Edition 11/2024

COMPACT OPERATING INSTRUCTIONS

SINAMICS
SIMOTICS

S200 servo drive system

PROFINET version (PN)
www.siemens.com

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SINAMICS S200 PROFINET servo drive system with SIMOTICS S-1FL2

Compact Operating Instructions

Legal information

Warning notice system

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

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

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

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

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

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

Qualified Personnel

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

Proper use of Siemens products

Note the following:

⚠ WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

A5E52388930A AD, 11/2024, FW V6.4

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1 Safety notes

DANGER

Danger to life if the safety instructions and operating instructions are not observed

The compact operating instructions only contain the most important information for operating the converter. If the safety instructions and operating instructions in the associated documentation are not observed, accidents involving severe injuries or death can occur.

- Observe the safety instructions and operating instructions given in the associated documentation.

2 Technical data

2.1 Technical data of the converter

2.1.1 Permissible climatic conditions for the converter

Feature		Usage phase		
		Long-term storage	**Transport**	**Operation**
Climatic environmental conditions	Surrounding air temperature	-40 °C ... +70 °C	-40 °C ... +70 °C	0 °C ... 55 °C, > 45 °C with power derating
	Humidity	≤ 95%, condensation not permissible	≤ 95% at 45 °C	≤ 95%, condensation not permissible
Mechanical environmental conditions	Vibration	Class 1M2 according to IEC 60721-3-1	Class 2M3 according to IEC 60721-3-2 • 2 Hz to 9 Hz: 7.5 mm deflection • 9 Hz to 200 Hz: 2 g vibration	Class 3M1 according to IEC 60721-3-3 • 10 Hz to 58 Hz: 0.075 mm deflection • 58 Hz to 200 Hz: 1 g vibration
	Shock	-	-	Class 3M1 according to IEC 60721-3-3 • Peak acceleration: 5 g • Duration of shock: 30 ms
Biological environmental conditions		Class 1B2 according to IEC 60721-3-1	Class 2B2 according to IEC 60721-3-2	Class 3B1 according to IEC 60721-3-3
Protection against chemical substances		Class 1C2 according to IEC 60721-3-1	Class 2C2 according to IEC 60721-3-2	Class 3C2 according to IEC 60721-3-3

2.1.2 Specific technical data of the 200 V converter

Article No. 6SL5□10-1BB			10-1AF0	10-2AF0	10-4AF0	10-8AF0	11-0AF0
Frame size			FSA	FSA	FSB	FSC	FSC
Weight (g)	S200 Basic PN		763	763	960	1741.4	1741.4
	S200 PN		763	809.6	1028.9	1741.4	1741.4
Rated output current (A)			0.81	1.33	2.4	4.4	4.4
Max. output current (A)			3.3	5.1	9.2	16.8	16.8
Max. supported motor power (kW)			0.1	0.2	0.4	0.75	1.0
Power loss (W)			12	15	24	45	46
Output frequency (Hz)			0 ... 550				
Pulse frequency (kHz)			8				
Permissible SCCR (kA rms)			100 [1]				
Mains supply	Permissible voltage		1 AC/3 AC 200 V ... 240 V (-15% ... +10%)				
	Frequency (Hz)		50/60 ± 10%				
	Rated input current (A)	1 AC	1.2	2.0	3.0	7.0	8.0
		3 AC	0.6	1.1	1.8	3.5	4.0
	Inrush current (A)	1 AC	8.9	8.9	8.4	6.2	6.2
		3 AC	10.5	10.5	8.5	7.6	7.6
External power supply	Permissible voltage (V)		22.8 ... 28.8 (for a motor with brake) 20.4 ... 28.8 (for a motor without brake)				
	Max. current (A)		2.2 (for a motor with brake) 1.2 (for a motor without brake)				
Cooling type			Natural cooling				
Installation altitude			• Up to 2000 m above sea level without power derating • Up to 4000 m above sea level with power derating				
Directives and standards			CE, UL, UKCA, EAC, KC, ISO 9001, ISO 14001, RCM, China RoHS, SEMI F47-0706				

[1] The maximum permissible short-circuit current for 200 V variants with Type E Combination Motor Controllers is 65 kA.

2.1.3 Specific technical data of the 400 V converter

Article No. 6SL5510-1BE		10-2AF0	10-4AF0	10-8AF0	11-0AF0	11-5AF0	12-5AF0	13-5AF0	15-0AF0	17-0AF0
Frame size		FSA	FSA	FSB	FSB	FSC	FSC	FSD	FSD	FSD
Weight (g)		1517.5	1517.5	1912.4	1912.4	2008.4	2008.4	4517.5	4517.5	4517.5
Rated output current (A)		1.3	1.3	2.5	3.0	5.3	7.8	11.0	12.6	13.2
Max. output current (A)		5.1	6.0	9.3	11.5	20.0	26.5	38.1	38.8	37.4
Max. supported motor power (kW)		0.2	0.4	0.75	1.0	1.75	2.5	3.5	5.0	7.0
Power loss (W)		31	32	46	54	84	123	171	194	205
Output frequency (Hz)		0 ... 550								
Pulse frequency (kHz)		8								
Permissible SCCR (kA rms)		65								
Mains supply	Permissible voltage	3 AC 380 V ... 480 V (-15% ... +10%)								
	Frequency (Hz)	50/60 ± 10%								
	Rated input current (A)	1.3	1.3	2.5	3.0	5.5	8.0	11.0	13.0	14.2
	Inrush current (A)	8.0	8.0	10.0	10.0	23.0	23.0	53.0	53.0	53.0
External power supply	Permissible voltage (V)	22.8 ... 28.8 (for a motor with brake) 20.4 ... 28.8 (for a motor without brake)								
	Max. current (A)	3.2 (for a motor with brake) 1.2 (for a motor without brake)								
Cooling type		Natural cooling				Fan cooling				
Installation altitude		• Up to 2000 m above sea level without power derating • Up to 4000 m above sea level with power derating								
Directives and standards		CE, UL, UKCA, EAC, KC, ISO 9001, ISO 14001, RCM, China RoHS, SEMI F47-0706								

2.2 Technical data of the 1FL2 motor

Property	Description
Cooling	Natural cooling
Type of construction according to IEC/EN 60034-7	IM B5 (IM V1, IM V3)
Degree of protection according to IEC/EN 60034-5	• 1FL2102, 1FL2□03, 1FL2104, 1FL2204: IP54 for the shaft extension (without shaft sealing) and IP65 for the motor body, optionally IP65 for the whole motor (with shaft sealing) • 1FL2□05, 1FL23□□: IP65
Temperature monitoring	Thermal motor model
Paint finish	Anthracite (614 Anthrazit)
Shaft extension according to DIN 748-3 and IEC 60072-1	Plain shaft, optionally shaft with feather key (half-key balancing)
Radial eccentricity, concentricity, and axial eccentricity according to DIN 42955 and IEC 60072-1	Tolerance N (normal)
Encoder	• Absolute encoder single-turn, 17-bit • Absolute encoder single-turn, 21-bit • Absolute encoder, 21-bit single-turn + 12-bit multiturn
Connection	• 1FL2102, 1FL2□03, 1FL2104, 1FL2204: dual-cable connections with a hybrid connector • 1FL2□05: two-cable connections with two angular connectors • 1FL23□□: three-cable connections with three angular connectors
Mechanical environmental conditions during operation	• Vibration severity grade: A (according to IEC 60034-14:2003) • Shock resistance (m/s^2): – 1FL2102, 1FL2□03, 1FL2104, 1FL2204, 1FL2□05: 50 (continuous in axial direction), 50 (continuous in radial direction), 300 (in a short time of 11 ms) – 1FL23□□: 25 (continuous in axial direction), 50 (continuous in radial direction), 300 (in a short time of 11 ms)
Operating temperature	-15 °C ... +40 °C, power derating at higher temperatures
Relative humidity	< 90% at 30 °C, condensation not permissible
Installation altitude according to EN 60034-6	≤ 1000 m above sea level; otherwise power derating
Directives and standards	CE, UL, UKCA, EAC, REACH, ISO 9001, ISO 14001, China RoHS, China Energy Label Grade 2

