SIEMENS

SIMOTION

SIMOTION SCOUT
SIMOTION ADI4 - Analog Drive Interface for 4 Axes

Manual

Valid for controller: SIMOTION P,
SIMOTION C, and
SIMOTION D

Software Version ADI4 1.4

05/2009
6FC5 297-0BA01-0BP6

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.

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The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

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Ordernumber: 6FC5 297-0BA01-0BP6
℗ 03/2009

Preface

Purpose of the manual

This manual describes the functionality and use of the ADI4 - Analog Drive Interface for 4 Axes.

Note

This manual provides information about the hardware and applications of the ADI4. In the SIMOTION manuals, you will find general information about working with the SIMOTION SCOUT engineering software, technology objects, etc.

Scope

ADI4 is supported by the following Siemens products:

- SCOUT Engineering System, Version 3.1.1 or later
- SIMOTION Runtime, Version 3.1.1 or later
- SINAMICS V2.1 or later

Organization of information

The information about ADI4 in this manual is organized as follows:

- General

  This chapter describes the properties and essential features as well as the higher-level boundary conditions of the ADI4.

- Hardware description

  This chapter describes the interfaces of the ADI4, the control cabinet installation, and the power supply of the module.

- Parameter assignment

  This chapter describes the assignment of ADI4 parameters for PROFIBUS DP and for functions.

- Commissioning

  This chapter presents a commissioning example using absolute and incremental encoders in conjunction with ADI4.

- Index

  The index helps you to locate information in the manual quickly and easily.

Standards and approvals

Our products meet the requirements of EU directive 89/336/EEC "Electromagnetic Compatibility" and the harmonized European Standards listed therein.

The EC declaration of conformity is available on the Internet at http://support.automation.siemens.com/WW/view/eng/15257461.

You will find detailed information about approvals and standards in the "Supplemental SINAMICS System Components for SIMOTION" manual.

Safety information

The following notices are intended to ensure both your personal safety and to prevent damage occurring to the products described or any connected devices and machines.

⚠ WARNING

Hazardous voltages are present in this electrical equipment during operation.

Actions by an **unqualified** device operator or failure to observe the warning notices may result in serious physical injury or material damage. Only suitably **qualified personnel** who are trained in assembling, installing, commissioning or operating the product should work on this device.

Should it be necessary to test or take measurements on live equipment, then the specifications and procedures defined in Accident Prevention Regulation VBG 4.0 must be adhered to, in particular §8 "Permissible deviations when working on live components". A suitable electric tool must be used.

⚠ WARNING

Repairs to devices that have been supplied by Siemens must only be carried out by **Siemens Customer Service** or by repair centers **authorized by Siemens**. When replacing parts or components, only use those parts or components that are included in the spare parts list.

Before opening the device, always disconnect the power supply.

EMERGENCY STOP devices complying with EN 60204 IEC 204 (VDE 0113) must remain effective in all automation equipment modes. Resetting the EMERGENCY STOP device must not cause an uncontrolled or undefined restart.

Additional external measures must be taken, or devices must be created that ensure or force a safe operational state even when there is a fault (e.g. using independent limit value switches, mechanical locks, etc.) at any location in the automation equipment where faults might cause major material damage or even physical injury, in other words, where faults could be dangerous.

⚠ CAUTION
Connecting cables and signal cables should be installed so that inductive and capacitive interference does not in any way impair the automation functions.

Hotline and Internet addresses

Siemens Internet address

The latest information about SIMOTION products, product support, and FAQs can be found on the Internet at:

- General information:
  - **http://www.siemens.de/simotion** (German)
  - **http://www.siemens.com/simotion** (international)
- Downloading documentation
  Further links for downloading files from Service & Support.
  http://support.automation.siemens.com/WW/view/en/10805436
- Individually compiling documentation on the basis of Siemens contents with the My Documentation Manager (MDM), refer to **http://www.siemens.com/mdm**

  My Documentation Manager provides you with a range of features for creating your own documentation.
- FAQs
  You can find information on FAQs (frequently asked questions) by clicking **http://support.automation.siemens.com/WW/view/en/10805436/133000**.

Additional support

We also offer introductory courses to help you familiarize yourself with SIMOTION.

For more information, please contact your regional Training Center or the main Training Center in 90027 Nuremberg, Germany.

Information about training courses on offer can be found at:

http://www.sitrain.com

Technical support

If you have any technical questions, please contact our hotline:

	Europe / Africa
Phone	+49 180 5050 222 (subject to charge)
Fax	+49 180 5050 223
€0.14/min from German wire-line network, mobile phone prices may differ.	
Internet	http://www.siemens.com/automation/support-request

	Americas
Phone	+1 423 262 2522
Fax	+1 423 262 2200
E-mail	mailto:techsupport.sea@siemens.com

	Asia / Pacific
Phone	+86 1064 757575
Fax	+86 1064 747474
E-mail	mailto:support.asia.automation@siemens.com

Note

Country-specific telephone numbers for technical support are provided under the following Internet address:

http://www.automation.siemens.com/partner

Questions about this documentation

If you have any questions (suggestions, corrections) regarding this documentation, please fax or e-mail us at:

Fax	+49 9131- 98 2176
E-mail	mailto:docu.motioncontrol@siemens.com

Table of contents

1 General

1.1 Overview

1.1.1 Properties

Properties of ADI4 module

An ADI4 module (Analog Drive Interface for 4 Axis) is an interface module suitable for running up to four drives with an analog setpoint interface on the equidistant PROFIBUS DP.

Communication between the controller and the ADI4 is performed via an ADI4-specific message frame type which, in addition to digital input/output data, also contains a message frame type (standard message frame 3) for each drive specified according to a PROFIDrive profile. As part of cyclic DP communication, the actual drive values (encoder values) are transferred from the ADI4 module to the controller via PROFIBUS DP, and the speed setpoints calculated by the controller are transferred to the ADI4 module.

The transferred speed setpoints are then output from the ADI4 module to the drives as analog values.

1.1.2 Essential features

Features of the ADI4 module

The module has the following essential features:

- PROFIBUS DP connection (maximum of 12 Mbits/s)
- 4 servo interfaces
  - Inputs: TTL/SSI encoder for incremental and absolute measuring systems
  - Outputs: ±10 V analog
- General and drive-specific digital input/output signals
- On-board status display via four diagnostic LEDs

To supply the module and digital outputs with power, an external voltage source (+24 VDC) is needed.

1.1.3 Order number and firmware version

Order number

Order no.: 6FC5 211-0BA01-0AA4

Firmware version

The firmware version is not displayed directly on the module. The order number and firmware version correlate as follows:

Order number	Firmware version
6FC5 211-0BA01-0AA0	1.1.4
6FC5 211-0BA01-0AA1	1.2.2
6FC5 211-0BA01-0AA2	1.3.1
6FC5 211-0BA01-0AA3	1.4.4
6FC5 211-0BA01-0AA4	1.4.7

1.1.4 Boundary conditions

Boundary conditions for the ADI4 module

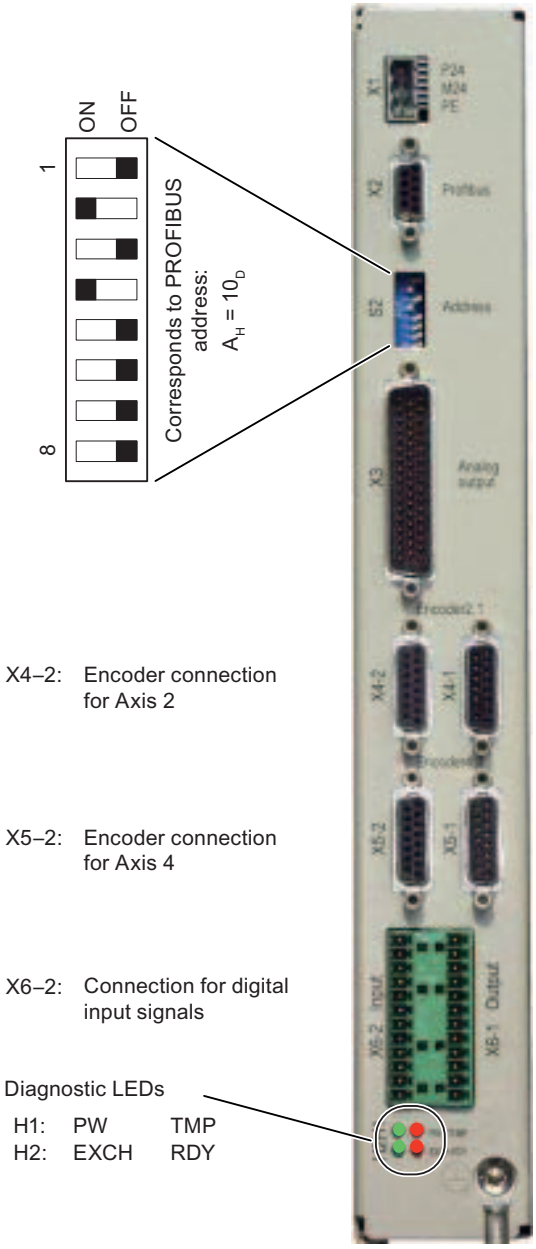
The following boundary conditions must be taken into account for the module:

- An ADI4 DP slave can only be operated on an **equidistant** PROFIBUS DP.
- An ADI4 DP slave is **not** a certified DP standard slave as defined by the PROFIDrive profile. For example, the ADI4 DP slave does not enable acyclic communication.

Hardware description

2

2.1 Overview of connections



X1: External power supply 24 VDC

X2: PROFIBUS connection

S2: DIP switch for setting the PROFIBUS address

X3: Analog setpoint outputs ± 10 VDC, Axis 1 to 4

X4–2: Encoder connection for Axis 2

X4–1: Encoder connection for Axis 1

X5–2: Encoder connection for Axis 4

X5–1: Encoder connection for Axis 3

X6–2: Connection for digital input signals

X6–1: Connection for digital output signals

Diagnostic LEDs

H1: PW TMP
H2: EXCH RDY

Connection for protective ground Screw M6

Figure 2-1 Overview of connections

2.2 Interface description

2.2.1 Interface overview

The module has the following interfaces:

Table 2- 1 Interface overview of ADI4

Interface	Designation	Type
External +24 V power supply	X1	Plug
PROFIBUS DP	X2	Socket
PROFIBUS DP address	S2	DIP switch
Analog setpoint interface	X3	Plug
Encoder connection for Axis 1	X4-1	Socket
Encoder connection for Axis 2	X4-2	Socket
Encoder connection for Axis 3	X5-1	Socket
Encoder connection for Axis 4	X5-2	Socket
Digital outputs	X6-1	Plug
Digital inputs	X6-2	Plug
Module status	H1/H2	LEDs

2.2.2 Interface (X1): External power supply

Connection

3-pin connector MSTB 2.5/3-ST-5.08 by Phoenix

Pin assignment

Table 2- 2 Pin assignment: External power supply (X1)

Pin	Designation	Type[1)]	Function
1	P24EXT1	VI	External supply for module (+24 V)
2	M24EXT1	VI	Reference for external supply
3	PE	VI	Protective conductor of the external supply
[1)] VI: Voltage input			

Connection cables

The required connecting cables must be provided by the user:

Wire, conductor cross section: 1.0 - 1.5 mm^2 (AWG17 - AWG16)

Supply voltage

The specifications of the supply voltage can be found in Section "Power supply (Page 28)".

2.2.3 Interface (X2): PROFIBUS DP

Connection

9-pin sub D socket

Pin assignment

Table 2- 3 Pin assignment: PROFIBUS DP (X2)

Pin	Designation	Type[1)]	Function
1	-	-	-
2	-	-	-
3	RxD/TxD-P	B	Receive/transmit data P (B line)
4	RTS	O	Request to Send
5	DGND	VO	Data reference potential (M5V)
6	VP	VO	Supply voltage plus (P5V)
7	-	-	-
8	RxD/TxD-N	B	Receive/transmit data N (A line)
9	-	-	-

[1)] VO: Voltage output
O: Output
B: Bidirectional

Connectors

- 6ES7 972-0BA41-0XA0; cable outlet 35°, without PG connection socket
- 6ES7 972-0BB41-0XA0; cable outlet 35°, with PG connection socket

Cables

- 6XV1 830-0EH10; by the meter; without trailing capability
- 6XV1 830-3EH10; by the meter; with trailing capability

Other technical data

Maximum possible data rate: 12 Mbits/s

2.2.4 Interface (S2): PROFIBUS address

Setting

The PROFIBUS address of the ADI4 DP slave is set via switch S2.

- Available PROFIBUS addresses: 1 - 127

Table 2- 4 Meaning of switch S2

Switches	Meaning
1	PROFIBUS address: $2^0 = 1$
2	PROFIBUS address: $2^1 = 2$
3	PROFIBUS address: $2^2 = 4$
4	PROFIBUS address: $2^3 = 8$
5	PROFIBUS address: $2^4 = 16$
6	PROFIBUS address: $2^5 = 32$
7	PROFIBUS address: $2^6 = 64$
8	Not used

NOTICE
A newly set PROFIBUS address will only come into effect after power OFF/ON.

2.2.5 Interface (X3): Analog setpoint interface

Connection

50-pin sub D connector

Pin assignment

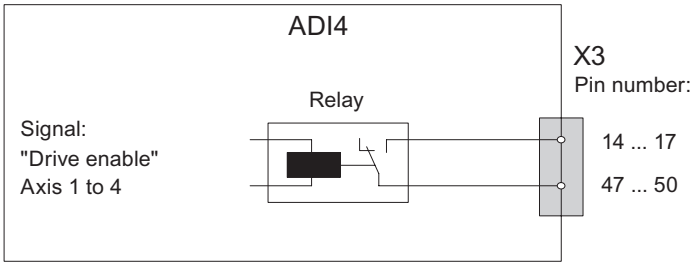
Table 2- 5 Pin assignment: Analog setpoint interface (X3)

Pin	Designation	Type[1)]	Function
1	SW1	VO [3)]	Setpoint of Axis 1 (±10 V)
2	BS2	VO	Reference for setpoint of Axis 2
3	SW3	VO [3)]	Setpoint of Axis 3 (±10 V)
4	BS4	VO	Reference for setpoint of Axis 4
5-13	-	-	-
14	RF1_1	K [2)]	"Drive enable" of Axis 1, Relay Contact 1
15	RF2_1	K [2)]	"Drive enable" of Axis 2, Relay Contact 1
16	RF3_1	K [2)]	"Drive enable" of Axis 3, Relay Contact 1
17	RF4_1	K [2)]	"Drive enable" of Axis 4, Relay Contact 1
18-33	-	-	-
34	BS1	VO	Reference for setpoint of Axis 1
35	SW2	VO [3)]	Setpoint of Axis 2 (±10 V)
36	BS3	VO	Reference for setpoint of Axis 3
37	SW4	VO [3)]	Setpoint of Axis 4 (±10 V)
38-46	-	-	-
47	RF1_2	K [2)]	"Drive enable" of Axis 1, Relay Contact 2
48	RF2_2	K [2)]	"Drive enable" of Axis 2, Relay Contact 2
49	RF3_2	K [2)]	"Drive enable" of Axis 3, Relay Contact 2
50	RF4_2	K [2)]	"Drive enable" of Axis 4, Relay Contact 2

1) VO Voltage output
K Relay contact

2) Max. current carrying capacity: 2 A for 150 VDC or 125 VAC
Max. number of switching cycles:
- 24 VDC, 1 A: 10^7
- 24 VDC, 2 A: 10^5

3) Max. current carrying capacity: 10 mA (RL: 1 kW - 2 kW)



Prefabricated cables

Order no.: 6FX2 002-3AD01-□□□□

Cable length: ≤ 35 m

Information regarding the length codes is provided in:
References: /Z/ Catalog NC Z

Resolution of setpoint outputs

The analog setpoint outputs on the interface (X3) have the following resolution: 16-bit, including sign.

2.2.6 Interfaces (X4-1/X4-2/X5-1/X5-2): Encoder interfaces

Connection

15-pin sub D socket

Pin assignment

Table 2- 6 Pin assignment: Encoder interface of Axis 1 to 4 (X4-1/X4-2/X5-1/X5-2) for incremental encoder (TTL) and absolute encoder (SSI)

Pin	Designation[1]		Type[2]	Function
	Incremental	Absolute (SSI)		
1	Not assigned		-	-
2	-	CLSx	O	SSI shift clock
3	-	CLSx_N	O	SSI shift clock inverted
4	P5MS		VO	5 VDC supply voltage
5	P24SSI		VO	24 VDC supply voltage
6	P5MS		VO	5 VDC supply voltage
7	MEXT		VO	Reference for supply voltage
8	Not assigned		-	-
9	MEXT		VO	Reference for supply voltage
10	Rx_S	-	I	Zero mark signal (U_{a0})
11	XRx_S	-	I	Zero mark signal inverted ($/U_{a0}$)
12	XBx_S	-	I	Encoder signal Track B inverted ($/U_{a2}$)
13	Bx_S	-	I	Encoder signal Track B (U_{a2})
14	XAx_S	-	I	Encoder signal Track A inverted (U_{a1})
	-	DATAx_N	I	SSI data inverse
15	Ax_S	-	I	Encoder signal Track A (U_{a1})
	-	DATAx	I	SSI data

[1] x_ : Number of the encoder interface with (X4-1) = 1, (X4-2) = 2, (X5-1) = 3, (X5-2) = 4
[2] VO: Voltage output
I: Signal input
O: Signal output

Prefabricated cables

The following prefabricated cables can be used, depending on the encoder type:

- **Incremental encoder (TTL) with RS 422 and operating voltage 5 V or 24 V**

  Order no.: 6FX8 002-2CD01-1□□0 (5 V)

  Order no.: 6FX5 002-2CD24-1□□0 (24 V)
  Information on the cable lengths can be found in the "Maximum cable lengths" section.

- **Absolute encoder with SSI**

  Order no.: 6FX8 002-2CC11-□□□0

  Information on the cable lengths can be found in the "Maximum cable lengths" section.

- **1FT5 motor with integrated ROD320 encoder**

  Order no.: 6FX8 002-2CE02-1□□0

  Cable length: Can be found in the "Maximum cable lengths" section.

  Information regarding the length codes is provided in:

  References: /Z/ Catalog NC Z

Maximum cable lengths

The maximum cable length depends on the following two parameters:

- **Encoder supply voltage**

Table 2- 7 Encoder supply voltage

Supply voltage: 5 VDC		
Tolerance	**Current consumption**	**Max. cable length**
4.75 V to 5.25 V	≤ 300 mA	25 m
4.75 V to 5.25 V	≤ 220 mA	35 m

Supply voltage: 24 VDC		
Tolerance	**Current consumption**	**Max. cable length**
20.4 V to 28.8 V	≤ 300 mA	100 m
11 V to 30 V	≤ 300 mA	300 m

- **Transmission frequency**

Table 2- 8 Transmission frequency

Encoder type	Supply voltage	Frequency	Max. cable length
Incremental (TTL)	5 V	1 MHz	10 m
		500 kHz	35 m
	24 V	500 kHz	150 m
Absolute (SSI)	24 V	1.5 Mbits/s	10 m
		187.5 Kbits/s	250 m

Note

If cable lengths longer than 25 m or 35 m are needed for incremental encoders, encoder types with a 24 VDC supply voltage can be used instead.

CAUTION

To ensure error-free transmission of encoder data, do not exceed the maximum cable lengths shown in these tables.

