SIEMENS

SIMODRIVE 611 digital

Configuration Manual **Edition 06/2013**

Drive Converters

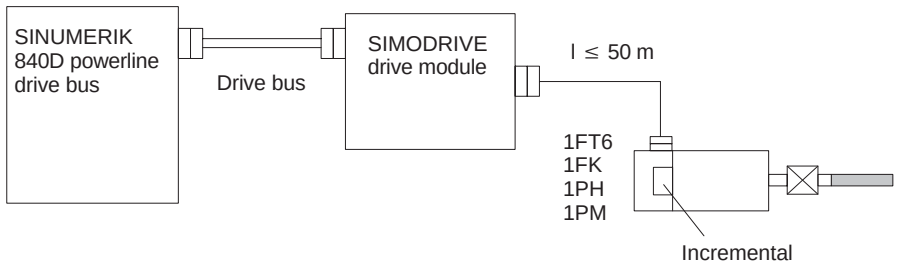
Manufacturer/Service Documentation

3.5 Overview, position sensing

Table 3-5 Assignment, motor measuring systems to control unit

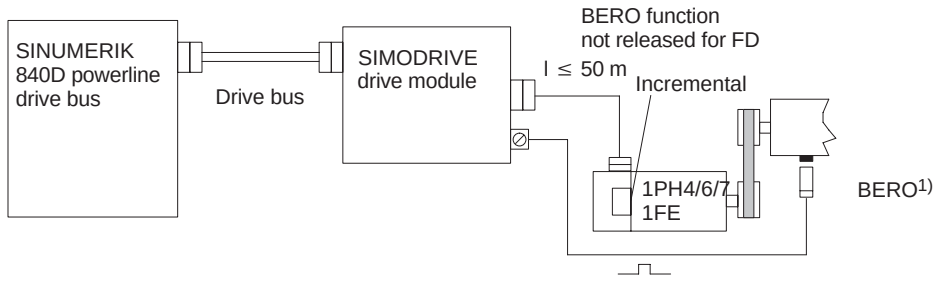
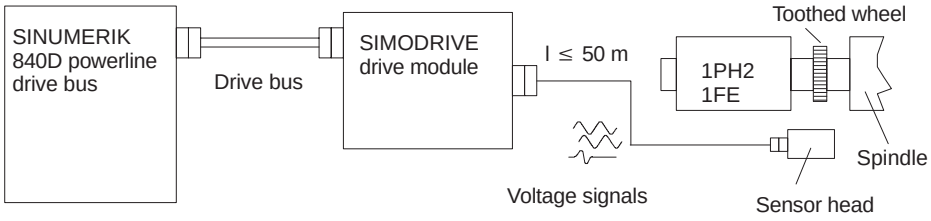
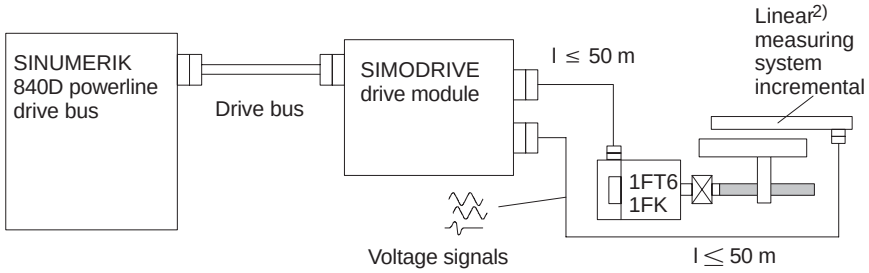
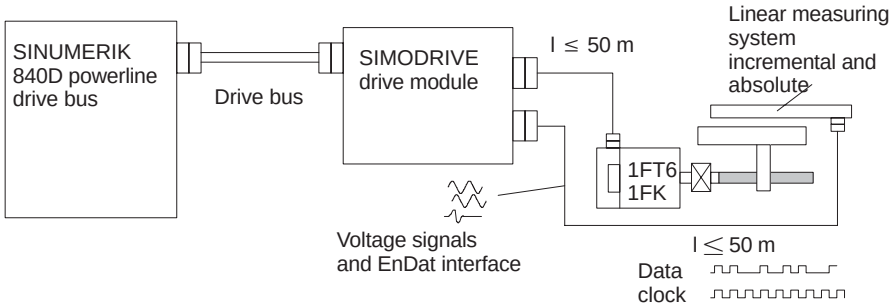
Drive control unit, High Performance (FD mode)	Drive control unit, High Performance (MSD mode)	Drive control unit, High Standard (FD mode)	Drive control unit, High Standard (MSD mode)	Drive control unit 611 universal HRS resolver	Drive control unit 611 universal HRS– 1 Vpp voltage signals	Motor type	Encoder system
				Yes		1FK Servo motor	Resolver
Yes		Yes			Yes	1FT/1FK Servo motor	Incremental encoder 1 Vpp
Yes		Yes			Yes	1FT/1FK Servo motor	Multiturn absolute encoders
Yes		Yes			Yes	1FN Linear motor	Incremental encoder (Hall sensor box) 1 Vpp Absolute encoder
	Yes		Yes		Yes	1PH4/6/7 Main spindle motor	Incremental encoder 1 Vpp
	Yes		Yes		Yes	1FE1/1PH2/1PM/2SP1 Main spindle motor	Incremental encoder (hollow–shaft encoder) 1 Vpp (toothed wheel or magnetic)
Yes		Yes			Yes	1FW Built–in torque motor	Incremental encoder 1 Vpp Absolute encoder
	Yes		Yes	Yes	Yes	1LA standard motor	Encoderless (sensorless)