2.3 Technical data of the MOTION-CONNECT cables

Property	Power cable	Encoder cable	Brake cable
Rated voltage U_0/U (V)	• 200 V converters: 300/1000 • 400 V converters: 600/1000	30/300	30/300
Number of conductors	• With brake conductors: 6 • Without brake conductors: 4	6	2
Outer diameter (mm)	• For 1FL2 SH20 ... SH65: ø (7.5 ± 0.2) • For 1FL2 SH90: – 2.5 kW: ø (7.8 ± 0.3) – 3.5 kW ... 7 kW: ø (9 ± 0.3)	ø (7 ± 0.2)	ø (6 ± 0.2)
Minimum bending radius, static (mm)	4 x outer diameter	4 x outer diameter	4 x outer diameter
Minimum bending radius, dynamic (mm)	7.5 x outer diameter	7.5 x outer diameter	7.5 x outer diameter
Operating temperature (°C)	-20 ... +80		
Shielding	Braided shield; coverage ≥ 85%		
Degree of protection	IP65		
Jacket material	• MOTION-CONNECT 350: PVC • MOTION-CONNECT 380: PUR		
Bending cycles	• MOTION-CONNECT 350: 1 million • MOTION-CONNECT 380: 5 million		
Directives and standards	CE, UL, UKCA, EAC, ISO 9001, ISO 14001, China RoHS		

3 Mounting

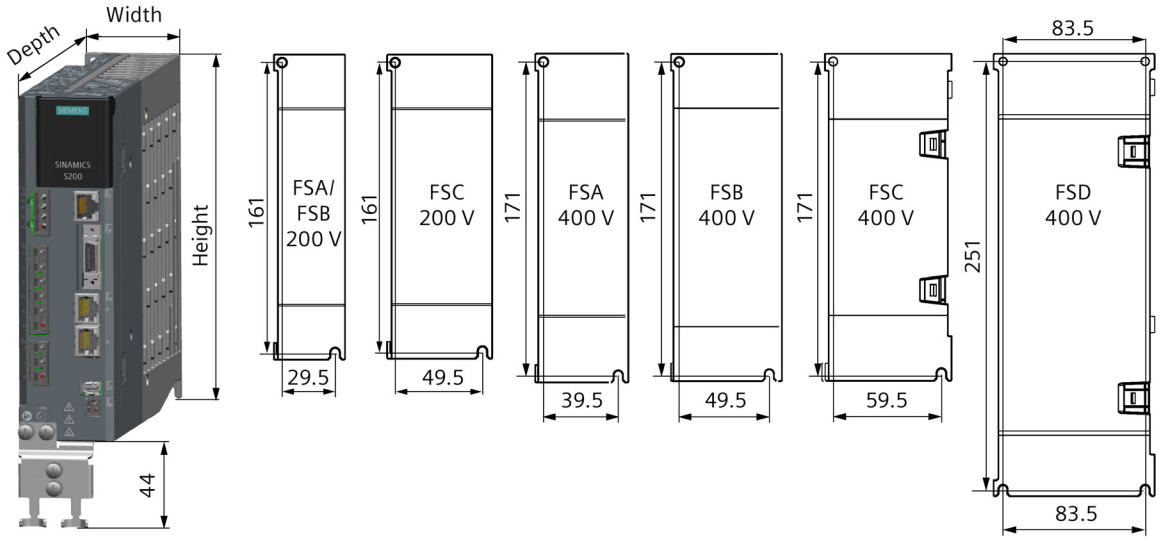
3.1 Mounting the converter

To ensure a reliable, continuous, and trouble-free converter operation, observe the following mounting conditions:

- The converter is designed for installation in a control cabinet.
- The converter is certified for use in environments with degree of pollution 2 without condensation, that is, in environments where no conductive pollution/dirt occurs. Condensation is not permissible.
- The converter fulfills degree of protection IP20 according to IEC 60529.
- The converter supports vertical mounting only. Mount the converter vertically with the operator panel facing upwards.
- Use a conductive steel sheet no thinner than 2 mm as the mounting plate.

3.1.1 Dimension drawings and drill dimensions

All dimensions are specified in millimeters.



Voltage	Frame size	Width	Height	Depth	Fixing
1 AC/3 AC 200 V	FSA	40 mm	170 mm	135 mm	2 x M4 / 2.5 Nm
	FSB	40 mm	170 mm	170 mm	
	FSC	60 mm	170 mm	195 mm	
3 AC 400 V	FSA	50 mm	180 mm	200 mm	2 x M4 / 2.5 Nm
	FSB	60 mm	180 mm	200 mm	
	FSC	70 mm	180 mm	200 mm	
	FSD	95 mm	260 mm	230 mm	4 x M4 / 2.5 Nm

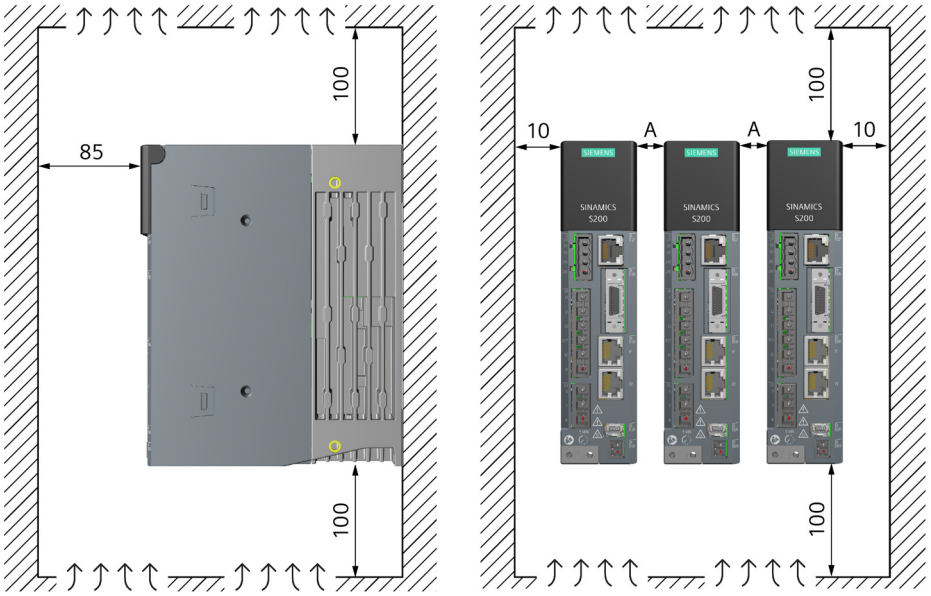
3.1.2 Minimum clearance

Observe the following minimum mounting clearances. For converters without built-in fans, install cooling fans above the converters for sufficient heat dissipation.

Note

For converters without built-in fans, when the surrounding temperature in the cabinet is ≥ 45 °C, the airflow velocity above the converters must be greater than 0.5 m/s.

All dimensions are specified in millimeters.



Minimum lateral clearance (A) between multiple converters:

- 200 V converter: 1 mm
- 400 V converter: 10 mm
- A mixture of 200 V and 400 V converters: 10 mm

3.2 Mounting the motor

3.2.1 Mounting instructions for the motor

NOTICE
Damage to the absolute encoder due to the magnetic interference from the magnetic field The magnetic interference from the magnetic field can cause a damage to the absolute encoder. • To avoid magnetic interference to the absolute encoder, keep the motor at least 15 mm away from devices that produce a magnetic field stronger than 10 mT.

- Adhere to the specifications on the rating plate.
- Observe the safety labels on the motor.
- Check the installation site and permissible environmental conditions such as temperature and installation altitude. For details, see Section "Technical data of the 1FL2 motor (Page 5)".
- Thoroughly remove any anti-corrosion agents from the shaft extension with commercially available solvents.
- Ensure that the flange is in even contact with the mounting surface.
- Use hexagon socket head cap screws with a property class of at least 8.8.
- Avoid any uneven stressing when tightening the fastening screws.

Permissible conditions for motor operation

Table 3-1 Safety labels on the motor

	"Hot surface" warning label
	"No shocks at the shaft extension" warning label

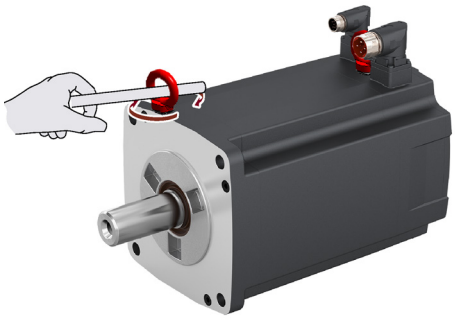
3.2.2 Lifting the motor

⚠WARNING

Death or injuries due to unresolved burdens

At the transport the motor can cause death or injuries by unchecked movements.

