1PosInc/Analog

4

4.1 Product overview

Order number

6ES7138-4DJ00-0AB0

Features

- **Positioning module for controlled positioning using the analog output**
  - Switchover and switch-off difference can be set using your control program
  - The voltage for rapid and creep feed, acceleration, and deceleration can be set using your control program
- **Incremental encoder with 5 V differential signals**
  - With or without zero mark
  - Quadruple evaluation of the encoder signals
- **Usable axis types**
  - Linear axis
  - Rotary axis
- **Operating range: 0 - 16 777 215 steps**
- **The drive is controlled using the analog output**
  - ± 10 V, digital output DO can be controlled freely
  - 0 V to 10 V, direction using digital output DO
- **3 digital inputs can be used for the following:**
  - Minus hardware limit switch
  - Plus hardware limit switch
  - Reducing cam/latch input
- **Diagnostics**
  - Encoder monitoring

Configuration

To configure the 1PosInc/Analog, you can use either

- A DDB file (http://www.ad.siemens.de/csi/gsd) or
- STEP 7 as of V5.1 SP2.

4.2 Brief Instructions on Commissioning the 1PosInc/Analog

Introduction

Using the example of inching mode, this brief introduction shows you a functioning application in which you get to know and check the hardware and software involved in a positioning operation of your 1PosInc/Analog.

Prerequisites for the Example

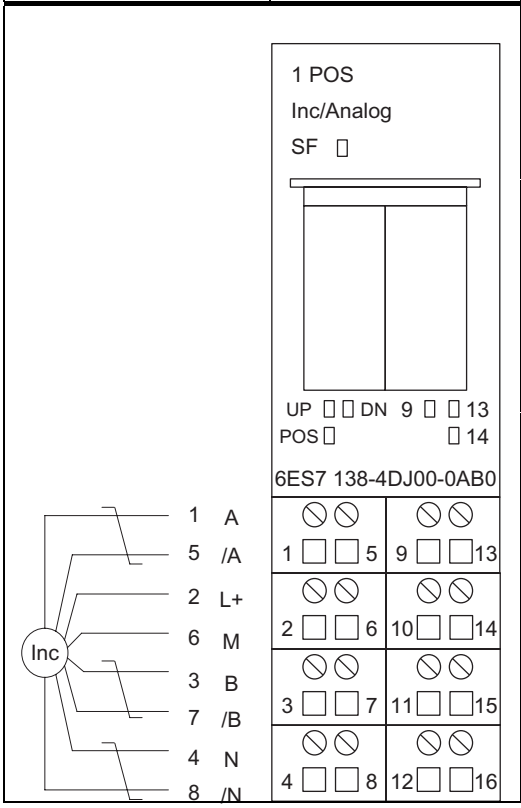
The following prerequisites must be fulfilled:

- You must have put an ET 200S station on an S7 station with a DP master into operation.
- You must have:
  - A TM-E30S44-01 terminal module (6ES7 193-4CG20-0AA0 or 6ES7 193-4CG30-0AA0)
  - A 1PosInc/Analog
  - An incremental encoder with 5V differential signals and a 24 V encoder supply
  - A drive with a power control system (a frequency converter with ±10 V analog input for speed control, for example)
  - A 24 VDC power supply
  - The necessary wiring material

Installation, Wiring, and Fitting

Install and wire the TM-E30S44-01 terminal module. Insert the 1PosInc/Analog in the terminal module (you can find detailed instructions in the *Distributed I/O Device* manual).

Table 4-1 Terminal assignment of the 1PosInc/Analog

Terminal assignment	View	Remarks			
		**Connection of the Incremental Encoder with 5 V Differential Signals: Terminals 1-8**		**Connection of the Switches and the Drive: Terminals 9-16**	
		1: A	Track A	9: IN0	Minus limit switch
		5: /A		13: IN1	Plus limit switch
		3: B	Track B	14: IN2	Reducing cam; latch signal
		7: /B		10: 24 VDC	Encoder supply for the switches
		2: 24 VDC	Voltage supply for incremental encoder	12: QV+	Analog output ± 10 or 0 V to 10 V to connect the drive
		6: M		16: M_{ana}	
		4: N	Track N; optional zero mark	11: OUT	Digital output DO for direct control or as a directional signal for the drive
		8:/N		15: M	

Configured with STEP 7 via HW Config

You begin by adapting the hardware configuration to your existing ET 200S station.

1. Open the relevant project in SIMATIC Manager.
2. Call the HWConfig configuration table in your project.
3. Select "1PosInc/Analog" from the hardware catalog. The number 6ES7 138-4DJ00-0AB0 appears in the info text. Drag the entry to the slot at which you have installed your 1PosInc/Analog.
4. Double-click this number to open the "Properties for the 1PosInc/Analog" dialog box.

   On the "Addresses" tab, you will find the addresses of the slot to which you have dragged the 1PosInc/Analog. Make a note of these addresses for subsequent programming.

   On the "Parameters" tab, you will find the default settings for the 1PosInc/Analog. If you are not connecting any limit switches to the 1PosInc/Analog, set the DI0 limit switch minus and DI1 limit switch plus parameters to "make contact". Adapt the "DO function" parameter to the drive interface.
5. Save and compile your configuration, and download the configuration in STOP mode of the CPU by choosing "PLC -> Download to Module".

Creating Blocks and Integrating Them Into The User Program

Integrate the following FC 101 block in your user program (in OB 1, for example). This block requires the DB1 data block with a length of 16 bytes. In the example below, the start is initiated by setting memory bit 30.0 (in the plus direction) or 30.1 (in the minus direction) with the programming device. Select the speed for inching mode using memory word 32.

```
STL                                  Explanation
Block: FC101
        L       PID 256              //Load feedback values from the 1PosInc/Analog
        T       DB1.DBD8
        L       PID 260
        T       DB1.DBD12
        L       DB1.DBB8             //Display status bits
        T       MB8
        L       DB1.DBB12
        T       MB9
        L       DB1.DBD8             //Display actual value
        UD      DW#16#FFFFFF
        T       MD12
        AN      M30.0
        SPB     DIRM
        L       B#16#13              //Travel in plus direction
        T       DB1.DBB0             //(START=1, DIR_P=1, DIR_M=0, CTRL_DO=1, INCH=1)
        SPA     CTRL
DIRM:   AN      M30.1
        SPB     STOP
        L       B#16#15              //Travel in minus direction
        T       DB1.DBB0             //(START=1, DIR_P=0, DIR_M=1, CTRL_DO=1, INCH=1)
        SPA     CTRL
STOP:   L       B#16#0               //Stop
        T       DB1.DBB0
        A       DB1.DBX8.2
        SPB     CTRL
        AN      DB1.DBX8.0           //Set/delete START depending on POS_ACK
        =       DB1.DBX0.0
CTRL:   L       MW32                 //Speed for inching mode
        T       DB1.DBW23
        L       B#16#0
        T       DB1.DBB1
        L       DB1.DBD0             //Transfer control values to the 1PosInc/Analog
        T       PAD256
        L       DB1.DBD4
        T       PAD260
```

Test

Start inching mode, and monitor the associated feedback.

1. Use "Monitor/Modify Variables" to check the actual value and the status bits POS_ACK, POS_ERR, POS_DONE, ERR_ENCODER.
2. Select the "Block" folder in your project. Choose the "Insert > S7 Block > Variable Table menu command to insert the VAT 1 variable table, and then confirm with OK.
3. Open the VAT 1 variable table, and enter the following variables in the "Address" column:
   - MD12 (actual value)
   - M8.0 (POS_ACK)
   - M8.1 (POS_ERR)
   - M8.2 (POS_DONE)
   - M8.7 (ERR_ENCODER)
   - M30.0 (inching in plus direction)
   - M30.1 (inching in minus direction)
   - MW32 (speed for inching mode; as S7 analog value 0-7EFFH)
4. Choose "PLC > File Connect To > Configured CPU" to switch to online.
5. Choose "Variable > Monitor" to switch to monitoring.
6. Switch the CPU to RUN mode.

Result

The following table shows you which activity triggers which result.

Activity	Result
Switch the CPU to RUN mode.	• The POS_ACK status bit is deleted • The POS_ERR status bit is deleted • The POS_DONE status bit is set
Check the encoder wiring	
Check the feedback bit ERR_ENCODER	• If ERR_ENCODER = 1, correct the wiring of the encoder
Inching in the plus direction:	
Start inching mode in the plus direction by setting memory marker 30.0 ("Variable > Modify >")	**The status bit POS_ERR = 0, the UP LED lights up** • The POS_ACK status bit is set • The POS_DONE status bit is deleted • The actual value is continuously updated • The POS LED lights up • The reversal of the direction of rotation you have parameterized and the wiring of the encoder and drive are correct **The status bit POS_ERR = 1, the DN LED lights up** Check the assigned parameter reversal of the direction of rotation and directional adjustment, and the wiring of the encoder and drive

Activity	Result
Check the speed of the drive in the plus direction	
Control the speed using memory marker word 32 ("Variable > Modify >")	• If the drive moves at the correct speed, your wiring is correct
Inching in the minus direction:	
Start inching mode in the minus direction by setting memory marker 30.1 ("Variable > Modify >")	**The status bit POS_ERR = 0, the DN LED lights up** • The POS_ACK status bit is set • The POS_ERR status bit is deleted • The POS_DONE status bit is deleted • The actual value is continuously updated • The POS LED lights up • The reversal of the direction of rotation you have parameterized and the wiring of the encoder and drive are correct **The status bit POS_ERR = 1, the UP LED lights up** Check the assigned parameter reversal of the direction of rotation and directional adjustment, and the wiring of the encoder and drive
Check the speed of the drive in the minus direction	
Control the speed using memory marker word 32 ("Variable > Modify >")	• If the drive moves at the correct speed, your wiring is correct

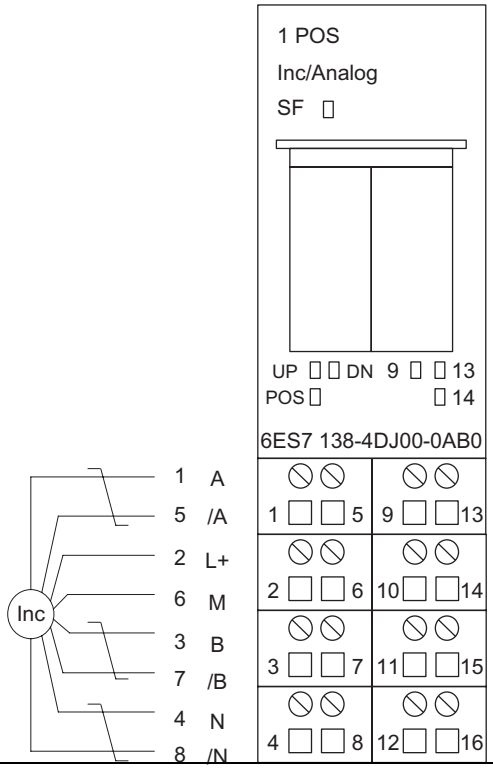
4.3 Terminal Assignment Diagram

Wiring rules

The wires to the incremental encoder (terminals 1 and 5, 3 and 7 and 4 and 8) have to be in twisted pairs and shielded. The shield must be supported at both ends. You use the shield contact element (Order Number: 6ES7 390-5AA00-0AA0) as a shield support.

Terminal assignment

Table 4-2 Terminal assignment of the 1PosInc/Analog

Terminal assignment	View	Remarks			
		Connection of the Incremental Encoder with 5 V Differential Signals: Terminals 1-8		**Connection of the Switches and the Drive: Terminals 9-16**	
		1: A	Track A	9: IN0	Minus limit switch
		5: /A		13: IN1	Plus limit switch
		3: B	Track B	14: IN2	Reducing cam; latch signal
		7: /B		10: 24 VDC	Encoder supply for the switches
		2: 24 VDC	Voltage supply for incremental encoder	12: QV+	Analog output ± 10 or 0 V to 10 V to connect the drive
		6: M		16: M_{ana}	
		4: N	Track N; optional zero mark	11: OUT	Digital output DO for direct control or as a directional signal for the drive
		8:/N		15: M	

Connection of Relays and Contactors to the Digital Output

Note

Direct connection of inductivities (such as relays and contactors) is possible without external circuiting.

If SIMATIC output circuits can be deactivated by additionally installed contacts (for example relay contacts), you have to provide additional overvoltage protection devices at inductivities (see the following example for overvoltage protection).

Overvoltage Protection Example

The following figure shows an output circuit that requires additional overvoltage protection devices. Direct-current coils are wired with diodes or Zener diodes.

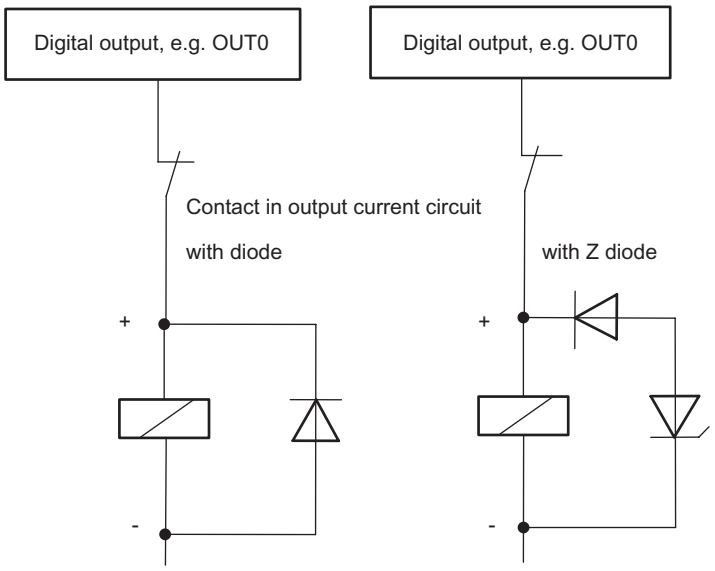


Figure 4-1 Relay contact in the output circuit

4.4 Safety concept

Principle

The following measures are vital to the safety of the system. Install them with particular care, and adapt them to meet the requirements of the system.

Check the measures are effective before the first run.

