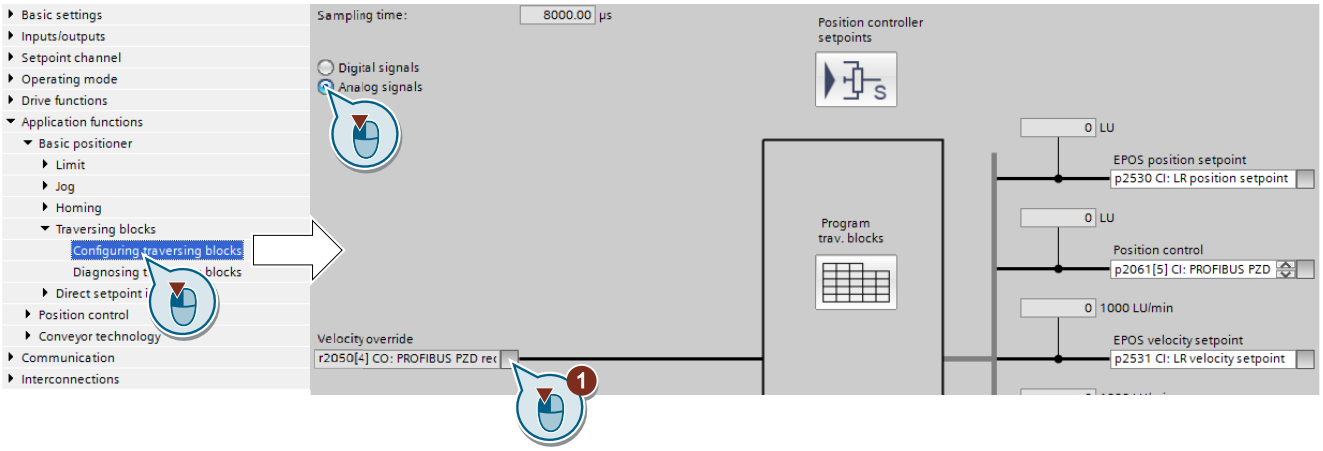
1. Define the signal for the start of the traversing block.
   The signal change 0 → 1 starts the currently selected traversing block.
2. In the factory setting, this signal is interconnected with the appropriate internal signals of the inverter. We recommend that you do not change this setting.
3. See ②.
4. See ②.
5. Define the signal for the settings for the intermediate stop.
   The axis temporarily stops for the "intermediate stop" = 0 signal. The axis continues its travel with "intermediate stop" = 1. The same traversing block as before the stop is active.
   Application examples (Page 84)
6. Define the signal for "reject signaling task".
   For the signal "reject traversing task" = 0, the inverter stops the axis with the maximum deceleration (p2573). If you start the axis again with "Activate traversing request" = 0 → 1, the inverter starts again with the currently selected traversing block.
7. Interconnect the signals for selecting the traversing block number.
   The inverter reads the traversing block number as binary code.



You have now defined the digital signals for controlling the traversing blocks.
❒

Define analog signals for controlling

Procedure



1. Change the signal source for the velocity override, if required.
   The velocity override refers to the velocity values you have set in the screen for programming the traversing blocks.

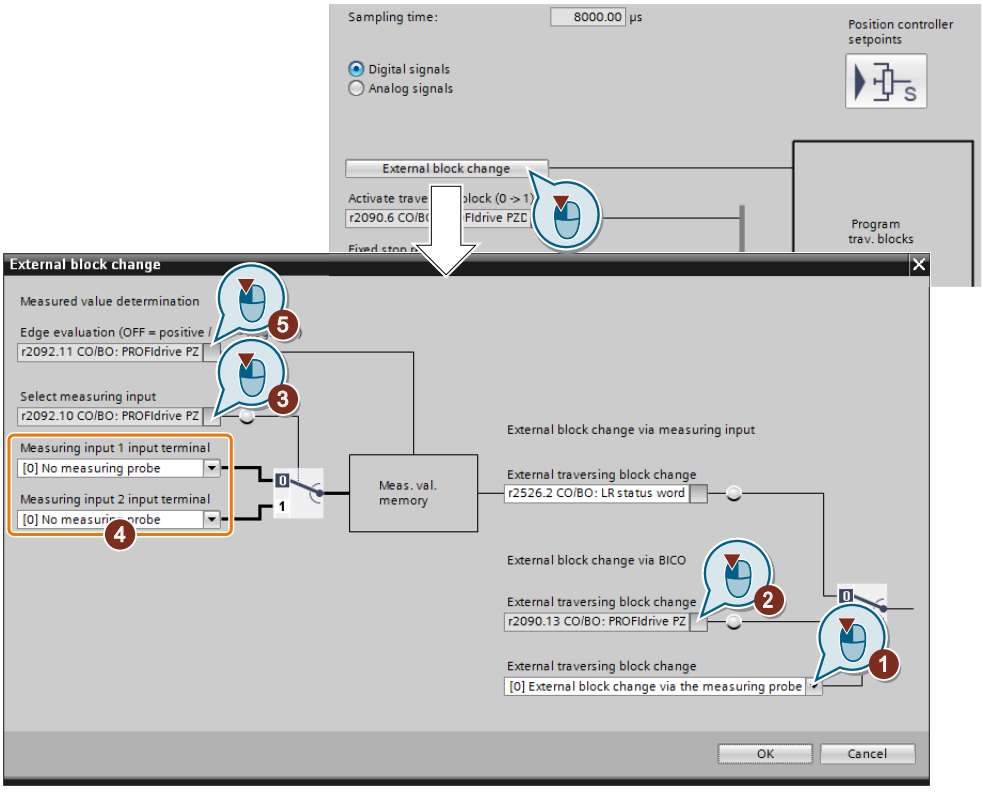
You have now defined the analog signals for controlling the traversing blocks.
❒

Define an external signal for block change

Requirement

You have selected the "External block change" button.