Table 3-6 Indirect position (motor rotor position) and motor speed sensing digital controls

Version of the control board	Indirect position (motor rotor position) and motor speed sensing digital controls
Drive control High Perfor–mance/ High Stan-dard	

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Table 3-7 Direct position sensing, digital control

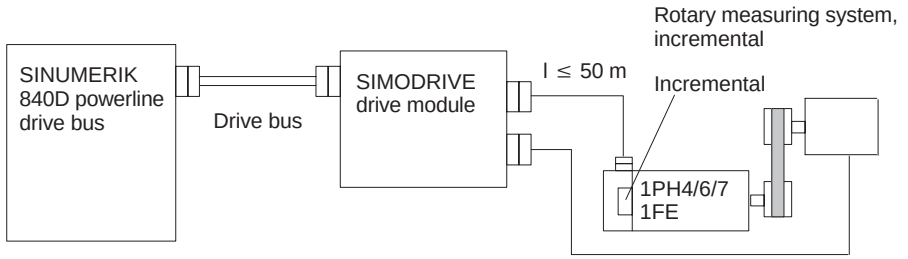
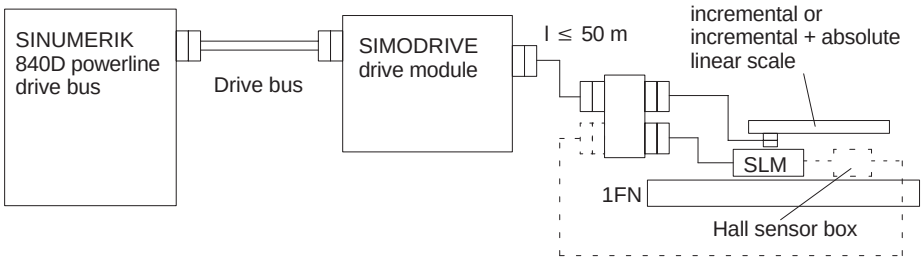
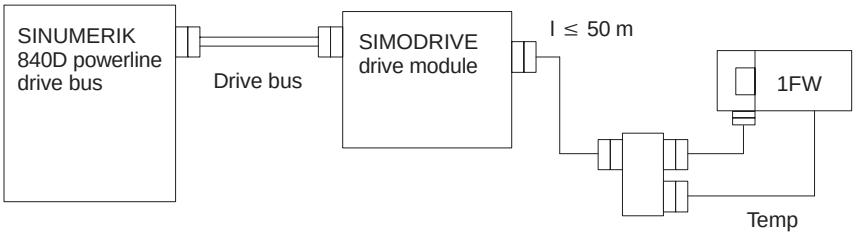
Version of the control board	Direct position sensing, digital controls
Drive control High Perfor–mance/ High Stan-dard	
	
	
	