⚠ WARNING

To avoid injury and damage to property, make sure you adhere to the following:

- Install an emergency stop system in keeping with current technical standards (for example, EN 60204, EN 418, etc.).
- Make sure that no one has access to areas of the system with moving parts.
- Install, for example, safety limit switches for the end positions of the axes that switch off the power control system directly.
- Install devices and take steps to protect motors and power electronics.

Setting up a positioning control

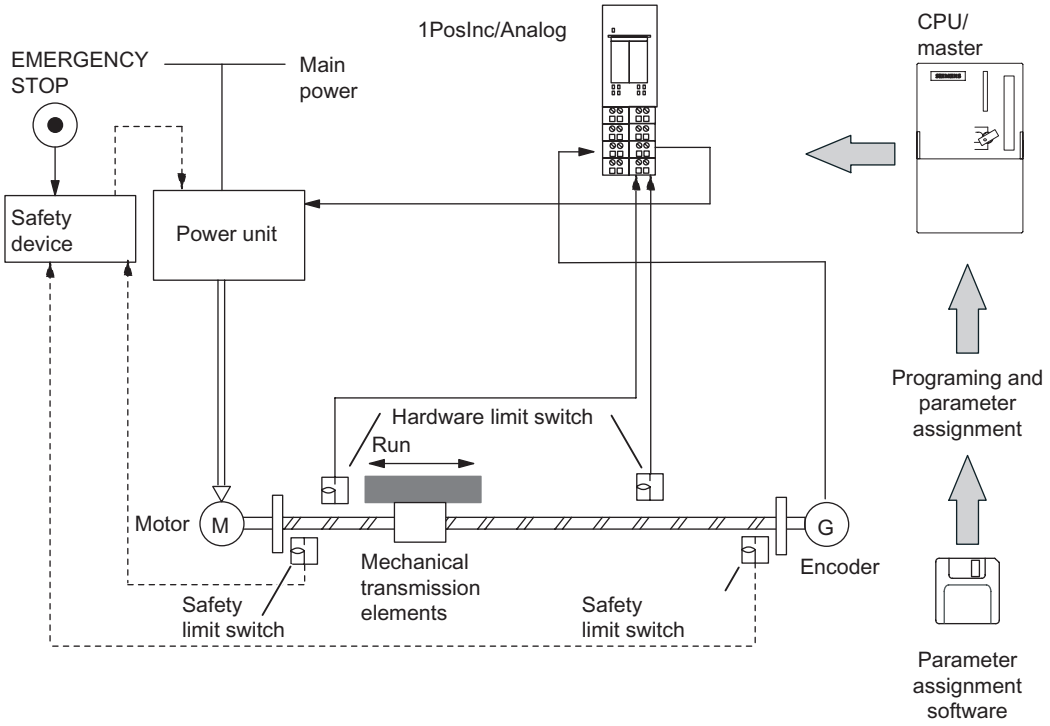


Figure 4-2 Design of a Positioning Control System (Example)

4.5 Fundamentals of Controlled Positioning Using the Analog Output

Positioning Operation

From the start position, the speed is increased (rapid feed) and the destination is approached at this speed. At a preset distance from the destination (switchover point), there is a change to a lower speed (creep feed).

Shortly before the axis reaches the destination and also at a preset distance to the destination, the drive can either be switched off (switch-off point) or be slowed down from creep feed to 0.

To facilitate understanding, the change in speed is illustrated over the path traversed.

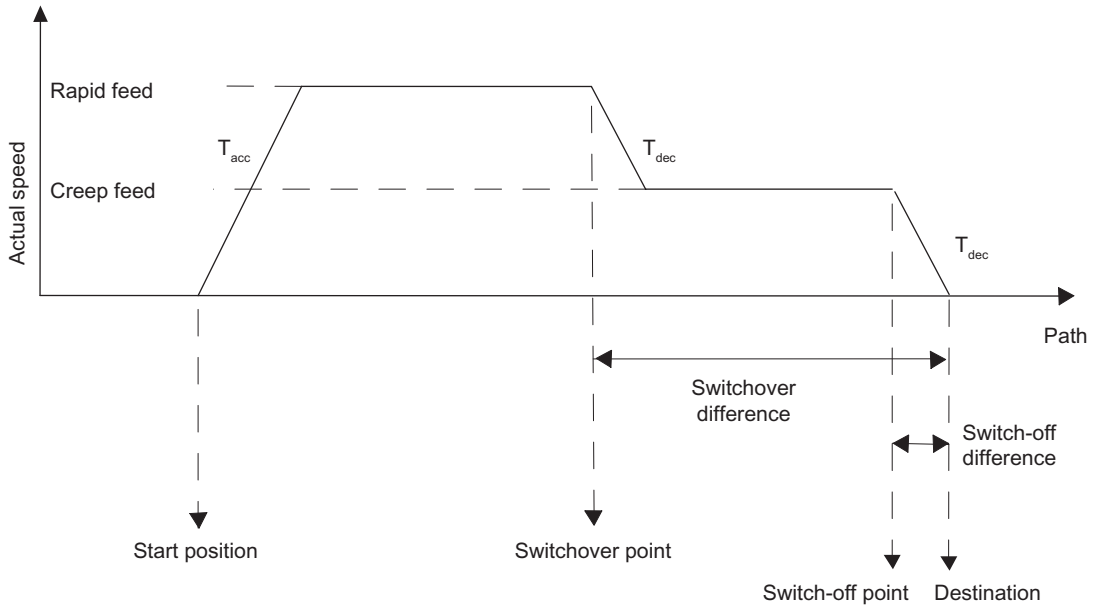


Figure 4-3 Switching points and switching differences

Definitions

Term	Explanation
Operating range	Defines the range, which you set for a particular task by means of the hardware limit switches. Maximum operating range: • Linear axis - max. 0 to 16,777,215 increments • Rotary axis - from 0 to the assigned parameter end of the rotary axis
Switchover difference	Defines the distance from the destination at which the drive is slowed down from rapid feed to creep feed.
Switchover point	Defines the position at which the drive is slowed down from rapid feed to creep feed.
Switch-off difference	Defines the distance from the destination at which the drive is slowed down from creep feed to 0. If the switch-off difference ≥ the switchover difference, there is no switchover point. There is no slowdown from rapid feed to creep feed.
Switch-off point	Defines the position at which the drive is switched off. The 1PosInc/Analog reports the end of the run at this point.
Start position	Defines the position of the drive within the operating range from which the run is started. If the start position is within the switch-off difference, the drive is not triggered. The 1PosInc/Analog reports the end of the run at this point. If the start position is within the switchover difference, the run is only executed in creep feed mode.
Target	Defines the absolute or relative position of the axis approached during positioning. The destination is the position to be reached on an axis during a run. In the case of an absolute run, you specify the destination directly by means of your control program. In the case of a relative run, the destination is calculated from the start position and the distance specified in the control program. If you want to find out how accurately you have reached the destination, you have to compare the actual value with the position specified.
Linear axis	Defines the axis type with a limited operating range. It is limited by the following: • The numeric range that can be represented (0 to 16 777 215 increments) • The hardware limit switch
Rotary axis	Defines the axis type with an infinite operating range. This includes resetting the axis position to 0 after one rotation (assigned parameter rotary axis end).
Minus direction	If the drive moves in the minus direction, the actual value displayed is decreased.
Plus direction	If the drive moves in the plus direction, the actual value displayed is increased.

4.6 Functions of the 1PosInc/Analog

4.6.1 Overview of the Functions

Overview

The 1PosInc/Analog offers you the following functions for moving your axis:

- Stop
- Search for Reference
- Inching
- Absolute Positioning
- Relative Positioning

In addition to the different types of motion, the 1PosInc/Analog also offers functions for:

- Setting of Actual Value
- Change Switch-Off Difference
- Change Switchover Difference
- Changing the Voltage for Rapid Feed
- Changing the Voltage for Creep Feed
- Changing the acceleration (T_{acc})
- Changing the deceleration (T_{dec})
- Reference Signal Evaluation
- Latch Function
- Setting the Monitoring of the Direction of Rotation
- Display Current Values
- Error Detection/Diagnostics
- Behavior at CPU-Master-STOP

Parameters: Define the variables that depend on the drive, axis, and encoder uniquely in the parameters.

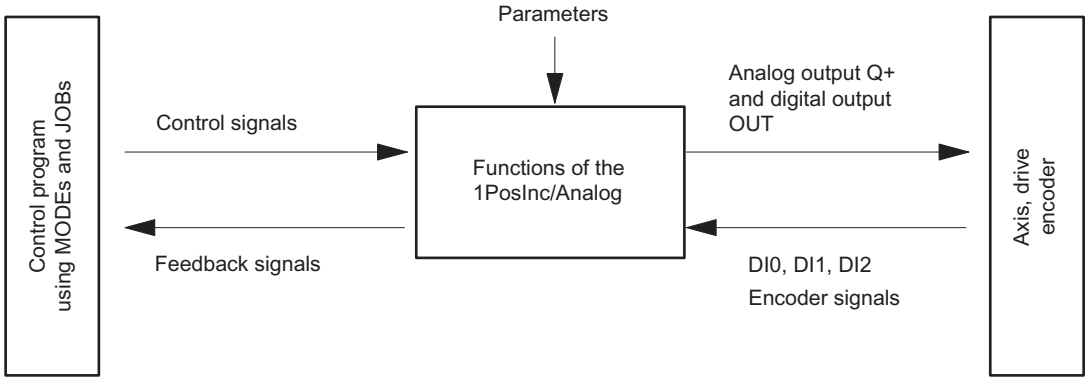


Figure 4-4 How the 1PosInc/Analog Works

Interfaces to the Control Program and the Axis

To execute the function, the 1PosInc/Analog has digital inputs as an interface to the axis, encoder signals for the connection of an incremental encoder, and an analog and a digital output to control the drive.

You can modify and monitor the types of motion (MODEs) and other functions (JOBs) with your control program using control signals and feedback signals.

See also

Parameter List (Page 178)

Principle

What You Do	Response of the 1PosInc/Analog
Provide the control interface with data depending on the MODE. Check the POS_ACK feedback bit is at 0	
Switch the START control bit from 0 to 1	The 1PosInc/Analog sets the feedback bit POS_ACK = 1 and POS_DONE = 0. You can tell by this that the start has been detected by 1PosInc/Analog and when POS_ERR = 0, the MODE is executed. The MODE is not executed when POS_ERR = 1.
Switch the START control bit from 1 to 0	The 1PosInc/Analog sets the feedback bit POS_ACK = 0
	In the case of a stop, the reference point run, and absolute and relative positioning, the 1PosInc/Analog sets the feedback bit POS_DONE = 1 when the MODE is completed without errors. When POS_ERR = 1 the MODE is terminated with an error.
Only when POS_ACK=0 can you start a new MODE. If you start when a MODE is running, the 1PosInc/Analog takes on the new motion and executes a change of direction, if necessary.	

Figure 4-5 Control and Feedback Signals with MODEs

Principle

What You Do	Response of the 1PosInc/Analog
Provide the control interface with data corresponding to the JOB. Check the JOB_ACK feedback bit is at 0	
Switch the JOB_REQ control bit from 1 to 0	The 1PosInc/Analog sets the feedback bit JOB_ACK = 1 You can tell by this that activation has been detected by 1PosInc/Analog and when JOB_ERR = 0, the JOB is executed. • When a reference signal is evaluated, the 1PosInc/Analog sets the SYNC = 0 feedback bit at the same time. • In the case of the latch function, the 1PosInc/Analog sets the feedback bit LATCH_DONE = 0 at the same time. • All the other JOBs are thus executed. The JOB is not executed when JOB_ERR = 1.
Switch the JOB_REQ control bit from 1 to 0	The 1PosInc/Analog sets the feedback bit JOB_ACK = 0
	When a reference signal is evaluated, the 1PosInc/Analog sets the feedback bit SYNC = 1 when the function has been executed. In the case of the latch function, the 1PosInc/Analog sets the feedback bit LATCH_DONE = 1 when the function has been executed.
Only when JOB_ACK=0 can you activate a new JOB again.	

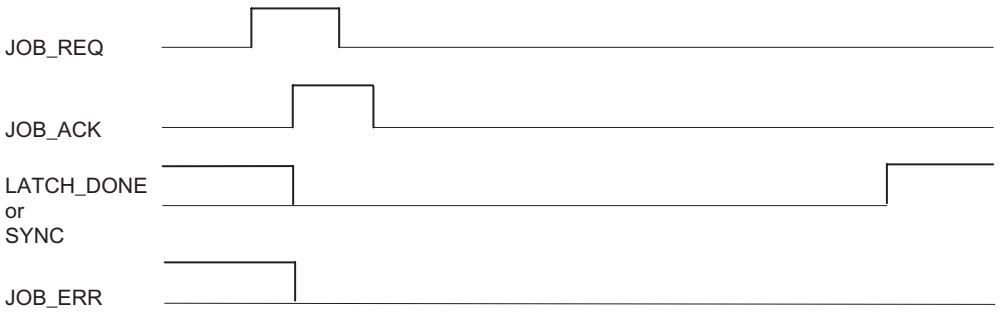


Figure 4-6 Control and Feedback Signals with JOBs

4.6.2 Axis, Drive and Encoder

Quadruple evaluation of the encoder signals

The 1PosInc/Analog evaluates the pulses supplied by the incremental encoder and adds them together to obtain the actual value. You must take the quadruple evaluation into account when you make settings for paths in the parameters and in the control and feedback interfaces:

1 pulse of the incremental encoder corresponds to 4 increments of the 1PosInc/Analog.

The current value is in the operating range 0 - 16 777 215 increments. The 1PosInc/Analog generates an overflow or underflow of the actual value in the operating range at the limits of the operating range.

Reversal of the Direction of Rotation of the Encoder Signals

You can use the parameter for the reversal of the direction of rotation to adapt the direction of rotation of the encoder to that of the drive and the axis.

Controlling the Drive

You assign parameters how the drive is to be controlled using the Function DO parameter.

If you select **Output**, the following applies: The control is **bipolar**. The drive is controlled using the analog output QV+/M_{ana} ±10 V to +10 V. You can use the digital output OUT as you wish. You can read the status of the OUT digital output from the feedback interface, with a delay that corresponds to the updating rate.