Procedure



1. Specify whether the external signal is received via a fast digital input (probe) or from another source, e.g. via the fieldbus.
2. To initiate a block change via the machine control system, you must interconnect this signal with a signal of your choice.
3. Select the input with which cam signal 1 is interconnected.
4. Select the input with which cam signal 2 is interconnected.
5. Specify the edge with which the inverter jumps to the next traversing block:
   0: Rising edge
   1: Falling edge

You have now defined an external signal for the block change.
❒

Parameter	Meaning	
p0488	**Probe 1, input terminal**	
p0489	**Probe 2, input terminal**	
p0581	**Probe edge**	
	0	Positive edge 0 → 1
	1	Negative edge 1 → 0
p2584	**Configuration functions**	
	.00	1 signal: activates position feedback signal (p2688 and r2689)

Parameter	Meaning				
p2615	**Maximum number of traversing blocks**				
p2616[0…n]	**Traversing block, block number**				
p2617[0…n]	**Traversing block, position**				
p2618[0…n]	**Traversing block, velocity**				
p2619[0…n]	**Traversing block, acceleration override**				
p2620[0…n]	**Traversing block, deceleration override**				
p2621[0…n]	**Traversing block, job**				
	1	POSITIONING	6	GOTO	
	2	FIXED STOP	7	SET_O	
	3	ENDLESS_POS	8	RESET_O	
	4	ENDLESS_NEG	9	JERK	
	5	WAIT			
p2622[0…n]	**Traversing block, job parameter**				
p2623[0…n]	**Traversing block, job mode** Value = 0000 cccc bbbb aaaa				
	cccc = 0000	Positioning mode	Absolute		
	cccc = 0001		Relative		
	cccc = 0010		Absolute positive (only for rotary axis with modulo correction)		
	cccc = 0011		Absolute negative (only for rotary axis with modulo correction)		
	bbbb = 0000	Advance condition	End		
	bbbb = 0001		Continue with stop		
	bbbb = 0010		Continue flying		
	bbbb = 0011		Continue external		
	bbbb = 0100		Continue external wait		
	bbbb = 0101		Continue external alarm		
	aaaa = 0001		Identifiers: Skip block		
p2624	**Sort traversing block** To sort the traversing blocks according to their block number: p2624 = 0 → 1.				
p2625	**Traversing block selection, bit 0**				
p2626	**Traversing block selection, bit 1**				
p2627	**Traversing block selection, bit 2**				
p2628	**Traversing block selection, bit 3**				
p2631	**Activate traversing block (0 → 1)**				
p2632	**External block change evaluation**				
	0	External block change via probe			
	1	External block change via BI: p2633			
p2633	**External block change (0 → 1)**				
p2640	**Intermediate stop (0 signal)**				
p2641	**Reject traversing job (0 signal)**				
p2646	**Velocity override**				

Parameter	Meaning	
p2688	**Position feedback signal tolerance window** The parameter is only active for p2584.0 = 1 If, for a positioning operation, the actual position (r2521) is within the tolerance window of the target position, then r2689 indicates the traversing block number.	
r2689	**Position feedback signal display** The parameter is only active for p2584.0 = 1 The block number of the traversing block, whose target position lies in the tolerance window around the actual position.	
	[0]	Bit-coded display of the traversing block numbers 0 to 31
	[1]	Bit-coded display of the traversing block numbers 32 to 63

6.8.2 Travel to fixed stop

Requirements

The "Travel to fixed stop" function is only possible with the control type vector control with encoder (VC):

"Travel to fixed stop" is not possible with the following types of control:

- V/f control
- Vector control without encoder (SLVC)

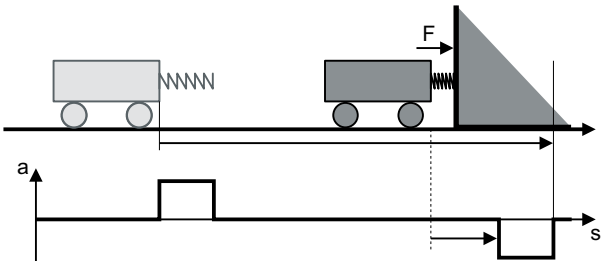
Description

With this function, the inverter positions a machine part to another machine part with force locking – and presses both machine parts together with an adjustable force.

Examples:

1. A door is pressed against a frame so that it is reliably closed.
2. A rotary table is pressed against a mechanical fixed stop, in order to secure a specific alignment.

When traveling to a fixed stop, the following applies:



- You must specify the position setpoint far enough behind the mechanical fixed stop. The load must reach the mechanical fixed stop before the inverter brakes the axis.
- If the start of braking point is located in front of the mechanical fixed stop, the inverter cancels the travel and outputs fault F07485.
- Before starting the travel, the inverter calculates the traversing profile for accelerating and braking the axis. The selected torque limit for the fixed stop has no influence on this calculation. However, the torque limit for the fixed stop reduces the available drive torque for the complete traversing distance. If the torque available for the predicted acceleration is not sufficient, then the following error is higher.
  If the following error monitoring for travel to fixed stop responds, then you must reduce the acceleration override.

Fixed stop has been reached

You have two options to define when the fixed stop is reached:

1. Fixed stop via an external sensor:
   At the fixed stop, the load actuates an external sensor. The sensor signals the inverter that the fixed stop has been reached. Depending on the advance condition, the inverter maintains the axis at the position with the set torque or goes to the next traversing block.
2. Fixed stop using maximum following error:
   If the axis comes into contact with the mechanical fixed stop, then the actual position value remains stationary. However, the inverter still increases its position setpoint. The inverter detects the fixed stop from a settable difference between the position setpoint and position actual value. Depending on the advance condition, the inverter maintains the axis at the position with the set torque or goes to the next traversing block.