Encoder supply voltages

The encoder supply voltages must comply with the following specification:

Table 2- 9 Specification of encoder supply voltages

	Supply voltage[1)]	
	P5MS	P24SSI
Voltage		
• Minimum	4.75 V	20.4 V
• Nominal	5 V	24 V
• Maximum	5.25 V	28.8 V
Ripple		
• Maximum	50 mV_{pp}	3.6 V_{pp}
Current load		
• Per encoder connection	0.3 A	
• Maximum	1.35 A	1 A

[1)] P5MS: Supply voltage for encoder (+5 VDC)
P24SSI: Supply voltage for encoder (+24 VDC)

Connectable measuring systems

Incremental encoder (TTL)

- Differential transmission with RS 422 and operating voltage 5 V or 24 V:
  - Track A as true and inverted signal (U_{a1}, /U_{a1})
  - Track B as true and inverted signal (U_{a2}, /U_{a2})
  - Zero signal N as true and inverted signal (U_{a0}, /U_{a0})
- Maximum output frequency: 1.5 MHz
- Phase shift of Track A to Track B: 90° ± 30°
- Current consumption: Max. 300 mA
- Encoders with distance-coded zero marks/reference marks are not generally enabled.

Absolute encoder (SSI)

- Transmission method: Synchronous serial interface (SSI) according to RS 485 with 5 V differential signal transmission (RS 422 standard)
  - Output signal: Data as true and inverted signal
  - Input signal: Shift clock as true and inverted signal
- Data transmission format: "Pine tree"
- Resolution: maximum of 25 bits
- Maximum transmission rate: 1 Mbit/s
- Current consumption: Max. 300 mA

The following SSI encoders are supported:

- All SSI encoders in the pine tree format whose MsgLength is equal to the number of "significant data bits":
  - 25-bit with 12-bit multiturn and 13-bit single-turn information (setting of the MsgLength 25)
  - 21-bit with 8-bit multiturn and 13-bit single-turn information (setting of the MsgLength 21)
  - 21-bit with 9-bit multiturn and 12-bit single-turn information (setting of the MsgLength 21)
  - 13-bit with 13-bit single-turn information (setting of the MsgLength 13)
- SSI encoder in the pine tree format with the following data:
  - 25-bit with 12-bit multiturn and 12-bit single-turn (setting of the MsgLength 24)
  - 21-bit with 8-bit multiturn and 12-bit single-turn information (setting of the MsgLength 20)
  - 13-bit with 12-bit single-turn information (setting of the MsgLength 12)
  - This applies as long as the encoder permits that not all available data is read!
- All right-justified encoders that satisfy the first condition indicated above.

2.2.7 Interface (X6-1): Digital outputs

Connection

Two 12-pin connectors FK-MCP 1.5/15-ST-3.81 by Phoenix

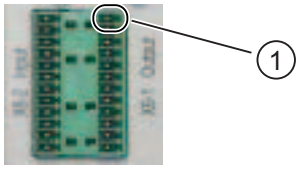
Pin assignment

Table 2- 10 Pin assignment: digital output interface (X6-1)

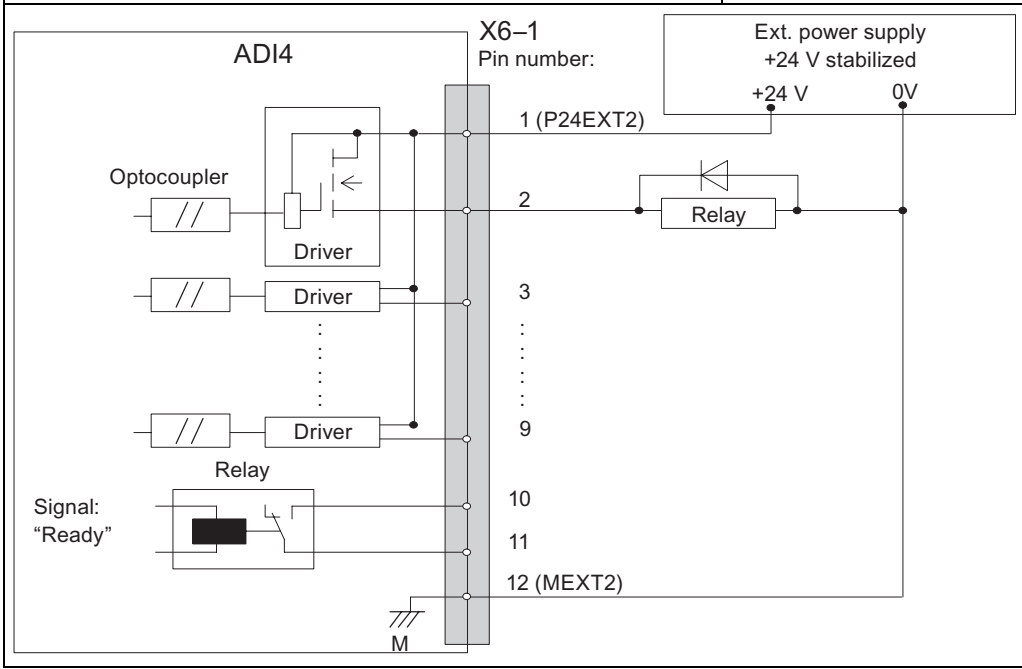
Pin	Designation	Type[1)]	Function
1	P24EXT2	VI	External 24 VDC supply voltage
2	Q0	DO	Digital output signal 1
3	Q1	DO	Digital output signal 2
4	Q2	DO	Digital output signal 3
5	Q3	DO	Digital output signal 4
6	DIR1	DO	Digital output signal 5 or directional signal of Axis 1[3)]
7	DIR2	DO	Digital output signal 6 or directional signal of Axis 2[3)]
8	DIR3	DO	Digital output signal 7 or directional signal of Axis 3[3)]
9	DIR4	DO	Digital output signal 8 or directional signal of Axis 4[3)]
10	RDY1	K [2)]	"Ready" signal of Relay Contact 1
11	RDY2	K [2)]	"Ready" signal of Relay Contact 2
12	MEXT2	VI	Reference of the external supply voltage

[1)] VI: Voltage input
DO: Digital output (24 V)
K: Relay contact
[2)] Max. current carrying capacity: 2 A for 150 VDC or 125 VAC;
Max. number of switching cycles:
- 24 VDC, 1 A: 10^7
- 24 VDC, 2 A: 10^5

[3)] For "unipolar spindle" function (or unipolar motor)



① PIN 1



Supply voltage

To supply the digital outputs with power, an external 24 VDC voltage source must be connected to X6-1, Pin 1 (P24EXT2).

The reference ground of the external voltage source must be connected to X6-1, Pin 15 (MEXT2).

You will find additional information in Section "Technical data (Page 31)".

Electrical specification

Table 2- 11 Electrical specification of the digital outputs

Digital outputs	Min.	Typical	Max.	Nominal
High-level voltage (U_H)	V_{CC} - 3 V	1)	V_{CC}	24 V
Output current I_{OUT}	-	-	500 mA	-
Voltage with low level (U_L)	-	-	-	0 V
Leakage current at low level	-	50 µA	400 µA	-
Signal delay T_{PHL}, T_{PLH} 2)	-	0.5 ms	-	-

Supply voltage of the digital outputs
1) Typical output voltage: V_{CC} - I_{OUT} *R_{ON} - 0.65 V
V_{CC}: Current operating voltage P24EXT2
Max. output current I_{OUT}: 500 mA
max. short-circuit current: 4 A (max. 100 µs, V_{CC} = 24 V)
Internal resistance R_{ON}: 0.4 Ω

2) The PROFIBUS communication time as well as the application cycle time must also be taken into account.

Incorrect connection (polarity reversal) causes neither high level nor destruction of the outputs.

General electrical properties

- Galvanic isolation using optocouplers
- Current limitation to a maximum 500 mA
- Protection against: short-circuit, overtemperature, and loss of ground
- Automatic disconnection in case of undervoltage

Relay contact: "Ready" signal

The relay contact remains open or is **opened** if the module is in one of the following states:

- Initialization of the module after Power ON
- Power failure or hardware interrupt (NMI)
- No cyclic communication to the DP master
- PLL error
- Synchronization error
- Overtemperature

The relay contact is **closed** if both conditions are present:

- Module status "Ready"
- Cyclic communication with the DP master

Connection cables

The required connecting cables must be provided by the user:

- Supply voltage X6-1, Pin 1 and 12 (P24EXT2):
  Wire, conductor cross-section of 1.5 mm^2 (AWG16)
- Digital outputs X6-1, Pins 2 to 9:
  Wire, conductor cross-section 0.5 to 1.5 mm^2 (AWG20 - AWG16)
- Ready X6-1, Pin 10 and 11:
  Wire, conductor cross-section of 1.5 mm^2 (AWG16)

NOTICE
The maximum permissible length of the digital signal cable is 30 m.

2.2.8 Interface (X6-2): Digital inputs

Connection

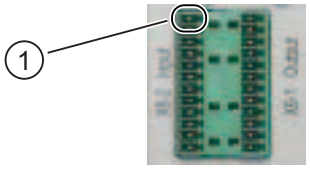
Two 12-pin connectors FK-MCP 1.5/15-ST-3.81 by Phoenix

Pin assignment

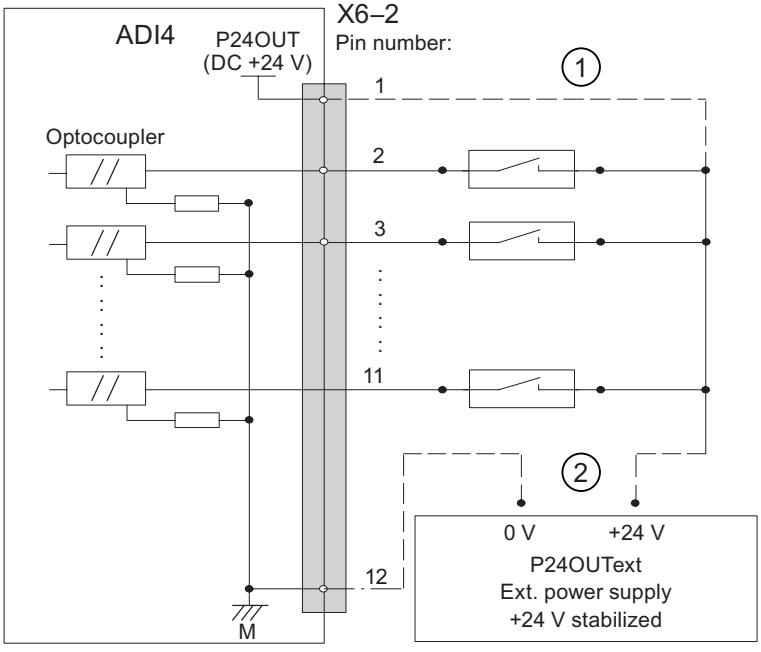
Table 2- 12 Pin assignment: Digital input interface (X6-2)

Pin	Designation	Type [1]	Function
1	P24OUT	VI	24 VDC supply voltage
2	BERO1	DI	Input signal of BERO / external zero mark 1
3	BERO2	DI	Input signal of BERO / external zero mark 2
4	BERO3	DI	Input signal of BERO / external zero mark 3
5	BERO4	DI	Input signal of BERO / external zero mark 4
6	MEPU1	DI	Measuring signal of Measuring Input 1 (see "Measuring inputs" below)
7	MEPU2	DI	Measuring signal of Measuring Input 2 (see "Measuring inputs" below)
8	DRV1_RDY	DI	"Drive Ready" signal of Axis 1
9	DRV2_RDY	DI	"Drive Ready" signal of Axis 2
10	DRV3_RDY	DI	"Drive Ready" signal of Axis 3
11	DRV4_RDY	DI	"Drive Ready" signal of Axis 4
12	MOUT	VI	Reference of the supply voltage

[1] VI: Voltage input
DI: Digital input (24 V)



① PIN 1



① Connection if the internal supply voltage P24OUT is used;
the connection in accordance with ② is no longer required.

② Connection if an external supply voltage P24OUText is used;
the connection in accordance with ① is no longer required.

Internal supply voltage P24OUT

Specification of the internal supply voltage P24OUT available at X6-2, Pin 1 for the digital inputs:

Table 2- 13 Specification of the supply voltage P24OUT

Voltage	
• Minimum	20.4 V
• Nominal	24 V
• Maximum	28.8 V
Ripple	
• Maximum	3.6 V_{pp}
Current load	
• Typical	0.1 A
• Maximum	1 A
Power consumption	
• Typical	3.02 W
• Maximum	30.2 W
Insulation Class	A, in accordance with DIN 57110b
Typical output voltage: V_{CC} - I_{OUT} * RON - 0.65 V V_{CC}: Current P24OUT operating voltage Max. output current I_{OUT}: 1 A Inner flow resistance R_{ON}: 0.4 Ω The supply voltage P24OUT is short-circuit proof.	

External supply voltage P24OUText

If an external supply voltage is used, its reference ground must be connected to X6-2, Pin 12 (M).

X6-2, Pin 1 (P24OUT) then remains open.

Electrical specification

Digital inputs	Min.	Typical	Max.	Nominal
High-level voltage (U_H)	15 V	1)	30 V	24 V
Input current I_{IN} at U_H	3.7 mA	-	7.5 mA	-
Voltage with low level (U_L)	-30 V	-	+5 V	0 V
Signal delay T_{PHL}, T_{PLH} 2)	-	3 µs	-	-
1) See table "Specification of the supply voltage P24OUT" 2) The PROFIBUS communication time as well as the application cycle time must also be taken into account. Incorrect connection (polarity reversal) causes neither high level nor destruction of the inputs.				

Connection cables

The required connection cables must be provided by the user.

- Supply voltage X6-2, Pin 1 (P24OUT), external supply voltage P24OUText:
  Wire, conductor cross-section of 1.5 mm² (AWG16)
- Digital inputs X6-2, Pins 2 to 11:
  Wire, conductor cross-section 0.5 to 1.5 mm² (AWG20 - AWG16)

General electrical properties

- Galvanic isolation using optocouplers
- Active current limiting of the inputs
- Protection from negative input voltage

Measuring input

ADI4 supports only measurement of a rising **or** falling edge of the measuring input. A simultaneous request for measurement on a rising edge and a falling edge of the measuring input cannot be parameterized.

2.2.9 Interface (H1/H2): Module status

The module status is displayed on the front of the module with four diagnostic LEDs.

Table 2- 14 Diagnostic LEDs (H1/H2)

Designation		Color	Description
H1	POWER	Green	Supply voltage LED = Off: Supply voltage not applied LED = On: Supply voltage is applied
	OVTEMP	Red	Overtemperature display LED = Off: Device temperature < overtemperature limit LED = On: Device temperature ≥ Overtemperature limit
H2	EXCHANGE	Green	Status: Message frame exchange with DP master LED = Off: No message frame exchange with DP master LED = On: Cyclic message frame exchange with DP master
	READY	Red	Ready status: Message frame exchange with DP master LED = Off: Not yet ready LED = On: Ready LED = Off and EXCHANGE = On: Message frame exchange active LED = flashing: Error occurred during message frame exchange

2.3 Control cabinet installation

Installation

For high frequency interference currents, the housing of the ADI4 module must be connected with low-resistance to the back wall of the control cabinet, and this wall in turn must be connected with low-resistance to the motors/machines. The module should be installed on a bare mounting wall. The connection between the mounting wall and the motors/machines must be electrically conductive and have a large surface area. Coated cabinet walls and DIN rails, or similar mounting means with a small contact area, do not meet this requirement.

Cable routing

Power and signal cables must always be routed separately. All I/O interface (X6-1/X6-2) signal lines should exit jointly. Single strands that are related from the signal point of view must be twisted together. Signal cables and encoder cables should be installed separately.

All cables and lines within the control cabinet should always be placed as close as possible to the control cabinet walls. Extended installation through open space can cause interference injections (antenna effect). The proximity to sources of interference (contactors, transformers, etc.) must be avoided by placing a shield plate between the cable and the source of interference, if necessary. Cables and conductors should not be extended using terminals or similar devices. To protect against interference injections from external sources, signal cables must be shielded.

⚠ WARNING
The module has been designed for operation in an enclosed control cabinet. Operation outside an enclosed control cabinet is not permissible.

2.4 Power supply

ADI4 module

To supply the ADI4 module (+24 VDC), an external power source is needed. The power supply is connected through terminal X1 (P24EXT1) on the front panel of the ADI4 module. Refer to Section "Interface (X1): External power supply (Page 13)" for more information.

Digital outputs

To supply (+24 VDC) the digital outputs, an external power source is needed. The power supply is connected through Terminal X6-1, Pin 1 (P24EXT2). Refer to Section "Interface (X6-1): Digital outputs (Page 21)" for more information.

Digital inputs

If the digital inputs are not supplied with the internal supply voltage of X6-2, Pin 1 (P24OUT), this supply voltage can optionally be replaced with an external power source (+24 VDC, 1 A maximum).

The reference ground (GND) of the external power supply source must be connected with X6-2, Pin 12. X6-2, Pin 1 (P24OUT) remains open.

Specification of the supply voltages (+24 VDC)

The external supply voltages for the ADI4 module, the digital outputs, and optionally the digital inputs must comply with the specifications provided in the "Encoder supply voltages" table.

Table 2- 15 Specification of the external supply voltages

	Supply voltage[1)]		
	P24EXT1	**P24EXT2**	**P24OUText**
Voltage			
• Minimum		18.5 V	
• Nominal		24 V	
• Maximum		30.2 V	
Ripple			
• Maximum		3.6 V_{pp}	
Current load			
• Typical	0.5 A	-	0.1 A
• Maximum	1 A	8 A	1 A
Power consumption			
• Typical	12 W	-	3.02 W
• Maximum	30.2 W	241.6 W	30.2 W

[1)] P24EXT1: Supply voltage of the ADI4 module
P24EXT2: Supply voltage for the digital outputs
P24OUText: Optional supply voltage for the digital inputs

CAUTION
The external supply voltages must each be generated as functional extra-low voltage with safe electrical isolation (DIN EN 60204-1, PELV).

Fuse

On the module side, supply voltages P24EXT1 and P24EXT2 must be protected against the following:

- Overvoltage
- Short-circuit (electrical current limiting of outputs)
- Polarity reversal
- Overload
  - P24EXT1: Fuse 2.5 A / 250 V
  - P24EXT2: Fuse 8 A / 125 V

2.5 Grounding

Grounding

The module must be installed according to EN 60204.

The user must ground each of the supply voltages. To do this, a connection must be established from Terminal X1, Pin 2 (MEXT1) or X6-1, Pin 15 (MEXT2) to a central grounding point of the system.

If a large-area, permanent metallic connection with the central grounding point is not possible using the rear panel, the module must be connected to the grounding rail by means of a wire (cross-section > 10 mm^2).

⚠ CAUTION
A protective conductor must be connected. An M6 screw is provided on the lower right of the front of the housing to connect the protective conductor. See "Overview of connections (Page 11)".