1) The absolute accuracy for so–called synchronization with a BERO depends on the following:
   – the switching time of the BERO
   – the hysteresis of the BERO
   – the signal edge gradient (rate–of–rise) of the BERO signal (depending on the direction of rotation) and the switching thresholds in the drive; high > 13 V, low < 5 V
   – the search speed and the signal runtimes in the evaluation electronics

2) Distancecoded reference marks can be evaluated

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Table 3-7 Direct position sensing, digital control, continued

Version of the control board	Direct position sensing, digital controls
Drive control High Perfor–mance/ High Stan-dard	
Drive control High Perfor–mance	
	

3.6 Ordering information

Refer to the relevant catalog for the Order Nos. of the specified components

- Pre–assembled encoder cables with the appropriate maximum permissible cable lengths — refer to Catalog NC Z
- Toothed–wheel encoder and the diagnostics box required to make adjustments — refer to Catalog NC Z or NC 60

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Control Units

4

Overview of the control units

The control units/boards listed in the following table can be used in the SIMODRIVE power modules.

Table 4-1 Overview of the control units/boards

Closed–loop control module	Variant	Axes	Motor encoder	Motors[1)]	Optional interfaces
SIMODRIVE 611 universal HRS	1–axis n–set	1	Resolver	SRM: 1FT6, 7 1FK, 1FE1, 1FW6, 2SP1 IM: 1PH, 1PM6, SLM: 1FN Third–party: If suitable	PROFIBUS DP, terminals; RS 232/485
SIMODRIVE 611 universal HRS	1–axis pos.	1	Resolver	SRM: 1FT6, 7 1FK, 1FE1, 1FW6, 2SP1 IM: 1PH, 1PM6, SLM: 1FN	PROFIBUS DP, terminals; RS 232/485
SIMODRIVE 611 universal HRS	2–axis n–set	2	Resolver	SRM: 1FT6, 7 1FK, 1FE1, 1FW6, 2SP1 IM: 1PH, 1PM6, SLM: 1FN Third–party: If suitable	PROFIBUS DP, terminals; RS 232/485
SIMODRIVE 611 universal HRS	2–axis pos	2	Resolver	SRM: 1FT6, 7 1FK, 1FE1 1FW6, 2SP1 IM: 1PH, 1PM6, SLM: 1FN	PROFIBUS DP, terminals; RS 232/485
SIMODRIVE 611 universal HRS	2–axis n–set	2	Incremental encoder sin/cos 1 V_{PP} Absolute encoder	SRM: 1FT6, 7 1FK, 1FE1 1FW6, 2SP1 IM: 1PH, 1PM6, SLM: 1FN Third–party: If suitable	PROFIBUS DP, terminals; RS 232/485
SIMODRIVE 611 universal HRS	2–axis pos	2	Incremental encoder sin/cos 1 V_{PP} Absolute encoder	SRM: 1FT6, 7 1FK, 1FE1 1FW6, 2SP1 IM: 1PH, 1PM6, SLM: 1FN Third–party: If suitable	PROFIBUS DP, terminals; RS 232/485
SIMODRIVE 611 universal E HRS		2	Incremental encoder sin/cos 1 V_{PP} Absolute encoder	SRM: 1FT6, 7 1FK, 1FE1 1FW6, 2SP1 IM: 1PH, 1PM6, SLM: 1FN Third–party: If suitable	PROFIBUS DP, terminals; RS 232

1) SRM: Synchronous rotating motor
IM: Induction rotating motor
IM: Synchronous linear motor
Standard: Standard motor
Third–party: Unlisted motor

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Table 4-1 Overview of the control units/boards

Closed–loop control module	Variant	Axes	Motor encoder	Motors[1)]	Optional interfaces
SIMODRIVE 611 with digital setpoint interface for FD and MSD	High Performance control	2	Incremental encoders sin/cos 1 V_{PP}, EnDat	SRM: 1FT6, 1FK, 1FE1, 1FW6, 2SP1 IM 1PH, 1PM SLM: 1FN Standard: 1LA Third–party: If suitable	
SIMODRIVE 611 with digital setpoint interface for FD and MSD	High Performance control	1	Incremental encoders sin/cos 1 V_{PP}, EnDat	SRM: 1FT6, 1FK, 1FE1, 1FW6, 2SP1 IM: 1PH7, 1PM SLM: 1FN Standard: 1LA Third–party: If suitable	
SIMODRIVE 611 with digital setpoint interface for FD and MSD	High Standard control	2	Incremental encoders sin/cos 1 V_{PP}, EnDat	SRM: 1FT6, 1FK, 1FE1, 2SP1 IM: 1PH7, 1PM6 Standard: 1LA Third–party: If suitable	
SIMODRIVE 611 with digital setpoint interface for hydraulic/analog Linear drives HLA/ANA		2	Incremental encoders sin/cos 1 V_{PP}, EnDat, SSI (SW 1.2.4 and higher)	Hydraulic linear axes/analog axis	