Application example: Fixed stop using maximum following error

Table 6-4 Traversing blocks

Ind.	No.	Job	Par.	Mode	s	v	a	-a	Advance
1	1	TRAVEL TO FIXED STOP	5	RELATIVE	10000	10	100	100	CONTINUE WITH STOP
2	2	POSITIONING	0	ABSOLUTE	0	500	100	100	END

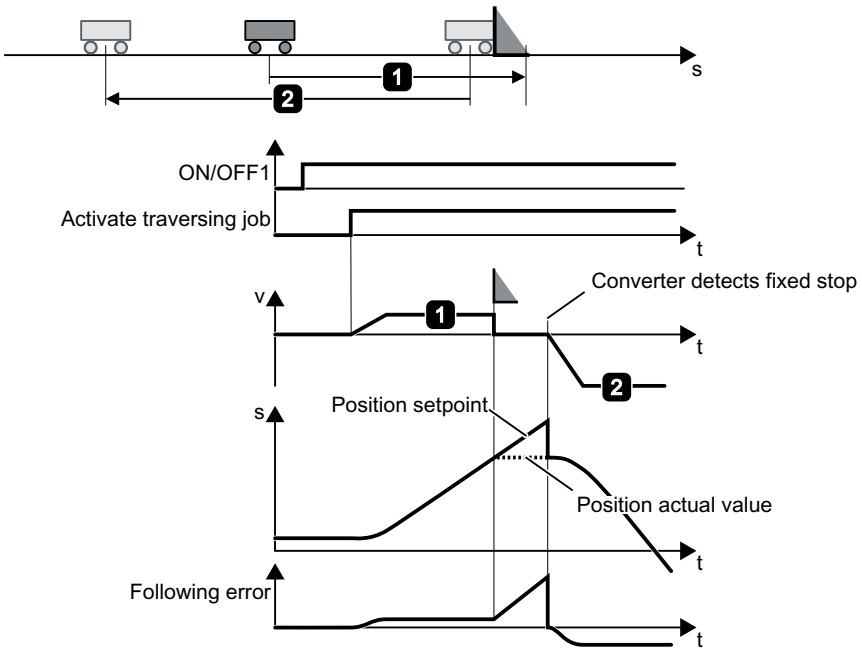
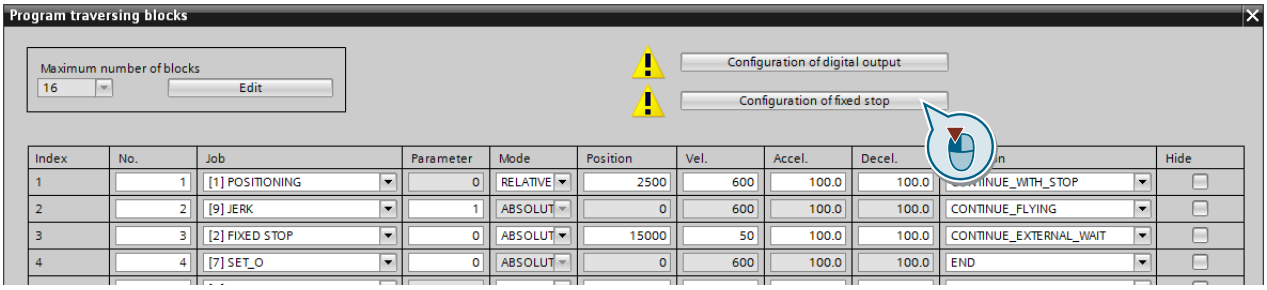


Figure 6-17 Inverter detects the fixed stop using the following error

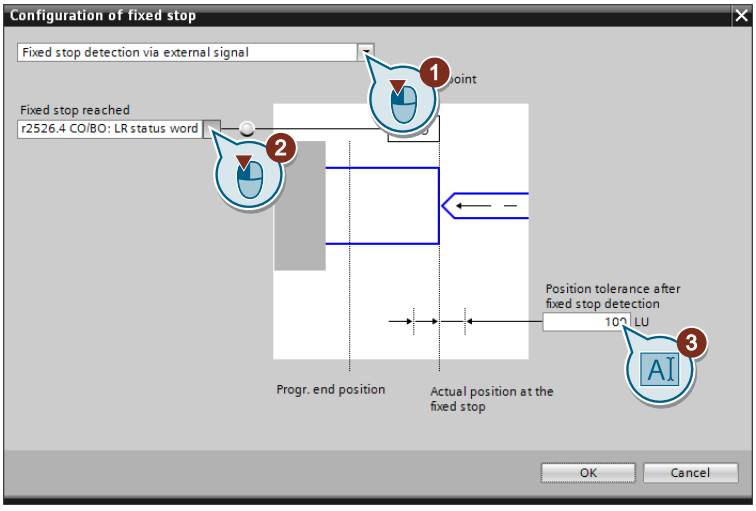
Set travel to fixed stop

Requirement

1. You have programmed "Travel to fixed stop" as the traversing block.
   Setting the traversing blocks (Page 75)
2. If you select the "Programming traversing blocks" button, the "Configuration of fixed stop" button appears.