- Use lifting equipment and load suspension devices which are only interpreted for the burden of the motor and intact.
- Do not stay under and in the jib range of unresolved burdens.
- Safeguard the motor against rolling away at the side when removing.



Lifting the 1FL2310 motor with eyebolts

The 1FL2310 motor (SH90) has two M8 threaded holes for screwing in two eyebolts.

Lift the 1FL2310 motor at the eyebolts. Make sure that the eyebolts are secured against unintentional loosening.

3.2.3 Non-thermally insulated mounting

To ensure good heat dissipation, do not insert any thermal insulator between the motor flange and the mounting flange. The motor requires a minimum clearance of 100 mm from adjacent components on three sides when installed. Observe the following mounting conditions for the specified motor data:

Motor	Screws	Tightening torque (Nm)	Steel plate: width x height x thickness (mm)
1FL2102	2 x M4	2.4	200 x 200 x 6
1FL2□03	4 x M5	4.7	250 x 250 x 6
1FL2104	4 x M6	8	
1FL2204	4 x M6	8	
1FL2105	4 x M8	20	300 x 300 x 12
1FL2205	4 x M6	8	
1FL2304	4 x M8	20	270 x 270 x 10
1FL2306	4 x M8	20	390 x 390 x 15
1FL2310	4 x M12	85	420 x 420 x 20

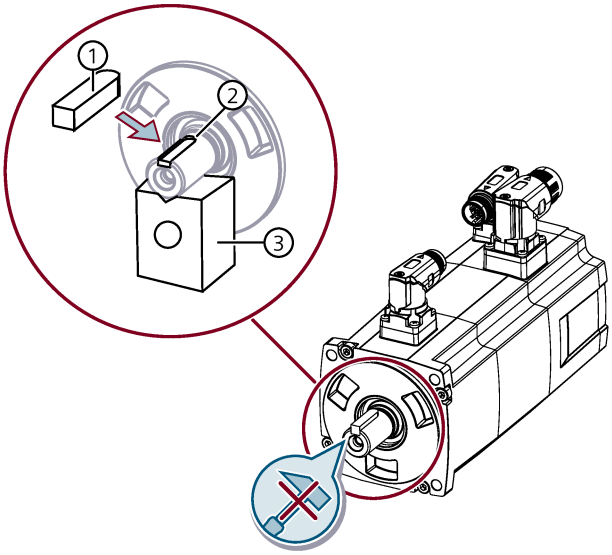
The data in the table refers to an ambient temperature of +40 °C and an installation altitude up to 1000 m above sea level. If the environmental conditions are different, derating may be required. For more information about derating, see Section "Derating factors" in the Operating Instructions.

Larger mounting surfaces improve heat dissipation.

3.2.4 Mounting the feather key

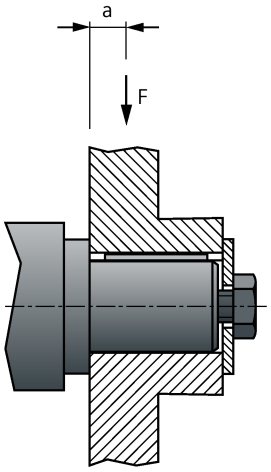
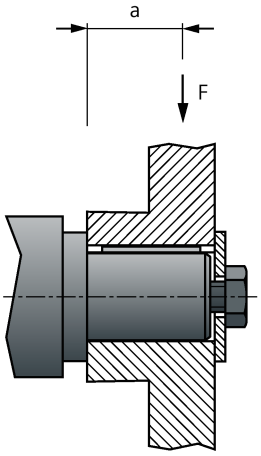
Proceed as follows to mount the feather key:

1. Install the well-lubricated feather key ("①") to the key slot ("②") and make sure that the feather key and the key slot are fitted closely.
2. Place a V-type block ("③") under the shaft extension for supporting (recommended).
3. Knock the feather key into the key slot by using a copper bar.
4. Mount the key without striking the key slot or the shaft extension.



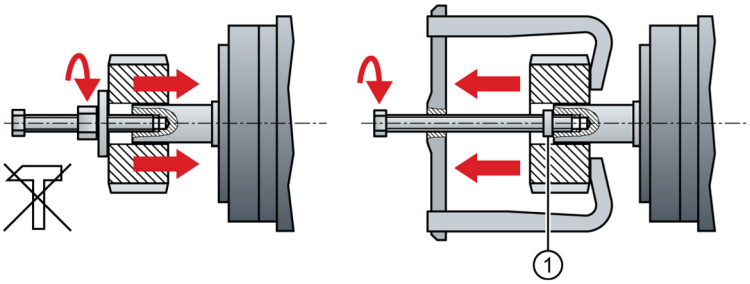
3.2.5 Attaching output elements

Mount the output elements as close as possible to the motor bearing.

Optimum	Unfavorable
	
Low stress on shafts and bearings	High stress on shafts and bearings

Mount or remove the output elements (for example, couplings, gear wheels, and belt pulleys) by using suitable devices only.

- Use the threaded hole in the shaft extension.
- If required, heat up the output elements before mounting or removing.
- If necessary, completely balance the motor together with the output elements according to ISO 1940.
- When removing the output elements, use an intermediate disk to protect the centering in the shaft extension.

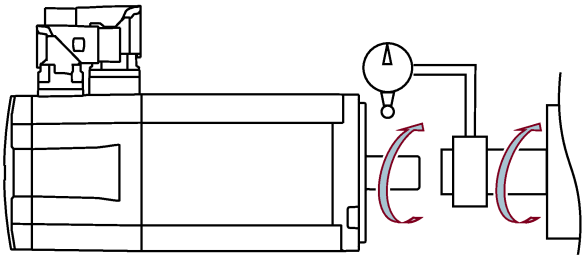


① Intermediate washer/disk

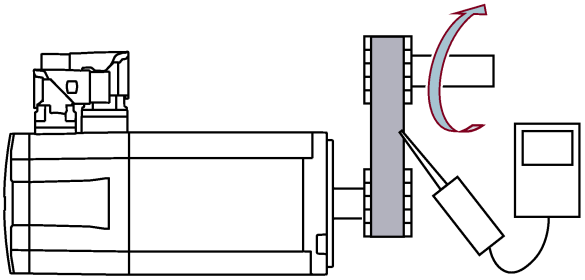
Procedure

Proceed as follows to attach an output element (for example, a coupling) to the motor:

1. Select a coupling.
   Use a flexible coupling with high torsional rigidity specifically designed for servo motors, which can transfer the motor torque to the mechanics and compensate radial, axial, and angular misalignments.
2. Install the coupling.
   Do not strike the shaft when installing a coupling. Ensure that the radial and axial forces are smaller than the allowable maximum values specified in the Operating Instructions.
3. Align the coupling.
   When a motor is used with a flange coupling, the radial deviation must be smaller than 0.03 mm; otherwise, the bearing will be damaged. The required alignment accuracy varies with the motor speed and the coupling type. Determine the accuracy according to actual applications.

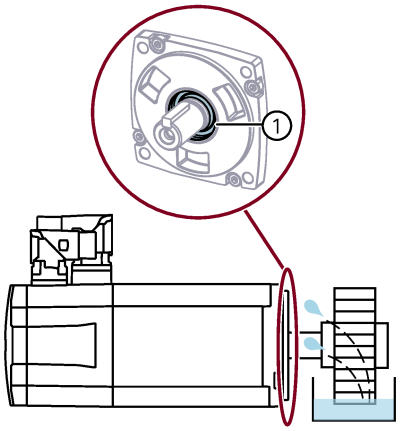


   – Rotate the motor shaft and the machine shaft to align the coupling.
   – An alignment accuracy test is preferred. If unachievable, judge the accuracy by observing whether the coupling can slide smoothly on both shafts.
4. Realign the coupling.
   If the coupling gives out abnormal sounds, you should refer to the step "3. Aligning the coupling" to realign the coupling until the sounds disappear.
5. Measure tension.
   The belt tension must be smaller than the allowable radial forces of the motor.