2.6 Dimension drawing

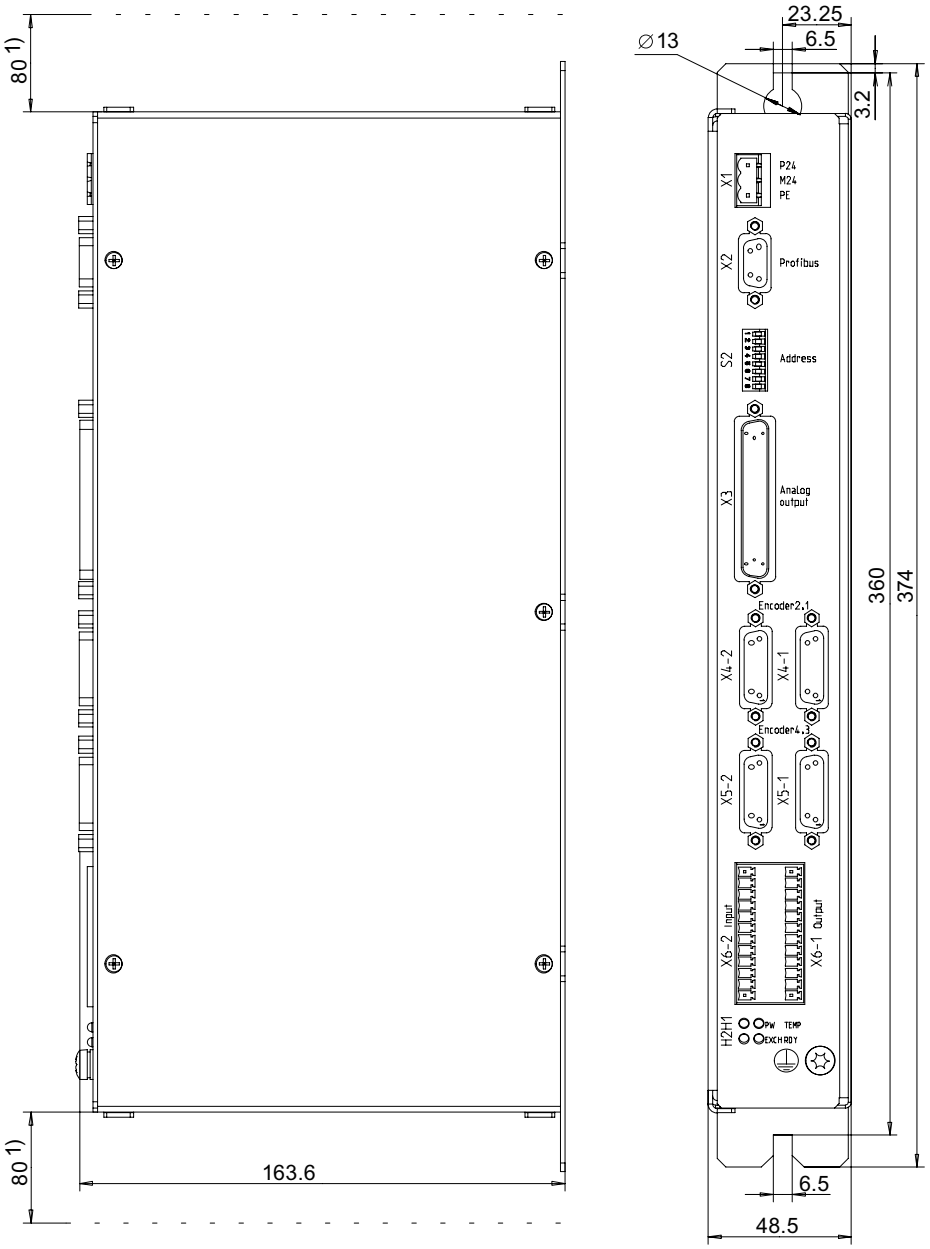


Figure 2-2 Dimension drawing: ADI4

1) Necessary clearance to ensure sufficient ventilation

Maximum tightening torque for all screws: 0.8 Nm

2.7 Technical data

Table 2- 16 Technical data of the ADI4 module

Safety		
Degree of protection	IP20	
Protection class	Protection class I in accordance with VDE 0106 Part 1: 1982 (IEC 536); Protection against ingress of foreign bodies and water in accordance with IEC 529	
Approvals	UL/CSA, CE	
Power consumption		
Nominal load	12 W	
Maximum	30.2 W	
Mechanical specifications		
Dimensions WxHxD [mm]	154.4 x 325 x 48.5	
Weight	Approximately 1.5 kg	
Climatic ambient conditions		
Heat dissipation	Open-circuit-ventilated	
	Operation	**Storage/transport**
Temperature limits	0 … +55° C	-20 to 55 °C/-40 to 70 °C
Relative humidity limits	5 to 95 % without condensation	5 to 95 % without condensation
Condensation	Not permitted	
Atmospheric pressure	700 to 1060 hPa	700 to 1060 hPa
Transportation altitude	-	-1000 to 3000 m
Shock stress during transportation		
Free fall in transport packaging	≤ 1000 mm	

Parameter assignment

3

3.1 Boundary conditions of ADI4 DP slave

NOTICE
The following boundary conditions must be taken into account for the operation of an ADI4 DP slave on the PROFIBUS DP: • An ADI4 DP slave is not a certified DP standard slave as defined by the PROFIDrive profile. For example, an ADI4 DP slave does not enable acyclic communication. Therefore, an ADI4 DP slave can only be operated on a DP master specially released for this purpose. • An ADI4 DP slave can only be operated on an equidistant PROFIBUS DP. The minimum DP cycle is 1 ms.

3.2 Requirements

Components for parameter assignment

The following components are required for assigning parameters for an ADI4 DP slave:

- ADI4:
  as of order number: 6FC5 211-0BA01-0AA1
  Firmware Version 01.02.02 and higher
- SIMATIC STEP 7 Version 5.1 and higher
- SIMOTION
  - SIMOTION P or C: SIMOTION V2.1 and higher (SCOUT and Runtime)
  - SIMOTION D: SIMOTION V3.1 and higher (SCOUT and Runtime)

3.3 PROFIBUS DP parameter assignment

3.3.1 Parameter assignment sequence

Parameter assignment sequence

The PROFIBUS DP parameter assignment for the ADI4 DP slave can be generally divided into the following steps:

1. Step

   After inserting the ADI4 DP slave in the configuration, the following parameters are assigned on a slave-specific basis:

   – PROFIBUS parameters (see Section "PROFIBUS parameters (Page 35)")

   – Function parameters (see Section "Function parameters (Page 43)")

   Step 1 should be carried out first for **all** ADI4 DP slaves needed in the configuration.

2. Step

   Parameter assignment of the equidistant cyclic DP communication (see Section "Parameter assignment of the DP communication (Page 55)")

   Step 2 can be performed **last** on **any** ADI4 DP slave. These settings can be transferred to all other ADI4 DP slaves by means of the adjustment function of the SlaveOM.

3.3.2 Inserting an ADI4 DP slave in the configuration

Procedure

1. To insert an ADI4 DP slave in the configuration, open the hardware catalog using the **View > Catalog** menu command.

   The ADI4 DP slave can be found at:

   – Profile: **Standard**

   PROFIBUS DP > SINUMERIK > ADI4

   SIMATIC Technology CPU
   If S7-Technology was installed for the Technology CPU, the ADI4 DP slave is located under:

   – Profile: **SIMATIC Technology CPU**

   PROFIBUS DP (DRIVE) > Other FIELD DEVICES > SINUMERIK > ADI4

2. Using a drag-and-drop operation, select the ADI4 DP slave and move it onto to the DP master system in the station window.

   The DP master system is displayed in the station window with the following symbol:

When you release the left mouse button, the DP slave ADI4 is inserted into the configuration.

Note

As you drag the DP slave, the cursor appears as a circle with a slash through it. When the cursor is positioned exactly over the DP master system, it changes to a plus sign, and the DP slave can be added to the configuration.

3.4 PROFIBUS parameters

3.4.1 Parameter components

Configuring the PROFIBUS parameters

The PROFIBUS parameters are a result of the following:

- PROFIBUS address
- Number of axes and encoders (message frame type)
- I/O addresses

3.4.2 PROFIBUS address

Procedure

Inserting an ADI4 DP slave into the configuration will open the "Properties - PROFIBUS Interface ADI4" dialog, "Parameters" tab:

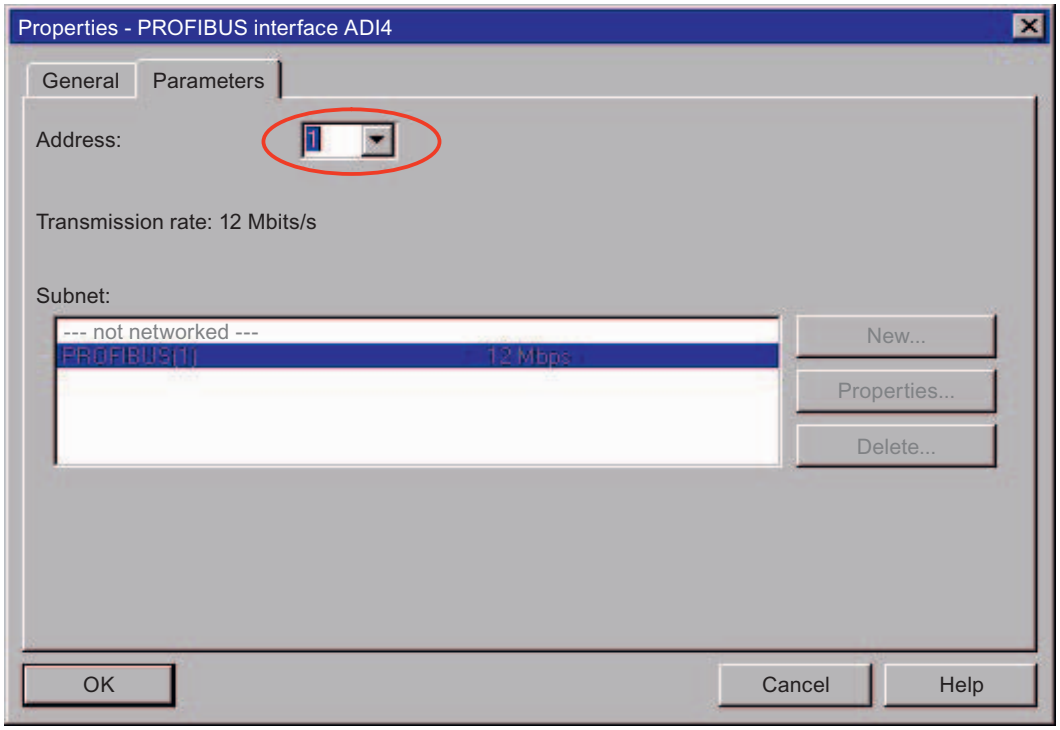


Figure 3-1 PROFIBUS address

The displayed address value was automatically set by HW Config to the next available PROFIBUS address within the configuration.

NOTICE
The PROFIBUS address of the ADI4 DP slave can be set to any value, in principle. However, it must be ensured that the PROFIBUS address setting in HW Config matches the DIP switch setting on the ADI4 DP slave: There is **no automatic adjustment**! The following data must agree: • SIMATIC S7 configuration ADI4 DP slave **PROFIBUS address** • ADI4 module DIP switch S2 **PROFIBUS address**

After the dialog is confirmed with "OK", the "DP Slave Properties" dialog box is opened. Continue with the parameter assignment for the message frame type.

3.4.3 Message frame type

Message frame type

The ADI4 DP slave is operated with a specific message frame type:

4 axes, each with one encoder (standard message frame 3) and I/O data

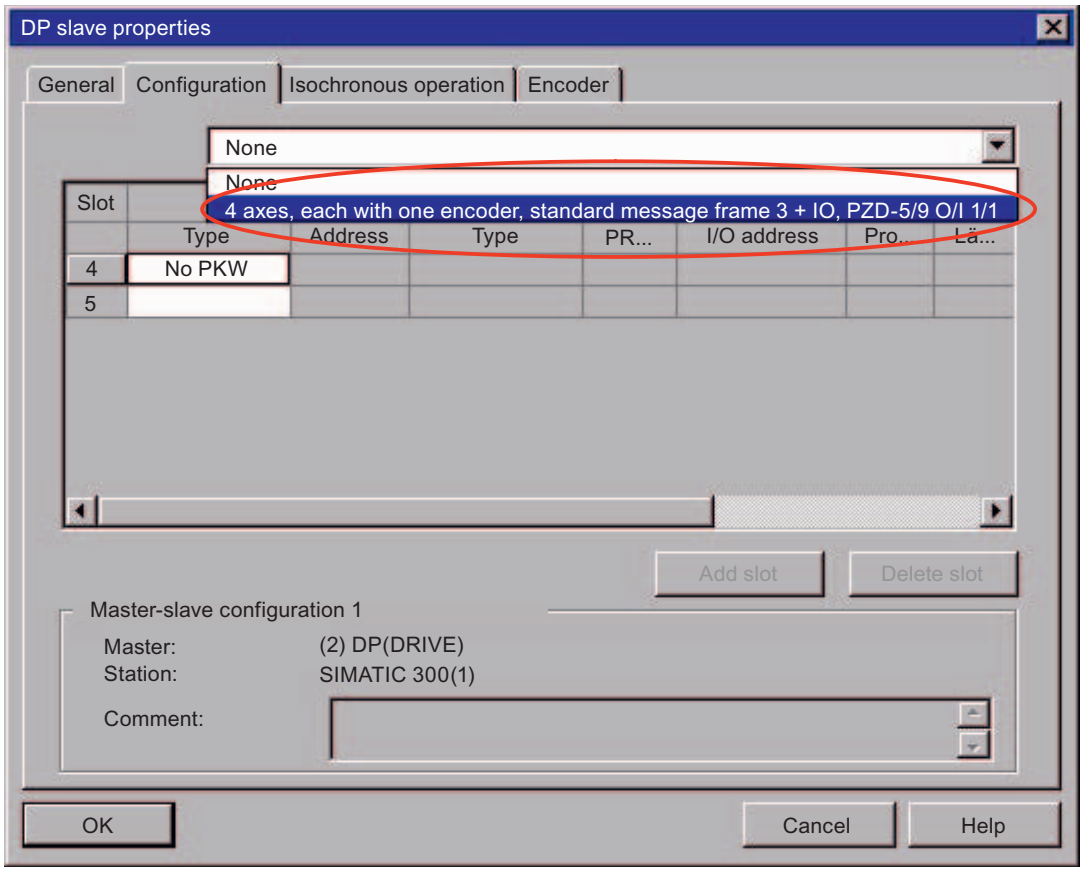


Figure 3-2 Message frame type

Setting the message frame type

By default, no message frame type is selected. The ADI4-specific message frame type must be explicitly selected in the "Configuration" tab.

1. In the "DP Slave Properties" dialog box, select the "Configuration" tab.
2. In the "Default" list, select the entry "4 axes, each with one encoder, Standard message frame 3 + IO, PZD-5/9 O/I 1/1".
3. Click "OK".

Message frame structure

The message frame is structured as follows:

Table 3- 1 Message frame structure

Message frame type	Description
4 axes, each with one encoder, Standard message frame 3 + IO, PZD-5/9 O/I 1/1	4 x Standard message frame 3 and 1 PZD word each for digital I/O data
PZD x/y Number of process data words, x: Setpoint, y: Actual value, e.g. PZD-5/9: 5 process data words for setpoints 9 process data words for actual values	

ADI4 message frame structure

Axis1	Axis2	Axis3	Axis4	I/O	
STD 3	STD 3	STD 3	STD 3	O word	Setpoints (master -> slave)

Low / High

Axis1	Axis2	Axis3	Axis4	I/O	
STD 3	STD 3	STD 3	STD 3	O word	Actual values (slave -> master)

STD 3: standard message frame 3 per PROFIDrive Specification V3.0
Q word: digital output data (16 bits)
I word: digital input data (16 bits)

Standard message frame 3: speed setpoint interface 32 bits with 1 encoder

PZD1	PZD2	PZD3	PZD4	PZD5	
STW1	NSET_B		STW2	G1_STW	Setpoint (master -> slave)

Low / High

PZD1	PZD2	PZD3	PZD4	PZD5	PZD6	PZD7
ZSW1	NACT_B		ZSW2	G1_ZSW	G1_XIST1	

PZD8	PZD9	
G1_XIST2		Actual value (slave -> master)

O word (dig. output data 16 bits)

High-Byte				Low-Byte			
15	12	11	8	7	4	3	0

- Dig. outputs 1–4 -> X6–1: Pin 2–5
- Dig. output 5–8 / direction signal 1–4 for unipolar spindle -> X6–1: Pin 6–9
- 611U conformant mode
Select: Homing using external zero mark signals 1 to 4
- Not used

O word (dig. output data 16 bits)

High-Byte			Low-Byte				
15	10	9	8	7	6	5	4	3	0

- Dig. inputs 1–4/ext. zero marks 1–4 –> X6–2: Pin 2–5
- Dig. input 5–6 / Measuring input 1–2 –> X6–2: Pin 6–7
- Dig. input 7–8 / Drv_Rdy 1–2 –> X6–2: Pin 8–9
- Dig. input 9–10/Drv_Rdy 3–4 –> X6–2: Pin 10–11
- Not used

NOTICE
The message frame type setting for the ADI4 DP slave in HW Config must agree with the message frame type setting in the controller. There is **no automatic adjustment**.

Encoder control word Gx_STW

Description of the encoder control word (extract) for:

- Find reference mark
- On-the-fly measurement
- Encoder error

Table 3- 2 Encoder control word Gx_STW (extract)

<table>
<tr><th>Bit</th><th colspan="2">Name</th><th colspan="4">Signal status, description</th></tr>
<tr><td rowspan="6">0</td><td rowspan="11" colspan="2">Find reference mark
or
On-the-fly measurement</td><td rowspan="11">Functions</td><td colspan="4">Find reference mark: Bit 7 = 0</td></tr>
<tr><td></td><td>Bit</td><td>Meaning</td><td>Homing using:</td></tr>
<tr><td></td><td>0</td><td>Function 1:</td><td>Encoder zero mark (except in "611U conformant mode")</td></tr>
<tr><td></td><td>1</td><td>Function 2:</td><td>Rising edge of external zero mark</td></tr>
<tr><td></td><td>2</td><td>Function 3:</td><td>Falling edge of external zero mark</td></tr>
<tr><td></td><td>3</td><td>Function 4:</td><td>Not used</td></tr>
<tr><td rowspan="6">1</td><td colspan="4">On-the-fly measurement: Bit 7 = 1</td></tr>
<tr><td></td><td>Bit</td><td>Meaning</td><td>Measuring using:</td></tr>
<tr><td></td><td>0</td><td>Function 1:</td><td>Measuring Input 1 rising edge</td></tr>
<tr><td></td><td>1</td><td>Function 2:</td><td>Measuring Input 1 falling edge</td></tr>
<tr><td></td><td>2</td><td>Function 3:</td><td>Measuring Input 2 rising edge</td></tr>
<tr><td></td><td>3</td><td>Function 4:</td><td>Measuring Input 2 falling edge</td></tr>
<tr><td>2</td><td colspan="4" rowspan="3">Note
• Bit 0 to 3
Bit x = 1 Function requested
Bit x = 0 Function not requested
• If more than one function is enabled, the values for all functions cannot be read until all functions have ended and this has been signaled via the relevant status bit (G1_ZSW, Bit 0 - Bit 3 = 0).
• On-the-fly measurement
The rising and falling edges of the measuring input can be enabled simultaneously. The measuring input signal is detected according to the direction of the signal change. The measured values are read out consecutively.
Notice
ADI4 only supports measurement on a rising or falling edge.
• Find reference mark and on-the-fly measurement
Only one of the two functions can be active at a time.</td></tr>
<tr><td>3</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Command</td><td>Bit 6, 5, 4</td><td colspan="2">Meaning</td></tr>
<tr><td>000</td><td colspan="2">- -</td></tr>
<tr><td>001</td><td colspan="2">Activate function x</td></tr>
<tr><td>010</td><td colspan="2">Read value x</td></tr>
<tr><td>5</td><td></td><td>011</td><td colspan="2">Cancel function x</td></tr>
<tr><td>6</td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>7</td><td colspan="2">Mode</td><td>0
1</td><td colspan="2">Find reference mark
On-the-fly measurement</td></tr>
<tr><td>:</td><td colspan="3"></td><td colspan="2">:</td></tr>
<tr><td>15</td><td colspan="3">Encoder error</td><td>0
1</td><td colspan="2">No error
Encoder error pending; error code in Gx_XIST2</td></tr>
</table>

Additional encoder actual value Gx_XIST2

Error codes in Gx_XIST2 where G1_ZSW, Bit 15 = 1

Table 3- 3 Error codes in Gx_XIST2

G1_XIST2	Meaning	Possible causes/description
1_{Hex}	Encoder sum error	The encoder signal levels are too low, faulty (inadequate shielding) or cable breakage monitoring has been tripped.
2_{Hex}	Zero mark monitoring	A fluctuation in the measured rotor position has arisen between two encoder zero marks (encoder pulses may be lost).