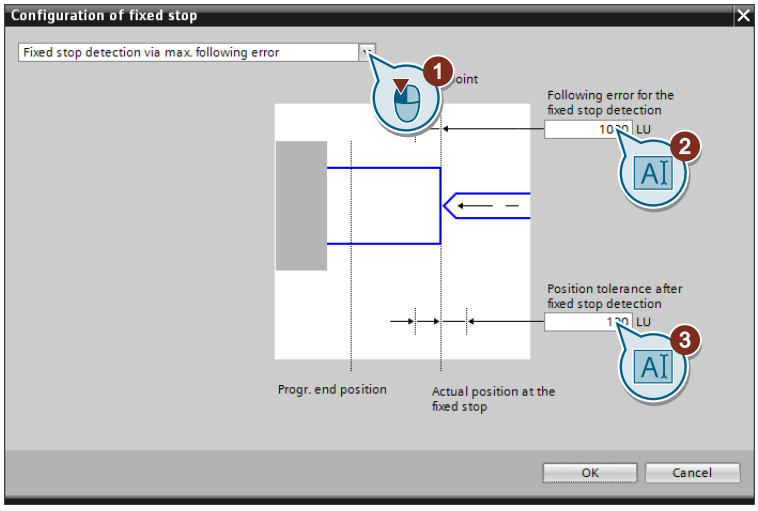
Procedure: Fixed stop using an external signal



1. Select "Fixed stop using an external signal".
2. Interconnect the sensor that signals when the fixed stop is reached with this signal.
3. Set the tolerance.
   After the fixed stop is detected, the inverter monitors the actual position of the axis. If the position actual value changes by more than this distance, then the inverter stops the axis and outputs fault F07484. Therefore, the inverter detects that the fixed stop has "broken away".

You have now set "Travel to fixed stop" using an external signal.
❒

Procedure: Fixed stop using maximum following error



1. Select "Fixed stop using maximum following error":
2. Set the following error that the inverter uses to detect the fixed stop.
3. Set the tolerance.
   After the fixed stop is detected, the inverter monitors the actual position of the axis. If the position actual value changes by more than this distance, then the inverter stops the axis and outputs fault F07484. Therefore, the inverter detects that the fixed stop has "broken away".

You have now set "Travel to fixed stop" using maximum following error.
❒

Parameter	Meaning	
p2634	**Fixed stop, maximum following error**	
p2635	**Fixed stop, monitoring window**	
p2637	**Fixed stop reached**	
	0	Fixed stop has not been reached.
	1	Fixed stop has been reached.
p2638	**Fixed stop outside the monitoring window**	
p2639	**Torque limit reached**	
	0	Torque limit has not been reached.
	1	Torque limit has been reached.

6.8.3 Application examples

1st example

Table 6-5 Traversing blocks

Ind.	No.	Job	Par.	Mode	s	v	a	-a	Advance
1	1	POSITIONING	0	RELATIVE	10000	5000	100	100	CONTINUE WITH STOP
2	2	POSITIONING	0	ABSOLUTE	0	5000	100	100	END

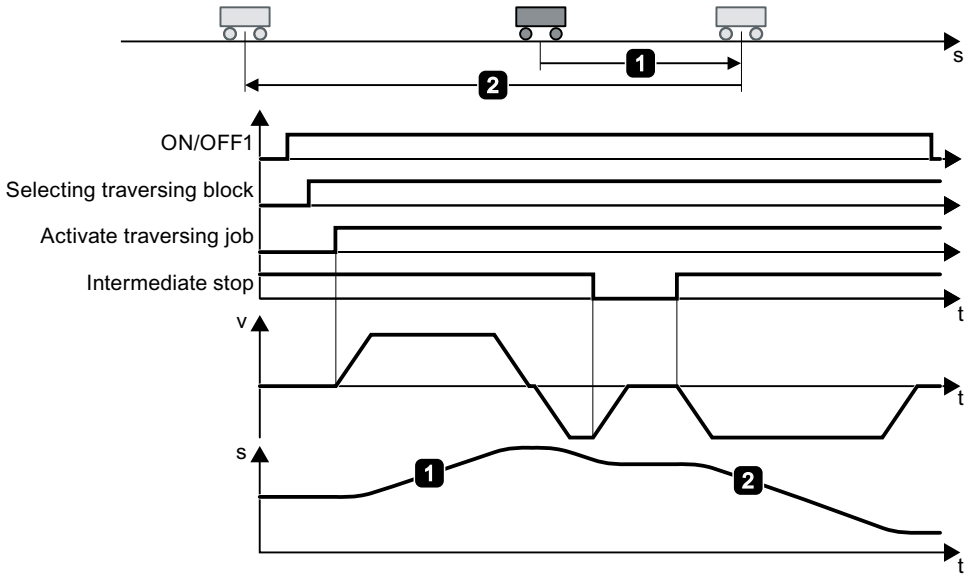


Figure 6-18 Positioning an axis using traversing blocks

2nd example

Table 6-6 Traversing blocks

Ind.	No.	Job	Par.	Mode	s	v	a	-a	Advance
1	1	POSITIONING	0	RELATIVE	10000	2000	100	100	CONTINUE EXTERNAL ALARM
2	2	POSITIONING	0	RELATIVE	10000	5000	100	100	CONTINUE EXTERNAL ALARM
3	3	POSITIONING	0	ABSOLUTE	0	5000	100	100	END

The inverter only goes to the next traversing block for the 0 → 1 change of the "External block selection" signal.