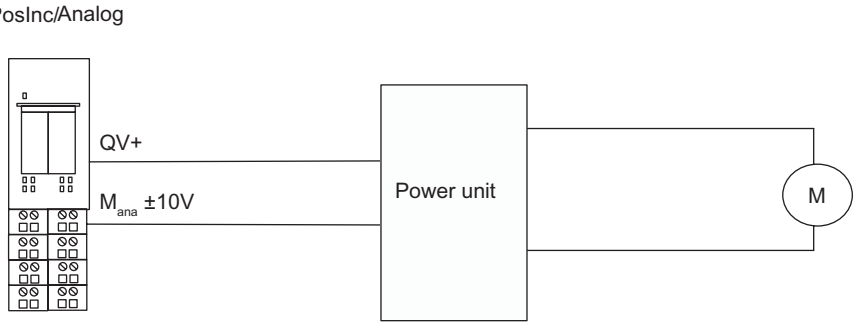


Figure 4-7 Schematic Diagram of the Bipolar Control of a Drive

If you select **Direction**, the following applies: The control is **unipolar**. The drive is controlled using the analog output QV+/M_{ana} with 0 V to +10 V.

The 1PosInc/Analog controls the direction using the OUT digital output.

You can read the status of the OUT digital output from the feedback interface, with a delay that corresponds to the updating rate.

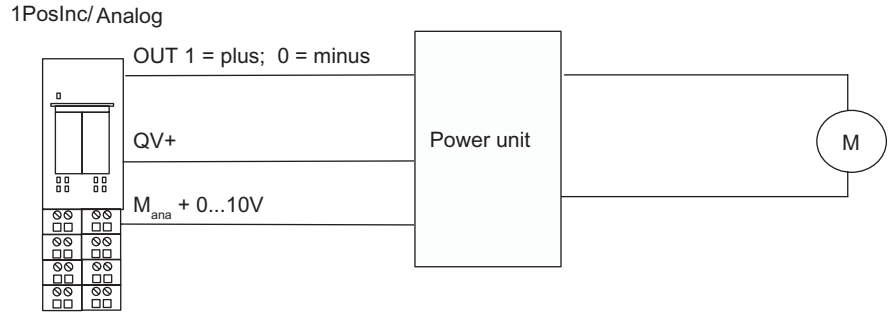


Figure 4-8 Schematic Diagram of the Unipolar Control of a Drive

Changing the Voltage for Rapid Feed and Creep Feed

The default setting for rapid feed is 10 V and the default setting for creep feed is 1 V. You can only change these settings using JOBs 5 and 6.

After the 1PosInc/Analog starts up or after parameter assignment with changed parameters, the values are accepted from the parameters.

You can set a voltage between 0 V and 11.7589 V (including overrange) in S7 analog value format (you will find a detailed explanation in the *Distributed I/O Device* manual).

If you have selected a greater voltage for creep feed than for rapid feed, there will be acceleration at the switchover point from rapid feed to creep feed.

Parameters	Meaning	Value range	Default setting
Drive			
Adapt direction	If you adjust the direction, this results in the polarity reversal of your drive	• Off • On	Off
Function DO	**Output:** Your drive is controlled by the analog output using ±10 V. You control the DO digital output using the CTRL_DO control bit. **Direction:** Your drive is controlled by the analog output using 0 V to 10 V. The direction for your drive is specified by the 1PosInc/Analog via the DO digital output. Plus direction: DO=1 Minus direction: DO=0	• Output • Direction	Output

Parameters	Meaning	Value range	Default setting
Switch-off	Use this parameter to determine the course of the voltage after the switch-off point. It is only effective in the relative and absolute positioning modes. Directly: The voltage is set directly to 0 V at switch-off point. Ramp: As of switch-off point, voltage is reduced to 0 V using the ramp.	• Directly • Ramp	Directly
Switch-off difference	Defines the distance from the destination at which the drive is slowed down from creep feed to 0. If the switch-off difference ≥ the switchover difference, there is no switchover point. There is no deceleration from rapid to creep feed, and instead the response is executed directly at the switch-off point. You can change the switch-off difference with JOB 3.	0 - 65 535	100
Switchover difference	Defines the distance from the destination at which the drive is slowed down from rapid feed to creep feed.	0 - 65 535	1000
Acceleration T_{acc} in ms	Time required for a change in voltage via a ramp from 0 V to10 V. At 0 ms acceleration is without a ramp.	0 - 65535	10000
Deceleration T_{dec} in ms	Time required for a change in voltage via a ramp from 10 V to 0 V. At 0 ms deceleration is without a ramp.	0 - 65535	10000

Displaying the Status of the Run

You can read the status of the run from the feedback interface from byte 0, bits 5 and 6. This status display is possible in the reference point run and absolute and relative positioning MODEs.

Table 4-3 Interpretation of Bits 5 and 6

Bit 5	Bit 6	Meaning	Corresponding Number in Figure
0	0	Quiet state or run completed	0
0	1	Acceleration to rapid feed or run with rapid feed	1
1	0	Deceleration to creep feed or run with creep feed	2
1	1	Deceleration to 0 V	3

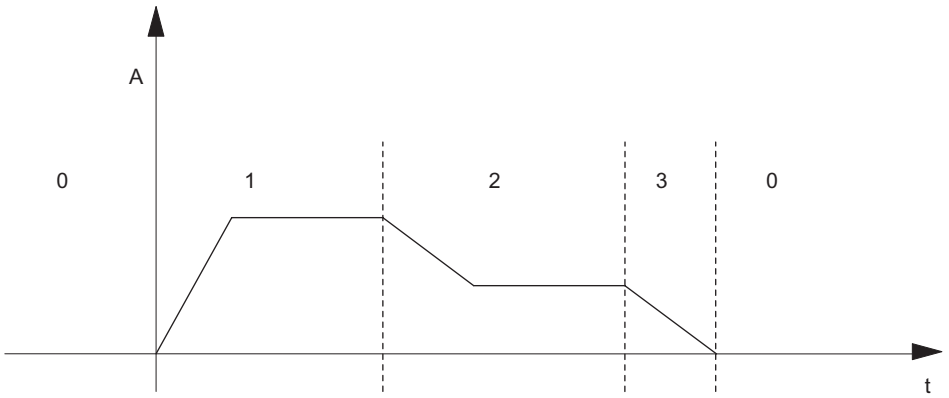


Figure 4-9 Schematic Diagram of the Status of the Run

Effect of the Hardware Limit Switches

The two digital inputs (DI0 and DI1) are evaluated by the 1PosInc/Analog as hardware limit switches:

- DI0 is the minus limit switch and limits the operating range in the minus direction.
- DI1 is the plus limit switch and limits the operating range in the plus direction.

You can assign parameters to the hardware limit switches separately as break contacts or make contacts.

The hardware limit switches are evaluated with linear axes and rotary axes.

This enables you to move away from a hardware limit switch without additional error acknowledgment by moving in the other direction if you reach or overrun a hardware limit switch.

Only the hardware limit switch that lies in the direction in which the drive is being moved is evaluated.

The current signal level of the digital inputs is displayed in the feedback interface, delayed by the update rate.

You can see from the following table what effect the hardware limit switches have in the individual MODEs:

MODE	Effect of the Hardware Limit Switches
Search for Reference	The 1PosInc/Analog automatically reverses the direction using deceleration and acceleration when a hardware limit switch is reached.
Inching	The motion of the axis is halted at the hardware limit switch with the output of 0 V on the analog output, and the feedback bit POS_ERR is reported.
Absolute Positioning	
Relative Positioning	

Starting on the hardware limit switch

Direction	Response of the 1PosInc/Analog
Starting into the operating range	The 1PosInc/Analog starts the specified MODE.
Starting away from the operating range	The POS_ERR=1 feedback bit is set.

4.6.3 Effect of the Directional Enables

Definition

Using control bits DIR_M and DIR_P, you can enable control of the drive in the corresponding direction:

- With DIR_M = 1 you can move in the minus direction.
- With DIR_P = 1 you can move in the plus direction.

Interrupting and Continuing the Run

If you reset the relevant directional enable during a run, the motion of the axis is halted by deceleration to 0 V at the analog output, and the run is interrupted.

If you set the relevant directional enable again, the run is continued.

4.6.4 Stop (MODE 0)

Definition

If you start MODE 0, the 1PosInc/Analog stops the current run by deceleration to 0 V at the analog output and the run is completed (POS_ERR = 0, POS_DONE = 1).

A run terminated with MODE 0 cannot be continued. To put the axis into motion again, you start a new MODE.

Control Signals: Stop

Address	Assignment					
Byte 0	Bits 0.7 to 0.4:					
	Bit	7	6	5	4	
		0	0	0	0	MODE 0 = Stop
	Bit 0: START					

Feedback Signals: Stop

Address	Assignment
Byte 0	Bit 2: POS_ DONE Bit 1: POS_ERR Bit 0: POS_ACK

Completing/Interrupting a Run

If you parameterized directly at switch-off and activate MODE 0

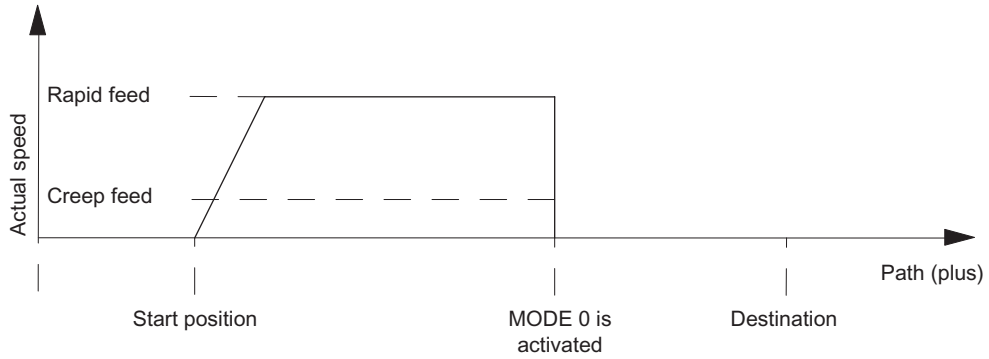


Figure 4-10 Interrupting the Run by Switching Off: Directly

If you parameterized ramp at switch-off and activate MODE 0

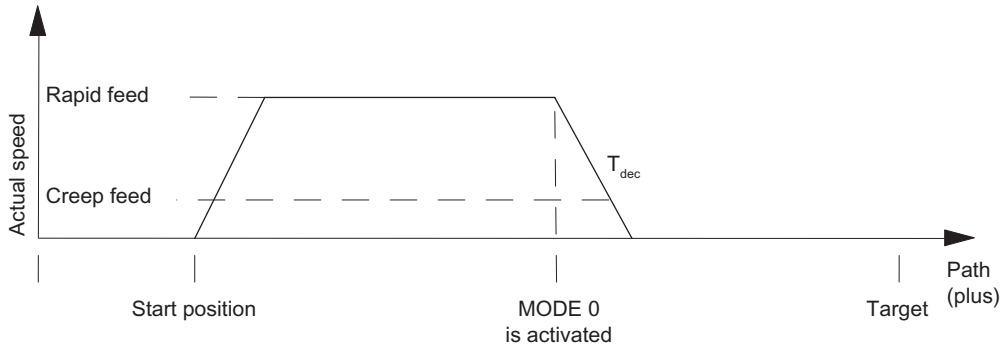


Figure 4-11 Interrupting the Run by Switching Off: Ramp

4.6.5 Reference Point Run (MODE 3)

Definition

You can use the reference point run to synchronize the axis on the basis of an external reference signal. You can use either the 3 digital inputs or the zero mark as a reference signal.

You can assign parameters to the digital inputs DI0 (minus limit switch) and DI1 (plus limit switch) and DI2 (reducing cam) as break or make contacts.

Provide the control interface with the reference point coordinates, and start MODE 3. The 1PosInc/Analog sets the feedback signal SYNC = 0 and moves the drive with the voltage set for rapid feed in the assigned parameter start direction and searches for the reference signal. To do this, the 1PosInc/Analog automatically makes the necessary change in direction at the limit switches and the reducing cam using deceleration and acceleration.

Set the necessary directional enables (DIR_M, DIR_P) to ensure that the drive is controlled.

If the 1PosInc/Analog detects the parameterized reference signal, it controls the drive at the set voltage for creep feed mode in the assigned parameter referencing direction. This is controlled by the reference signal and reference switch parameters.

	Reference switch: Reduction cam towards minus	**Reference switch: Reduction cam towards plus**	**Reference switch: Minus limit switch**	**Reference switch: Plus limit switch**
Reference signal: Reference switch and zero mark	Minus referencing direction	Plus referencing direction	Plus referencing direction	Minus referencing direction
Reference signal: Reference switch				
Reference signal: Zero mark	The referencing direction is not defined. The axis is synchronized at the next zero mark.			

When the assigned parameter conditions are met, the axis is synchronized. The 1PosInc/Analog sets the feedback signal SYNC = 1, assigns the reference point coordinates to the actual value, and decelerates to 0 V.