   – Measure the belt tension at multiple points using a tension meter while turning the motor shaft by 45°.
   – Reduce the axial misalignment of the belt-pulleys to keep the axial forces to the motor shaft to a minimum.

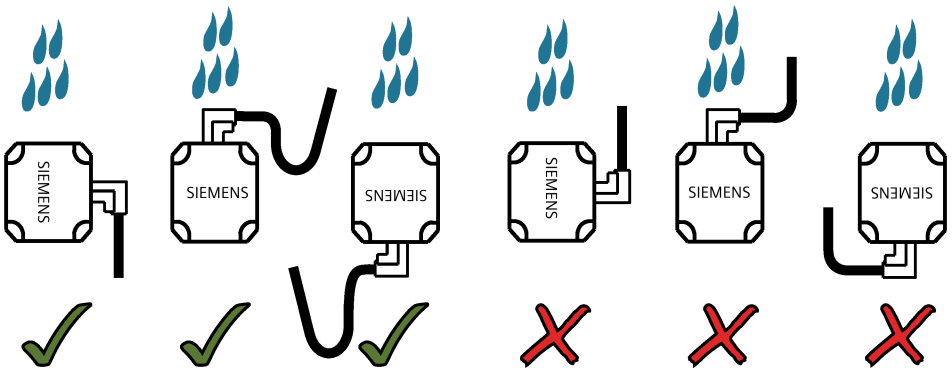
3.2.6 Lubricating the shaft sealing ring



The shaft sealing ("①") should be used with sufficient lubricant oil splashed on it. Do not use a motor with a shaft sealing submerged in oil.

3.2.7 Routing cables in damp environments

To operate the motor in a damp environment, follow the installation instructions below:



4 Connecting

Note

Note for connecting the drive system

Fix all the connecting cables to the converter shield plate by using shield clamps or suitable cable ties.

Note

The converter provides short-circuit protection at the motor output terminals.

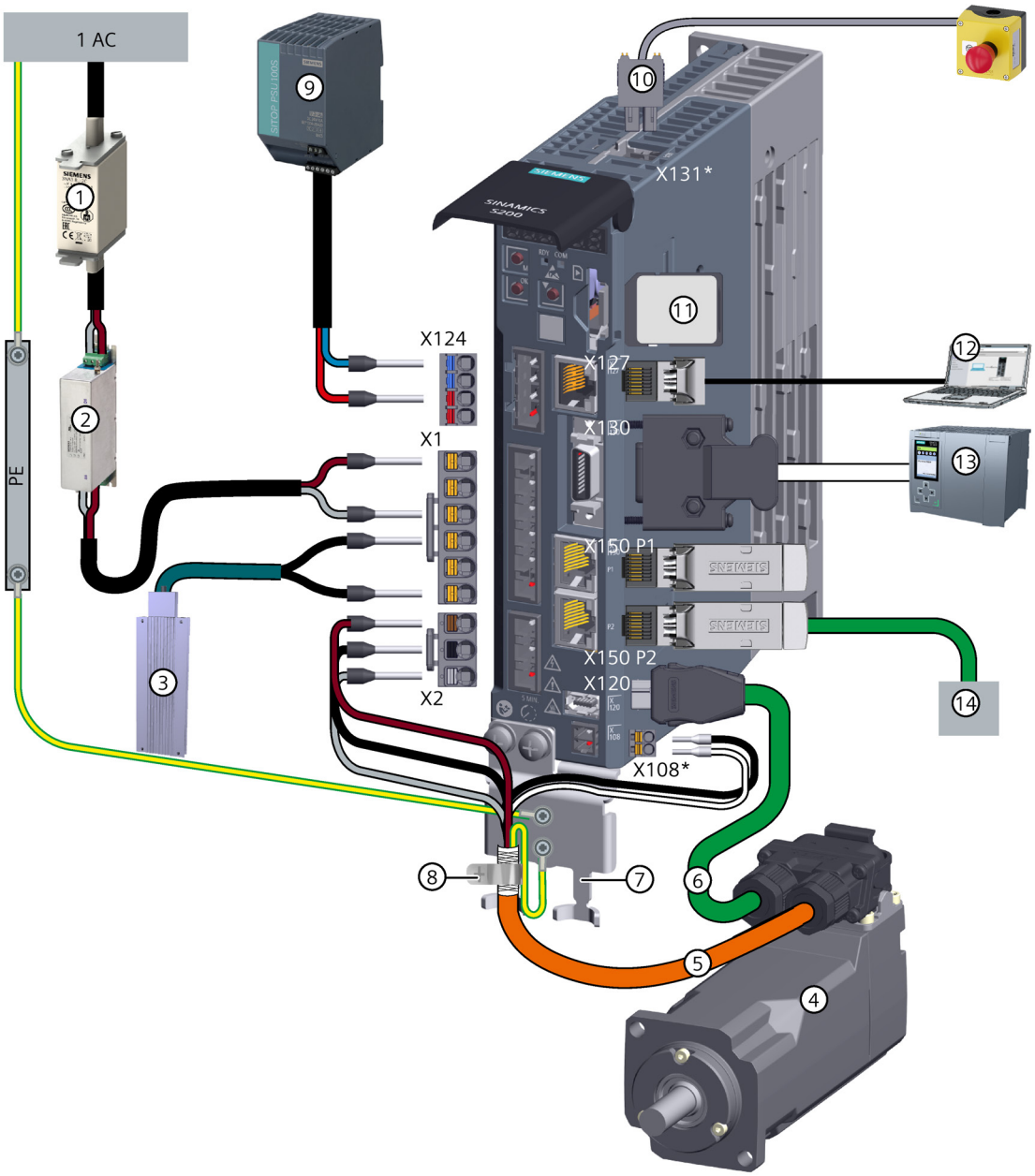
Observe the conditions specified in the manufacturer's declaration regarding protection against electric shock in the event of an insulation failure in the motor circuit.

You can find more information on the Internet:

Manufacturer's declaration (https://support.industry.siemens.com/cs/ww/en/view/109476638)