3.4.4 I/O addresses

Requirements

For communication between the controller and the individual axes of an ADI4 DP slave, it is necessary that the setpoint and the actual value of an axis have the same I/O address.

HW Config takes this requirement into account automatically when an ADI4 DP slave is inserted in the configuration.

Inserting I/O addresses

1. In the "DP Slave Properties" dialog box, select the "Configuration" tab.
2. Under PROFIBUS partner, I/O addr., enter: **<I/O address>**.
3. Click "OK".

NOTICE

The setpoint and actual value of an axis must have the same I/O address.

I address (actual value) = O address (setpoint)

If an ADI4 DP slave is inserted into an S7 project through a copy operation, e.g., from another S7 project, the I/O addresses are assigned directly by HW Config. This may have the consequence that an axis is assigned different I/O addresses for setpoint and actual values. The I/O addresses must be manually corrected in this case.

To avoid access conflicts between the PROFIBUS DP drives and the I/O modules, values **≥ 272** must be used for I/O addresses for the ADI4 DP slave.

3.4.5 Consistency

Consistency setting

The default setting for I/O data consistency is "Total length".

The "Total length" consistency setting means that direct access from the PLC user program (e.g. byte, word, or double word) to this address area of the PLC operating system is not permitted.

3.5 Function parameters

Parameters

All function-specific parameters of the ADI4 DP slave are set in the "Encoder" tab:

- Encoder type
- Unipolar spindle (or unipolar motor)
- Shutdown ramp
- Shutdown delay
- Tolerable sign-of-life failures
- Reserved bits for fine resolution
- 611U conformant mode

The figure shows the corresponding dialog box with sample values for the various encoder types and parameters.

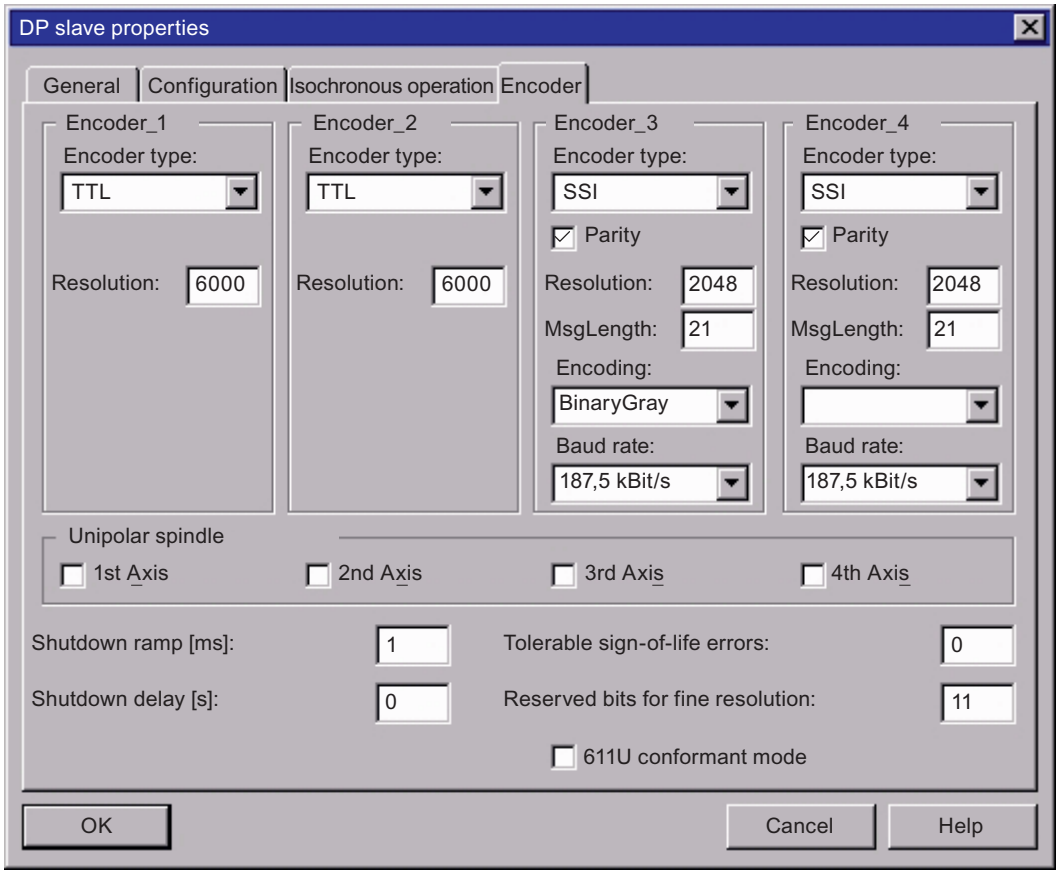


Figure 3-3 "DP Slave Properties" dialog box, "Encoder" tab

3.5.1 Encoder type

Encoder type "not available"

An encoder type setting of "not available" for Encoder x means that Axis x does not exist, or that it is not to be operated. User data transmitted for this axis in the PROFIBUS message frame are empty.

Encoder type TTL

Encoder parameters:

- Resolution
  Encoder resolution in encoder pulses per encoder revolution

---

Note

In the case of spindles with a low-resolution encoder, the actual-value characteristic (incrementing) may be displayed in a non-linear fashion. The incrementing that is visible on the actual-value display is the result of the speed resolution (RR), where:

- RR: 60000 / (T_{DP} * ER * PM)
- RR (speed resolution): [(revolutions/min) / encoder pulse]
- T_{DP} (position control cycle clock = PROFIBUS cycle clock): [ms]
- ER (encoder resolution): [Encoder pulse / revolution]
- PM (pulse multiplication)

Example:

T_{DP} (position control cycle clock = PROFIBUS cycle clock): 2 ms

ER (encoder resolution): 2500 pulses/revolution

PM (pulse multiplication): 4

RR = 60000 (2*2500*4) = 3 (revolutions/min) / encoder pulse

Encoder type SSI

Encoder parameters:

- Parity
  Select this check box if the encoder data are to be transmitted from the encoder to the ADI4 with a parity bit.
- Resolution
  Encoder resolution in encoder pulses per encoder revolution
- MsgLength
  Number of user data bits transmitted by the encoder
- Encoding
  The following encoder codes are supported:
  - Binary
  - Gray
- Baud rate
  The following baud rates are supported:
  - 187.5 Kbits/s
  - 375 Kbits/s
  - 750 Kbits/s

NOTICE
The following boundary conditions must be taken into account for SSI encoders: • The baud rate setting must be identical for all SSI encoders. If baud rate settings are different, the baud rate of the SSI encoder with the highest encoder number is used. • In conjunction with ADI4, only absolute encoders (SSI) with "Pine tree" data output format (TSSI) can be operated.

3.5.2 Unipolar spindle or unipolar motor

Introduction

The drive can be moved in two directions. Selecting the "Unipolar spindle" option switches the voltage range of the analog output voltage.

Unipolar spindle not selected

If the "Unipolar spindle" option is **not** selected, an analog voltage in the range of **-10 V** to **+10 V** is output as the setpoint.

Unipolar spindle selected

If the "Unipolar spindle" check box **is selected**, an analog voltage in the range of **0 V** to **+10 V** is output as the setpoint. The direction of rotation is then output from the ADI4, depending on the current speed setpoint, via a digital output of the ADI4:

- Direction of rotation signal for Axis 1 → Digital output X6-1, Pin 6
- Direction of rotation signal for Axis 2 → Digital output X6-1, Pin 7
- Direction of rotation signal for Axis 3 → Digital output X6-1, Pin 8
- Direction of rotation signal for Axis 4 → Digital output X6-1, Pin 9

Note

"Unipolar spindle" (or "Unipolar motor") function is not available.

3.5.3 Shutdown ramp

Shutdown ramp

The "Shutdown ramp" parameter specifies a function that is linear with respect to time. If an error is detected in the ADI4, all ADI4 drives are slowed down to Setpoint "0" in accordance with this function.

A parameter value of "0" brings the drives to an immediate stop (braking at the current limit).

- Unit: [ms]

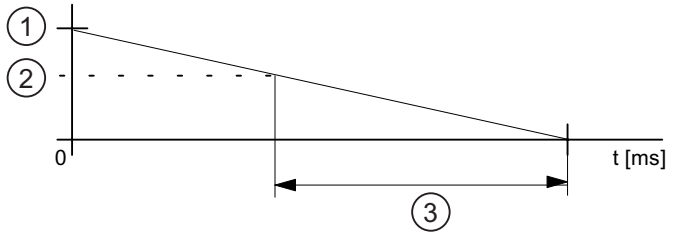


Figure 3-4 Parameter: Shutdown ramp

① Maximum setpoint
② Current setpoint
③ Parameter value: Shutdown ramp

3.5.4 Shutdown delay

Shutdown delay parameter

The "Shutdown delay" parameter can be used to specify a time after which all ADI4 drives are slowed down to the setpoint "0" following a temperature alarm in the ADI4.

After the "Shutdown delay" has elapsed, the "Shutdown ramp" is taken into account.

- Unit: [s]

3.5.5 Tolerable sign-of-life failures

"Tolerable sign-of-life failures" parameter

The "Tolerable sign-of-life failures" parameter specifies the number of sign-of-life failures tolerated for the DP master. If the assigned number is exceeded, the setpoint interfaces of the drives are ramped down to the value "0" using the "Shutdown ramp".

NOTICE
Presently, the "Tolerable sign-of-life failures" parameter may only be used on values in the range of 0 to 13.

3.5.6 Reserved bits for fine resolution

"Additional substitute bits for fine resolution" parameter

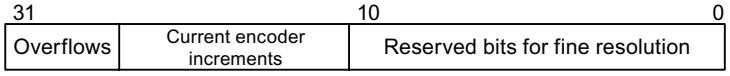
The "Additional substitute bits for fine resolution" parameter specifies the desired pulse multiplication of the encoder increments transmitted in actual encoder values G1_XIST1 and G1_XIST2.

G1_XIST1

Presently, the number of additional substitute bits for fine resolution must be set permanently to "11". This corresponds to a pulse multiplication of: $2^{11} = 2048$.

NOTICE
Presently, the "Reserved bits for fine resolution" parameter setting must always be set to "11".

Transmitted actual encoder value G1_XIST1



G1_XIST2

The number of additional substitute bits for fine resolution is set permanently to "1" and cannot be changed.

Absolute position values supplied in G1_XIST2 are never provided with a number of reserved bits for fine resolution. They are always supplied as they were read from the SSI encoder.

3.5.7 611U conformant mode

Possible settings

In 611U conformant mode, the signal source for homing of axes is no longer specified using the PROFIDrive standard message frame (STD3, encoder control word G1_STW), but rather using the additional digital output word in the PROFIBUS message frame of the ADI4 (see table "Message frame structure" in Section "Message frame type (Page 37)").

611U conformant mode:

- Not selected
  The signal source for homing is specified via the encoder control word Gx_STW in the PROFIDrive standard message frame.
- Selected
  The signal source for homing is specified via the additional digital output word in the PROFIBUS message frame.

Digital output word

The signal sources for the homing are selected on an axis-specific basis via the following bits of the output word (see also output word in the table "Message frame structure" in Section "Message frame type"):

Table 3- 4 Output word: signal sources for homing

Bit	Value	Signal source for homing
8	0	Axis 1: Zero mark of Encoder 1 (X4-1)
	1	Axis 1: **Rising** edge of External zero mark 1 (X6-2, Pin 2)
9	0	Axis 2: Zero mark of Encoder 2 (X4-2)
	1	Axis 2: **Rising** edge of External zero mark 2 (X6-2, Pin 3)
10	0	Axis 3: Zero mark of Encoder 3 (X4-3)
	1	Axis 3: **Rising** edge of External zero mark 3 (X6-2, Pin 4)
11	0	Axis 4: Zero mark of Encoder 4 (X4-4)
	1	Axis 4: **Rising** edge of External zero mark 4 (X6-2, Pin 5)

If the 611U conformant mode has been assigned for an axis to be homed, the axis-specific signal for selection of the signal source must be set in the digital output word of the ADI4 from the PLC user program. This must take place prior to the request of the "Find reference mark" function in the control word.

Note

With 611U conformant mode

- For homing of an axis using an encoder zero mark and an external zero mark, the appropriate axis-specific bit must be set to 0 (encoder zero mark) in the digital output word by the PLC user program.
- The signal source for homing can be switched during operation.

Without 611U conformant mode

- Homing is always performed in relation to the zero mark of the axis.

The following sections show the basic system structure and the respective boundary conditions of the individual homing methods.

Exiting the dialog box

If the "DP Slave Properties" dialog box is exited with "OK", the data are accepted and the dialog box is closed.

Step 1: End

Step 1 of the ADI4 DP slave parameter assignment is now complete.

3.5.8 Homing using encoder zero mark

System structure

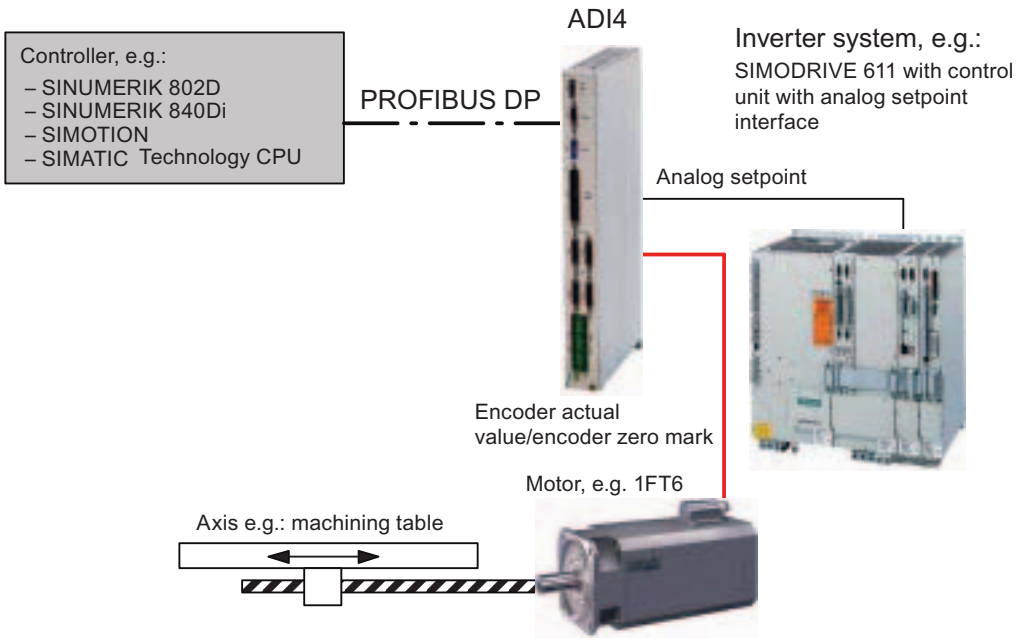


Figure 3-5 Basic system structure: Homing using encoder zero mark

Function

Once the controller requests homing, the ADI4 transmits the actual encoder value to the controller as the home position the next time it detects an encoder zero mark.

Without 611U conformant mode

No further measures are required.

With 611U conformant mode

The relevant signal for the axis to be homed (e.g. Axis 1) must be set in the digital output word:

- Digital output word:
  Bit 0: = 0 ⇒ "Axis 1: Zero mark of Encoder 1 (X4-1)"

3.5.9 Homing using external zero mark

System structure

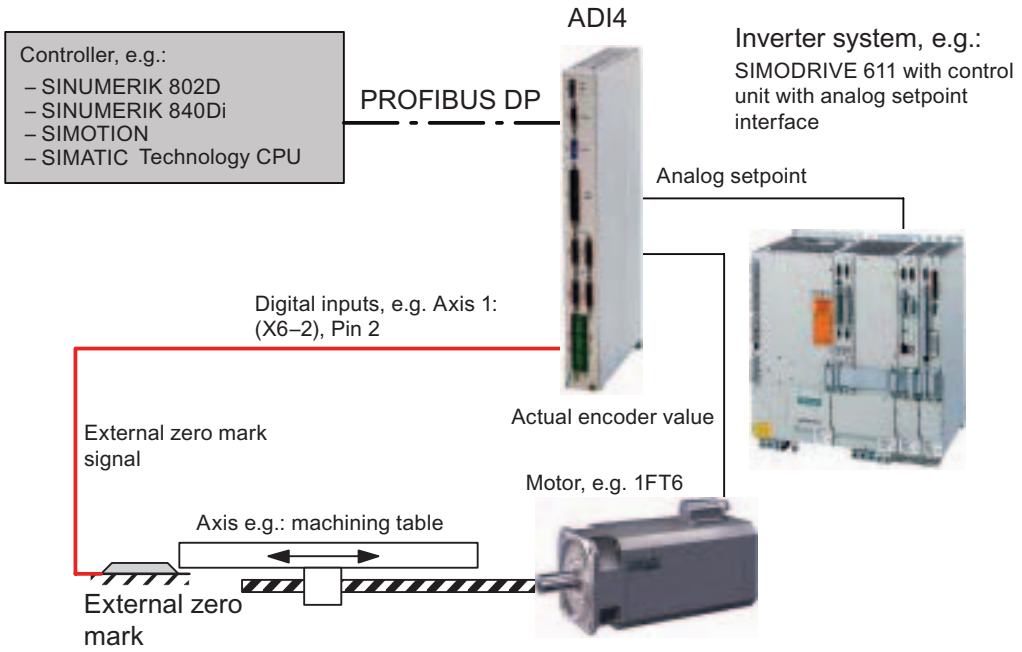


Figure 3-6 Basic system structure: Homing using external zero mark

Function

Once the controller requests homing, the ADI4 transmits the actual encoder value to the controller as the home position the next time it detects an external zero mark signal.

Without 611U conformant mode

The controller must define the relevant function via encoder control word G1_STW:

- Function 2 (Homing via rising edge of external zero mark)
- Function 3 (Homing via falling edge of external zero mark)

With 611U conformant mode

The relevant signal for the axis to be homed (e.g. Axis 1) must be set in the digital output word:

- Digital output word:
  Bit 0: = 1 ⇒ "Axis 1: Rising edge of external zero mark 1 (X6-2, Pin 2)"

Note

Homing using an external zero mark requires 611U conformant mode to be selected.

3.5.10 Homing using encoder zero mark and homing output cam

System structure

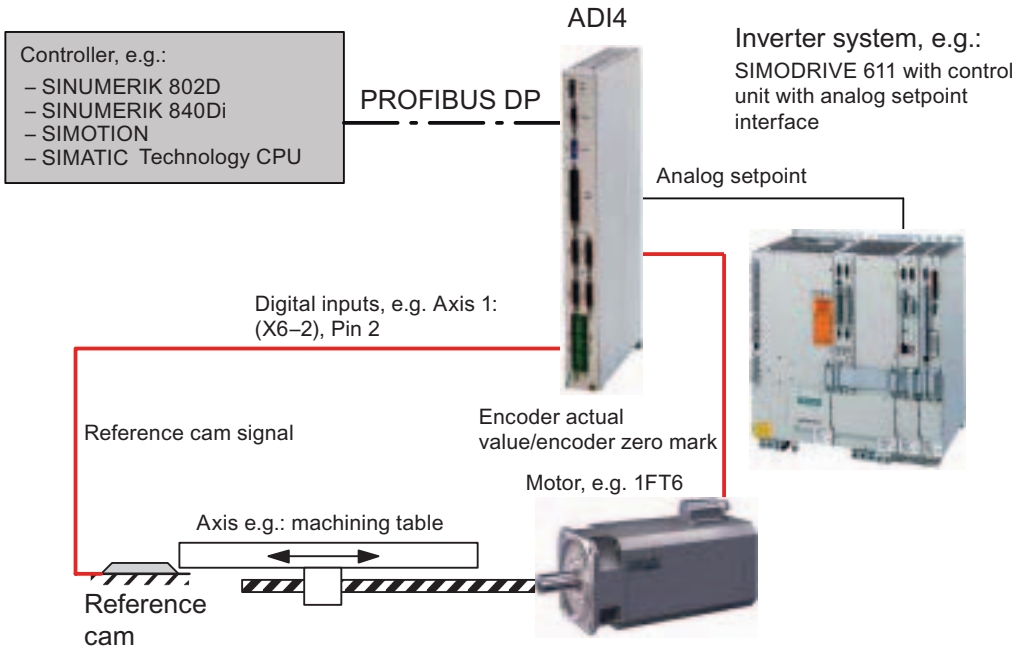


Figure 3-7 Basic system structure: Homing using encoder zero mark and external zero mark

Function

The homing output cam signal must be connected to a digital input on the ADI4 (X6-2, Pins 2 to 5). The homing output cam signal is processed in the controller as part of the homing operation.