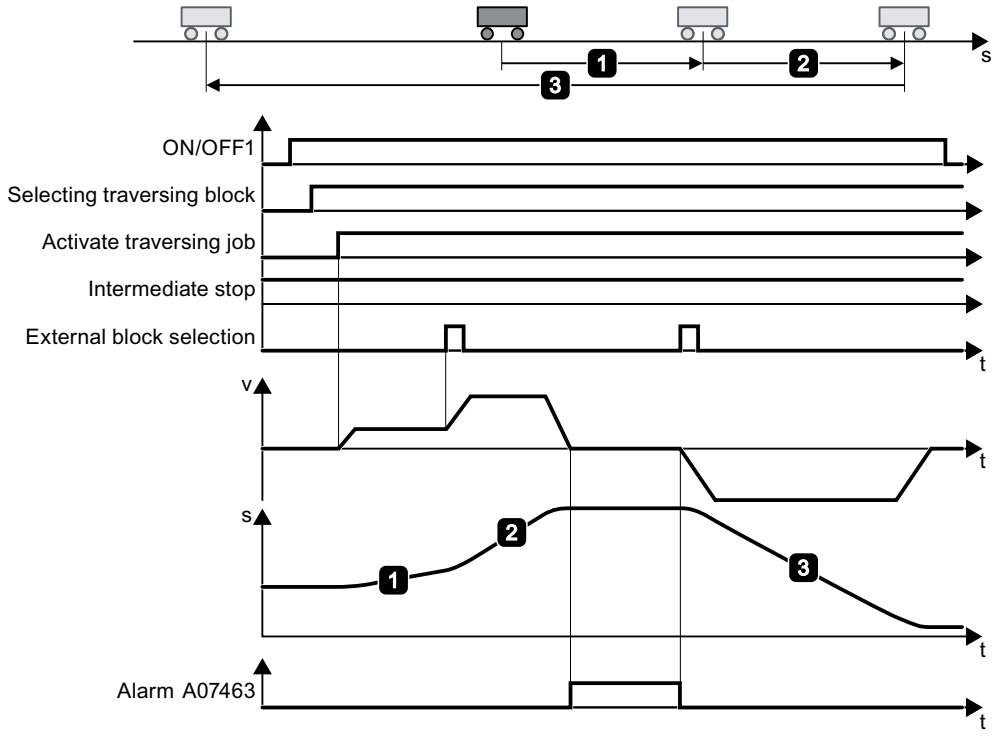


Figure 6-19 Positioning an axis using traversing blocks

6.9 Direct setpoint input (MDI)

Description

For direct setpoint input (MDI, Manual Data Input), a higher-level control provides the inverter with the position setpoint and traversing profile.

Example 1

The higher-level control specifies the value of the setpoint either as a relative or an absolute position setpoint:

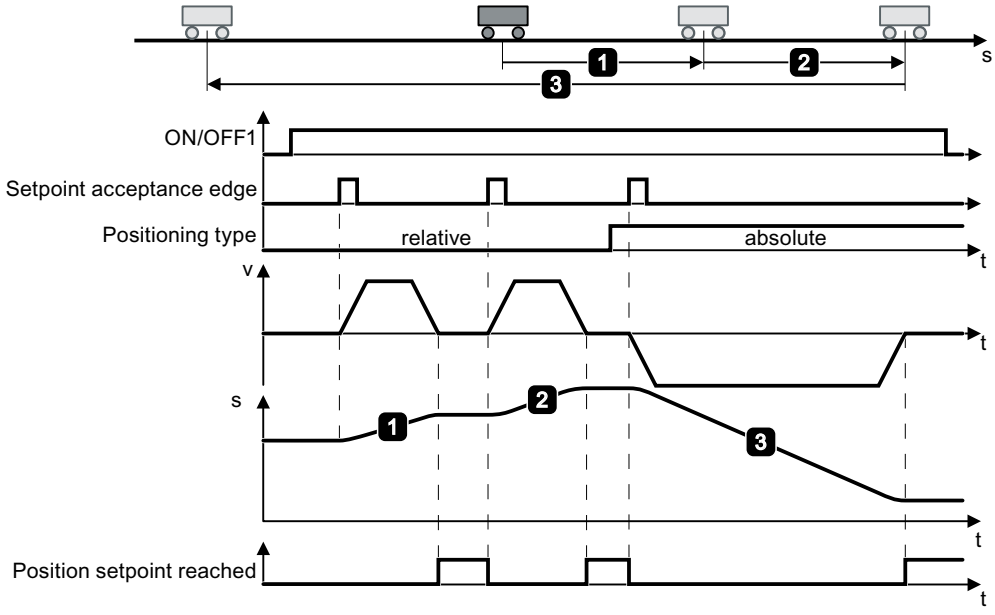


Figure 6-20 Position axis with direct setpoint input (MDI)

Example 2

The higher-level control selects the mode "Set-up":