1) SRM: Synchronous rotating motor
IM: Induction rotating motor
IM: Synchronous linear motor
Standard: Standard motor
Third–party: Unlisted motor

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4.1 Closed–loop control with digital setpoint interface

General information

Digital control units in 1–axis and 2–axis versions (for 1PH, 2–axis control is only possible with High Performance) are available to operate motors 1FT6/1FK/1FN1/1FN3/1FE1/1PH/1PM/1FM6/2SP1.

During the initialization phase (power on or reset), the drive software is downloaded from the SINUMERIK 840D to the control board via the drive bus.

1–axis drive control

High Performance: Order No.: 6SN1118–0DJ2□–0AA□

The digital 1–axis High Performance control can be loaded with the drive software for either FD control or MSD control. MSD and FD have the same user interface. The board is available in the following versions:

- Basic version with sinusoidal **voltage signals** and the possibility of connecting absolute encoders with EnDat interface
- In addition, the evaluation of a direct position measuring system with sinusoidal **voltage signals** and the connection of absolute encoders with EnDat interface and SSI interface (as of SW 5.1.9) is possible.

2–axis drive control

The module is available in three basic versions that differ in the controller performance and in the evaluation of the direct position measuring systems:

High Performance: Order No.: 6SN1118–0DK2□–0AA□

- Basic version with sinusoidal **voltage signals** and the possibility of connecting absolute encoders with EnDat interface
- In addition, the evaluation of two direct measuring systems with sinusoidal **voltage signals** and the connection of absolute encoders with EnDat interface and SSI interface (as of SW 5.1.9) is possible.

High Standard: Order No.: 6SN1118–0DM3□–0AA□

- Basic version with sinusoidal **voltage signals** and the possibility of connecting absolute encoders with EnDat interface.
- Additionally with evaluation for 2 direct measuring systems with sinusoidal **voltage signals** and the possibility of connecting absolute encoders with EnDat interface and SSI interface (from SW 5.1.9).

Note

A 2–axis drive control can also be operated in a single axis power module for single axis applications. It is engineered as a 1–axis board.

For motor encoders without any adjustment to the EMF of the synchronous motor (1FE1/1FN1/1FN3) a configurable, automatic identification technique can be used to determine the electrical rotor position. In so doing, motion of typically $< \pm 5$ degrees mechanical is not exceeded. The identification routine is performed after each power up operation.

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Software versions

The digital drive controls can be used with the following software releases of the SIEMENS drive components:

Table 4-2 Software functions

	High Performance	High Standard
MLFB	6SN1118–0DJ2□–0AA□ 6SN1118–0DK2□–0AA□	6SN1118–0DM3□–0AA□
NCU version	≥ 6.4.9	≥ 6.4.9
drive version	≥ 6.3.11	≥ 6.5.4
PCU50/PCU20	≥ 6.2.18	≥ 6.2.18
Commissioning tool for the PC	≥ 6.2.18	≥ 6.2.18
NCU hardware	≥ 573.3; ≥ 572.3; 571.3	≥ 573.3; ≥ 572.3; 571.3
Mixed operation, FD/MSD	≥ 6.2.12	≥ 6.2.12