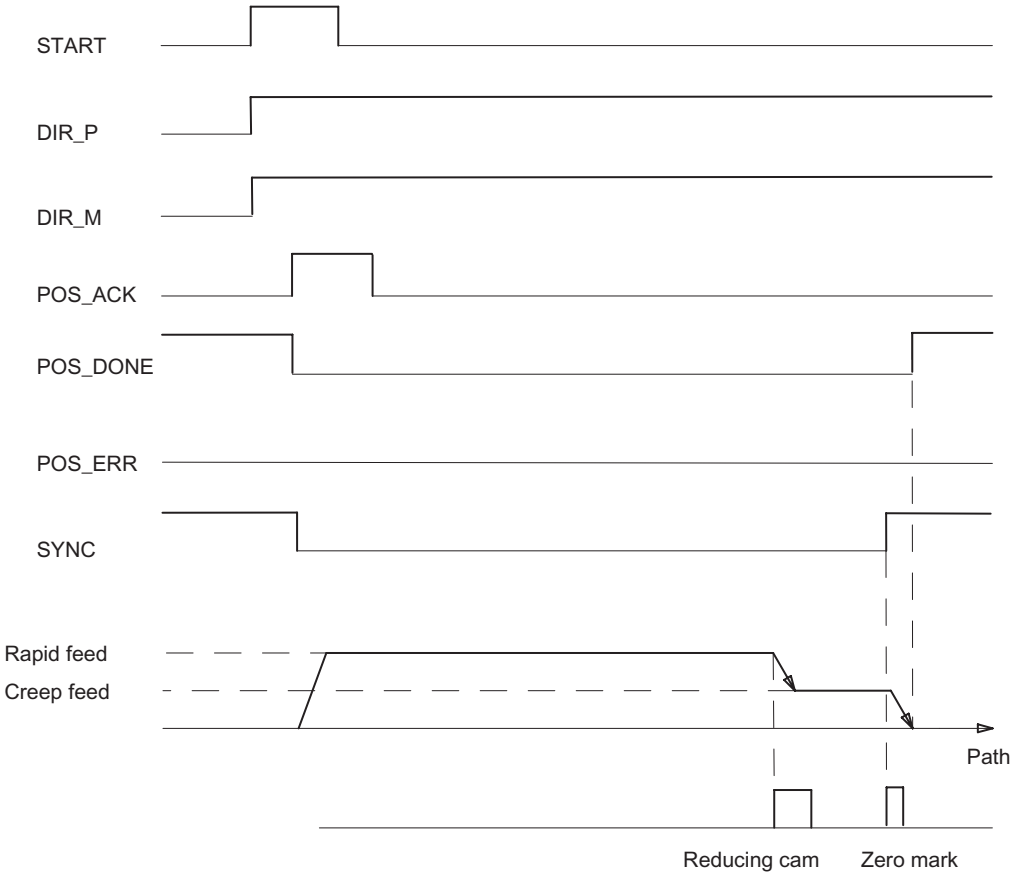


Figure 4-12 Sequence of Execution of the Search for Reference

Control Signals: Search for Reference

Address	Assignment					
Byte 0	Bits 0.7 to 0.4:					
	Bit	7	6	5	4	
		0	0	1	1	MODE 3 = Reference Point Run
	Bit 2: DIR_M Bit 1: DIR_P Bit 0: START					
Bytes 1 to 3	Reference point coordinates (linear axis: 0 to 16 777 215; rotary axis: 0 to end of rotary axis - 1)					

Feedback Signals: Search for Reference

Address	Assignment
Byte 0	Bit 3: SYNC Bit 2: POS_ DONE Bit 1: POS_ERR Bit 0: POS_ACK
Bytes 1 to 3	Actual value (linear axis: 0 to 16 777 215; rotary axis: 0 to end of rotary axis - 1)

Parameters: Search for Reference

Parameters	Meaning	Value range	Default setting
Reference point run and evaluation of the reference signal			
Reference signal	This parameter defines the relevant switch or the combination of switch and zero mark.	• Reference switch and zero mark • Reference switch • Zero mark	Reference switch and zero mark
Reference switch	Relevant in the case of reference signal: • Reference switch and zero mark • Reference switch This parameter defines the referencing direction in which the relevant switch must be traversed.	• Reduction cam towards minus • Reduction cam towards plus • Minus limit switch • Plus limit switch	Reduction cam towards minus
Start direction of the reference point run		• Plus • Minus	Plus
Acceleration T_{acc} in ms	Time required for a change in voltage via a ramp from 0 V to10 V. At 0 ms acceleration is without a ramp. You can change the acceleration using Job 7.	0 - 65535	10000
Deceleration T_{dec} in ms	Time required for a change in voltage via a ramp from 10 V to 0 V. At 0 ms deceleration is without a ramp. You can change the deceleration using Job 8.	0 - 65535	10000

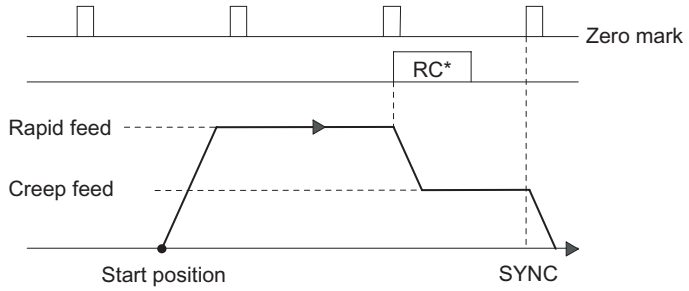
Execution of a Reference Point Run Depending on Parameterization and Start Position

In a reference point run, you have to distinguish between different cases that depend on the following:

- The start position of the drive at the start of the reference point run
- The assigned parameter start direction
- The assigned parameter reference signal
- The assigned parameter reference switch.

Example 1: Search for Reference Point Run with Reducing Cam and Zero Mark

- Start position: between the minus limit switch and the reducing cam
- Start direction: Plus
- Reference signal: Reference switch and zero mark
- Reference switch: Reduction cam towards plus



*RC = reducing cam

Figure 4-13 Search for Reference Point Run with Reducing Cam and Zero Mark

You can also carry out synchronization using the reducing cam without a zero mark.

If the start position is on the reducing cam, the 1PosInc/Analog controls the drive directly in creep feed mode in the referencing direction.

Example 2: Reference Point Run with Minus Limit Switch

- Start position: between the minus limit switch and the plus limit switch
- Start direction: Minus
- Reference signal: Reference switch
- Reference switch: Minus limit switch

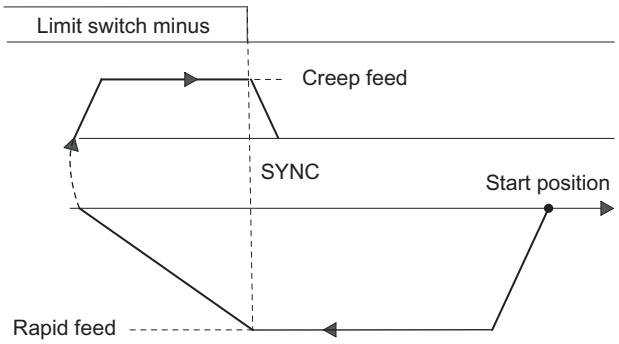


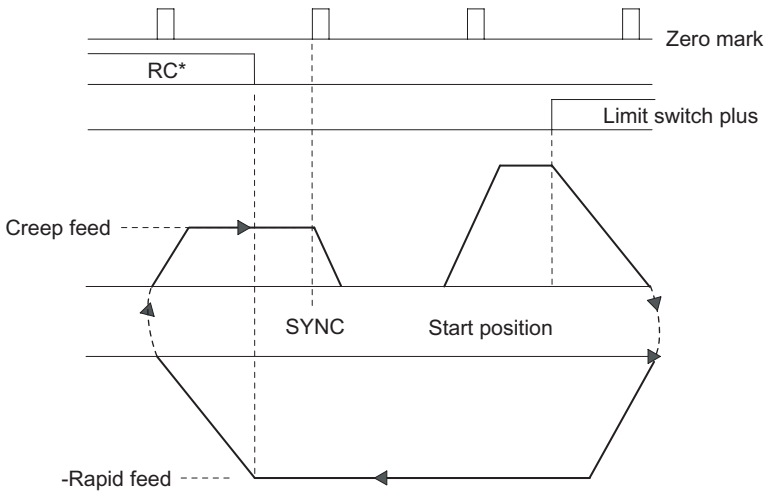
Figure 4-14 Reference Point Run with Minus Limit Switch

You can also carry out synchronization at the limit switch with the following zero mark.

If the start position is at the limit switch, the 1PosInc/Analog controls the drive directly with creep feed in the referencing direction.

Example 3: Reference Point Run with Reversal of Direction at the Plus Limit Switch

- Start position: between the minus limit switch and the reducing cam
- Start direction: Plus
- Reference signal: Reference switch and zero mark
- Reference switch: Reduction cam towards plus



*RC = Reducing cam

Figure 4-15 Reference Point Run with Reversal of Direction at the Plus Limit Switch

If the start position is at the plus limit switch, the 1PosInc/Analog moves the drive with rapid feed directly in the opposite direction to the assigned parameter start direction.

Example 4: Reference Point Run Only with Zero Mark

- Start position: between the minus limit switch and the plus limit switch
- Start direction: Minus
- Reference signal: Zero mark
- Reference switch: irrelevant

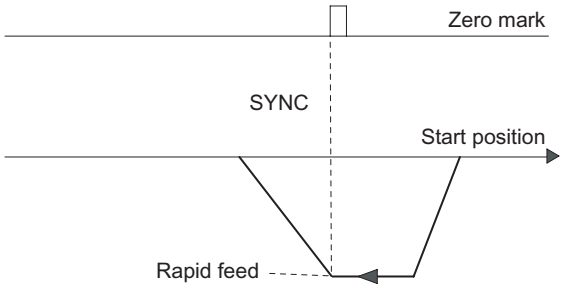


Figure 4-16 Reference Point Run Only with Zero Mark

Search for reference: Causes of Errors for POS_ERR

You must find out the causes of errors with JOB 15 (displays current values).

Error Number	Cause	What to Do
3	ERR_ENCODER is displayed	Check the encoder wiring
10	Search for reference: Reference point coordinates ≥ end of rotary axis	
11	Search for reference: No reference signal found up to the limit switch or between the limit switches	Check your switches, the encoder and the wiring
13	Direction of rotation of the drive and the encoder varies	Check the wiring of the drive and the encoder as well as the parameters for the reversal of the direction of rotation and adapting the direction of the drive.

4.6.6 Inching (MODE 1)

Definition

You use inching mode to control the drive directly in a particular direction using the DIR_M or DIR_P control bits.

You can set a voltage between 0 V and 11.7589 V (including overrange) in S7 analog value format (you will find a detailed explanation in the *Distributed I/O Device* manual).

When you start MODE 1, the 1PosInc/Analog moves the drive with the set voltage for inching mode (from the control interface) in the specified direction (control bits DIR_M or DIR_P).

You stop the drive by decelerating to 0 V by setting the control bits DIR_P = 0 and DIR_M = 0.

You can change direction using deceleration or acceleration.

You can also activate inching on an unsynchronized axis (feedback bit SYNC = 0) or when there is a pending encoder error (feedback bit ERR_ENCODER = 1) or without an encoder connected.

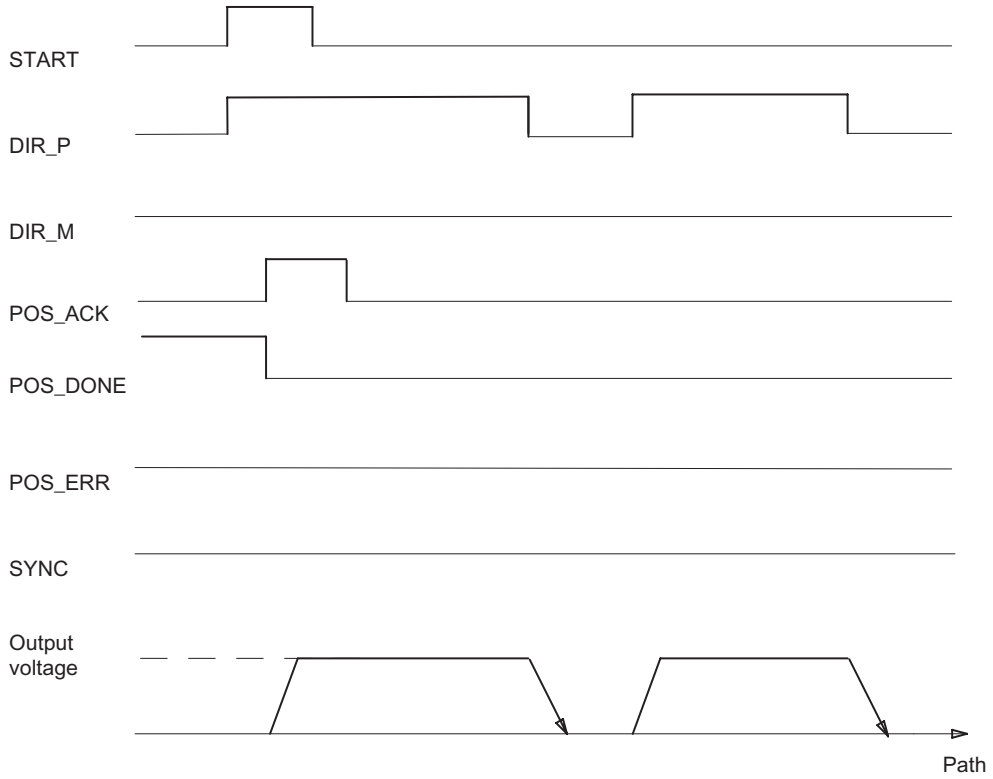


Figure 4-17 Execution of Inching

Control Signals: Inching

Address	Assignment					
Byte 0	Bits 0.7 to 0.4:					
	Bit	7	6	5	4	
		0	0	0	1	MODE 1 = Inching
	Bit 2: DIR_M Bit 1: DIR_P Bit 0: START					
Bytes 1 to 3	Voltage for inching (0 to 32 511)					

Feedback Signals: Inching

Address	Assignment
Byte 0	Bit 2: POS_ DONE Bit 1: POS_ERR Bit 0: POS_ACK
Bytes 1 to 3	Actual value (linear axis: 0 to 16 777 215; rotary axis: 0 to end of rotary axis - 1)

Inching: Causes of Errors for POS_ERR

You must find out the causes of errors with JOB 15 (displays current values).

Error Number	Cause	What to Do
5	The limit switch that lies in the direction in which the drive is moved is active	Check your switches and the wiring as well as the DI0 limit switch minus and DI1 limit switch plus parameters
7	Inching: DIR_P and DIR_M = 1	
13	Direction of rotation of the drive and the encoder varies	Check the wiring of the drive and the encoder as well as the parameter for the reversal of the direction of rotation and adapting the direction of the drive.
	Voltage for inching >32 511 or < 0	

4.6.7 Absolute Positioning (MODE 5)

Definition

Using absolute positioning, the 1PosInc/Analog moves the drive towards absolute destinations. To do this, the axis must be synchronized.

Supply the control interface with the destination, and start MODE 5 with the necessary directional enable (DIR_M, DIR_P). The 1PosInc/Analog moves the drive towards the destination with the set voltage for rapid feed. At the switchover point, the 1PosInc/Analog decelerates from rapid to creep feed. At the switch-off point, the 1PosInc/Analog completes the run either directly or via the ramp depending on the parameter assignment.