Once the homing output cam signal is detected, the controller reduces the axis velocity to the homing approach velocity and requests the ADI4 to home to the next encoder zero mark. Once the request is detected, the ADI4 transmits the actual encoder value to the controller as the home position the next time it detects an encoder zero mark.

Without 611U conformant mode

No further measures are required.

With 611U conformant mode

The relevant signal for the axis to be homed (e.g. Axis 1) must be set in the digital output word:

- Digital output word:
  Bit 0: = 0 ⇒ "Axis 1: Zero mark of Encoder 1 (X4-1)"

3.5.11 Boundary conditions

Measuring input or on-the-fly measurement

ADI4 supports only measurement using a rising **or** falling edge of the measuring input. It is not possible to parameterize simultaneous measurement on a rising edge and a negative edge.

Actual speed

The actual speed value (PZD2/3: NIST_B) contained in Standard message frame 3 (see table "Message frame structure" in Section "Message frame type (Page 37)") is not supported by the ADI4. The ADI4 always sends the value "0" as the actual speed value.

External encoder interface (encoders without an axis)

If encoders are connected to the ADI4 without at least one axis being assigned, i.e. ADI4 is used exclusively as an external encoder interface, a "Ready" signal (interface X6-1, Pin 10/11) will not be output. For information on the "Ready" signal, refer to Section "Interface (X6-1): Digital outputs (Page 21)".

Error 20005

In conjunction with an ADI4 DP slave, the following message is displayed when the SIMOTION CPU switches from RUN to STOP mode:

- Error 20005: Device type: 1/2, log. address: x faulted. (Bit: 0, reason: 0x...)

The message can be ignored.

This message is automatically deleted by the system the next time there is a transition from STOP to RUN mode.

Homing using external zero mark

Homing always occurs at a rising edge, irrespective of which external zero mark edge (rising or falling) was selected for homing in SIMOTION.

3.6 Parameter assignment of the DP communication

3.6.1 Parameter assignment of the equidistant cyclic DP communication

Action steps

Once all the DP slaves have been inserted in the configuration and their function parameters have been assigned as described (Step 1), the parameters for the equidistant cyclic DP communication must then be assigned (Step 2).

Parameters are assigned to the equidistant cyclic DP communication in two steps, as well:

Step 1

- Activation of the equidistant DP cycle
- Equidistant master cyclic component T_{DX}

Step 2

- Equidistant DP cycle T_{DP}
- Master application cycle T_{MAPC}
- Actual value acquisition T_i
- Setpoint acceptance T_o

NOTICE
When assigning parameters for DP communication, you must observe the boundary conditions applicable to the individual parameters (see Section "Boundary conditions (Page 69)").

3.6.2 Activation of the equidistant DP cycle

Procedure

Double-click an ADI4 DP slave. In the station window of HW Config, the dialog box: "DP Slave Properties" opens.

Note

It is recommended that the equidistant DP cycle be enabled for all ADI4 DP slaves by enabling the equidistant DP cycle within the selected ADI4 DP slave, and then performing an alignment:

During an alignment, all values displayed in the "DP Slave Properties" dialog box, "Isochronous mode" tab are transferred to all DP slaves of the same type, ADI4 DP slave here, of the configuration.

Dialog: Start

Dialog: DP slave properties
Tab: Isochronous operation
Radio button: Synchronize drive to equidistant DP cycle ☑
Button: Alignment

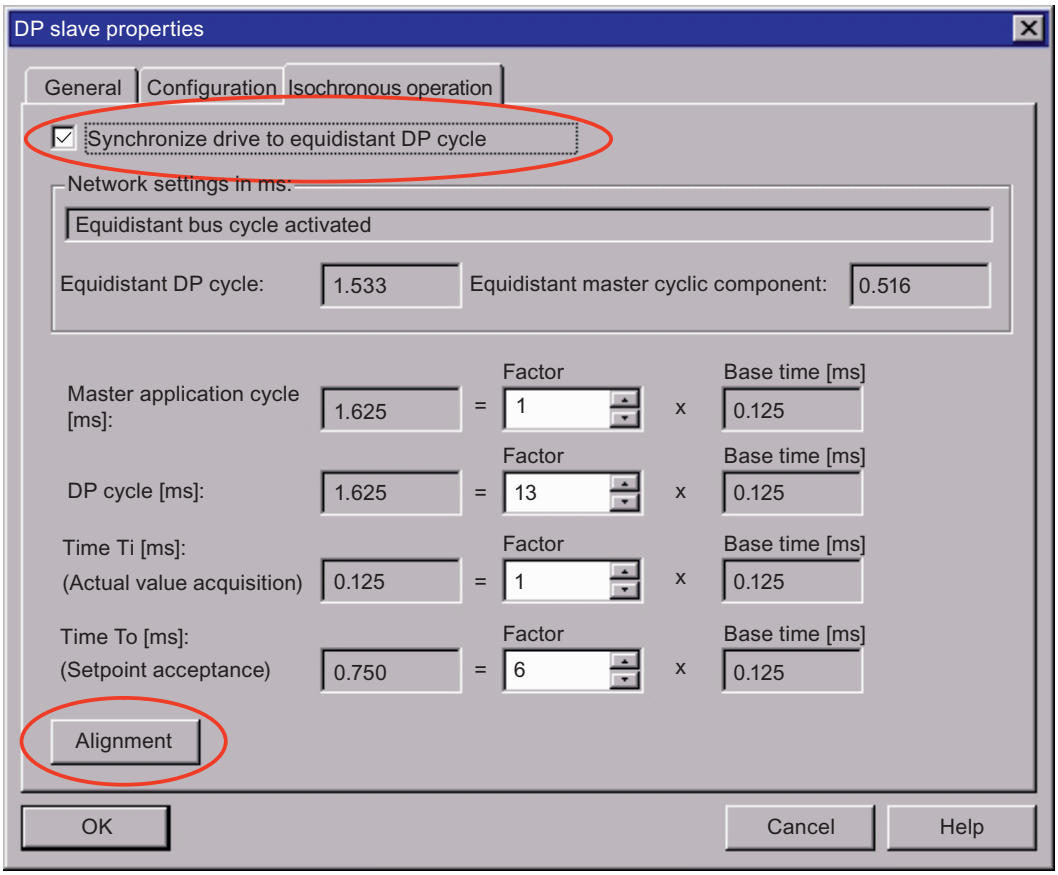


Figure 3-8 "DP Slave Properties" dialog box

3.6.3 Equidistant master cyclic component TDX

Procedure

Once synchronization to the equidistant DP cycle has been enabled for all DP slaves, the time required for the cyclic component of the DP communication must be recalculated.

The calculation is performed automatically by the DP master each time the equidistant bus cycle is enabled. This is performed in the following dialog box by selecting/clearing the "Activate equidistant bus cycle" check box.

Dialog: Continuation

Dialog box: DP slave properties
Tab: General
Group:: Node/Master System
Button: PROFIBUS...
Dialog box: Properties - PROFIBUS interface ADI4 ...
Tab: Parameters
Button: Properties...
Dialog box: PROFIBUS properties
Tab: Network settings
Button: Options...
Dialog box: Options
Tab: Equidistance
1. Radio button: Activate equidistant bus cycle ☐ (deselect)
2. Radio button: Activate equidistant bus cycle ☑ (select)

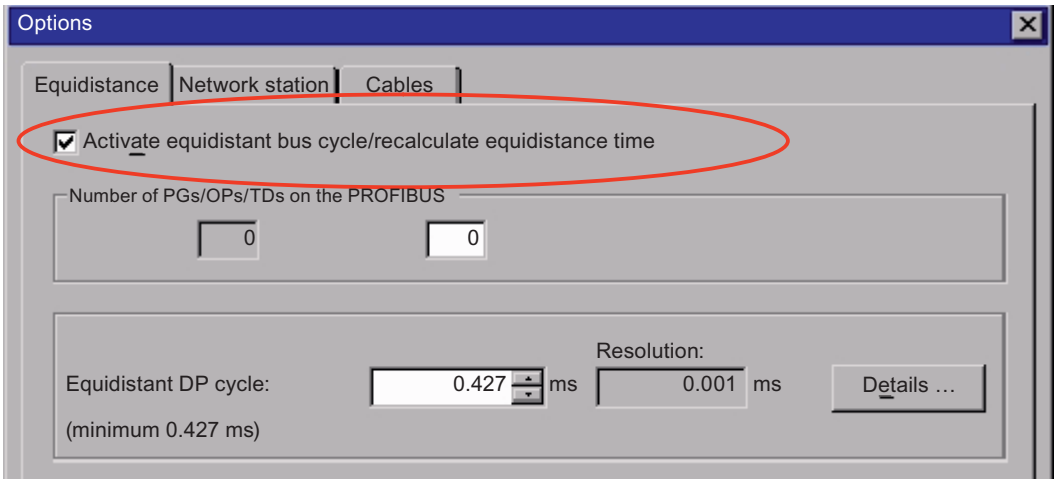


Figure 3-9 "Options" dialog box (excerpt)

Note

If there are different equidistant DP slave types (for example, different SIMODRIVE drives, ADI4, etc.) in an S7 project, you must first perform the following two steps for each DP slave type:

1. Synchronize drive to equidistant DP cycle
2. Perform alignment

You can then continue to set the other parameters.

See also

Function parameters (Page 43)

3.6.4 Equidistant DP cycle TDP

Procedure

When the cyclic component of the DP communication is calculated, the DP master automatically changes the value for the equidistant DP cycle to the minimum required time. This change must be undone by re-entering the intended value for the equidistant DP cycle.

Dialog: Continuation

Dialog box: Options
Tab: Equidistance
Entry field: Equidistant DP cycle = 2,000 ms (example value)
OK (close dialog box: Options)
OK (close dialog box: PROFIBUS properties)
OK (close dialog box: Properties - PROFIBUS interface ADI4 ...)

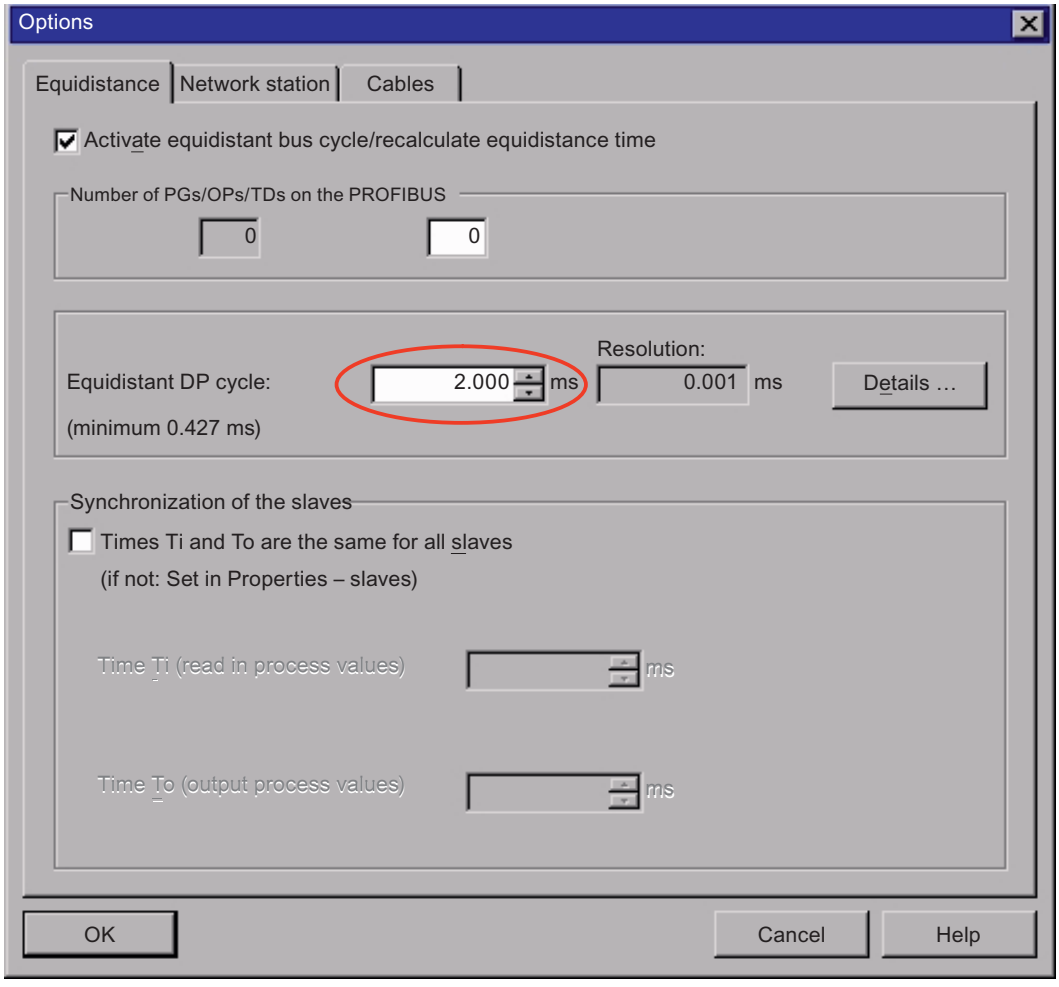


Figure 3-10 "Options" dialog box

3.6.5 DP cycle TDP

Procedure

In the "Factor" entry field of the "DP cycle (ms)", enter a value such that the resulting DP cycle is equal to the equidistant DP cycle.

Dialog: Start

Dialog: DP slave properties
Tab: Isochronous operation
Entry field: Factor = 16 (example value)

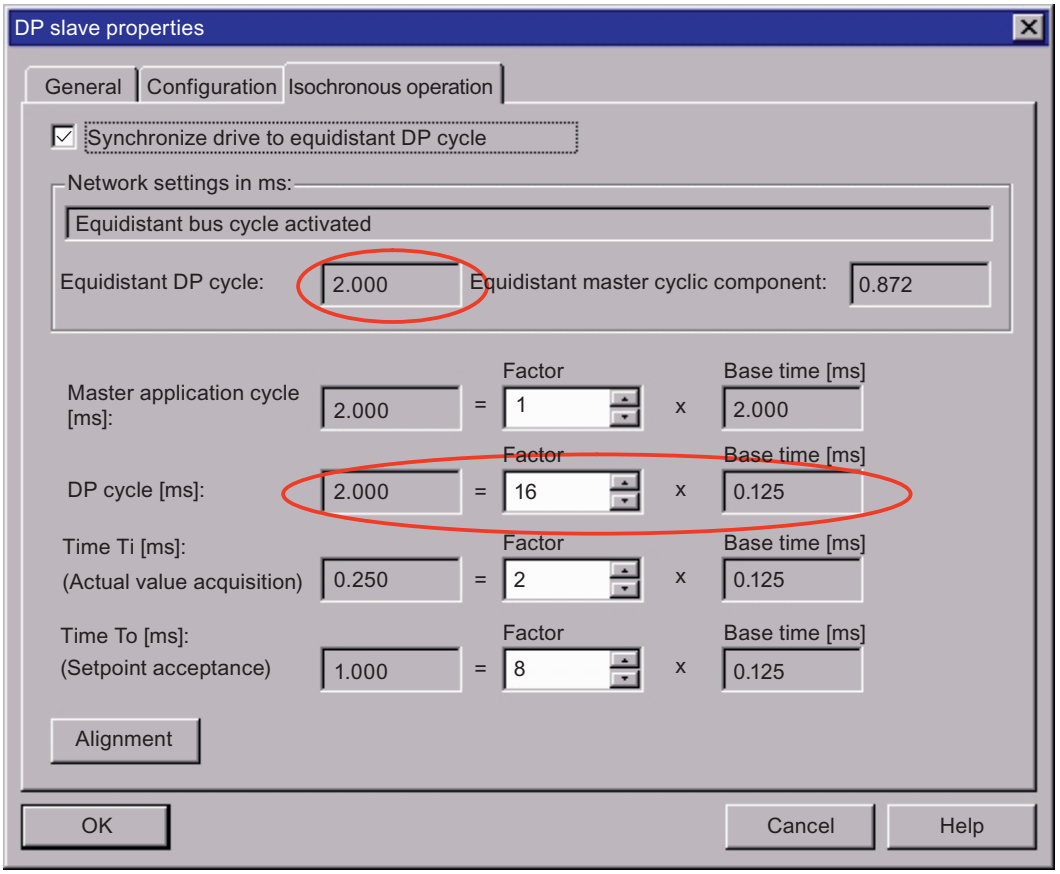


Figure 3-11 "DP Slave Properties" dialog box

Note

The DP cycle time ("DP cycle" parameter) of the ADI4 DP slave must be set to the same value as the DP cycle time setting for the DP master ("Equidistant DP cycle" parameter):

DP cycle = equidistant DP cycle

3.6.6 Master application cycle TMAPC

Introduction

The "Master application cycle T_{MAPC}" parameter specifies the integer ratio between the cycle time of the master application (position controller) and the equidistant DP cycle.

Note

The ratio between master application cycle T_{MAPC} and DP cycle time T_{DP} **must** be 1:1.

Procedure

In the entry field for the factor of the "Master application cycle [ms], enter a value such that the required time ratio is achieved.