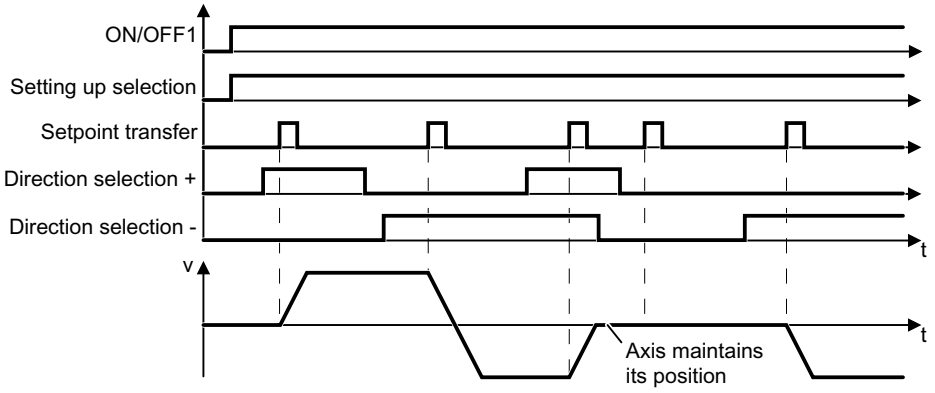


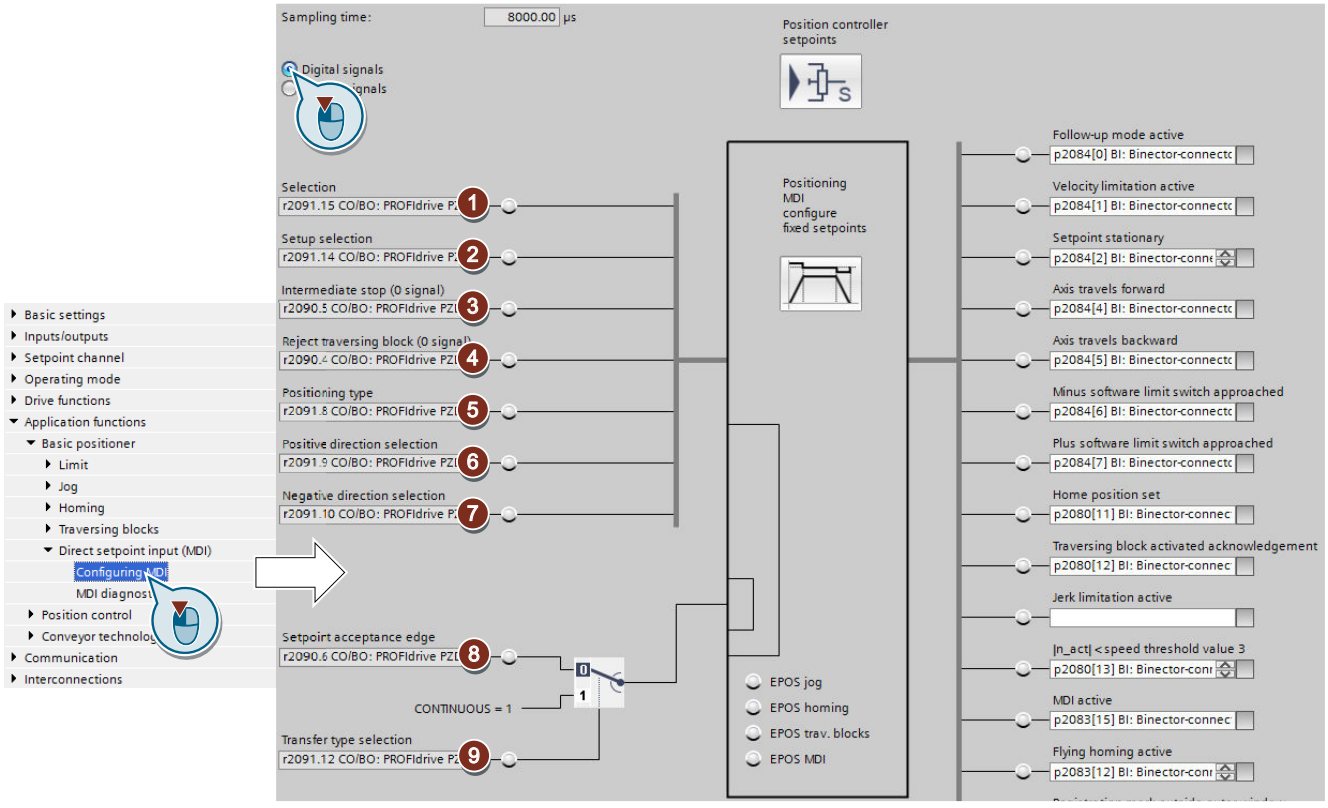
Figure 6-21 Set up axis with direct setpoint input (MDI)

Defining digital signals to control the direct setpoint input

Requirement

You have selected the "Direct setpoint input (MDI)" screen.

Procedure



Interconnect the signals to control the direct setpoint input using the appropriate signals from your machine control.

① The signal enables MDI. The signal must be = 1 if you control the inverter using MDI.

② Specifies the MDI mode:

0: Positioning: Traverse the axis with position control over the target position.

1: Set up: Traverse the axis position-controlled using velocity input

While operational, the axis operating mode can be switched over from "Set up" to "Positioning".

If "Set up" is active, then the two bits ⑥ and ⑦ define the direction of travel.

③ Intermediate stop:

0: The inverter stops the axis and maintains the axis in position after standstill. The current traversing block remains valid.

1: The axis continues the interrupted traversing block.

④ Discard traversing block:

0: The inverter stops the axis and maintains the axis in position after standstill. The inverter can no longer continue the current traversing block, however.

1: Axis waits for a new start command.

⑤ Positioning mode:

0: Relative (see also Bit ⑨).

1: Absolute (the axis must be referenced).

⑥ Direction selection for "Set up" (Bit ② = 1):

⑦ Bit ⑥ = 1: Positive direction.

Bit ⑦ = 1: Negative direction.

If both bits are the same, the axis stops.

These signals are only effective if, in the interface for analog signals, the value ⑥ is not interconnected. See also the table below.

⑧ Accept setpoint:
0 → 1: Start axis
Is only active, if bit ⑨ = 0.

⑨ 1: Continuous mode:

The inverter continually accepts changes to the position setpoint. In this mode, relative positioning is not permitted (see bit ⑤).

0: The inverter starts using bit ⑧.