If you start during a current run, the 1PosInc/Analog executes any required change in direction using deceleration or acceleration.

Linear axis

The 1PosInc/Analog determines the direction the destination is to be approached from. You must set the necessary directional enable (DIR_M, DIR_P) to start. You can also set both enables.

Rotary axis

You determine the direction in which the destination is approached by selecting the directional enable (DIR_M, DIR_P):

Control bits DIR_P and DIR_M	Direction
DIR_P = 1 DIR_M = 0	The destination is approached in the plus direction.
DIR_P = 0 DIR_M = 1	The destination is approached in the minus direction.
DIR_P = 1 DIR_M = 1	The destination is approached by the shortest route. The 1PosInc/Analog determines the direction the destination is to be approached from.

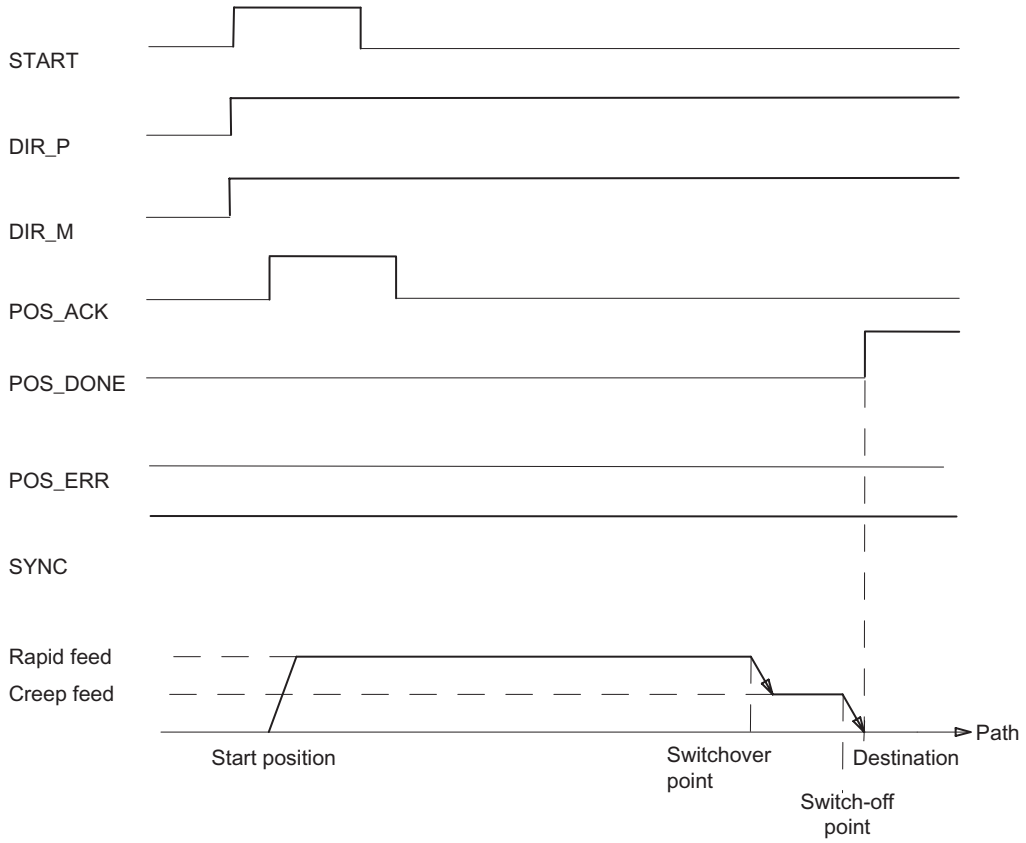


Figure 4-18 Execution of Absolute Positioning (Switch-Off Parameter: Ramp)

Control Signals: Absolute Positioning

Address	Assignment					
Byte 0	Bits 0.7 to 0.4:					
	Bit	7	6	5	4	
		0	1	0	1	MODE 5 = Absolute Positioning
	Bit 2: DIR_M Bit 1: DIR_P Bit 0: START					
Bytes 1 to 3	Destination (linear axis: 0 to 16 777 215; rotary axis: 0 to end of rotary axis - 1)					

Feedback Signals: Absolute Positioning

Address	Assignment
Byte 0	Bit 3: SYNC Bit 2: POS_ DONE Bit 1: POS_ERR Bit 0: POS_ACK
Bytes 1 to 3	Actual value (linear axis: 0 to 16 777 215; rotary axis: 0 to end of rotary axis - 1)

Parameters: Absolute Positioning

Parameters	Meaning	Value range	Default setting
Drive			
Switch-off difference	Defines the distance from the destination at which the drive is slowed down from creep feed to 0. If the switch-off difference ≥ the switchover difference, there is no switchover point. There is no slowdown from rapid feed to creep feed.	0 - 65 535	100
Switchover difference	Defines the distance from the destination at which the drive is slowed down from rapid feed to creep feed.	0 - 65 535	1000

Absolute positioning: Causes of Errors for POS_ERR

You must find out the causes of errors with JOB 15 (displays current values).

Error Number	Cause	What to Do
3	ERR_ENCODER is displayed	Check the encoder wiring
4	The axis is not synchronized (SYNC=0)	You can synchronize the axis with: • Reference point run • Reference Signal Evaluation • Setting of Actual Value
5	The limit switch that lies in the direction in which the drive is moved is active	Check your switches and the wiring as well as the DI0 limit switch minus and DI1 limit switch plus parameters
7	Absolute positioning: Start with DIR_P and DIR_M = 0 or relevant control bit DIR_P or DIR_M = 0	
8	Absolute positioning: destination ≥ end of rotary axis	
9	Absolute positioning was terminated because JOB 9 (evaluate referencing signal) was initiated	
13	Direction of rotation of the drive and the encoder varies	Check the wiring of the drive and the encoder as well as the reversal of the direction of rotation parameter

4.6.8 Relative Positioning (MODE 4)

Definition

With relative positioning, the 1PosInc/Analog moves the drive from the start position for a set distance in the specified direction.

Supply the control interface with the distance to be traveled, and start MODE 4, specifying the direction (DIR_M or DIR_P). The 1PosInc/Analog moves the drive towards the destination for a certain distance with the set voltage for rapid feed. At the switchover point, the 1PosInc/Analog switches from rapid to creep feed. At the switch-off point, the 1PosInc/Analog completes the run either directly or via the ramp depending on the parameter assignment.

If you start during a current run, the 1PosInc/Analog executes any required change in direction using deceleration or acceleration.

The set distance is not checked by the 1PosInc/Analog. This means that more than one revolution may be involved with rotary axes.

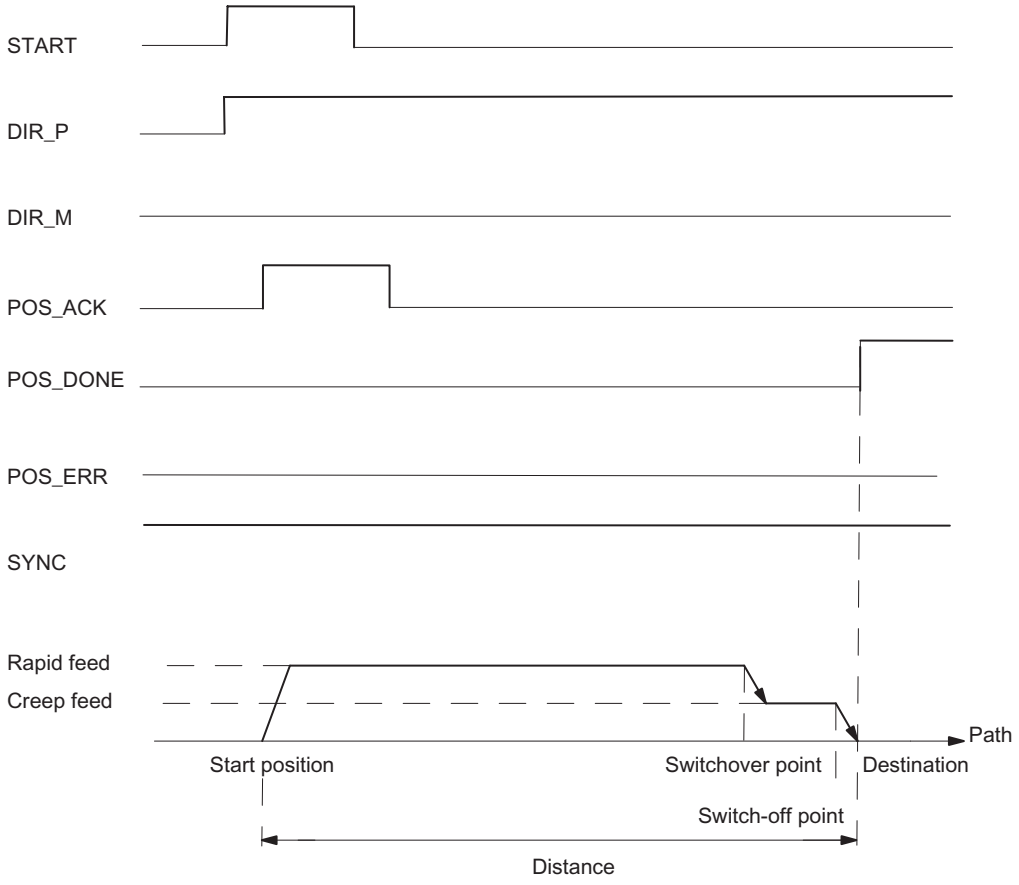


Figure 4-19 Execution of Relative Positioning

Control Signals: Relative Positioning

Address	Assignment					
Byte 0	Bits 0.7 to 0.4:					
	Bit	7	6	5	4	
		0	1	0	0	MODE 4 = Relative Positioning
	Bit 2: DIR_M Bit 1: DIR_P Bit 0: START					
Bytes 1 to 3	Distance (linear axis: 0 to 16 777 215; rotary axis: 0...16 777 215)					

Feedback Signals: Relative Positioning

Address	Assignment
Byte 0	Bit 3: SYNC Bit 2: POS_ DONE Bit 1: POS_ERR Bit 0: POS_ACK
Bytes 1 to 3	Actual value (linear axis: 0 to 16 777 215; rotary axis: 0 to end of rotary axis - 1)

Parameters: Relative Positioning

Parameters	Meaning	Value range	Default setting
Drive			
Switch-off difference	Defines the distance from the destination at which the drive is slowed down from creep feed to 0. If the switch-off difference ≥ the switchover difference, there is no switchover point. There is no slowdown from rapid feed to creep feed.	0 - 65 535	100
Switchover difference	Defines the distance from the destination at which the drive is slowed down from rapid feed to creep feed.	0 - 65 535	1000

Relative Positioning: Causes of Errors for POS_ERR

You must find out the causes of errors with JOB 15 (displays current values).

Error Number	Cause	What to Do
3	ERR_ENCODER is displayed	Check the encoder wiring
5	The limit switch that lies in the direction in which the drive is moved is active	Check your switches and the wiring as well as the DI0 limit switch minus and DI1 limit switch plus parameters
7	Relative positioning: Start with DIR_P and DIR_M = 0 or DIR_P and DIR_M = 1	
13	Direction of rotation of the drive and the encoder varies	Check the wiring of the drive and the encoder as well as the reversal of the direction of rotation parameter

4.6.9 Canceling JOB Processing (JOB 0)

Definition

If you activate JOB 0, the 1PosInc/Analog responds as follows:

- It cancels the current JOB 9 (reference signal evaluation)
- It cancels the current JOB 10 (latch function)
- It sets a pending JOB_ERR = 0.

You can activate JOB 0 whatever the state of the axis.

Effect on the MODEs

MODEs are not affected by JOB 0.

Control Signals: Canceling JOB processing

Address	Assignment					
Byte 4	Bits 4.7 to 4.4 :					
	Bit	7	6	5	4	
		0	0	0	0	JOB 0 = Cancel JOB processing
	Bit 0: JOB_REQ					

Feedback Signals: Canceling JOB processing

Address	Assignment
Byte 4	Bit 1: JOB_ERR Bit 0: JOB_ACK

4.6.10 Setting the Actual Value (JOB 1)

Definition

Setting an actual value assigns new coordinates to the actual value displayed. This moves the operating range to a different range on the axis and synchronizes the axis.

At the switchover point the 1PosInc/Digital switches from rapid feed to creep feed, and at the switch-off it terminates the run.

The 1PosInc/Analog sets the preset actual value coordinates to the actual value displayed in the feedback interface and sets the feedback bit SYNC = 1.

Effect on the MODEs

MODE	What Happens
Search for Reference	Make sure when the reference point run is evaluated that the feedback bit SYNC = 1 is set immediately. The reference point run still continues to run.
Inching	-
Absolute Positioning	The following responses are possible: • Distance to the destination ≤ switch-off difference The switch-off point is reached or overshot; positioning is switched off immediately, and the run is terminated with POS_DONE = 1. In this case, the destination is sometimes overshot. • Distance to the destination ≤ the switchover difference The switchover point is reached or overshot; there is an immediate deceleration from rapid feed to creep feed. In this case the distance covered in creep feed is less than (switchover difference - switch-off difference). • Distance to the destination > switchover difference The drive is accelerated again up to the voltage for rapid feed.
Relative Positioning	The preset distance continues to be traversed.

Control Signals: Setting of Actual Value

Address	Assignment					
Byte 4	Bits 4.7 to 4.4 :					
	Bit	7	6	5	4	
		0	0	0	1	JOB 1 = Set the actual value
	Bit 0: JOB_REQ					
Bytes 5 to 7	Actual value coordinates (linear axis: 0 to 16 777 215; rotary axis: 0 to end of rotary axis - 1)					

Feedback Signals: Setting of Actual Value

Address	Assignment
Byte 0	Bit 3: SYNC
Bytes 1 to 3	Actual value (linear axis: 0 to 16 777 215; rotary axis: 0 to end of rotary axis - 1)
Byte 4	Bit 1: JOB_ERR Bit 0: JOB_ACK

Setting an Actual Value: Causes of Errors for JOB_ERR

Error Number	Meaning	What to Do
23	ERR_ENCODER is displayed	Check the encoder wiring
34	Setting an Actual Value: actual value coordinates ≥ end of rotary axis	

4.6.11 Changing the Switch-Off Difference (JOB 3)

Definition

Changing the switch-off difference allows you to adjust the drive control to adapt to any changes in the load and mechanical conditions.