Dialog: Continuation

Dialog: DP slave properties
Tab: Isochronous operation
Entry field: Factor = 1

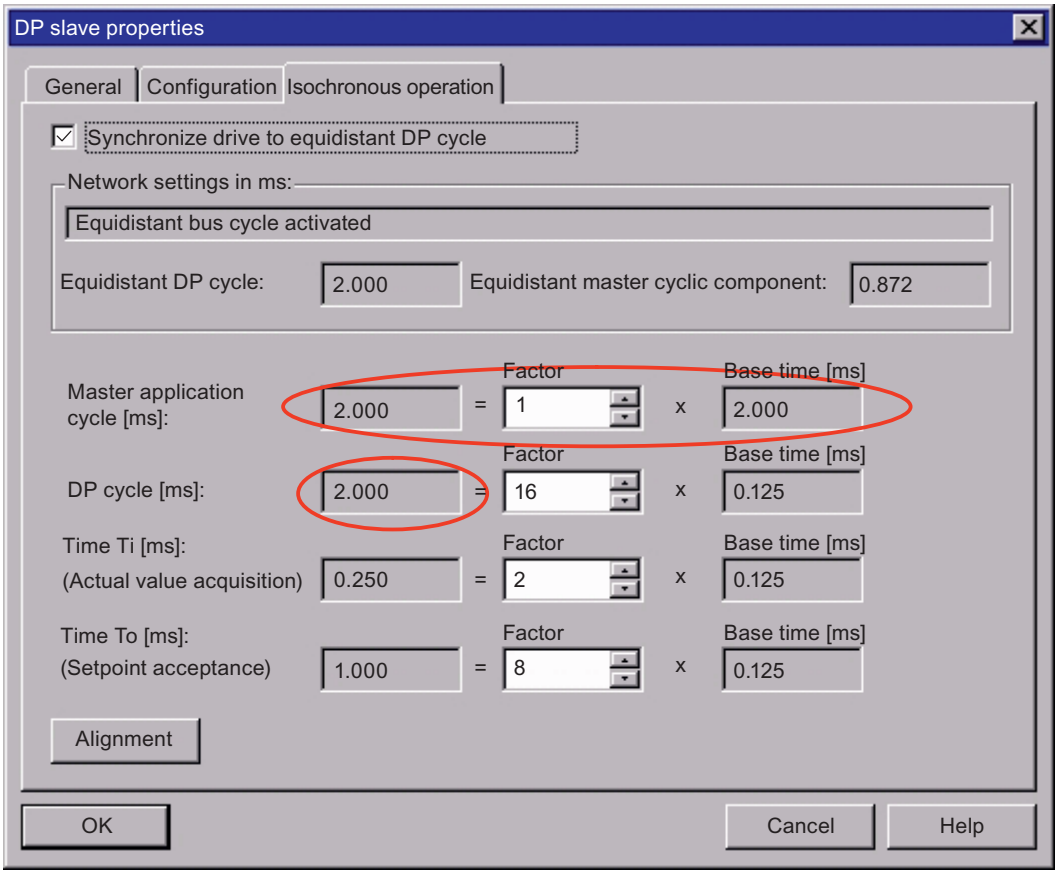


Figure 3-12 "DP Slave Properties" dialog box

Execution scheme T_{MAPC} : T_{DP} = 1 : 1

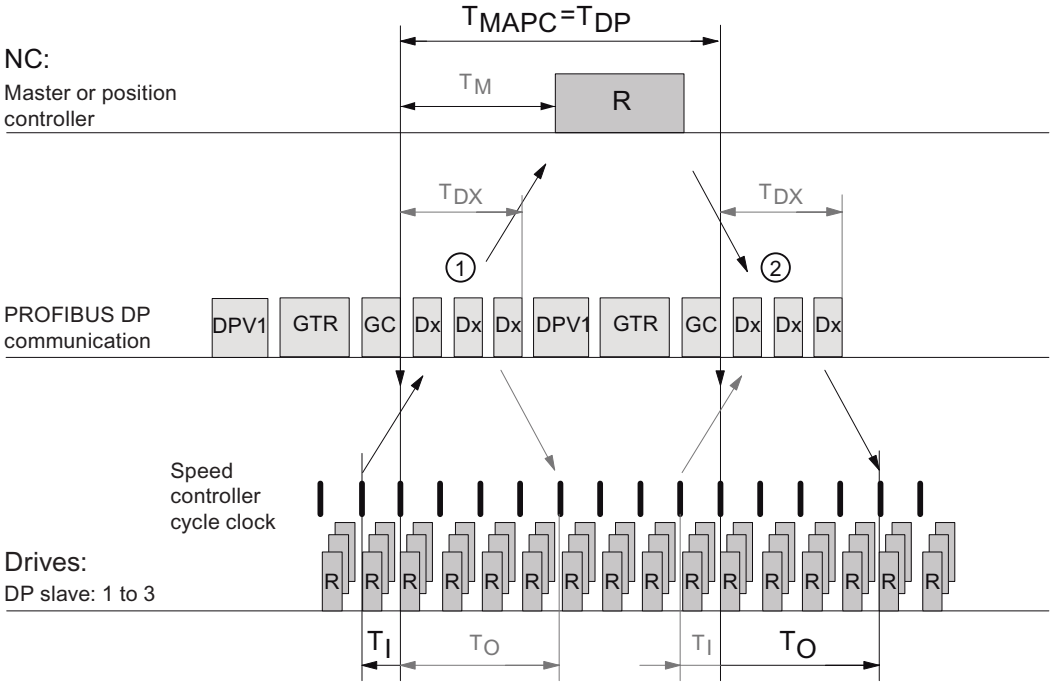


Figure 3-13 Example: Optimized DP cycle with T_{MAPC} : T_{DP} = 1 : 1

T_{MAPC}	Master application cycle: Position control cycle clock
T_{DP}	DP cycle time: DP cycle time
T_{DX}	Data exchange time: Total transfer time for all DP slaves
T_M	Master time: Offset of the start time for NC position control
T_I	Input time: Time of the actual value acquisition. The actual values are transferred to the DP master in the **next** DP cycle.
T_O	Output time: Time of the setpoint acceptance. The setpoints were generated by the DP master application in the **previous** DP cycle.
GC	Global control message frame (broadcast message frame) for cyclic synchronization of the equidistance between the DP master and DP slaves
R	Processing time for speed or position controller
Dx	User data exchange between the DP master and DP slaves
DPV1	After cyclic communication, an acyclic service is sent, if the token holding time T_{TH} has not yet been exceeded. T_{TH} is calculated by the engineering system.
GTR	GAP, TOKEN, RESERVE: GAP: An attempt is made during GAP to accept new active stations. TOKEN: The token passing is either to itself or other masters. RESERVE: The reserve is used as an "Active break" for the station to send the token to itself until the equidistant cycle expires.
①	The actual values for the current DP-Cycle/position control cycle clock are transferred from the DP slave drives to the NC position controller.
②	The setpoints computed by the NC position controller are transferred to the DP slave drives.

3.6.7 Actual value acquisition Ti

Introduction

The "Actual value acquisition T_i" parameter specifies the time when an ADI4 DP slave reads in the actual values (actual position value).

It is recommended to specify the same time for the actual value acquisition T_i for all ADI4 DP slaves. Special attention must be paid to this if axes of different ADI4 DP slaves move according to interpolation on a common path.

Procedure

Enter the required value in the entry field for the factor of the actual value acquisition.

Dialog: Start

Dialog: DP slave properties
Tab: Isochronous operation
Entry field: Factor = 2 (example value)

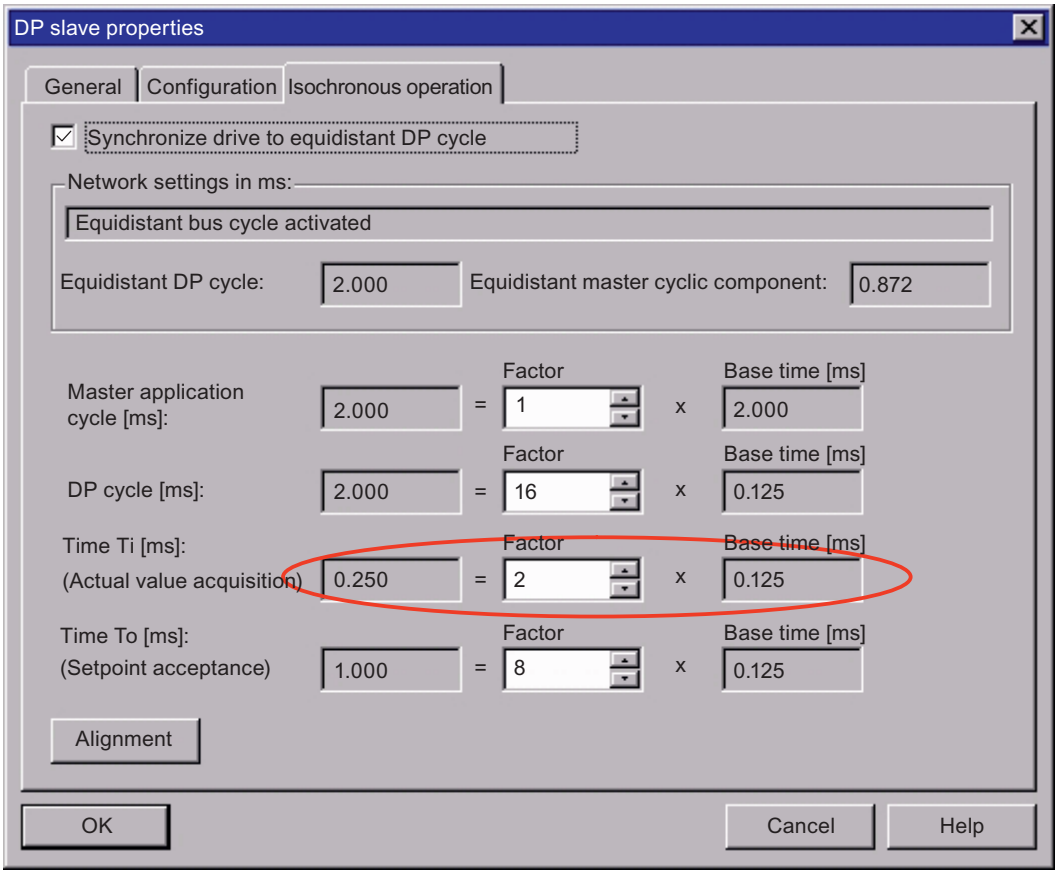


Figure 3-14 "DP Slave Properties" dialog box

Note

The following condition must be observed for the time of actual value acquisition T_i:

Base time ≤ actual value acquisition ≤ DP cycle

3.6.8 Setpoint acceptance To

Introduction

The "Setpoint acceptance T_o" parameter specifies the time when the ADI4 DP slave receives the speed setpoint from the position controller.

It is recommended that setpoint acceptance time T_o be the same for all ADI4 DP slaves, particularly if axes are interpolated together.

Procedure

Enter the required value in the entry field for the factor of the setpoint acceptance.

Dialog: Start

Dialog: DP slave properties
Tab: Isochronous operation
Entry field: Factor = 8 (example value)

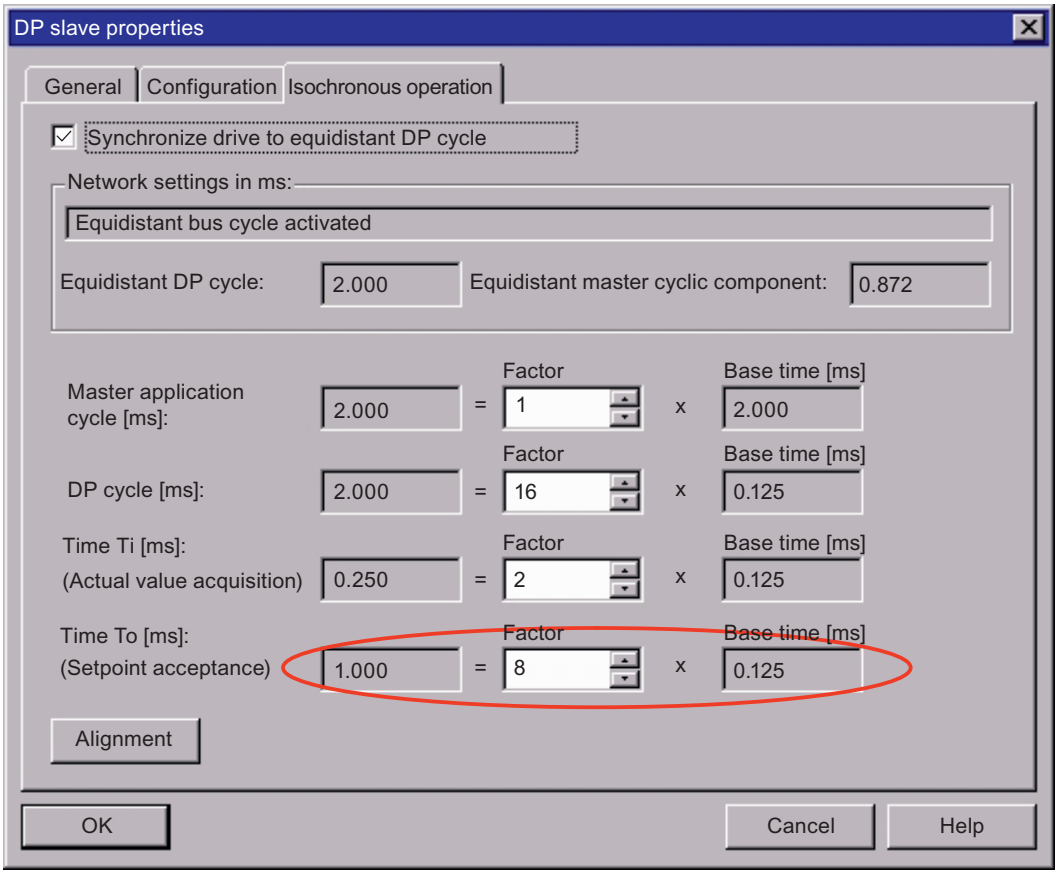


Figure 3-15 "DP Slave Properties" dialog box

Note

The following condition must be observed for the time of setpoint acceptance T_o:

Equidistant master cyclic component + base time ≤ setpoint acceptance ≤ DP cycle

3.6.9 Alignment

Procedure

The alignment is used to transfer the values of the current ADI4 DP slave displayed in the "Isochronous operation" tab to all the other ADI4 DP slaves of the configuration.

Dialog: End

Dialog: DP slave properties
Tab: Isochronous operation
Button: Alignment
OK

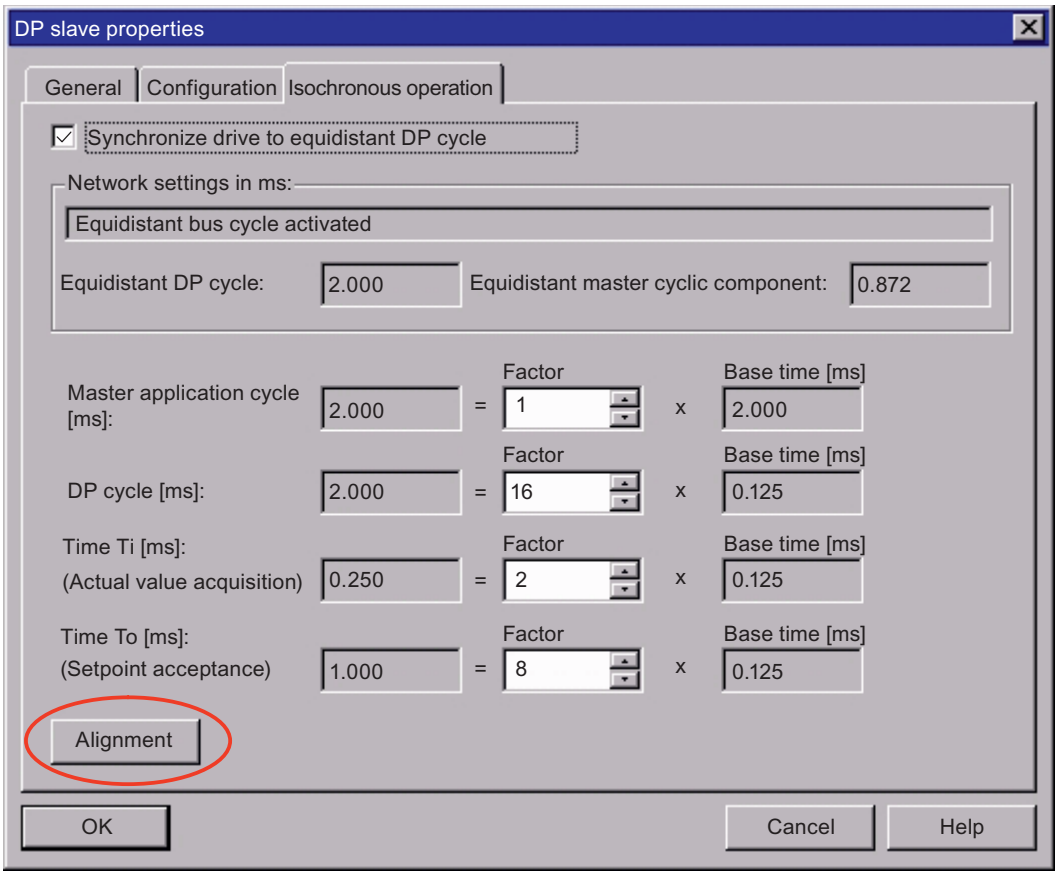


Figure 3-16 "DP Slave Properties" dialog box

Note

If an S7 project includes different equidistant DP slave types, such as different SIMODRIVE drives, ADI4, etc., the following parameter settings must be made for each DP slave type as described above, and an alignment must be performed:

- Equidistant DP cycle T_{DP}
- Master application cycle T_{MAPC}
- Actual value acquisition T_i
- Setpoint acceptance T_o

The alignment only transfers the values displayed in the "Isochronous operation" tab to the DP slaves **of the same** type.

The alignment concludes the parameter assignment of all ADI4 DP slaves with respect to the DP communication.

3.6.10 Boundary conditions

ADI4 with order number 6FC5 211-0BA01-0AA1 or higher

The following boundary conditions must be observed during the final parameter assignment of the equidistant DP cycle in conjunction with ADI4 with order number 6FC5 211-0BA01-0AA1 and higher:

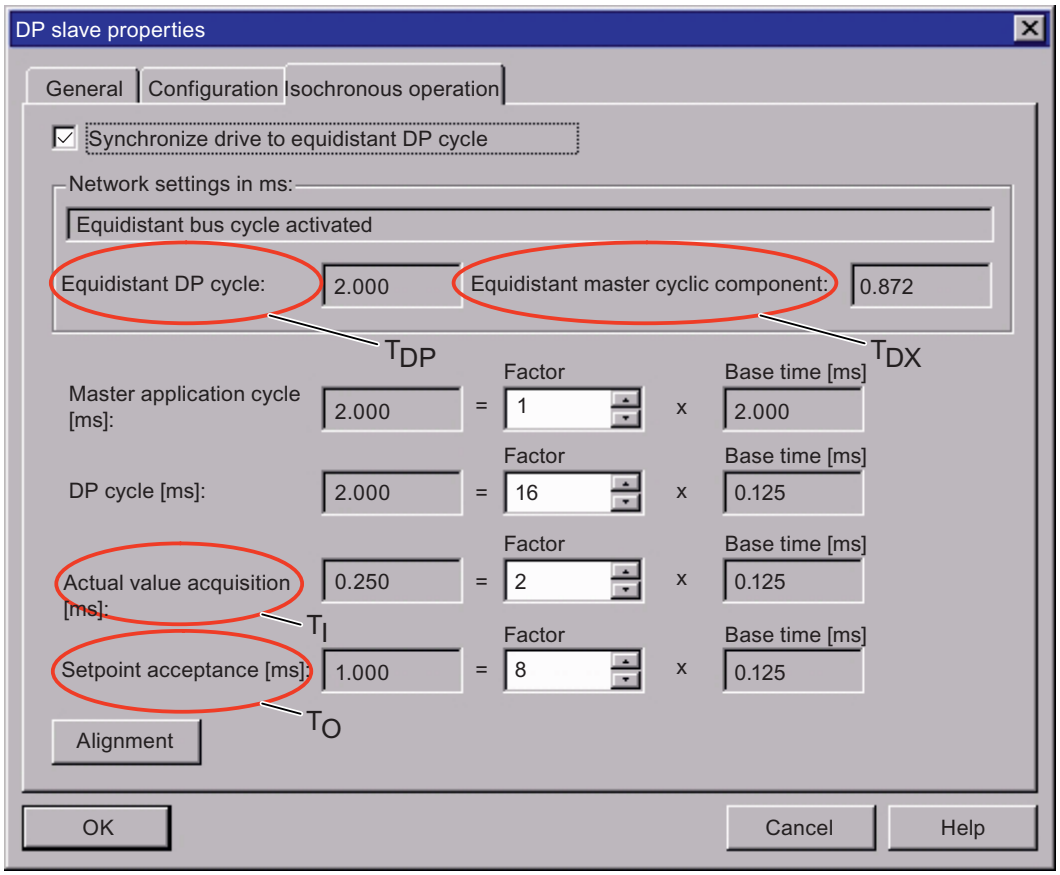


Figure 3-17 Excerpt of "DP Slave Properties" dialog box

1. Equidistant DP cycle (T_{DP})

   $\mathbf{T}_{DP}$ = 2 * n * 125 µs;
   with n ≥ 4 (⇒ Minimum T_{DP} = 1 ms)

2. Setpoint acceptance (T_o)

   (TDX + 125 µs) ≤ $\mathbf{T}_o$ < T_{DP};
   with rounded variable TDX = T_{DX}, rounded to an integer multiple of 125 µs

3. Actual value acquisition (T_i)

   (250 µs ≤ $\mathbf{T}_i$ ≤ 625 µs) and ($\mathbf{T}_i$ ≠ 500 µs)

4. T_i and T_o cannot be in the same 125 µs cycle clock

   ΔT ≠ 0; with ΔT = T_{DP} - $\mathbf{T}_i$ - $\mathbf{T}_o$

5. If $\mathbf{T_o}$ = (T_{DP} - 125 µs)

   Then for T_i, the following must apply: $\mathbf{T_i}$ > 3 * 125 µs

6. If $\mathbf{T_o}$ = (TDX + 125 µs)

   Then for (T_i + T_o), the following must apply: ($\mathbf{T_i}$ + $\mathbf{T_o}$) ≠(T_{DP} + 125 µs)

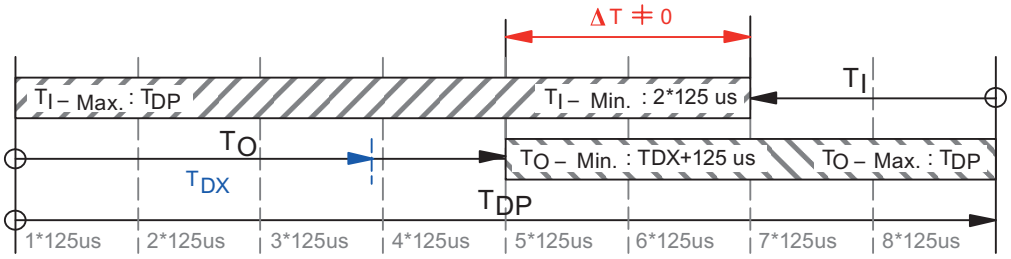


Figure 3-18 Graphic illustration of the boundary conditions

Typical parameter values

Equidistant DP cycle (T_{DP})	2.000 ms	3.000 ms
Actual value acquisition (T_i)	0.250 ms	0.250 ms
Setpoint acceptance (T_o)	1.250 ms	1.000 ms

Note

ADI4 DP slaves

- Order no.: 6FC5 211-0BA01-0AA**0**
- Order no.: 6FC5 211-0BA01-0AA**1** or …-0AA**2**

exhibit a different behavior for a parameter assignment for actual value acquisition (T_i) and setpoint acceptance (T_o) deviating from the boundary conditions indicated above.