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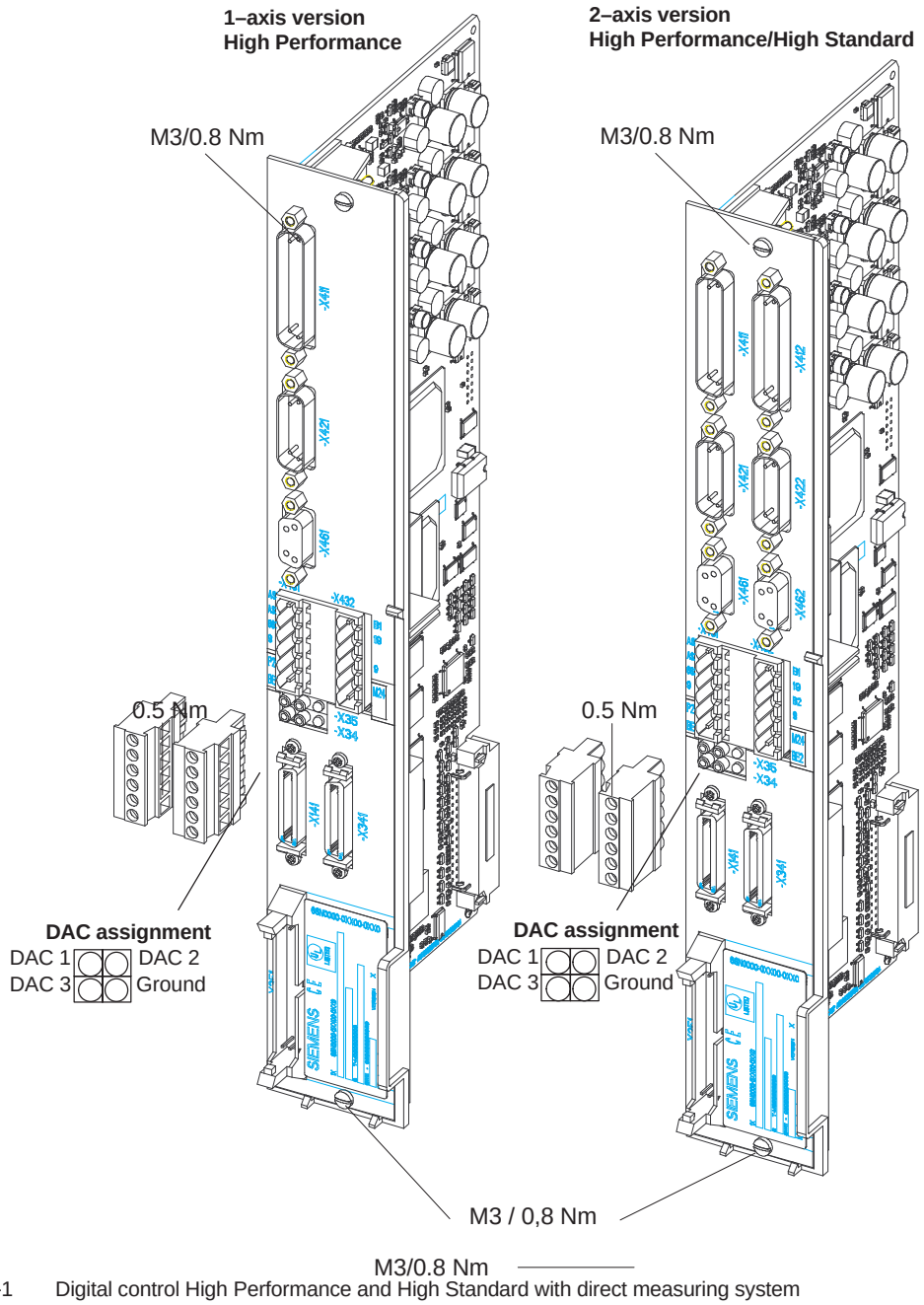


Fig. 4-1 Digital control High Performance and High Standard with direct measuring system

Notice

When using non–PELV circuits at terminals AS1, AS2, connectors must be coded to prevent the connectors being incorrectly inserted (refer to EN60204–1, Section 6.4).
For Order No. for coded connectors, refer to Catalog NC 60.

Warning

At terminals 19, P24 and M24, only PELV circuits may be connected. If this is not carefully observed, then this can result in personal injury in the form of electric shock.