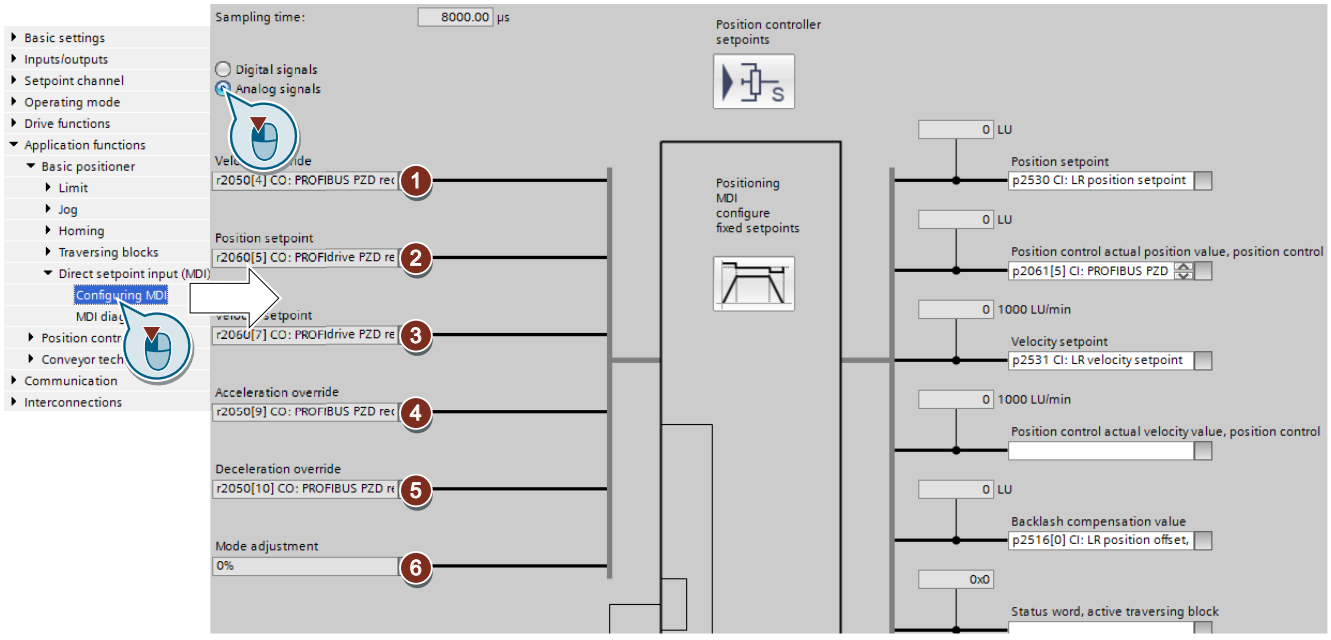
You have now interconnected the digital signals for controlling the direct setpoint input.
❒

Defining the signals to control the direct setpoint input

Requirement

You have selected the "Direct setpoint input (MDI)" screen.

Procedure



Interconnect the signals to control the direct setpoint input using the appropriate signals from your machine control:

① Override velocity, referred to ③
② Position setpoint
③ Velocity setpoint for the traversing profile.
④ Acceleration override and deceleration, referred to the values of the traversing profile lim-
⑤ itation.

Limiting the traversing profile (Page 49)

⑥ **"Mode adaptation" is interconnected with a signal:**

xx0x hex	Absolute positioning.
xx1x hex	Relative positioning.
xx2x hex	Position the rotary axis in the positive direction.
xx3x hex	Position the rotary axis in the negative direction.

"Mode adaptation" is not interconnected (=0):

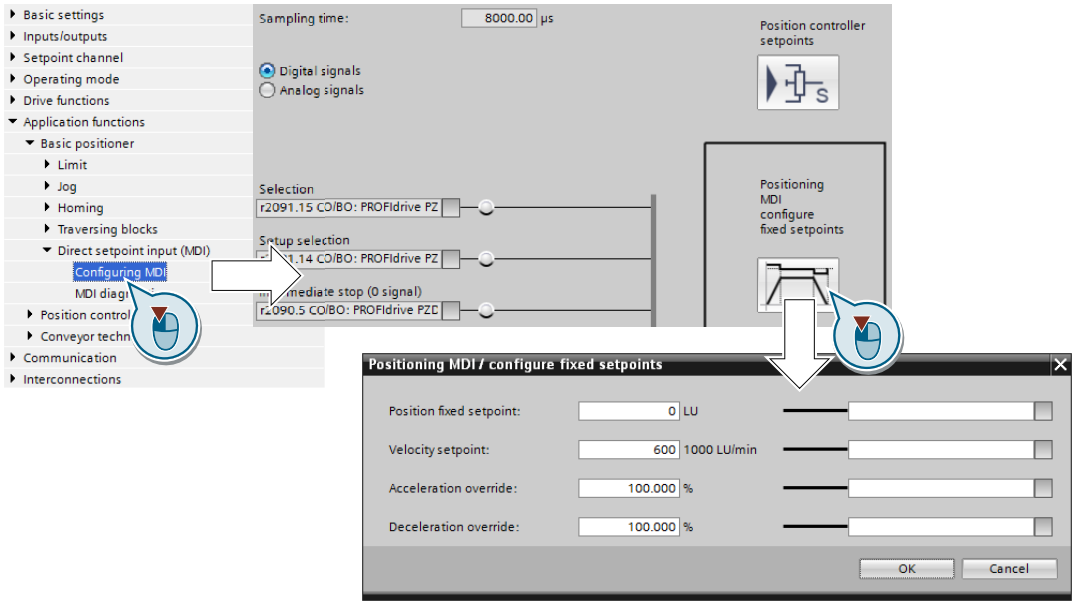
The signals ⑤, ⑥ and ⑦ of the upper table are effective.

You have now interconnected the analog signals for controlling the direct setpoint input.
❒

Set fixed setpoint

In some applications it is sufficient if the inverter moves the axis for each task in the same way, absolute or relative to the position setpoint. This approach can be achieved with fixed setpoints.