- ADI4 DP slave with order number ...-0AA**0**
  If parameters are assigned that deviate from the boundary conditions indicated above, they are ignored by this ADI4 DP slave, as parameters are fixed internally. The ADI4 DP slave establishes cyclic communication with the DP master using the preset values (and not the assigned parameters) without an error message.
- ADI4 DP slave with order number ...-0AA**1** or ...-0AA**2**
  If a parameter assignment that deviates from the boundary conditions indicated above is downloaded to this ADI4 DP slave, the ADI4 DP slave does **not** establish cyclic communication with the DP master.

Commissioning

4

4.1 Wiring of drive ready signals

In order to use the S7 function block FB 401 (MC_POWER) to switch on a drive connected to the ADI4, the drive must signal its readiness. For this purpose, the ready signal of the drive must be wired with one of the ready signal inputs "Drive Ready" Axis x (DRVx_RDY), Interface (X6-2) of the ADI4.

The ready signal must continue to exist at the ADI4 input even after the drive is switched on. If the signal is cleared, the drive will stop.

Note

Drives without ready signal

If a ready signal is not available for a drive, the corresponding digital ready signal input "Drive Ready" Axis x (DRVx_RDY) of the ADI4 can be assigned statically with 24 V. The disadvantage of this is that the S7 function block FB 401 (MC_POWER) can no longer detect a drive failure. FB 401 returns the status "TRUE" at its output even after a drive failure.

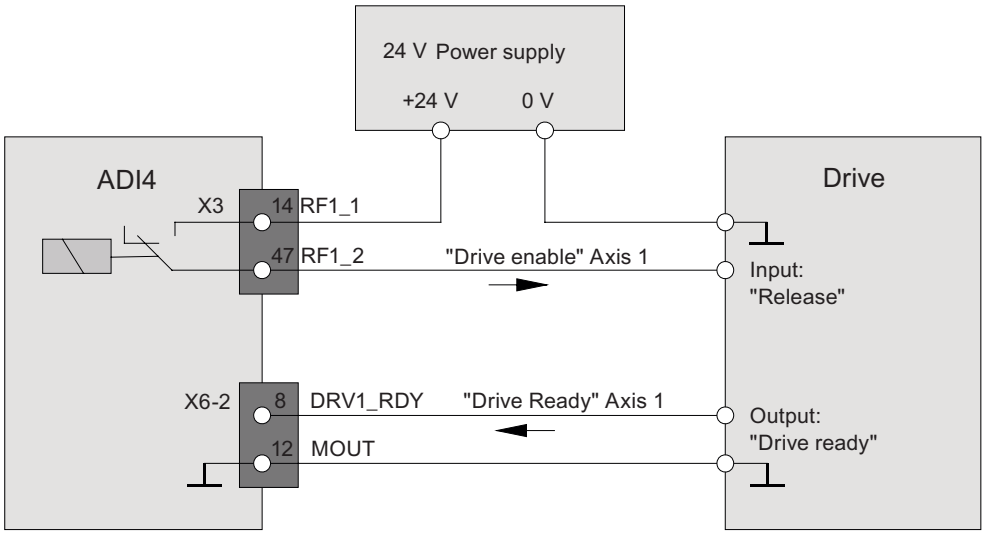


Figure 4-1 Drive enable for Axis 1 (principle)

4.2 Absolute encoder (SSI), single-turn

General

The parameter assignment of a single-turn absolute encoder (SSI) illustrated in the following example is performed using the "External encoder" technology object.

If the encoder belongs permanently to an axis, the "Axis" technology object is used to assign parameters.

Note

In conjunction with ADI4, SIMOTION only supports encoders with 13-bit and 25-bit message frames.

Encoder data

The encoder used in this example is a Siemens encoder, order number 6FX2 001-5HS12 with the following data:

Parameters	Value
Encoder type	Rotary
Encoder type	Cyclic absolute encoder (SSI)
Increments/revolution	4096
User data length	12
Message length	13
Message frame format	PINETREE
Actual value protocol format	GRAY

Settings in STEP 7, HW Config

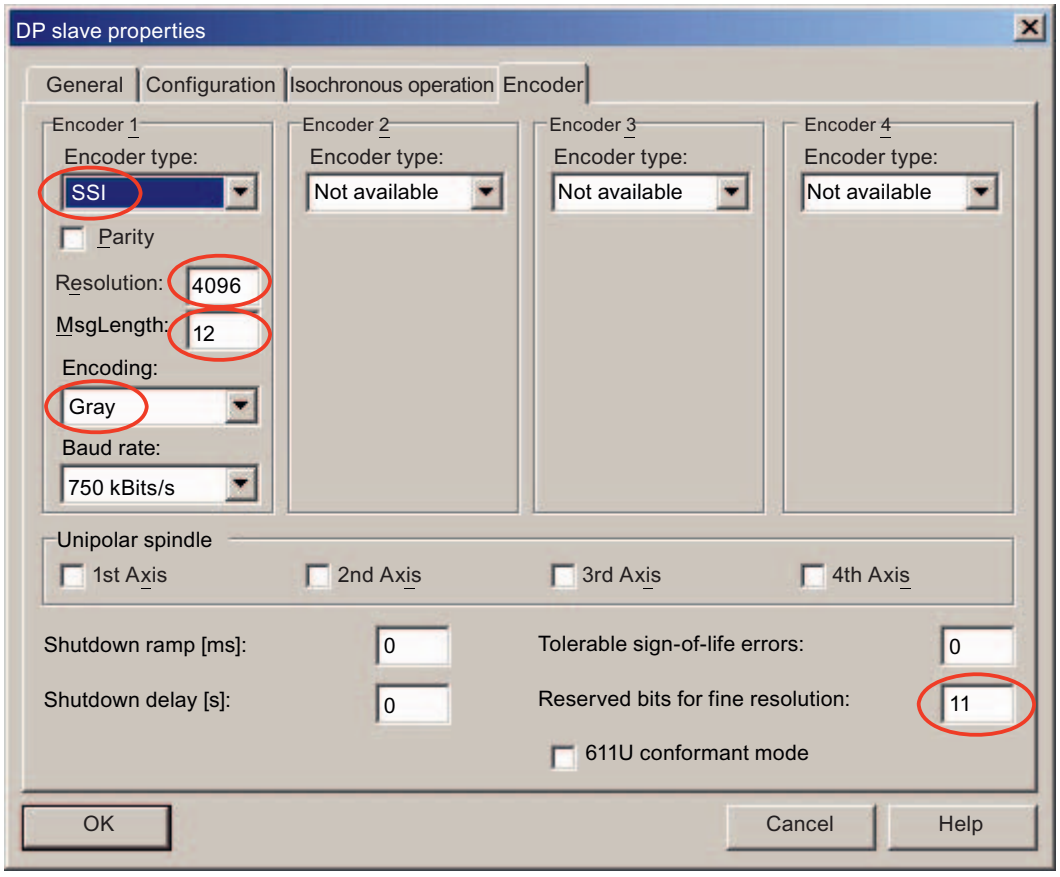


Figure 4-2 Encoder settings in STEP 7, HW Config

Settings	Value
Resolution	Encoder parameters: "Increments/revolution (resolution)"
MsgLength	Encoder parameters: "User data length"
Encoding	Encoder parameters: "Actual value protocol format"
Reserved bits for fine resolution	**Note**: The value is permanently set by ADI4.

SIMOTION/TCPU settings

After you have created a new encoder in the project navigator of SIMOTION SCOUT under "EXTERNAL ENCODERS" and have assigned the technology object parameters in the displayed dialog boxes, e.g. "Axis Type" and "Units", the encoder data must be entered in the "Encoder Assignment" and "Encoder - Data" dialog boxes.

1. Settings in the "Encoder Assignment" dialog box

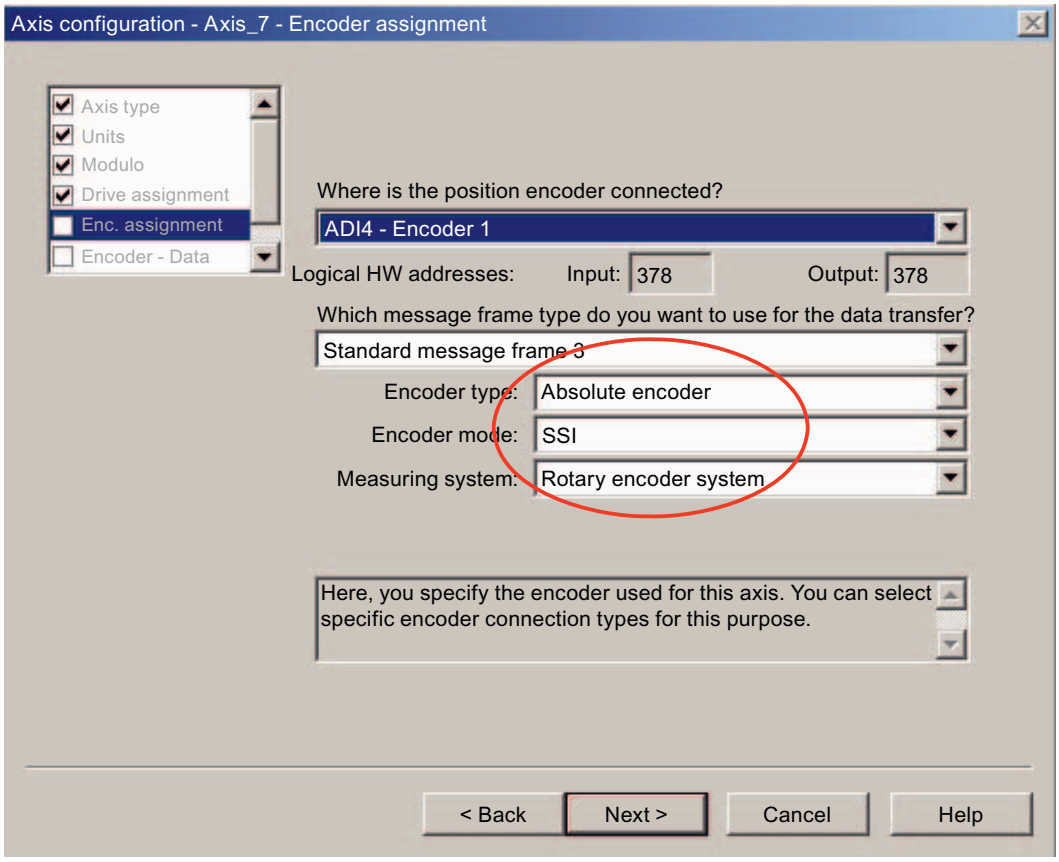


Figure 4-3 Encoder assignment settings

2. Settings in the "Encoder - Data" dialog box

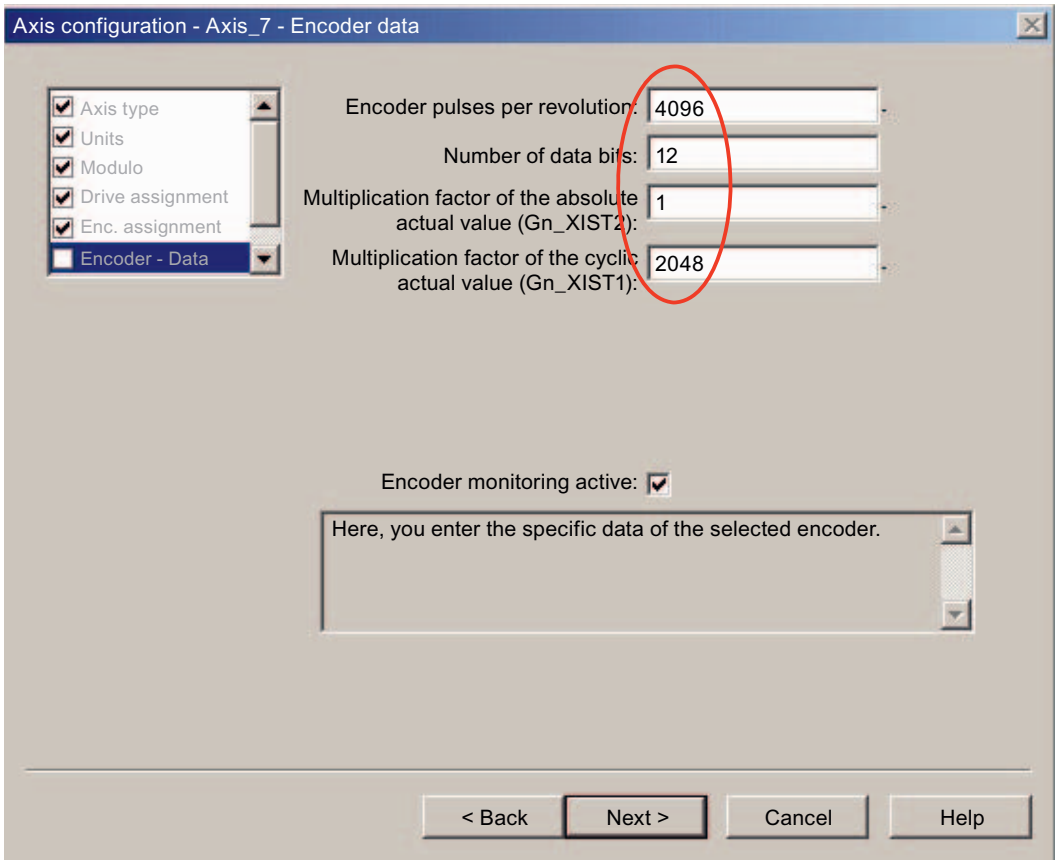


Figure 4-4 Encoder data settings

Settings:

Encoder data settings	Value
Encoder pulses per revolution	Encoder parameters: "Increments/revolution (resolution)"
Number of data bits	Encoder parameters: "User data length of the encoder"
Multiplication factor of the absolute actual value (Gn_XIST2)	1 (The absolute actual value (Gn_XIST2) is taken over directly)
Multiplication factor of the cyclic actual value (Gn_XIST1)	2^(STEP 7, HW Config: "Reserved bits for fine resolution") = 2^{11} = 2048

Overview: SIMOTION encoder parameters

Parameter: TypeOfAxis > Encoder_1 >	Value
encoderTyp	SENSOR_CYCLIC_ABSOLUT
encoderMode	SSI_MODE
encoderSystem	ROTATORY_SYSTEM
AbsEncoder > absResolution	4096
AbsEncoder > absDataLength	12
AbsEncoder > absResolutionMutiplierAbsolute	1 [1)]
AbsEncoder > absResolutionMutiplierCyclic	2048 [2)]
[1)] After the ramp-up of the controller, the absolute actual value of the encoder is read out once. [2)] 2048 = 2^{11}; corresponds to STEP 7, HW Config: "Reserved bits for fine resolution" = 11	

4.3 Absolute encoder (SSI), multiturn

General

The parameter assignment of a multiturn absolute encoder (SSI) illustrated in the following example is performed using the "External encoder" technology object.

If the encoder belongs permanently to an axis, the "Axis" technology object is used to assign parameters.

Note

In conjunction with ADI4, SIMOTION only supports encoders with 13-bit and 25-bit message frames.

Encoder data

The encoder used in this example is a Siemens encoder, order number 6FX2 001-5HS24 with the following data:

Encoder parameters	Value
Encoder type	Rotary
Encoder type	Cyclic absolute encoder (SSI)
Increments/revolution	8192
User data length	25
Message length	25
Message frame format	PINETREE
Actual value protocol format	GRAY

Settings in STEP 7, HW Config

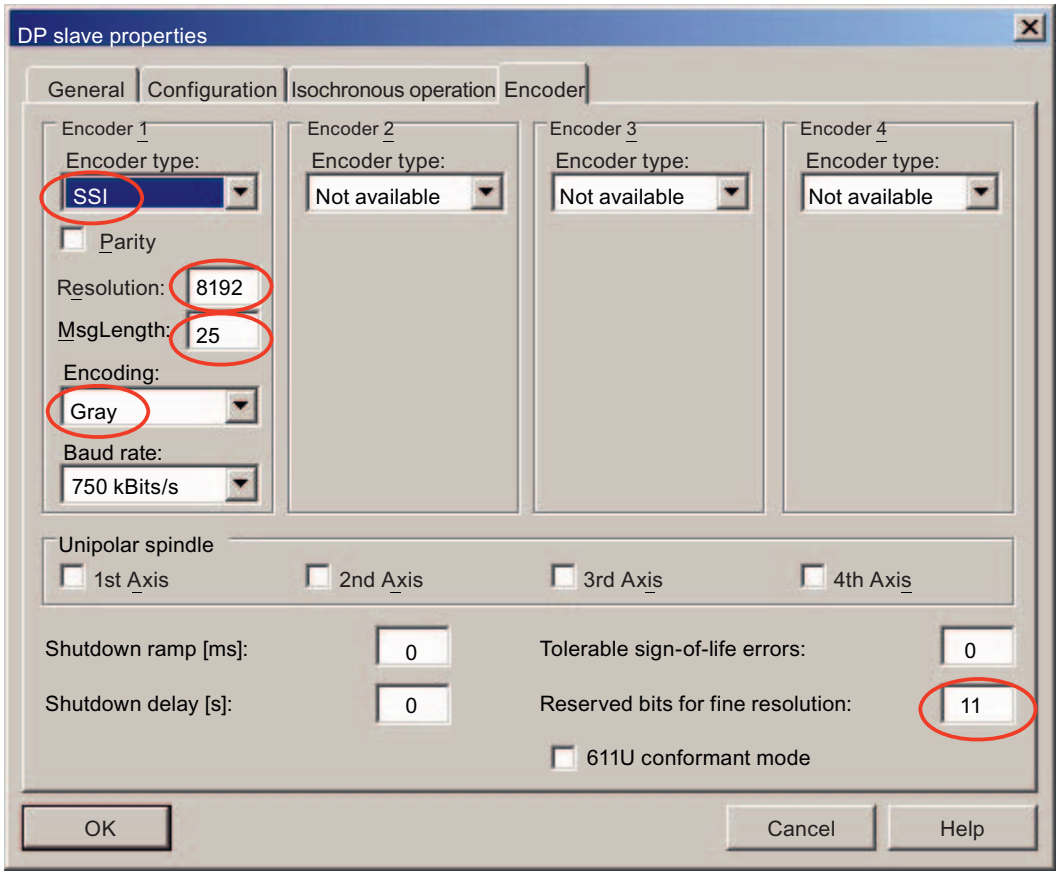


Figure 4-5 Encoder settings in STEP 7, HW Config

STEP 7 settings, HW Config	Corresponding encoder parameters
Encoder type	Encoder parameters: "Encoder type"
Resolution	Encoder parameters: "Increments/revolution (resolution)"
MsgLength	Encoder parameters: "User data length"
Encoding	Encoder parameters: "Actual value protocol format"
Reserved bits for fine resolution	**Note**: The value is permanently set by ADI4.