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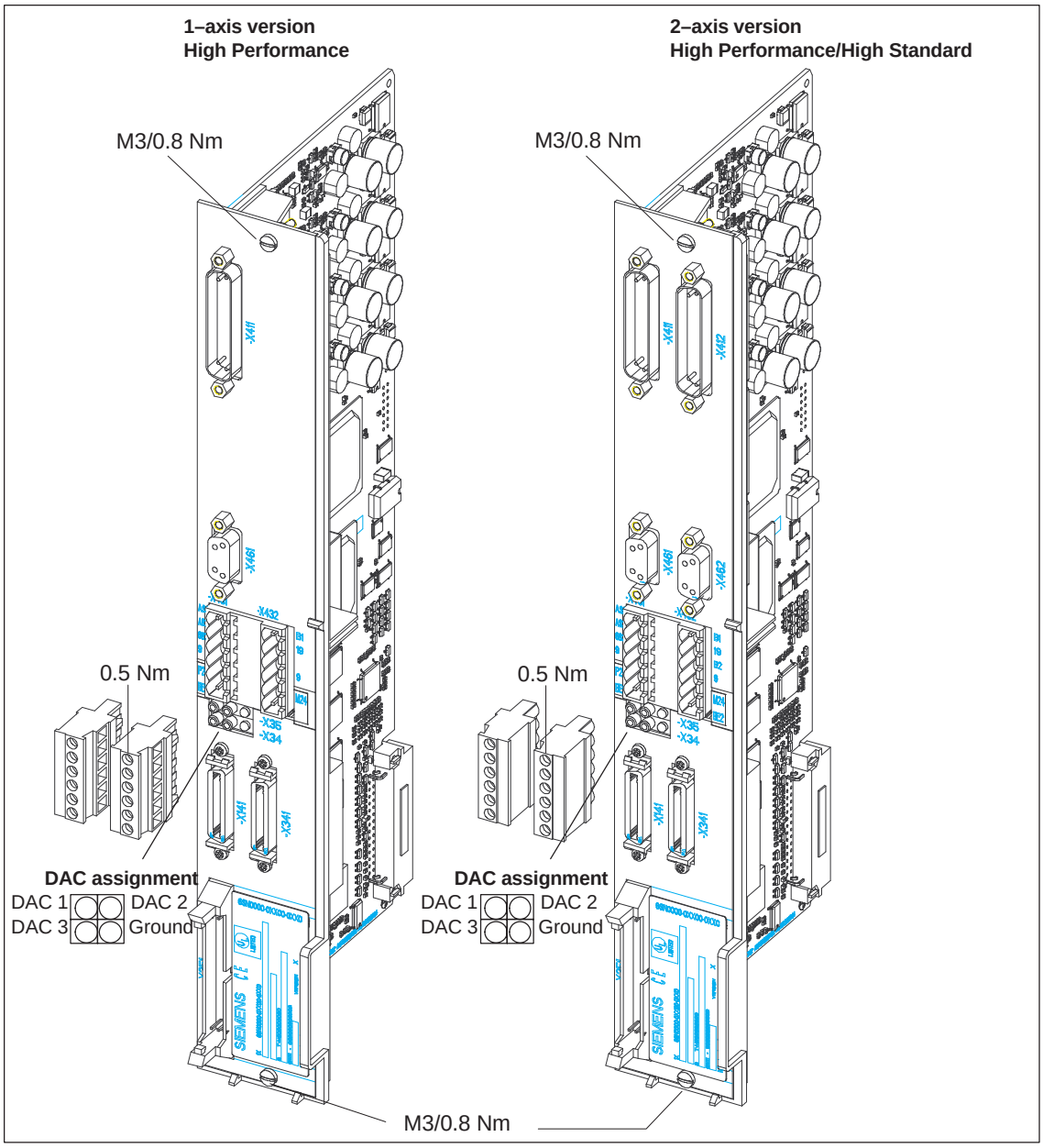


Fig. 4-2 Digital control High Performance and High Standard without direct measuring system

Notice

When using non–PELV circuits at terminals AS1, AS2, connectors must be coded to prevent the connectors being incorrectly inserted (refer to EN60204–1, Section 6.4).
For the order number for coded connectors, refer to Catalog NC 60.

Warning

At terminals 19, P24 and M24, only PELV circuits may be connected. If this is not carefully observed, then this can result in personal injury in the form of electric shock.