Procedure



1. Select the button for configuring the fixed setpoint:
2. Set the values suitable to your application:

You have set the fixed setpoints.
❒

Parameter	Meaning	
p2640	**Intermediate stop (0 signal)**	
p2641	**Reject traversing job (0 signal)**	
p2642	**Direct setpoint input/MDI, position setpoint**	
p2643	**Direct setpoint input/MDI, velocity setpoint**	
p2644	**Direct setpoint input/MDI, acceleration override**	
p2645	**Direct setpoint input/MDI, deceleration override**	
p2646	**Velocity override**	
p2647	**Direct setpoint input/MDI selection**	
p2648	**Direct setpoint input/MDI, positioning type**	
	0	Absolute positioning is selected
	1	Relative positioning is selected
p2649	**Direct setpoint input/MDI, acceptance method selection**	
	0	Values are accepted when p2650 = 0 → 1
	1	Continuous acceptance of values
p2650	**Direct setpoint input/MDI, setpoint acceptance, signal edge** p2650 = 0 → 1 and p2649 = 0 signal	
p2651	**Direct setpoint input/MDI, positive direction selection**	
p2652	**Direct setpoint input/MDI, negative direction selection**	
p2653	**Direct setpoint input/MDI, set up selection** Signal = 1: Set up is selected.	

Parameter	Meaning
p2654	**Direct setpoint input/MDI, mode adaptation**
p2690	**Position fixed setpoint** Interconnect fixed setpoint: p2642 = 2690
p2691	**Velocity fixed setpoint** Interconnect fixed setpoint: p2643 = 2691
p2692	**Acceleration override fixed setpoint** Interconnect fixed setpoint: p2644 = 2692
p2693	**Deceleration override fixed setpoint** Interconnect fixed setpoint: p2645 = 2693

Appendix

A

A.1 Manuals and technical support

A.1.1 Overview of the manuals

You can find manuals here with additional information for downloading

- CU250S-2 operating instructions (https://support.industry.siemens.com/cs/ww/en/view/109482997)
  Installing, commissioning and maintaining the inverter. Advanced commissioning
- CU250S-2 List Manual (https://support.industry.siemens.com/cs/ww/en/view/109482981)
  List of all parameters, alarms and faults, graphic function diagrams.
- "Basic positioner" function manual (https://support.industry.siemens.com/cs/ww/en/view/109477922)
  Commissioning the basic positioner (this manual).
- "Safety Integrated" function manual (https://support.industry.siemens.com/cs/ww/ene/view/109751320)
  Configuring PROFIsafe.
  Installing, commissioning and operating fail-safe functions of the inverter.
- "Fieldbus" function manual (https://support.industry.siemens.com/cs/ww/en/view/109751350)
  Configuring fieldbuses

Finding the most recent edition of a manual

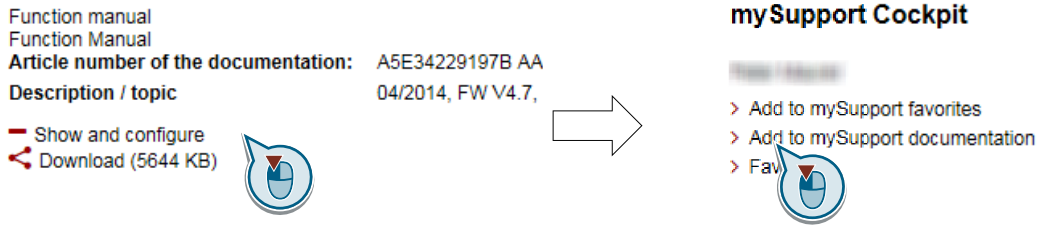
If there a multiple editions of a manual, select the latest edition:

Configuring a manual

Further information about the configurability of manuals is available in the Internet:

MyDocumentationManager (https://www.industry.siemens.com/topics/global/en/planning-efficiency/documentation/Pages/default.aspx).

Select "Display and configure" and add the manual to your "mySupport-documentation":



Not all manuals can be configured.

The configured manual can be exported in RTF, PDF or XML format.

A.1.2 Configuring support

Catalog

Ordering data and technical information for SINAMICS G inverters.

Catalogs for download or online catalog (Industry Mall):

Everything about SINAMICS G120 (www.siemens.en/sinamics-g120)

SIZER

The configuration tool for SINAMICS, MICROMASTER and DYNAVERT T drives, motor starters, as well as SINUMERIK, SIMOTION controllers and SIMATIC technology

SIZER on DVD:

Article number: 6SL3070-0AA00-0AG0

Download SIZER (https://support.industry.siemens.com/cs/ww/en/view/54992004)

EMC (electromagnetic compatibility) technical overview

Standards and guidelines, EMC-compliant control cabinet design

EMC overview (https://support.industry.siemens.com/cs/ww/en/view/103704610)

EMC Guidelines configuration manual

EMC-compliant control cabinet design, potential equalization and cable routing

EMC installation guideline (http://support.automation.siemens.com/WW/view/en/60612658)

Safety Integrated for novices technical overview

Application examples for SINAMICS G drives with Safety Integrated

Safety Integrated for novices (https://support.industry.siemens.com/cs/ww/en/view/80561520)

A.1.3 Product Support

You can find additional information about the product on the Internet:

 Product support (https://support.industry.siemens.com/cs/ww/en/)

This URL provides the following:

- Up-to-date product information (product announcements)
- FAQs
- Downloads
- The Newsletter contains the latest information on the products you use.
- The Knowledge Manager (Intelligent Search) helps you find the documents you need.
- Users and specialists from around the world share their experience and knowledge in the Forum.
- You can find your local representative for Automation & Drives via our contact database under "Contact & Partner".
- Information about local service, repair, spare parts and much more can be found under "Services".

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Further information

SINAMICS converters:
www.siemens.com/sinamics

Safety Integrated
www.siemens.com/safety-integrated

PROFINET
www.siemens.com/profinet

Siemens AG
Digital Factory
Motion Control
Postfach 3180
91050 ERLANGEN
Germany

Scan the QR code for additional information about SINAMICS G120.