4.1 System overview

System components and accessories for converters with 1 AC line connection

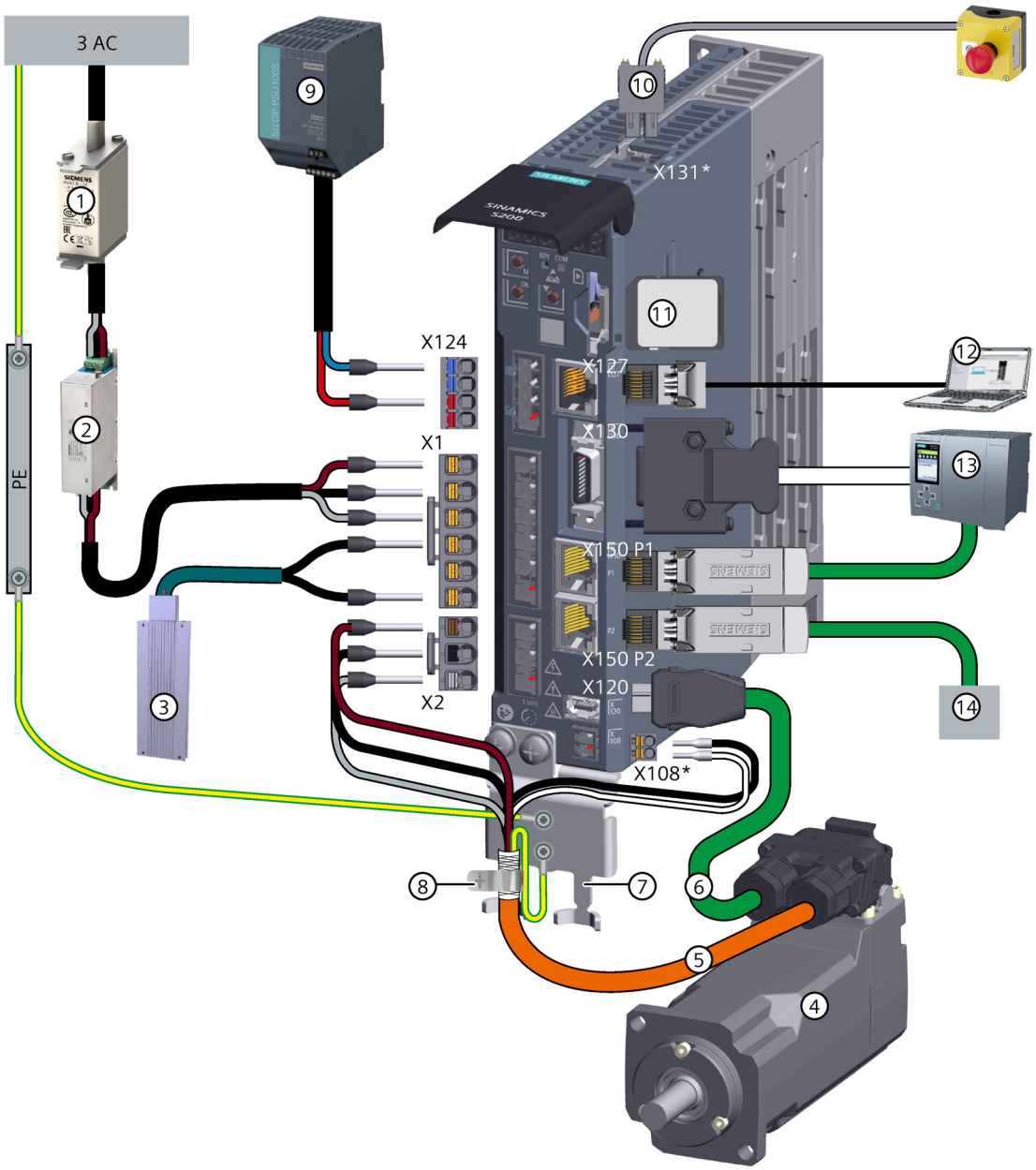


* The interfaces X131 and X108 are available on SINAMICS S200 PN only. For more information about the motor holding brake connection on SINAMICS S200 Basic PN, see Section "Connecting the motor holding brake - X108 (Page 19)".

① Fuse or motor starter protector
② Line filter (optional)[1)]
③ External braking resistor (optional)[1)]
④ SIMOTICS S-1FL2 motor
⑤ Motor power cable (with brake conductors)
⑥ Encoder cable
⑦ Shield plate
⑧ Shield clamp
⑨ 24 V DC power supply
⑩ STO plug
⑪ SD card (optional)
⑫ Commissioning device
⑬ Controller (for example, SIMATIC S7-1500)
⑭ PROFINET to the next participant

[1)] When using the components, make sure that they are connected to the ground correctly.

System components and accessories for converters with 3 AC line connection

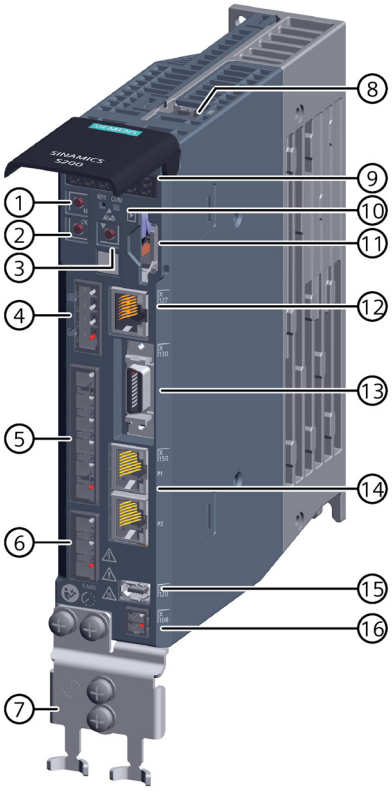


* The interfaces X131 and X108 are available on SINAMICS S200 PN only. For more information about the motor holding brake connection on SINAMICS S200 Basic PN, see Section "Connecting the motor holding brake - X108 (Page 19)".

① Fuse or motor starter protector
② Line filter (optional)[1)]
③ External braking resistor (optional)[1)]
④ SIMOTICS S-1FL2 motor
⑤ Motor power cable (with brake conductors)
⑥ Encoder cable
⑦ Shield plate
⑧ Shield clamp
⑨ 24 V DC power supply
⑩ STO plug
⑪ SD card (optional)
⑫ Commissioning device
⑬ Controller (for example, SIMATIC S7-1500)
⑭ PROFINET to the next participant

[1)] When using the components, make sure that they are connected to the ground correctly.

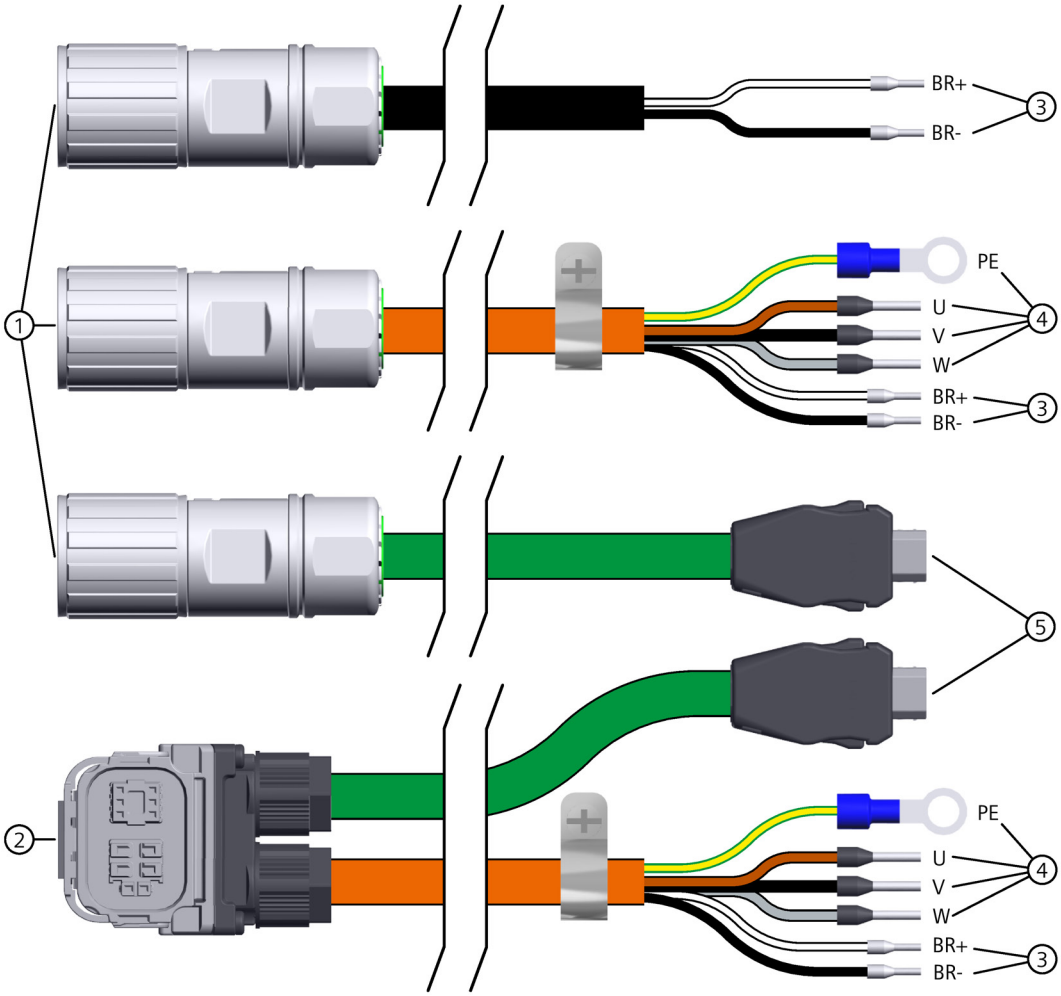
4.2 Overview of the converter interfaces



① M button
② OK button
③ DOWN button
④ 24 V DC power supply - X124
⑤ Mains and braking resistor interface - X1
⑥ Motor power interface - X2
⑦ Shield plate
⑧ STO interface - X131[1)]
⑨ 6-digit display
⑩ LED status indicators
⑪ SD card slot
⑫ Service interface (Ethernet) - X127
⑬ Control/status inputs and outputs - X130
⑭ PROFINET interface - X150
⑮ Encoder interface - X120
⑯ Motor holding brake interface - X108[1)]

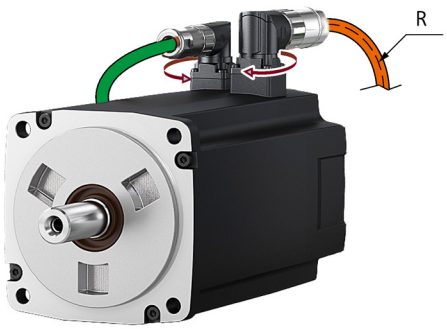
[1)] The interfaces X131 and X108 are available on SINAMICS S200 PN only.