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4.2 Interface overview, closed–loop drive control

High Standard and High Performance

Table 4-3 Interface overview, High Standard and High Performance closed–loop drive control

Term. no.	Designation	Function	Type 1)	Typ. voltage/limit values	Max. cross–section
AS1 3)	X431	Relay start inhibit (feedback signal, terminal 663)	NC	max. 250 V AC/1 A,	1.5 mm^2
AS2 3)	X431	Relay start inhibit (feedback signal, terminal 663)		30 V DC/2 A	1.5 mm^2
663	X431	Pulse enable: The ”starting lockout” relay is operated with terminal 663. On opening, the trigger pulses are inhibited and the motor is switched into a torque–free condition.	I	+21 V ... 30 V	1.5 mm^2
9	X431	Enable voltage 2)	O	+24 V	1.5 mm^2
P24	X431	+24 V supply for the brake control 4)	I	+18 ... 30 V	1.5 mm^2
BE1	X431	Output, brake control, axis 1	O	max. 500 mA	1.5 mm^2
B1	X432	Input, external zero mark (BERO) axis 1	I	+13 ... 30 V	1.5 mm^2
19	X432	Negative enable voltage	O	0 V	1.5 mm^2
B2	X432	Input, external zero mark (BERO) axis 2	I	+13 ... 30 V	1.5 mm^2
9	X432	Positive enable voltage 2)	O	+24 V	1.5 mm^2
M24	X432	0 V supply for the brake control	I		1.5 mm^2
BE2	X432	Output, brake control, axis 2	O	max. 500 mA	1.5 mm^2
	X34/X35	Test socket, DAC			
	X411	Motor encoder, axis 1 5)		For the terminal assignment, refer to Table 4-4	
	X412	Motor encoder, axis 2 5)			
	X421	Direct position encoder, axis 1 5)		For the terminal assignment, refer to Table	
	X422	Direct position encoder, axis 2 5)			
	X461	BERO input, axis 1		For the terminal assignment, refer to Table 4-6	
	X462	BERO input, axis 2			
	X351	Equipment bus			
	X141/341	Drive bus			

1) I=Input; O=Output; NC=NC contact; NO=NO contact (for a signal, NO=High/NC=Low)

2) The terminal may only be used to enable the associated drive group.

3) When connecting contacts AS1/AS2 in series, a contact voltage drop up to max. 0.2 V must be taken into account for the lifetime of the contacts (100000 switching operations). For a 24 V switching voltage, due to the non–linear contact characteristics, from experience, five contacts can be simply connected in series without encountering any problems.

4) A UL–certified miniature fuse (max. 3.15 A) must be provided at the supply for the brake control:
Value: e.g. 3.15 AT/250 V; 5x20 mm UL
From: ekontor GmbH
Uhdestraße 31–33
D–74006 Heilbronn
or
Postfach 1661
D–74006 Heilbronn
Order No.: Littlefuse 021602.5TXP

5) In order to increase the strength with respect to surge disturbances, for encoder cables > 30 m long, the screen connection 6SN1162–0FA00–0AA2 can be used. In order to ensure noise immunity in compliance with the standard, the encoder cable shields should be connected where the cable enters the control cabinet.
The permissible voltage range for the common mode component of the individual encoder signals (A+. A–. B+, B–, C+, C–, D+, D–, R+, R–) is 1.5...3.5 V.

6) According to EN 60204–1 (Safety of Machinery) control transformers should be used when using AC control voltages.

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Encoder connection X411/X412

Table 4-4 Encoder signal input of motor encoder X411, X412

Pin	X411 (axis 1) X412 (axis 2)	Function
1	PENC	Encoder power supply
2	MENC	Encoder power supply ground
3	AP	Incremental signal for track A
4	AN	Inverse incremental signal for track A
5	M	Inner shield ground
6	BP	Incremental signal for track B
7	BN	Inverse incremental signal for track B
8	M	Inner shield ground
9	–	Reserved, do not use
10	ENDATCLK	EnDat interface clock signal
11	–	Reserved, do not use
12	XENDATCLK	Inverse clock signal, EnDat interface
13	THMOTP	KTY 84 (+) temperature sensor
14	PSENSE	Remote sense encoder power supply (P)
15	ENDATDAT	Data signal EnDat interface
16	MSENSE	Remote sense encoder power supply (N)
17	RP	Reference mark signal/zero pulse
18	RN	Inverse reference mark signal/zero pulse
19	CP	Singleturn absolute track signal C
20	CN	Inverse singleturn absolute track signal C
21	DP	Singleturn absolute track signal D
22	DN	Inverse singleturn absolute track signal D
23	XENDATDAT	Inverse EnDat interface data signal
24	M	Inner shield ground
25	THMOTCOM	KTY 84 (–) temperature sensor

Note:
The inputs on the control must not be assigned any signals other than the intended signals. Otherwise, sporadic or permanent malfunction or damage can occur. In particular, any existing signals of additional temperature sensors (PTCs, NTCs, etc.) for spindle applications must **NOT** be applied to the unused CP, CN, DP, or DN inputs when using induction motors!