Supply the control interface with the new switch-off difference, and activate JOB 3.

The 1PosInc/Analog accepts the preset switch-off difference.

The switch-off difference remains valid until the parameter assignment of the 1PosInc/Analog is changed.

Effect on the MODEs

MODE	What Happens
Search for Reference	-
Inching	
Absolute Positioning	Distance to the destination ≤ switch-off difference The switch-off point is reached or overshot; positioning is switched off immediately, and the run is terminated with POS_DONE = 1. In this case, the destination is sometimes overshot.
Relative Positioning	

Control Signals: Change Switch-Off Difference

Address	Assignment					
Byte 4	Bits 4.7 to 4.4 :					
	Bit	7	6	5	4	JOB 3 = Change the switch-off difference
		0	0	1	1	
	Bit 0: JOB_REQ					
Bytes 5 to 7	Switch-off difference 0 to 16 777 215					

Feedback Signals: Change Switch-Off Difference

Address	Assignment
Byte 4	Bit 0: JOB_ACK

See also

CPU/Master Stop and RESET State (Page 176)

4.6.12 Changing the Switchover Difference (JOB 4)

Definition

Changing the switchover difference allows you to adjust the drive control to adapt to any changes in the load and mechanical conditions.

Supply the control interface with the new switchover difference, and activate JOB 4.

The 1PosInc/Analog accepts the preset switchover difference. The switchover difference remains valid until the parameter assignment of the 1PosInc/Analog is changed.

Effect on the MODEs

MODE	What Happens
Search for Reference	-
Inching	
Absolute Positioning	The following responses are possible: • Distance to the destination ≤ the switchover difference Switchover difference is reached or overshot; there is an immediate reduction from rapid feed to creep feed. In this case the distance covered in creep feed is less than (switchover difference - switch-off difference). • Distance to the destination > the switchover difference The drive is moved using rapid feed, even if it was switched over to creep feed beforehand.
Relative Positioning	

Control Signals: Change Switchover Difference

Address	Assignment					
Byte 4	Bits 4.7 to 4.4 :					
	Bit	7	6	5	4	JOB 4 = Change the switchover difference
		0	1	0	0	
	Bit 0: JOB_REQ					
Bytes 5 to 7	Switchover difference 0 to 16 777 215					

Feedback Signals: Change Switchover Difference

Address	Assignment
Byte 4	Bit 0: JOB_ACK

See also

CPU/Master Stop and RESET State (Page 176)

4.6.13 Changing the Voltage for Rapid Feed (JOB 5)

Definition

By changing the voltage for rapid feed (JOB 5) you can adjust the speed for rapid feed.

Supply the control interface with the new rapid feed voltage and activate JOB 5.

You can set a voltage between 0 V and 11.7589 V (including overrange) in S7 analog value format (you will find a detailed explanation in the *Distributed I/O Device* manual).

The 1PosInc/Analog accepts the preset voltage. When the drive runs in rapid feed, it accelerates/decelerates at the set acceleration/deceleration rate to the new rapid feed voltage. The voltage remains valid until the parameter assignment of the 1PosInc/Analog is changed.

Effect on the MODEs

MODE	What Happens
Search for Reference	When the drive runs in rapid feed, it accelerates/decelerates at the set acceleration/deceleration rate to the new rapid feed voltage.
Inching	-
Absolute Positioning	When the drive runs in rapid feed, it accelerates/decelerates at the set acceleration/deceleration rate to the new rapid feed voltage.
Relative Positioning	

Control Signals: Changing the Voltage for Rapid Feed

Address	Assignment					
Byte 4	Bits 4.7 to 4.4 :					
	Bit	7	6	5	4	JOB 5 = Change the voltage for rapid feed
		0	1	0	1	
	Bit 0: JOB_REQ					
Bytes 5 to 7	Voltage for rapid feed 0 to 32 511 in S7 analog value format					

Feedback Signals: Voltage for rapid feed

Address	Assignment
Byte 4	Bit 1: JOB_ERR Bit 0: JOB_ACK

Voltage for Rapid Feed: Causes of Errors for JOB_ERR

Error Number	Meaning	What to Do
40	Voltage setting Rapid feed speed > 32 511	

See also

CPU/Master Stop and RESET State (Page 176)

4.6.14 Changing the Voltage for Creep Feed (JOB 6)

Definition

By changing the voltage for creep feed (JOB 6) you can adjust the speed for creep feed.

Supply the control interface with the new creep feed voltage and activate JOB 6.

You can set a voltage between 0 V and 11.7589 V (including overrange) in S7 analog value format (you will find a detailed explanation in the *Distributed I/O Device* manual).

The 1PosInc/Analog accepts the preset voltage. The voltage remains valid until the parameter assignment of the 1PosInc/Analog is changed.

Effect on the MODEs

MODE	What Happens
Search for Reference	When the drive runs in creep feed, it accelerates/decelerates at the set acceleration/deceleration rate to the new creep feed voltage.
Inching	-
Absolute Positioning	When the drive runs in creep feed, it accelerates/decelerates at the set acceleration/deceleration rate to the new creep feed voltage.
Relative Positioning	

Control Signals: Changing the Voltage for Creep Feed

Address	Assignment					
Byte 4	Bits 4.7 to 4.4 :					
	Bit	7	6	5	4	
		0	1	1	0	JOB 6 = Change the voltage for creep feed
	Bit 0: JOB_REQ					
Bytes 5 to 7	Voltage for creep feed 0 to 32 511 in S7 analog value format					

Feedback Signals: Voltage for creep feed

Address	Assignment
Byte 4	Bit 1: JOB_ERR Bit 0: JOB_ACK

Voltage for Creep Feed: Causes of Errors for JOB_ERR

Error Number	Meaning	What to Do
41	Voltage setting creep feed speed > 32 511	

See also

CPU/Master Stop and RESET State (Page 176)

4.6.15 Changing the Acceleration Tacc (JOB 7)

Definition

By changing T_{acc} (JOB 7) you can adjust the acceleration.

Supply the control interface with the new acceleration value and activate JOB 7.

The 1PosInc/Analog accepts the new acceleration value. The acceleration remains valid until the parameter assignment of the 1PosInc/Analog is changed.

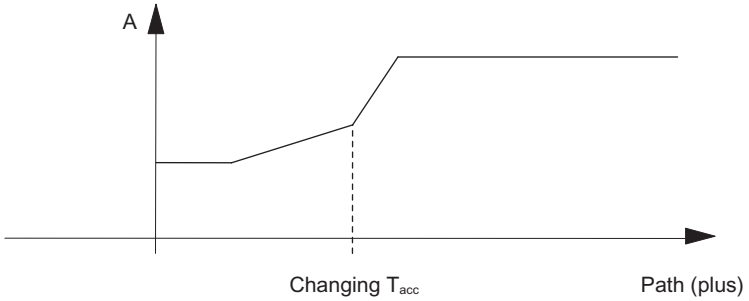


Figure 4-20 Changing the Acceleration T_{acc} During Acceleration

Effect on the MODEs

MODE	What Happens
Search for Reference	The currently valid acceleration is replaced by the new value. The new acceleration is immediately effective.
Inching	
Absolute Positioning	
Relative Positioning	

Control Signals: Changing the acceleration (T_{acc})

Address	Assignment					
Byte 4	Bits 4.7 to 4.4 :					
	Bit	7	6	5	4	JOB 7 = Changing the acceleration T_{acc}
		0	1	1	1	
	Bit 0: JOB_REQ					
Bytes 5 to 7	Acceleration T_{acc} in ms (0 to 65 535)					

Feedback Signals: Changing the acceleration (T_{acc})

Address	Assignment
Byte 4	Bit 1: JOB_ERR Bit 0: JOB_ACK

Changing the acceleration T_{acc}: Causes of Errors for JOB_ERR

Error Number	Meaning	What to Do
42	Changing the acceleration T_{acc} > 65 535	

See also

CPU/Master Stop and RESET State (Page 176)

4.6.16 Changing the Deceleration Tdec (JOB 8)

Definition

By changing T_{dec} (JOB 8) you can adjust the deceleration.

Supply the control interface with the new deceleration value and activate JOB 8.

The 1PosInc/Analog accepts the new deceleration value. The acceleration remains valid until the parameter assignment of the 1PosInc/Analog is changed.

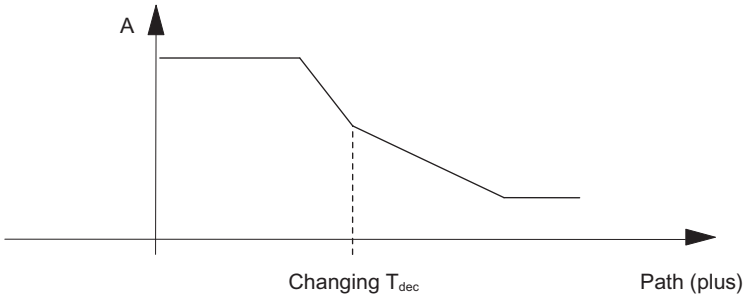


Figure 4-21 Changing the Deceleration T_{dec} During Deceleration

Effect on the MODEs

MODE	What Happens
Search for Reference	The currently valid deceleration is replaced by the new value. The new deceleration is immediately effective.
Inching	
Absolute Positioning	
Relative Positioning	

Control Signals: Changing the deceleration (T_{dec})

Address	Assignment					
Byte 4	Bits 4.7 to 4.4 :					
	Bit	7	6	5	4	
		1	0	0	0	JOB 8 = Changing the Deceleration T_{dec}
	Bit 0: JOB_REQ					
Bytes 5 to 7	Deceleration T_{dec} in ms (0 to 65 535)					

Feedback Signals: Changing the deceleration (T_{dec})

Address	Assignment
Byte 4	Bit 1: JOB_ERR Bit 0: JOB_ACK

Changing the deceleration T_{dec}: Causes of Errors for JOB_ERR

Error Number	Meaning	What to Do
43	Deceleration T_{dec} > 65 535	

See also

CPU/Master Stop and RESET State (Page 176)

4.6.17 Evaluating the Reference Signal (JOB 9)

Definition

By evaluating the reference signal you can synchronize the axis using an external reference signal during a current run in inching or relative positioning mode. You can use either the 3 digital inputs or the zero mark as a reference signal.

You can assign parameters to the digital inputs DI0 (minus limit switch), DI1 (plus limit switch) and DI2 (reducing cam) as normally closed or normally open contacts.

Supply the control interface with the new actual value coordinates and activate JOB 9. The 1PosInc/Analog sets the feedback signal SYNC = 0.

If the 1PosInc/Analog detects the overrunning of the assigned parameter reference signal in the referencing direction, the axis is synchronized. The 1PosInc/Analog sets the feedback signal SYNC = 1 and assigns the reference point coordinates to the actual value.

The referencing direction is determined by the reference signal and reference switch parameters.

	Reference switch: Reduction cam towards minus	**Reference switch: Reduction cam towards plus**	**Reference switch: Minus limit switch**	**Reference switch: Plus limit switch**
Reference signal: Reference switch and zero mark	Minus referencing direction	Plus referencing direction	Plus referencing direction	Minus referencing direction
Reference signal: Reference switch				
Reference signal: Zero mark	The referencing direction is not defined. The axis is synchronized at the next zero mark.			

Effect on the MODEs

MODE	**What Happens**
Search for Reference	The reference coordinates transferred with JOB 9 are valid
Inching	-
Absolute Positioning	Run canceled with POS_ERR = 1 because SYNC is deleted
Relative Positioning	-

Control Signals: Reference Signal Evaluation

Address	Assignment					
Byte 4	Bits 4.7 to 4.4 :					
	Bit	7	6	5	4	
		1	0	0	1	JOB 9 = Evaluate the reference signal
	Bit 0: JOB_REQ					
Bytes 5 to 7	Reference point coordinates (linear axis: 0 to 16 777 215; rotary axis: 0 to end of rotary axis - 1)					

Feedback Signals: Reference Signal Evaluation

Address	Assignment
Byte 0	Bit 3: SYNC
Bytes 1 to 3	Actual value (linear axis: 0 to 16 777 215; rotary axis: 0 to end of rotary axis - 1)
Byte 4	Bit 1: JOB_ERR Bit 0: JOB_ACK

Parameters: Reference Signal Evaluation

Parameters	Meaning	Value range	Default setting
Reference point run and evaluation of the reference signal			
Reference signal	This parameter defines the relevant switch or the combination of switch and zero mark.	• Reference switch and zero mark • Reference switch • Zero mark	Reference switch and zero mark
Reference switch	Relevant in the case of reference signal: • Reference switch and zero mark • Reference switch This parameter defines the referencing direction in which the switch must be traversed.	• Reduction cam towards minus • Reduction cam towards plus • Minus limit switch • Plus limit switch	Reduction cam towards minus

Evaluating the Reference Signal: Causes of Errors for JOB_ERR

Error Number	Meaning	What to Do
23	ERR_ENCODER is displayed	Check the encoder wiring
30	Evaluating the Reference Signal: Reference point coordinates ≥ end of rotary axis	

4.6.18 Latch Function (JOB 10)

Definition

The latch function allows you to store the actual value at an edge at the DI2 digital input. You can use this function, for example, to detect edges or measure lengths.

Supply the control interface with the desired edge, and activate JOB 10.

If the 1PosInc/Analog detects the preset edge at the D12 digital input, it stores the associated actual value, displays it as the feedback value and sets the feedback bit LATCH_DONE=1.

You can then activate the latch function again.

Latch Function and Reference Point Run or Reference Signal

If the 1PosInc/Analog synchronizes at the same edge, it stores the actual value before it assigns the reference point coordinates.

Effect on the MODEs

MODEs are not affected by JOB 10.