4.3 MOTION-CONNECT cables



① M17/M23 circular connector
② Hybrid connector
③ Conductors for holding brake
④ Conductors for power supply
⑤ Cables for encoder

Connecting the cables to the motor

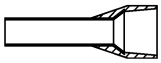
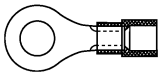
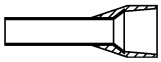
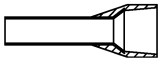
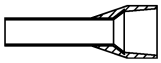
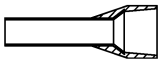
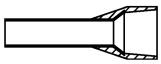


Cable connection example

- Do not put much stress upon cables or connectors while wiring.
  Minimum bending radius (R) for the MOTION-CONNECT cables
  - Static: 4 x outer diameter
  - Dynamic: 7.5 x outer diameter
- For medium and high inertia motors, you can adjust the cable directions by rotating the connectors.
- Before adjusting the cables, switch off the power supply. Otherwise, the motor contains a hazardous voltage and a risk of electric shock.

4.4 System connection

4.4.1 Conductor cross-sections and cable lugs

Connection type	Terminal type	Conductor cross-section	Stripping length	Cable lug
Mains supply (L1, L2, L3)	Spring-loaded	0.75 mm² ... 2.5 mm² (AWG: 14 ... 12)	9 mm ... 10 mm	Pin-type 
Mains supply (PE)	Screw-type	0.75 mm² ... 2.5 mm² (AWG: 14 ... 12)	10 mm	Ring type 
24 V DC power supply	Spring-loaded	0.5 mm² ... 2.5 mm² (AWG: 20 ... 12)	10 mm ... 11 mm[1)]	Pin-type 
External braking resistor	Spring-loaded	0.75 mm² ... 2.5 mm² (AWG: 18 ... 12)	9 mm ... 10 mm	Pin-type 
STO connection[2)]	Spring-loaded	0.2 mm² ... 1.5 mm² (AWG: 24 ... 16)	10 mm	Pin-type 
Motor power connection	Spring-loaded	0.75 mm² ... 2.5 mm² (AWG: 18 ... 12)	9 mm ... 10 mm	Pin-type 
Motor holding brake[2)]	Spring-loaded	0.38 mm² ... 0.75 mm² (AWG: 22 ... 18)	9 mm ... 10 mm	Pin-type 

1) If you use insulated cable lugs, the length of the cable lugs is 12 mm.

2) For S200 PN only

4.4.2 Connecting the mains supply and braking resistor - X1

X1	Terminal	Designation	Technical data
 L1 L2 L3 DCP R2 R1	L1	Line phase L1/line phase L	Maximum current limit: 20 A
	L2	Line phase L2	
	L3	Line phase L3/neutral N	
	DCP	DC link positive (for connection to the braking resistor)	
	R2[3)]	Connection to the internal braking resistor[1)]	
	R1[3)]	Connection to the external braking resistor[2)]	

1) To use the integrated braking resistor, connect DCP and R2 with the jumper included in the scope of delivery. The S200 Basic PN (FSA and FSB) and S200 PN FSA (0.1 kW) do not have an internal braking resistor.

2) To use an external braking resistor, remove the connection between DCP and R2 first. Connect the converter to an external braking resistor via terminals DCP and R1.

3) When the terminal R1 or R2 is not in use, cover it with the blanking plug provided in the connector kit (installed on R1 upon delivery).

Note

For applications on the single-phase mains supply network, you can connect the mains supply to any two terminals out of L1, L2, and L3.

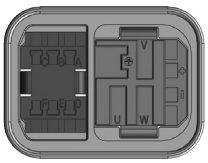
4.4.3 Connecting the motor power - X2

Converter side

X2	Terminal	Designation	Technical data
	U	Motor phase U	Maximum current limit: 20 A
	V	Motor phase V	
	W	Motor phase W	

Motor side

- 1FL2 shaft heights 20, 30, and 40

Motor power interface	Pin	Designation
 Hybrid connector	U	Phase U
	V	Phase V
	W	Phase W
	PE	Protective grounding
	+	Holding brake, positive
	-	Holding brake, negative
	A	Encoder power supply, 5 V
	B	Encoder power supply, reference ground
	C	Absolute encoder clock signal, positive
	D	Absolute encoder clock signal, negative
	E	Absolute encoder data signal, positive
	F	Absolute encoder data signal, negative

- 1FL2 shaft heights 48 and 52

Motor power interface	Pin	Designation
 M17 angular connector	U	Phase U
	V	Phase V
	W	Phase W
	PE	Protective grounding
	A	Holding brake, positive
	B	Holding brake, negative

- 1FL2 shaft heights 45, 65, and 90

Motor power interface	Pin	Designation
 M23 angular connector	1	Phase U
	2	Phase V
	3	Phase W
	PE	Protective grounding

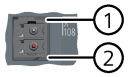
4.4.4 Connecting the motor holding brake - X108

Converter side

NOTICE
Before connecting the brake cable, ensure that the 24 V power supply has a voltage tolerance of ±10%. Otherwise, the brake cannot work normally.

Note

The motor brake is designed for holding purpose only. Unless necessary, do not apply the motor brake as an emergency stop or deceleration mechanism.

X108	Terminal	Designation	Technical data
	1	Motor holding brake, negative	Maximum current limit: • 200 V: 1 A • 400 V: 2 A
	2	Motor holding brake, positive	

S200 Basic PN does not have a designated interface for connecting to the holding brake. To use the holding brake, connect a third-party device via a digital output at the interface X130 and configure the holding brake function as follows:

- Set p1215 to 3.
- Interconnect the digital output signal to r0899.12.

You can extend the connection of the holding brake to the relay by using a two-pole fast wiring terminal or two one-pole fast wiring terminals. For more information, see Section "Connecting the motor holding brake" in the Operating Instructions.

Motor side

- 1FL2 shaft heights 20, 30, and 40

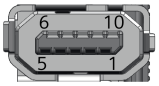
  The holding brake interface is integrated into the hybrid connector. For more information, see Section "Connecting the motor power - X2 (Page 18)".
- 1FL2 shaft heights 48 and 52

  The holding brake interface is integrated into the M17 power connector. For more information, see Section "Connecting the motor power - X2 (Page 18)".
- 1FL2 shaft heights 45, 65, and 90

Holding brake interface	Pin	Designation
 M17 angular connector	1	Holding brake, positive
	2	Holding brake, negative

4.4.5 Connecting the encoder - X120

Converter side

X120	Pin	Designation	Technical data
 IX-C socket	1	DP1	Absolute encoder data signal, positive
	2	DN1	Absolute encoder data signal, negative
	3	Reserved	Reserved
	4	CLKP1	Absolute encoder clock signal, positive
	5	CLKN1	Absolute encoder clock signal, negative
	6	M	Reserved for reference ground
	7	Power_ENC1	Encoder power supply, 5 V DC
	8	M_ENC1	Encoder power supply, reference ground
	9	Reserved	Reserved
	10	Reserved	Reserved

Motor side

Note
Do not touch the encoder pins at the motor with naked hands to avoid being contaminated.