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Encoder connection X421/X422

Table 4-5 Encoder signal input of direct measuring system X421. X422

Pin	X421 (axis 1) X422 (axis 2)	Function
1	PENC	Encoder power supply
2	MENC	Encoder power supply ground
3	AP	Incremental signal for track A
4	AN	Inverse incremental signal for track A
5	ENDATDAT	Data signal EnDat interface
6	BP	Incremental signal for track B
7	BN	Inverse incremental signal for track B
8	XENDATDAT	Inverse EnDat interface data signal
9	PSENSE	Remote sense encoder power supply (P)
10	RP	Reference mark signal/zero pulse
11	MSENSE	Remote sense encoder power supply (N)
12	RN	Inverse reference mark signal/zero pulse
13	M	Inner shield ground
14	ENDATCLK	EnDat interface clock signal
15	XENDATCLK	Inverse clock signal, EnDat interface

Note:
The inputs on the control must not be assigned any signals other than the intended signals. Otherwise, sporadic or permanent malfunction or damage can occur.
It is especially important for spindle applications, that possibly available signals from additional temperature sensors (PTCs, NTCs or similar) must NOT be connected to the CP–, CN–, DP–, DN inputs that are not used when using induction motors!
When ”parking axis” is selected, the encoder can be withdrawn and inserted also under voltage.

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Holding brake connection

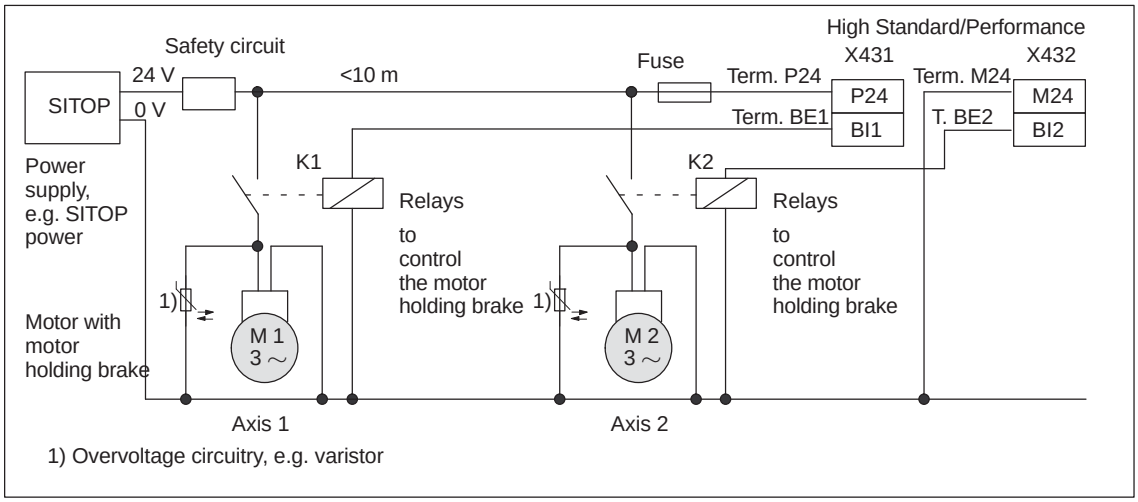


Fig. 4-3 Circuit example: Connecting a motor holding brake to a High Standard/High Performance control board

BERO input X461/X462

Table 4-6 BERO input X461/X462

Pin No.	Pin Designation X461	Pin Designation X462	Function	Type 1)	Technical specifications
	X461	**X462**	Type: 9–pin D–sub socket connector		
1	FRP	FRP	Internal enable voltage (jumpered with terminal 9)	O	+24 V
2	BERO1	BERO2	BERO input	I	+15 ... 30 V
3	Reserved, do not use	Reserved, do not use		–	
4				–	
5				–	
6	FRM	FRM	Internal enable voltage (jumpered with terminal 19)	O	0 V
7	Reserved, do not use	Reserved, do not use		–	
8				–	
9				–	

1) I: Input; O: Output

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