Control Signals: Latch Function

Address	Assignment					
Byte 4	Bits 4.7 to 4.4 :					
	Bit	7	6	5	4	
		1	0	1	0	JOB 10 = Latch function
	Bit 0: JOB_REQ					
Byte 5	Bit 1: Latch at negative edge at DI2 Bit 0: Latch at positive edge at DI2					

Feedback Signals: Latch Function

Address	Assignment
Byte 4	Bit 2: LATCH_DONE Bit 1: JOB_ERR Bit 0: JOB_ACK
Bytes 5 to 7	Feedback value: Actual value at the edge at DI2 (linear axis: 0 to 16 777 215; rotary axis: 0 to end of rotary axis - 1)

Latch Function: Causes of Errors for JOB_ERR

Error Number	Meaning	What to Do
36	Latch Function: Edge selection unknown	

4.6.19 Setting the Monitoring of the Direction of Rotation (JOB 11)

Definition

You can set the direction of rotation monitoring of the 1PosInc/Analog to suit the load and mechanical conditions.

Monitoring of the direction of rotation is always active. The 1PosInc/Analog recognizes whether the drive and encoder have the same direction of rotation. Direction of rotation monitoring will tolerate different directions for the drive and the encoder up to the preset path difference. If the preset path difference is exceeded, the 1PosInc/Analog POS_ERR =1.

Unless you have activated JOB 11, double the switch-off difference is used from the parameters as the path difference. JOB 3 (which changes the switch-off difference) does not affect the path difference for the purpose of monitoring of the direction of rotation.

Supply the control interface with the new path difference, and activate JOB 11.

The 1PosInc/Analog accepts the preset path difference for the monitoring of the direction of rotation.

The preset path difference for the monitoring of the direction of rotation remains valid until the parameter assignment of the 1PosInc/Analog is changed.

Disabling the Monitoring of the Direction of Rotation

Monitoring of the direction of rotation is disabled when the path difference is 0.

Effect on the MODEs

MODEs are not affected by JOB 11.

Control Signals: Setting the Monitoring of the Direction of Rotation

<table>
<tr><th>Address</th><th colspan="6">Assignment</th></tr>
<tr><td rowspan="3">Byte 4</td><td colspan="6">Bits 4.7 to 4.4 :</td></tr>
<tr><td rowspan="2">Bit</td><td>7</td><td>6</td><td>5</td><td>4</td><td rowspan="2">JOB 11 = Set the monitoring of the direction of rotation</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td colspan="6">Bit 0: JOB_REQ</td></tr>
<tr><td>Byte 5</td><td colspan="6">0</td></tr>
<tr><td>Bytes 6, 7</td><td colspan="6">Path difference for monitoring of the direction of rotation
(0 to 65 535)</td></tr>
</table>

Feedback Signals: Setting the Monitoring of the Direction of Rotation

Address	Assignment
Byte 4	Bit 1: JOB_ERR Bit 0: JOB_ACK

Setting the Monitoring of the Direction of Rotation: Causes of Errors for JOB_ERR

Error Number	Meaning	What to Do
38	Monitoring of the direction of rotation Path difference > 65 535	

See also

CPU/Master Stop and RESET State (Page 176)
Error Detection/Diagnostics (Page 171)

4.6.20 Displaying Current Values (JOB 15)

Definition

You can display the following values in the feedback interface as feedback values:

- Residual distance
- Actual speed
- Causes of errors for POS_ERR and JOB_ERR

The 1PosInc/Analog presets the residual distance as a feedback value.

The 1PosInc/Analog continuously displays the actual value in the feedback interface irrespective of the selected feedback value.

This moves the operating range to another part of the axis and synchronizes the axis.

The selected feedback value remains valid until the parameter assignment of the 1PosInc/Analog is changed.

Displaying Current Values and the Latch Function

If you activate the latch function, the 1PosInc/Analog sets a feedback value of 0 and displays the actual value at the edge at the D12 digital input.

You can only activate JOB 15 again after the latch function has terminated.

Residual distance

In absolute positioning and relative positioning modes, the 1PosInc/Analog calculates the distance to the destination as the residual distance. As long as the actual value is before the destination, the residual distance remains positive. It becomes negative once the destination is overshot. The residual distance is 0 in the other MODEs.

The 1PosInc/Analog displays the residual distance with a sign between -8 388 608 and 8 388 607 increments. Negative values are displayed in twos complement. If the actual residual distance is beyond these limits, the limit value is displayed.

Actual speed

The 1PosInc/Analog calculates the actual speed as an encoder value change in increments per 10 ms. It displays these between 0 and 16 777 215.

Causes of errors for POS_ERR and JOB_ERR

The 1PosInc/Analog displays the causes of errors for POS_ERR and JOB_ERR as well as the MODE and JOB entered in the control interface.

Effect on the MODEs

MODEs are not affected by JOB 15.

Control Signals: Display Current Values

Address	Assignment					
Byte 4	Bits 4.7 to 4.4 :					
	Bit	7	6	5	4	
		1	1	1	1	JOB 15 = Display current values
	Bit 0: JOB_REQ					
Byte 5	0: Residual distance 1: Actual speed 2: Causes of errors for POS_ERR and JOB_ERR					

Feedback Signals: Display Current Values

Address	Assignment
Byte 4	Bit 1: JOB_ERR Bit 0: JOB_ACK
Bytes 5 to 7	In accordance with the selected feedback value: • With a residual distance of: - 8 388 608...8 388 607 • With an actual speed of: 0...16 777 215 • With causes of errors for POS_ERR and JOB_ERR – Byte 5: Causes of Errors for POS_ERR – Byte 6: Causes of Errors for JOB_ERR – Bits 7.3 to 7.0: MODE (= bits 0.7 to 0.4 from the control signals) – Bits 7.7 to 7.4: JOB (= bits 4.7 to 4.4 from the control signals)

Display current values: Causes of Errors for JOB_ERR

Error Number	Meaning	What to Do
35	Display current values: Selection unknown	
37	Display current values: JOB 15 cannot be activated with the latch function running.	

See also

Error Detection/Diagnostics (Page 171)
CPU/Master Stop and RESET State (Page 176)

4.6.21 Error Detection/Diagnostics

Parameter assignment error

Parameter assignment error	Response of the 1PosInc/Analog
Causes: • The 1PosInc/Analog cannot identify existing parameters as its own. • The slot of the 1PosInc/Analog you have configured does not match the setup. What to Do: • Check the configuration and setup	• The 1PosInc/Analog is not assigned parameters and cannot execute its functions. • Generate channel-specific diagnostics

External Errors

Short circuit of the sensor supply	Response of the 1PosInc/Analog
Causes: • Short circuit of the encoder supply made available at terminals 2 and 10 What to Do: • Check the wiring and correct the short circuit. • Acknowledge the error with the EXTF_ACK control bit.	• The current reference point run, relative positioning, and absolute positioning modes are stopped; it is not possible to start a new run in these modes. – Analog output QV+ is set to 0 V – Digital output OUT: If the direction is assigned parameters for the DO function, the digital output OUT=0 is set – Feedback bit POS_ERR = 1 – Feedback bit POS_DONE = 0 • Feedback bit ERR_ENCODER = 1 • Feedback bit SYNC = 0 • Generate channel-specific diagnostics • Waits for error acknowledgment EXTF_ACK • Inching MODE is not affected by this error. • The current JOB (reference signal evaluation) is canceled.
Wire Break/Short Circuit of the Encoder Signals	**Response of the 1PosInc/Analog**
Prerequisite: • You must enable the encoder signal diagnostics parameter in order to allow error recognition for the signals A, /A and B, /B. • You must enable the zero marker diagnostics parameter in order to allow error recognition for the signals N, /N. If you use an encoder without a zero mark, switch off error detection. Causes: • Wire break or short circuit of the encoder signals at terminals 1, 5 or 3, 7 or 4, 8. What to Do: • Check the wiring and correct the short circuit. • Acknowledge the error with the EXTF_ACK control bit.	• The current reference point run, relative positioning, and absolute positioning modes are stopped; it is not possible to start a new run in these modes. – Analog output QV+ is set to 0 V – Digital output: if the direction is assigned parameters with the DO function, the digital output OUT=0 is set – Feedback bit POS_ERR = 1 – Feedback bit POS_DONE = 0 • Feedback bit ERR_ENCODER = 1 • Feedback bit SYNC = 0 • Generate channel-specific diagnostics • Waits for error acknowledgment EXTF_ACK • Inching MODE is not affected by this error. • The current JOB (reference signal evaluation) is canceled.

Errors in the Control of MODEs and JOBs

POS_ERR	Response of the 1PosInc/Analog
Causes: • Certain requirements or conditions have not been met at the start of a MODE	• The MODE started is not executed. • The current run is stopped. – Analog output is slowed down to 0 V using the ramp. – Feedback bit POS_ERR = 1 – Feedback bit POS_DONE = 0

JOB_ERR	Response of the 1PosInc/Analog
Causes: • Certain requirements or conditions have not been met at the activation of a JOB	• The activated JOB is not executed. – Feedback bit JOB_ERR = 1

Generating a Channel-Specific Diagnostics

In the event of parameter assignment errors (short circuit of the sensor supply or open circuit/short circuit of the sensor signals), the 1PosInc/Analog generates a channel-specific diagnostics for the connected CPU/master. To do this, you must enable the Group Diagnostics parameter (see the *Distributed I/O Device* manual).

Error Acknowledgment EXTF_ACK

You must acknowledge the corrected errors (short circuit of the sensor supply and open circuit/short circuit of the sensor signals).

What You Do	Response of the 1PosInc/Analog
	Feedback bit ERR_ENCODER = 1
Your control program detects the set feedback bit ERR_ENCODER. Execute your application-specific error response. Eliminate the cause of the error.	
Switch the EXTF_ACK control bit from 0 to 1	The 1PosInc/Analog sets the feedback bit ERR_ENCODER = 0. This tells you that the cause has been eliminated and acknowledged. If ERR_ENCODER = 1, the cause of the error is not yet eliminated.
Switch the EXTF_ACK control bit from 1 to 0	
In the case of constant error acknowledgment (EXTF_ACK = 1) or at CPU/Master Stop, the 1PosInc/Analog reports the errors as soon as they are detected and deletes them as soon as they have been eliminated.	

Parameters

Parameters	Meaning	Value range	Default setting
Enables			
Group diagnostics	An encoder error (ERR_ENCODER) or parameter assignment error results in a channel-specific diagnostics if group diagnostics is enabled.	• Disable • Enable	Disable
Encoder signal diagnostics	Encoder signals A, /A and B, /B are monitored for short circuit and wire break.	• On • Off	On
Zero marker diagnostics	Zero marker signals N, /N are monitored for short circuit and wire break.	• On • Off	On

Feedback Messages

Address	Assignment
Byte 0	Bit 7: ERR_ENCODER Bit 3: SYNC Bit 2: POS_ DONE Bit 1: POS_ERR Bit 0: POS_ACK
Byte 4	Bit 1: JOB_ERR Bit 0: JOB_ACK

Causes of Errors for POS_ERR

Table 4-4 Causes of Errors for POS_ERR

Error Number	Cause	Remedy
1	MODE unknown	Permissible MODEs are: • MODE 0 • MODE 1 • MODE 3 • MODE 4 • MODE 5
3	ERR_ENCODER is displayed	Check the encoder wiring
4	The axis is not synchronized (SYNC=0)	You can synchronize the axis with: • Reference point run • Reference Signal Evaluation • Setting of Actual Value
5	The limit switch that lies in the direction in which the drive is moved is active	Check your switches and the wiring as well as the DI0 limit switch minus and DI1 limit switch plus parameters
7	Inching: DIR_P and DIR_M = 1 Absolute positioning: Start with DIR_P and DIR_M = 0 or relevant control bit DIR_P or DIR_M = 0 Relative positioning: Start with DIR_P and DIR_M = 0 or DIR_P and DIR_M = 1	
8	Absolute positioning: destination ≥ end of rotary axis	
9	Absolute positioning was terminated because JOB 9 was initiated	
10	Search for reference: Reference point coordinates ≥ end of rotary axis	
11	Search for reference: No reference signal found up to the limit switch or between the limit switches	Check your switches, the encoder and the wiring
13	Direction of rotation of the drive and the encoder varies	Check the wiring of the drive and the encoder as well as the reversal of the direction of rotation parameter

Causes of Errors for JOB_ERR

Table 4-5 Causes of Errors for JOB_ERR

Error Number	Meaning	Remedy
21	JOB unknown	Permissible JOBs are: • JOB 0 • JOB 1 • JOB 3 • JOB 4 • JOB 9 • JOB 10 • JOB 11 • JOB 15
23	ERR_ENCODER is displayed	Check the encoder wiring
30	Evaluating the Reference Signal: Reference point coordinates ≥ end of rotary axis	
34	Setting an Actual Value: actual value coordinates ≥ end of rotary axis	
35	Display current values: Selection unknown	
36	Latch Function: Edge selection unknown	
37	Display current values: JOB 15 cannot be activated with the latch function running.	
38	Monitoring of the direction of rotation Path difference > 65 535	
40	Voltage setting Rapid feed speed > 32 511	
41	Voltage setting creep feed speed > 32 511	
42	Changing the acceleration T_{acc} > 65 535	
43	Deceleration T_{dec} > 65 535	

4.7 CPU/Master Stop and RESET State

Behavior at CPU-Master-STOP

Behavior at CPU-Master-STOP	Response of the 1PosInc/Analog
• Due to power-off of the CPU/DP master or • Due to power-off of the IM 151/ IM 151 FO or • Due to failure of DP transmission or • Due to change from RUN to STOP	• The current run is stopped. – Analog output QV+ is set to 0 V – Digital output: if the direction is assigned parameters for the DO function, the digital output OUT=0 is set • Feedback bit POS_ERR = 0 • Feedback bit POS_DONE = 1

Exiting the CPU-Master-STOP Status

Exiting the CPU-Master-STOP Status	Response of the 1PosInc/Analog
• At power-on of the CPU/DP master or • At power-on of the IM 151/ IM 151 FO or • After failure of the DP transmission or • After a change from STOP to RUN	• The feedback interface of the 1PosInc/Analog remains current. • The axis remains synchronized, and the actual value is current. • The following changed values remain valid: – Voltage for rapid feed – Voltage for creep feed – Acceleration (T_{acc}) – Deceleration T_{dec} – Switch-off and switchover difference – The path difference for the monitoring of the direction of rotation remains valid. • An initiated JOB 9: Evaluating the Reference Signal and JOB 10: Latch function remains active. • The feedback bit selected with JOB 15 is current.