SIMOTION/TCPU settings

After you have created a new encoder in the project navigator of SIMOTION SCOUT under "EXTERNAL ENCODERS" and have assigned the technology object parameters in the displayed dialog boxes, e.g. "Axis Type" and "Units", the encoder data must be entered in the "Encoder Assignment" and "Encoder - Data" dialog boxes.

1. Settings in the "Encoder Assignment" dialog box

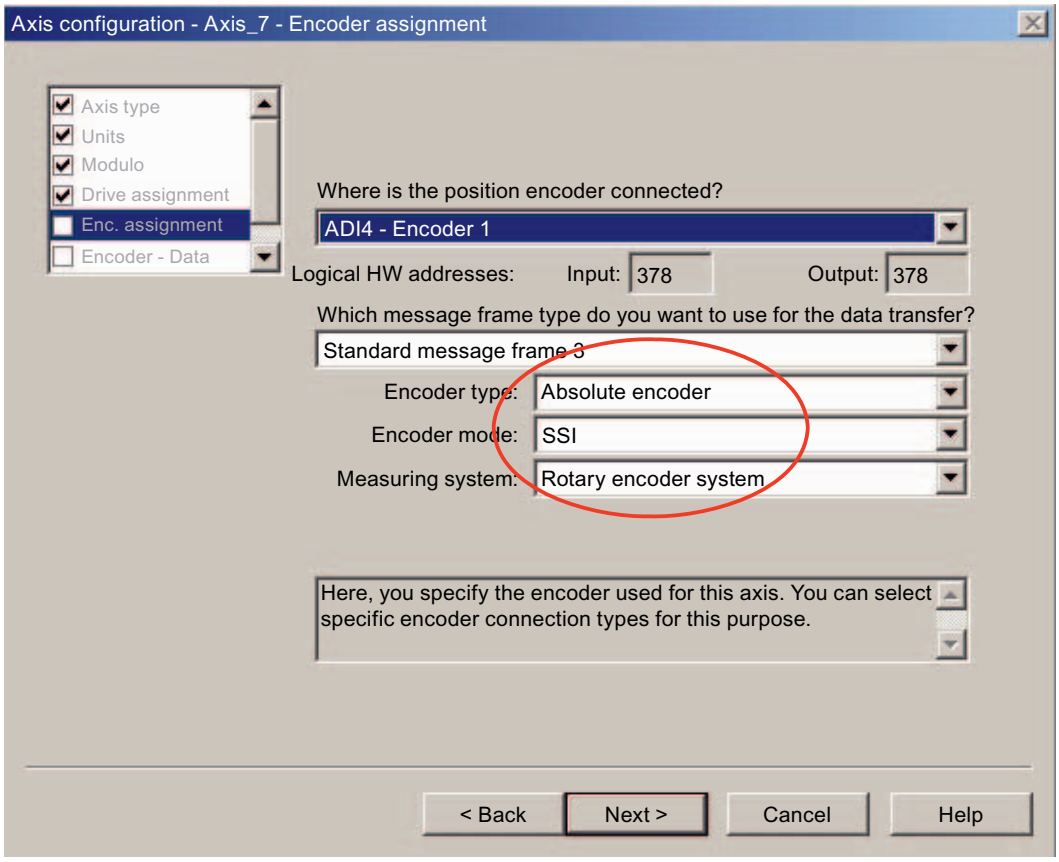


Figure 4-6 Encoder assignment settings

2. Settings in the "Encoder - Data" dialog box

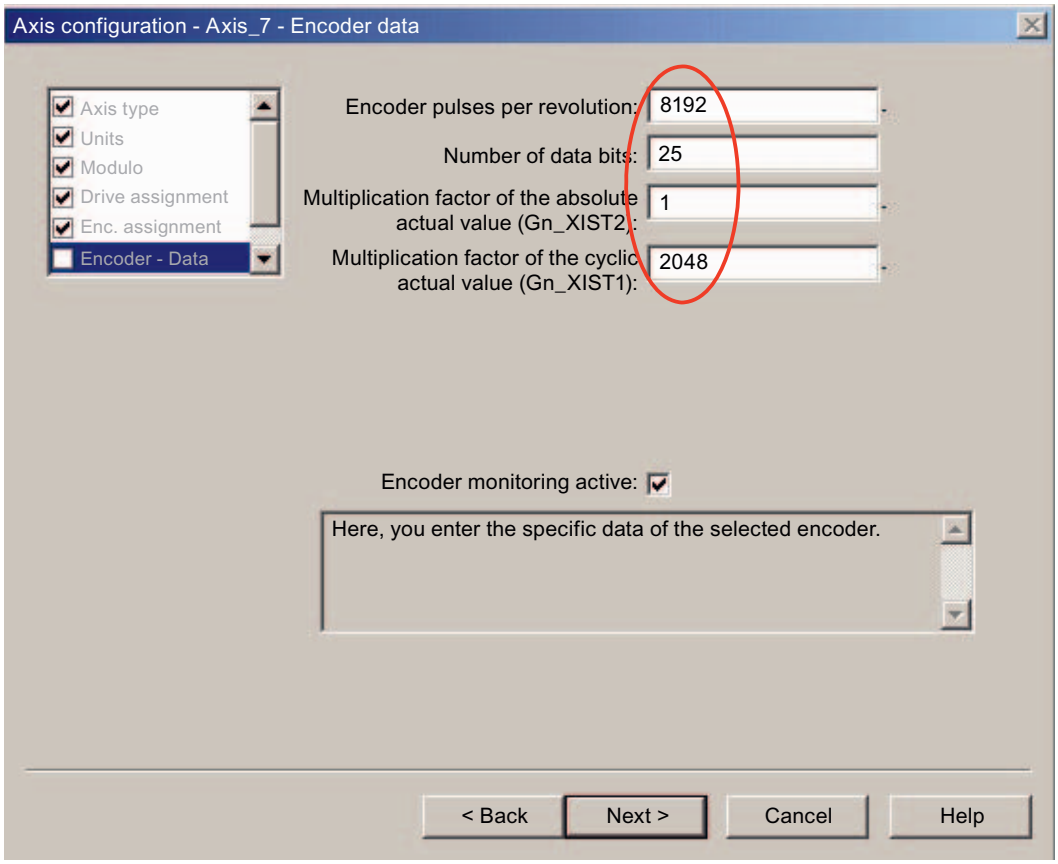


Figure 4-7 Encoder data settings

Settings:

Encoder data settings	Value
Encoder pulses per revolution	Encoder parameters: "Increments/revolution (resolution)"
Number of data bits	Encoder parameters: "User data length of the encoder"
Multiplication factor of the absolute actual value (Gn_XIST2)	1 (The absolute actual value (Gn_XIST2) is taken over directly)
Multiplication factor of the cyclic actual value (Gn_XIST1)	2^(STEP 7, HW Config: "Reserved bits for fine resolution") = 2^{11} = 2048

Overview: SIMOTION encoder parameters

Parameter: TypeOfAxis > Encoder_1 >	Value
encoderTyp	SENSOR_CYCLIC_ABSOLUT
encoderMode	SSI_MODE
encoderSystem	ROTATORY_SYSTEM
AbsEncoder > absResolution	8192
AbsEncoder > absDataLength	25
AbsEncoder > absResolutionMutiplierAbsolute	1 [1]
AbsEncoder > absResolutionMutiplierCyclic	2048 [2]
[1] After the ramp-up of the controller, the absolute actual value of the encoder is read out once. [2] 2048 = 2^{11}; corresponds to STEP 7, HW Config: "Reserved bits for fine resolution" = 11	

4.4 Incremental encoder (TTL)

General

The parameter assignment of an incremental encoder (TTL) illustrated in the following example is performed using the "External Encoder" technology object.

If the encoder belongs permanently to an axis, the "Axis" technology object is used to assign parameters.

Note

In conjunction with ADI4, SIMOTION only supports encoders with 13-bit and 25-bit message frames.

Encoder data

The encoder used in this example is a Siemens encoder, order number 6FX2 001-2GB02 with the following data:

Parameters	Value
Encoder type	Rotary
Encoder type	Incremental encoder
Increments/revolution (resolution)	1024
Encoder mode	RECTANGLE_TTL

Settings in STEP 7, HW Config

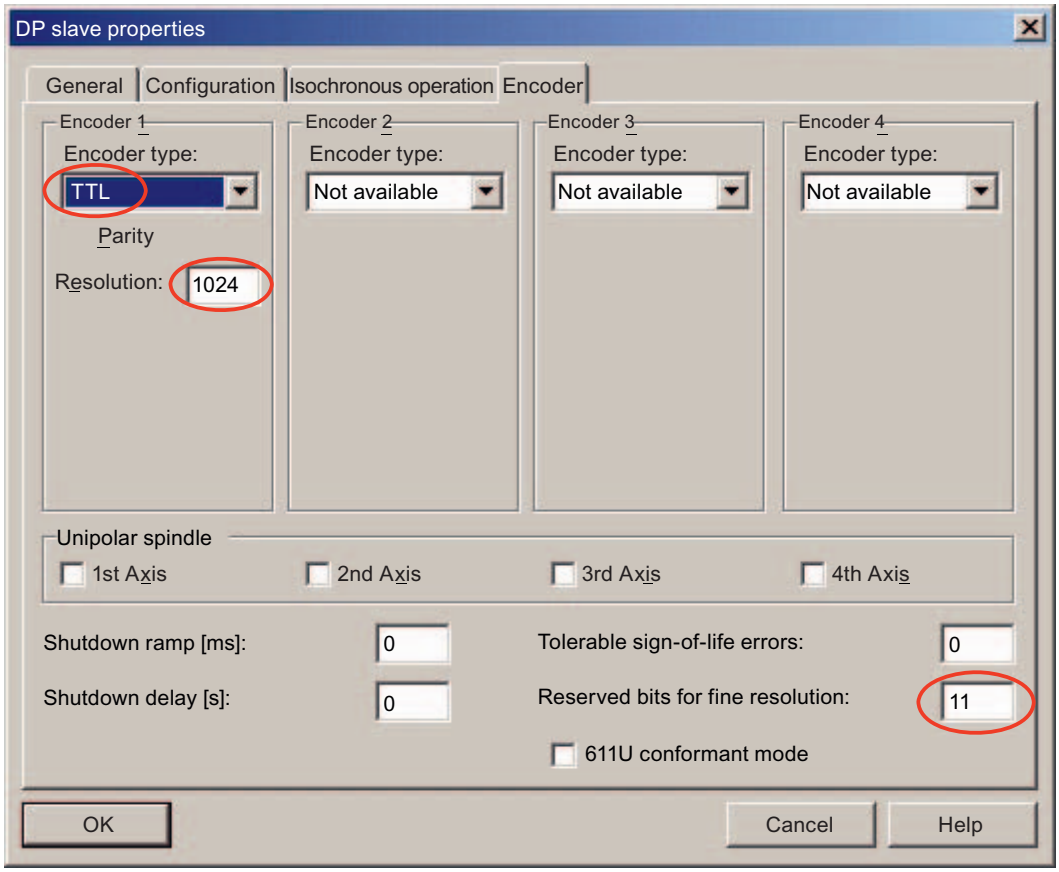


Figure 4-8 Encoder settings in STEP 7, HW Config

Settings:

Settings	
Resolution	Encoder parameters: "Increments/revolution (resolution)"
Reserved bits for fine resolution	The value is permanently set by ADI4.

Settings: SIMOTION/TCPU

After you have created a new encoder in the project navigator of SIMOTION SCOUT under "EXTERNAL ENCODERS" and have assigned the technology object parameters in the displayed dialog boxes, e.g. "Axis Type" and "Units", the encoder data must be entered in the "Encoder Assignment" and "Encoder - Data" dialog boxes:

1. Settings in the "Encoder Assignment" dialog box

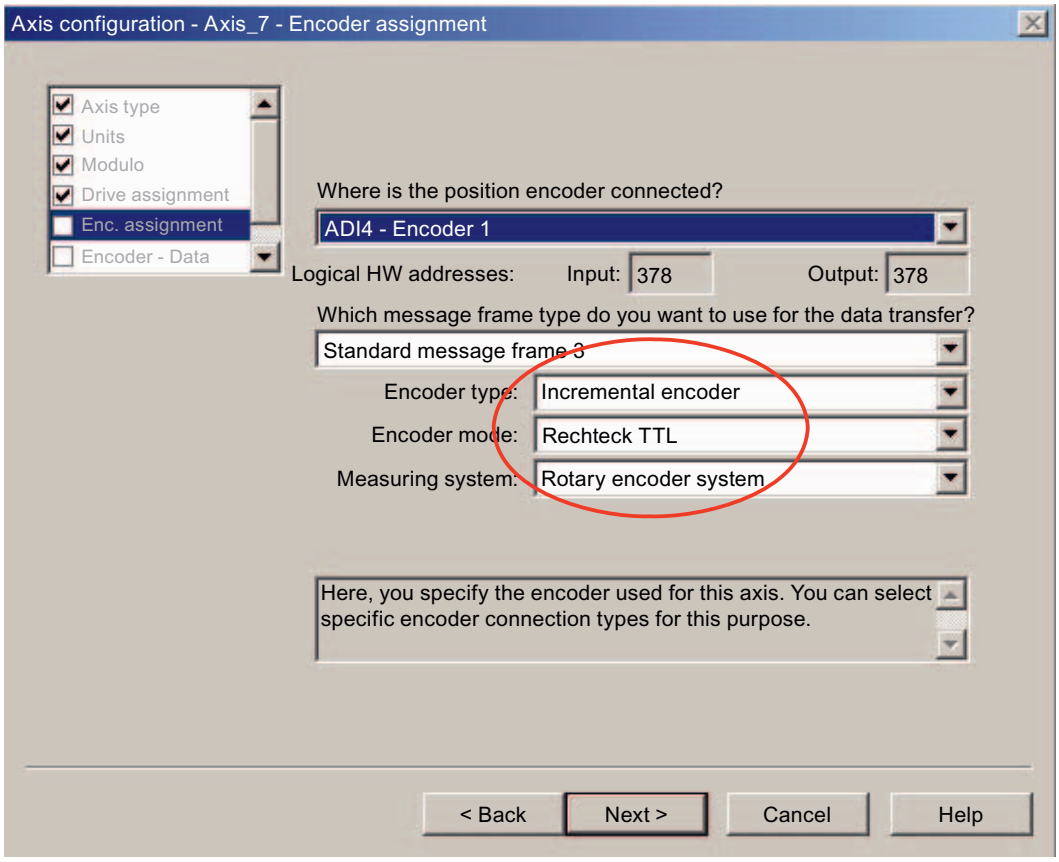


Figure 4-9 Encoder assignment settings

2. Settings in the "Encoder - Data" dialog box

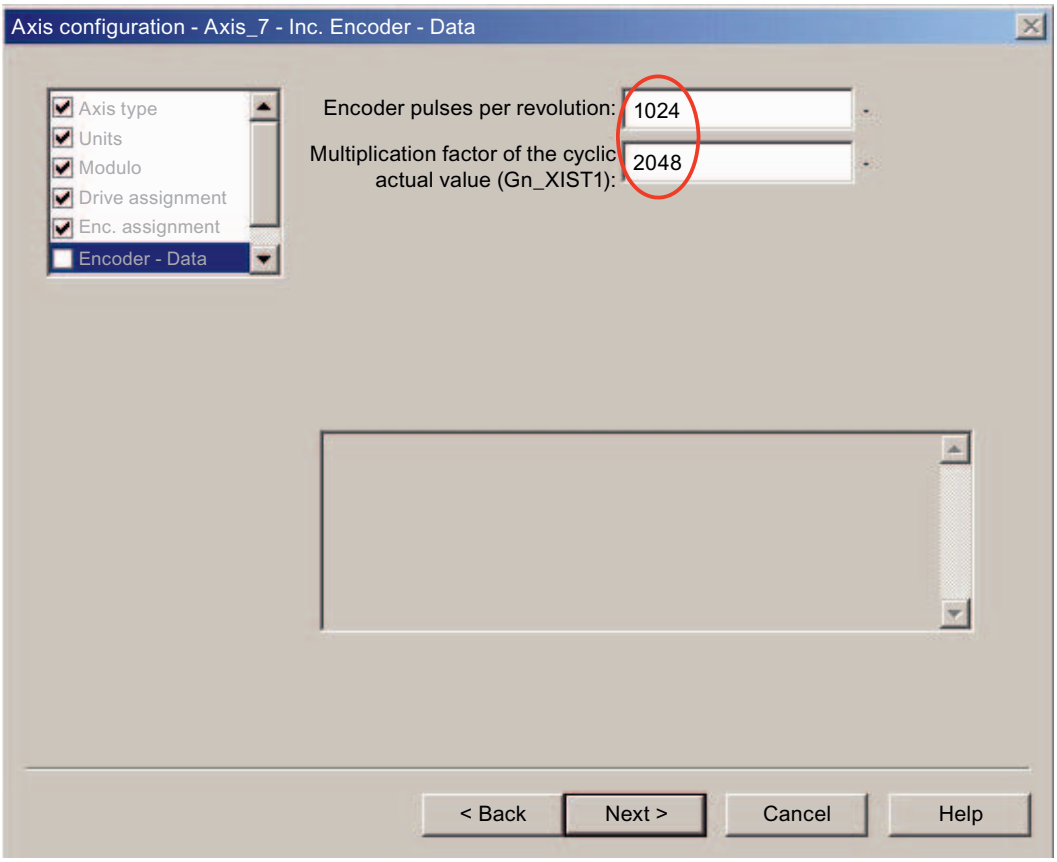


Figure 4-10 Encoder data settings

Settings:

Settings	
Encoder pulses per revolution	Encoder parameters: "Increments/revolution (resolution)"
Multiplication factor of the cyclic actual value (Gn_XIST1)	2^(STEP 7, HW Config: "Reserved bits for fine resolution") = 2^{11} = 2048

Overview: SIMOTION encoder parameters

Parameter: TypeOfAxis > Encoder_1	Value
encoderTyp	SENSOR_INCREMENTAL
encoderMode	RECTANGLE_TTL
encoderSystem	ROTATORY_SYSTEM
IncEncoder > incResolution	1024
IncEncoder > incResolutionMutiplierCyclic	2048 [1]
[1] 2048 = 2^{11}; corresponds to STEP 7, HW Config: "Reserved bits for fine resolution" = 11	

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