- 1FL2 shaft heights 20, 30, and 40
  The encoder interface is integrated into the hybrid connector. For more information, see Section "Connecting the motor power - X2 (Page 18)".
- 1FL2 shaft heights 48 and 52

Encoder interface	Pin	Designation
 M17 angular connector	1	Encoder power supply, 5 V
	2	Encoder power supply, reference ground
	3	Absolute encoder clock signal, positive
	4	Absolute encoder clock signal, negative
	5	Absolute encoder data signal, positive
	6	Absolute encoder data signal, negative

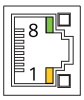
- 1FL2 shaft heights 45, 65, and 90

Encoder interface	Pin	Designation
 M17 angular connector	1	Encoder power supply, 5 V
	2	Encoder power supply, reference ground
	3	Reserved
	4	Absolute encoder clock signal, negative
	5	Absolute encoder data signal, positive
	6	Absolute encoder clock signal, positive
	7	Reserved
	8	Absolute encoder data signal, negative

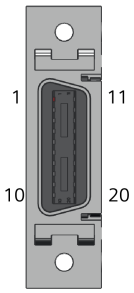
4.4.6 Connecting the 24 V DC power supply - X124

X124	Terminal	Designation	Technical data
	0 V	Power supply, 0 V	Maximum current limit: 10 A
	0 V	Power supply, 0 V	
	24 V	Power supply, 24 V DC	
	24 V	Power supply, 24 V DC	

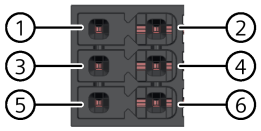
4.4.7 Connecting the service interface - X127

X127	Pin	Designation	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	P24_POE	Power supply over Ethernet, 24 V DC
	5	P24_POE	Power supply over Ethernet, 24 V DC
	6	RXN	Receive data -
	7	M_POE	Power supply over Ethernet, reference ground
	8	M_POE	Power supply over Ethernet, reference ground

4.4.8 Connecting the inputs and outputs - X130

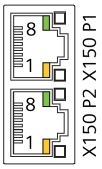
X130	Pin	Designation		Technical data
		S200	S200 Basic	
	1	DI0	DI0	Digital input 0 (high-speed digital input)
	2	DI1	DI1	Digital input 1 (high-speed digital input)
	3	DI2	DI2	Digital input 2
	4	DI3	DI3	Digital input 3
	5	M	M	Reference ground
	6	DI_COM	DI_COM	Common terminal for digital inputs
	7	DI_COM	DI_COM	Common terminal for digital inputs
	8	M	M	Reference ground
	9	-	-	-
20-pin MDR socket	10	FE	FE	Functional grounding
	11	DO0+	DO0+	Digital output 0, positive
Tightening torque: 0.2 Nm	12	DO0-	DO0-	Digital output 0, negative
	13	DO1+	-	Digital output 1, positive
	14	DO1-	-	Digital output 1, negative
	15	PTOA+	-	Pulse train output A, positive
	16	PTOA-	-	Pulse train output A, negative
	17	PTOB+	-	Pulse train output B, positive
	18	PTOB-	-	Pulse train output B, negative
	19	PTOZ+	-	Pulse train output Z, positive
	20	PTOZ-	-	Pulse train output Z, negative

4.4.9 Connecting STO - X131 (for S200 PN only)

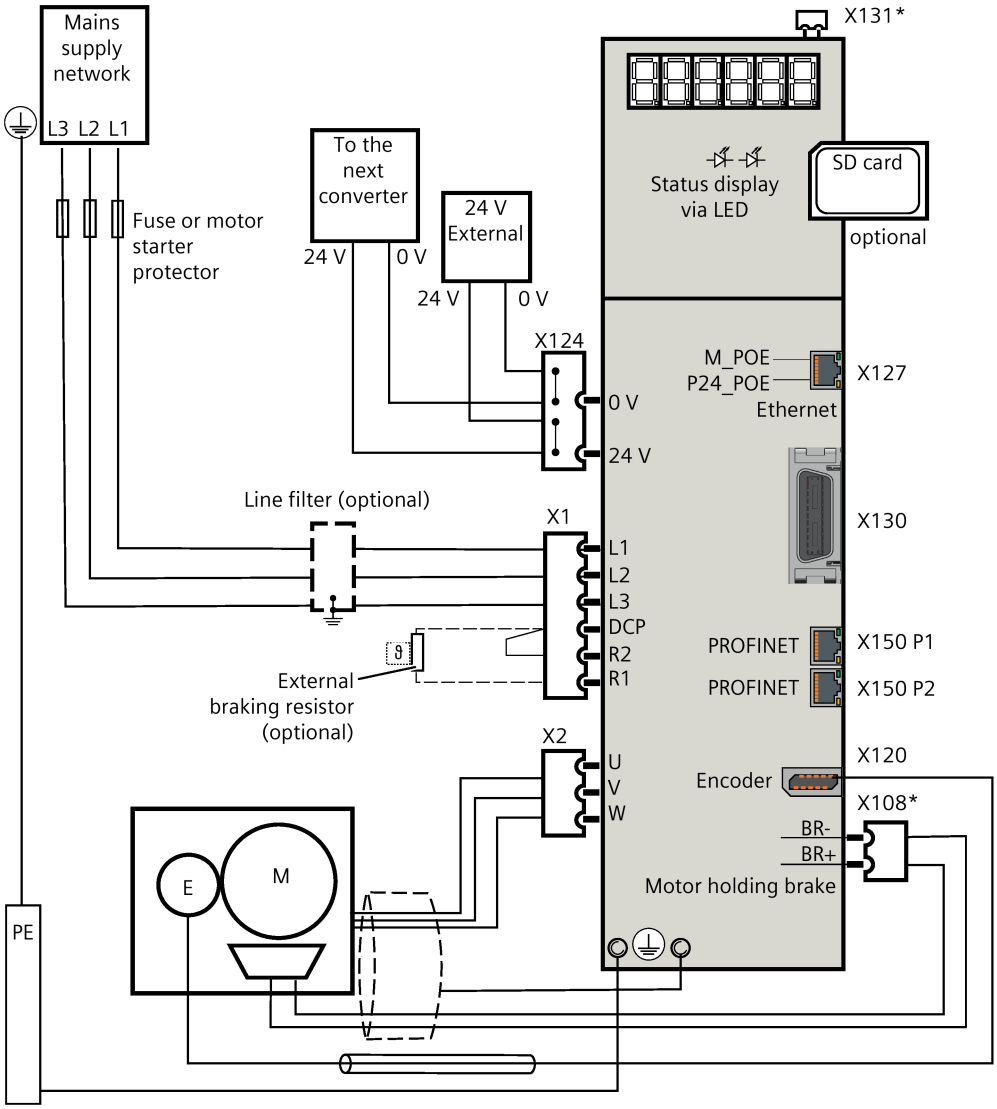
X131	Terminal	Designation	Explanation
	1	STO1+	STO channel 1, positive
	2	STO1-	STO channel 1, negative
	3	STO-VS	STO power supply
	4	STO-M	STO power supply, reference ground
	5	STO2+	STO channel 2, positive
	6	STO2-	STO channel 2, negative

The Safe Torque Off (STO) function is enabled by default and cannot be configured. To disable the Safety Integrated Functions, cover the interface X131 with the STO disable plug included in the connector kit.

4.4.10 Connecting to the fieldbus - X150

X150	Pin	Designation	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved	Reserved
	5	Reserved	Reserved
	6	RXN	Receive data -
	7	Reserved	Reserved
	8	Reserved	Reserved

4.5 Block diagram



* The interfaces X131 and X108 are available on S200 PN only.

Figure 4-1 Connection example for converters with 3 AC line connection

5 Commissioning with web server

The following engineering tools can be used for commissioning and configuring the converter:

- Web server
  - Integrated in the converter
  - Suitable for online diagnostics and configuration without a control system
- Startdrive
  - If the converter is completely configured in the TIA Portal
  - If the converter is configured together with a control system (e.g. SIMATIC PLC)

The following description refers exclusively to commissioning via the web server.

For more information about commissioning with Startdrive, see the Operating Instructions (https://support.industry.siemens.com/cs/ww/en/ps/29596).

5.1 Supported hardware and software

Use the web server integrated in the converter for commissioning. The following operating units and browsers are supported by the web server:

Operating units	Browsers and versions[1)]
• PC • Smartphone or tablet PC • SINAMICS SDI Pro 5.5" The optional component SINAMICS Smart Adapter establishes a WLAN for the wireless connection between the converter and mobile devices.	• Apple Safari (≥ Version 15.0) • Google Chrome (≥ Version 83) • Microsoft Edge (≥ Version 88) • Mozilla Firefox (≥ Version 91)

1) Siemens recommends that you use the latest version of the browsers.