RESET State of the 1PosInc/Analog

RESET Status of the 1PosInc/Analog and Changing the Parameters of the 1PosInc/Analog	Response of the 1PosInc/Analog
• Changing the parameters of the 1PosInc/Analog and downloading the parameter assignment and configuration of the ET 200S station to the CPU/DP master or • Power-on at the power module of the 1PosInc/Analog or • Inserting the 1PosInc/Analog in an energized state	• The axis is not synchronized and the actual value = 0. • The voltage for rapid feed is set to 10 V. • The voltage for creep feed is set to 1 V. • Acceleration (T_{acc}) and deceleration (T_{dec}) are transferred from the parameters. • The switch-off and switchover difference is accepted from the parameters. • The path difference for the monitoring of the direction of rotation is set at double the switch-off difference. • JOB 9: Evaluating the Reference Signal and JOB 10: Latch function are not active. • The residual distance is displayed as a feedback value.

4.8 Parameter List

Overview

Parameters	Meaning	Value range	Default setting
Enables			
Group diagnostics	An encoder error (ERR_ENCODER) or parameter assignment error results in a channel-specific diagnostics if group diagnostics is enabled.	• Disable • Enable	Disable
Encoder signal diagnostics	Encoder signals A, /A and B, /B are monitored for short circuit and wire break.	• On • Off	On
Zero marker diagnostics	Zero marker signals N, /N are monitored for short circuit and wire break.	• On • Off	On
Axis			
Reversal of the direction of rotation	Adjustment of the direction of rotation of the encoder	• Off • On	Off
Axis type	Selection of linear axis without limitation or rotary axis with overrun/underrun at end of rotary axis	• Linear • Rotary	Linear
End of rotary axis	Only relevant for rotary axis type: Underrun: 0 to end of rotary axis - 1 Overrun: End of rotary axis - 1 to 0 Parameter assignment error at 0	1 - 16 777 215	36000
Digital Inputs			
DI0 limit switch minus	Switch on the DI0 digital input is a break or make contact	• Break contact • Make contact	Break contact
DI1 limit switch plus	Switch on the DI1 digital input is a break or make contact	• Break contact • Make contact	Break contact
DI2 reducing cam	Switch on the DI2 digital input is a break or make contact	• Break contact • Make contact	Make contact

Parameters	Meaning	Value range	Default setting
Reference point run and evaluation of the reference signal			
Reference signal	This parameter defines the relevant switch or the combination of switch and zero mark.	• Reference switch and zero mark • Reference switch • Zero mark	Reference switch and zero mark
Reference switch	Relevant in the case of reference signal: • Reference switch and zero mark • Reference switch This parameter defines the referencing direction in which the switch must be traversed.	• Reduction cam towards minus • Reduction cam towards plus • Minus limit switch • Plus limit switch	Reduction cam towards minus
Start direction of the reference point run		• Plus • Minus	Plus
Drive			
Adapt direction	If you adjust the direction, this results in the polarity reversal of your drive	• Off • On	Off
Function DO	**Output:** Your drive is controlled by the analog output using ±10 V. You control the DO digital output using the CTRL_DO control bit. **Direction:** Your drive is controlled by the analog output using 0 V to 10 V. The direction for your drive is specified by the 1PosInc/Analog via the DO digital output. Plus direction: DO = 1 Minus direction: DO = 0	• Output • Direction	Output
Switch-off	Use this parameter to determine the course of the voltage after the switch-off point. Directly: The voltage is set directly to 0 V at switch-off point. Ramp: As of switch-off point, voltage is reduced to 0 V using the ramp.	• Directly • Ramp	Directly
Switch-off difference	Defines the distance from the destination at which the drive is slowed down from creep feed to 0. If the switch-off difference ≥ the switchover difference, there is no switchover point. There is no slowdown from rapid feed to creep feed.	0 - 65 535	100
Switchover difference	Defines the distance from the destination at which the drive is slowed down from rapid feed to creep feed.	0 - 65 535	1000

Parameters	Meaning	Value range	Default setting
Acceleration T_{acc} in ms	Time required for a change in voltage via a ramp from 0 V to10 V. At 0 ms acceleration is without a ramp.	0 - 65535	10000
Deceleration T_{dec} in ms	Time required for a change in voltage via a ramp from 10 V to 0 V. At 0 ms deceleration is without a ramp.	0 - 65535	10000

4.9 Control and Feedback Signals

Assignment of the Control Interface

<table>
<tr><th>Address</th><th colspan="6">Assignment</th></tr>
<tr><td rowspan="8">Byte 0</td><td colspan="6">Bits 0.7 to 0.4 stand for the MODEs</td></tr>
<tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td><td></td></tr>
<tr><td></td><td>0</td><td>0</td><td>0</td><td>0</td><td>MODE 0 = Stop</td></tr>
<tr><td></td><td>0</td><td>0</td><td>0</td><td>1</td><td>MODE 1 = Inching</td></tr>
<tr><td></td><td>0</td><td>0</td><td>1</td><td>1</td><td>MODE 3 = Reference Point Run</td></tr>
<tr><td></td><td>0</td><td>1</td><td>0</td><td>0</td><td>MODE 4 = Relative Positioning</td></tr>
<tr><td></td><td>0</td><td>1</td><td>0</td><td>1</td><td>MODE 5 = Absolute Positioning</td></tr>
<tr><td colspan="6">Bit 3: CTRL_DO
Bit 2: DIR_M
Bit 1: DIR_P
Bit 0: START</td></tr>
<tr><td>Bytes 1 to 3</td><td colspan="6">In MODE 1= inching: voltage for inching
With MODE 3 = reference point run: reference point coordinates
at MODE 4 = Relative positioning: distance
at MODE 5 = Absolute positioning: target</td></tr>
<tr><td rowspan="19">Byte 4</td><td colspan="6">Bits 4.7 to 4.4 stand for the MODEs</td></tr>
<tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td><td></td></tr>
<tr><td></td><td>0</td><td>0</td><td>0</td><td>0</td><td>JOB 0 = Cancel JOB processing</td></tr>
<tr><td></td><td>0</td><td>0</td><td>0</td><td>1</td><td>JOB 1 = Set the actual value</td></tr>
<tr><td></td><td>0</td><td>0</td><td>1</td><td>1</td><td>JOB 3 = Change the switch-off difference</td></tr>
<tr><td></td><td>0</td><td>1</td><td>0</td><td>0</td><td>JOB 4 = Change the switchover difference</td></tr>
<tr><td></td><td>0</td><td>1</td><td>0</td><td>1</td><td>JOB 5 = Change the voltage for rapid feed</td></tr>
<tr><td></td><td>0</td><td>1</td><td>1</td><td>0</td><td>JOB 6 = Change the voltage for creep feed</td></tr>
<tr><td></td><td>0</td><td>1</td><td>1</td><td>1</td><td>JOB 7 = Changing the acceleration T_{acc}</td></tr>
<tr><td></td><td>1</td><td>0</td><td>0</td><td>0</td><td>JOB 8 = Changing the Deceleration T_{dec}</td></tr>
<tr><td></td><td>1</td><td>0</td><td>0</td><td>1</td><td>JOB 9 = Evaluate the reference signal</td></tr>
<tr><td></td><td>1</td><td>0</td><td>1</td><td>0</td><td>JOB 10 = Latch function</td></tr>
<tr><td></td><td>1</td><td>0</td><td>1</td><td>1</td><td>JOB 11 = Set the monitoring of the direction of rotation</td></tr>
<tr><td></td><td>1</td><td>1</td><td>1</td><td>1</td><td>JOB 15 = Display current values</td></tr>
<tr><td colspan="6">Bit 3: EXTF_ACK
Bit 2:Reserve = 0
Bit 1: Reserve = 0
Bit 0: JOB_REQ</td></tr>
</table>

Address	Assignment
Bytes 5 to 7	Corresponding to the selected JOB: • With JOB 1= actual value coordinates • With JOB 3 = switch-off difference • With JOB 4 = switchover difference • With JOB 5 = voltage for rapid feed • With JOB 6= voltage for creep feed • With JOB 7 = acceleration T_{acc} • With JOB 8 = deceleration T_{dec} • With JOB 9 = reference point coordinates • With JOB 10 – Byte 5: Bit 0 = latch at positive edge at DI2 – Byte 5: Bit 1 = latch at negative edge at DI2 • With JOB 11 = path difference for direction of rotation monitoring • With JOB 15 – Byte 5: 0 = Residual distance – Byte 5: 1 = Actual speed – Byte 5: 2 = error information

Assignment of the Feedback Interface

Address	Assignment
Byte 0	Bit 7: ERR_ENCODER Bits 6 and 5: Status phase of the run Bit 4: STATUS DO Bit 3: SYNC Bit 2: POS_ DONE Bit 1: POS_ERR Bit 0: POS_ACK
Bytes 1 to 3	Actual value
Byte 4	Bit 7: Reserve Bit 6: STATUS DI 2 reduction cams Bit 5: STATUS DI 1 limit switch plus Bit 4: STATUS DI 0 limit switch minus Bit 3: Reserve Bit 2: LATCH_DONE Bit 1: JOB_ERR Bit 0: JOB_ACK
Bytes 5 to 7	Feedback value

Access to Control and Feedback Interface in STEP 7 Programming

	Configured with STEP 7 via GSD file [1)] (hardware catalog\PROFIBUS DP\ other field devices\ET 200S)	**Configured with STEP 7 via HW Config (hardware catalog\PROFIBUS DP\ET 200S)**
Feedback interface	Read with SFC 14 "DPRD_DAT"	Load command e.g. L PED
Control interface	Write with SFC 15 "DPWR_DAT"	Transfer command e.g. T PAD
[1]Load and transfer commands are also possible with CPU 3xxC, CPU 318-2 (as of V3.0), CPU 4xx (as of V3.0)		

4.10 Technical Specifications for the 1PosInc/Analog

Overview

Technical Data of the 1PosInc/Analog	
Dimensions and weight	
Dimension W x H x D (mm)	30 x 81 x 52
Weight	Approx. 65 g
Data for specific modules	
Number of channels	1
Voltages, currents, potentials	
Rated load voltage L+ • Range • P1	24 VDC 20.4 ... 28.8 V Yes
Isolation • Between the backplane bus and the I/O • Between analog output and load voltage L+	 Yes Yes
Permissible potential difference between M_{ANA} and the central grounding point U_{iso}	75 V DC/60 V AC
Insulation tested	500 VDC
Sensor supply • Output voltage • Output current	 L+ -0.8 V Maximum 500 mA, short-circuit proof
Current consumption • From the backplane bus • From the load voltage L+ (no load)	 Max. 10 mA Max. 50 mA
Power dissipation	Typ. 2 W
Data for the digital inputs	
Input voltage • Rated value • 0 signal • 1 signal	 24 VDC -30 V to 5 V 11 V to 30 V
Input current • 0 signal • 1 signal	 ≤ 2 mA (perm. leakage current) 9 mA (typ.)
Minimum pulse width	500 µs
Connection of a two-wire BERO Type 2	Possible
Input characteristic curve	To IEC 1131, Part 2, Type 2
Length of cable	50 m

Technical Data of the 1PosInc/Analog	
Data on the Digital Output	
Output voltage • Rated value • 0 signal • 1 signal	 24 VDC ≤ 3 V ≥ L+ -1 V
Output current • 0 signal (leakage current) • 1 signal – Rated value – Permitted range	 ≤ 0.3 mA 0.5 A 7 mA to 0.6 A
Switch rate • Resistive load • Inductive load • Lamp load	 100 Hz 2 Hz ≤ 10 Hz
Lamp load	≤5 W
Output delay (resistive load, output current 0.5 A) • At 0 to 1 • At 1 to 0	 typ. 150 µs typ. 150 µs
Short-circuit protection of the output	Yes
Threshold on	0.7 A to 1.8 A
Inductive extinction	Yes; L+ -(55 to 60 V)
Digital input control	Yes
Cable lengths • Unshielded • Shielded	 600 m 1000 m
Data for the Analog Output	
Resolution (including overrange)	± 10 V/13 bits + sign
Settling time • For resistive load • For capacitive load • For inductive load	 0,1 ms 0.5 ms 0.5 ms
Length of cable • Shielded	 Max. 100 m

Technical Data of the 1PosInc/Analog	
Suppression of interference, limits of error	
Operational limit (in the entire temperature range, with reference to the output range)	± 0.4 %
Basic error limit (operational limit at 25°C with reference to output range)	± 0.2 %
Temperature error (with reference to the output range)	± 0.01 %/K
Linearity error (with reference to the output range)	± 0.02 %
Repeatability (in steady state at 25°C with reference to output range)	± 0.05 %
Output ripple (with reference to output range, bandwidth 0 to 50 kHz)	± 0.02 %
Data for selecting an actuator	
Output range (rated value)	±10 V
Load resistance • For capacitive load • Short-circuit protection • Short-circuit current	Min. 1.0 kΩ Max. 1 µF Yes Approx. 25 mA
Destruction limit against voltages/currents applied from outside • Voltage at the outputs to M_{ANA} • Current	 Max. 15 V continuous; 75 V for max. 1 s (pulse duty factor 1/20) Max. DC 50 mA
Connection of actuators	
• 2-conductor connection	No compensation for surge impedance
Encoder signals	
Level • Terminating resistance • Differential input voltage • Max. frequency	To RS 422 330 Ω Min. 1 V 500 kHz
Length of cable	
• Shielded	Max. 50 m
Status, Diagnostics	
Change in actual value (up)	UP LED (green)
Change in actual value (down)	DN LED (green)
Status display positioning in operation	LED POS (green)
Status display DI0 (minus hardware limit switch)	LED 9 (green)
Status display DI1 (plus hardware limit switch)	LED 13 (green)
Status display DI2 (reducing cam)	LED 14 (green)
Group error on the 1PosInc/Analog	SF LED (red)
Diagnostic information	Yes

Technical Data of the 1PosInc/Analog	
Response Times	
Update rate for feedback messages	2 ms
Response time at the switchover or switch-off point	0.1 ms - 2 ms
Latch response time	Typ. 400 µs