5.2 Preparing for commissioning

Proceed as follows to prepare for commissioning:

1. Mount the motor on the mechanical system. Connect the motor to the converter.
2. Connect the converter to the operating unit via X127, X150, or WLAN.
3. Switch the converter on.
4. Start the Internet browser for commissioning.
5. Enter the IP address of the converter.
   - Preset IP address for X127: 169.254.11.22
   - Preset IP address for X150: 0.0.0.0
     To access the integrated web server, you must assign X150 a valid IP address using advanced setup or Startdrive. The IP addresses of X127 and X150 must not be in the same subnet.

5.3 Configuring the fundamental settings

If you call the web server for the first time, proceed as follows to define the fundamental settings:

1. Configure the following basic settings:
   - Preferred language of the web server user interface
   - Converter date and time
2. Click the "Next" button to open the Security Wizard.
3. Select between the following options:
   - Low protection: "Continue with low security settings"
     With this selection, access to "User Management and Access Control" is deactivated.
   - Complete protection: "Configure security settings"
     Siemens recommends this factory setting.

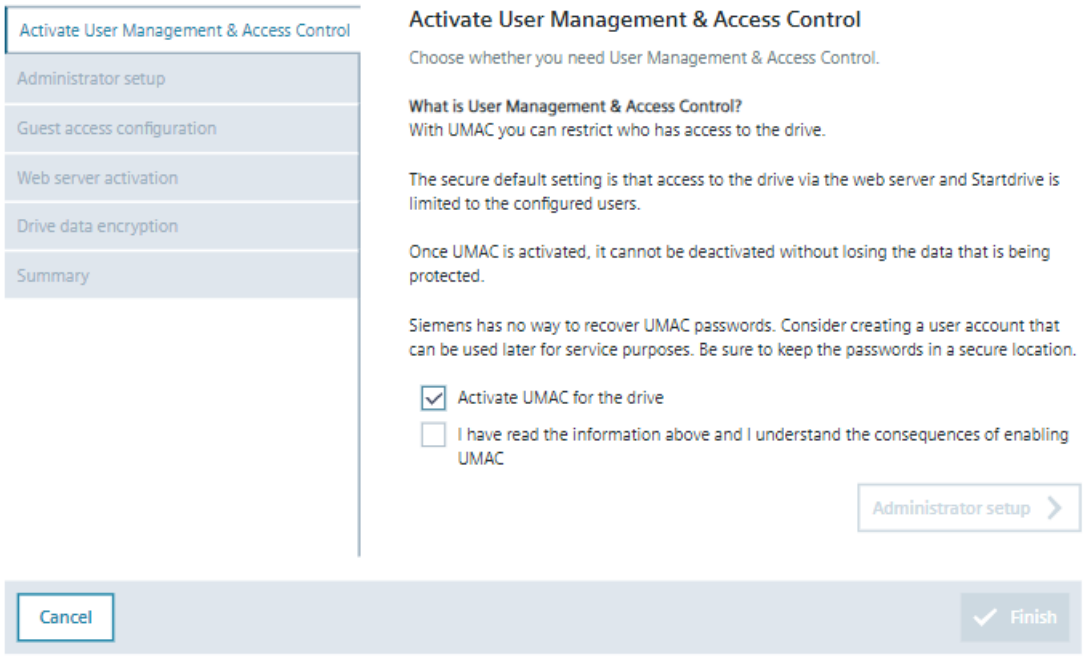
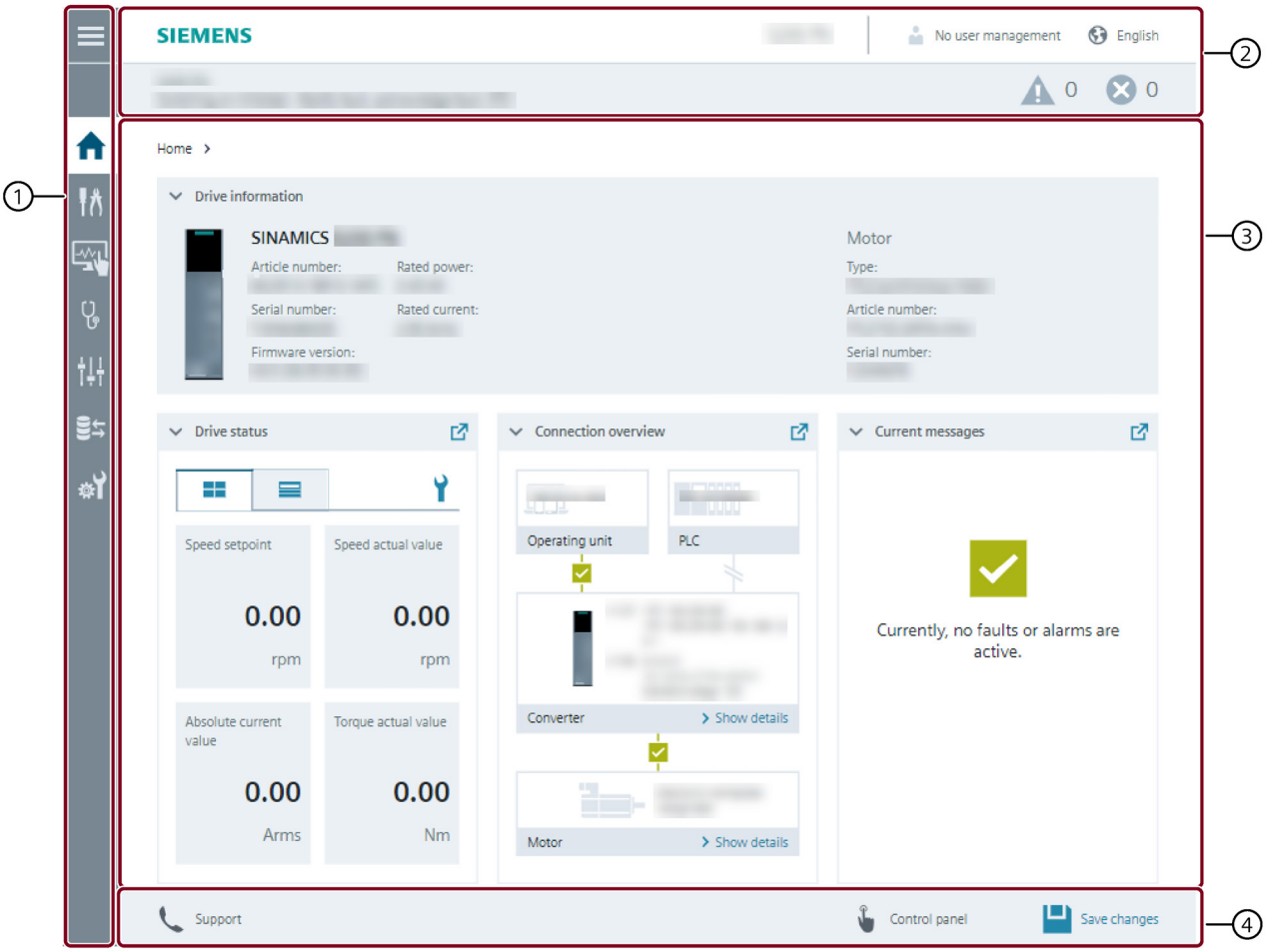


Figure 5-1 Configuring security settings

5.4 Structure of the web server

The following figure shows the basic structure of the web server pages.



① Navigation bar

The navigation bar provides access to converter functions and menus.

② Status bar

The status bar displays the converter product name and the converter status. Log in at the status bar and select the user interface language.

③ Main window

The main window provides information about converter functions and allows settings to be made.

④ Action bar

When manual saving is activated in menu "System" > "Settings", then symbol is also shown in the action bar.

Figure 5-2 Structure of the web server (example)

Menu and functions

Icon	Function	Description
	Commissioning	You can perform quick setup, advanced setup, and optimization.
	Diagnostics	You can view faults and alarms including information concerning causes and remedies in the menu "Diagnostics > Messages".
	Monitoring and operation	You can view the current status of the converter and the inputs and outputs.
	Parameter	Further adjustments can be made by selecting the menu item "Parameter".
	Backup and restore	You can save drive data to backup file, restore drive data from backup file, and restore factory settings.
	System	You can configure the basic settings for the web server and the converter.
	Control panel	The function controls the motor without the higher-level controller. You can use this function for purposes such as testing the converter settings after commissioning.
	Support	You can access links to additional information for the converter, and can also generate diagnostics reports to communicate with the hotline.

5.5 Performing quick setup

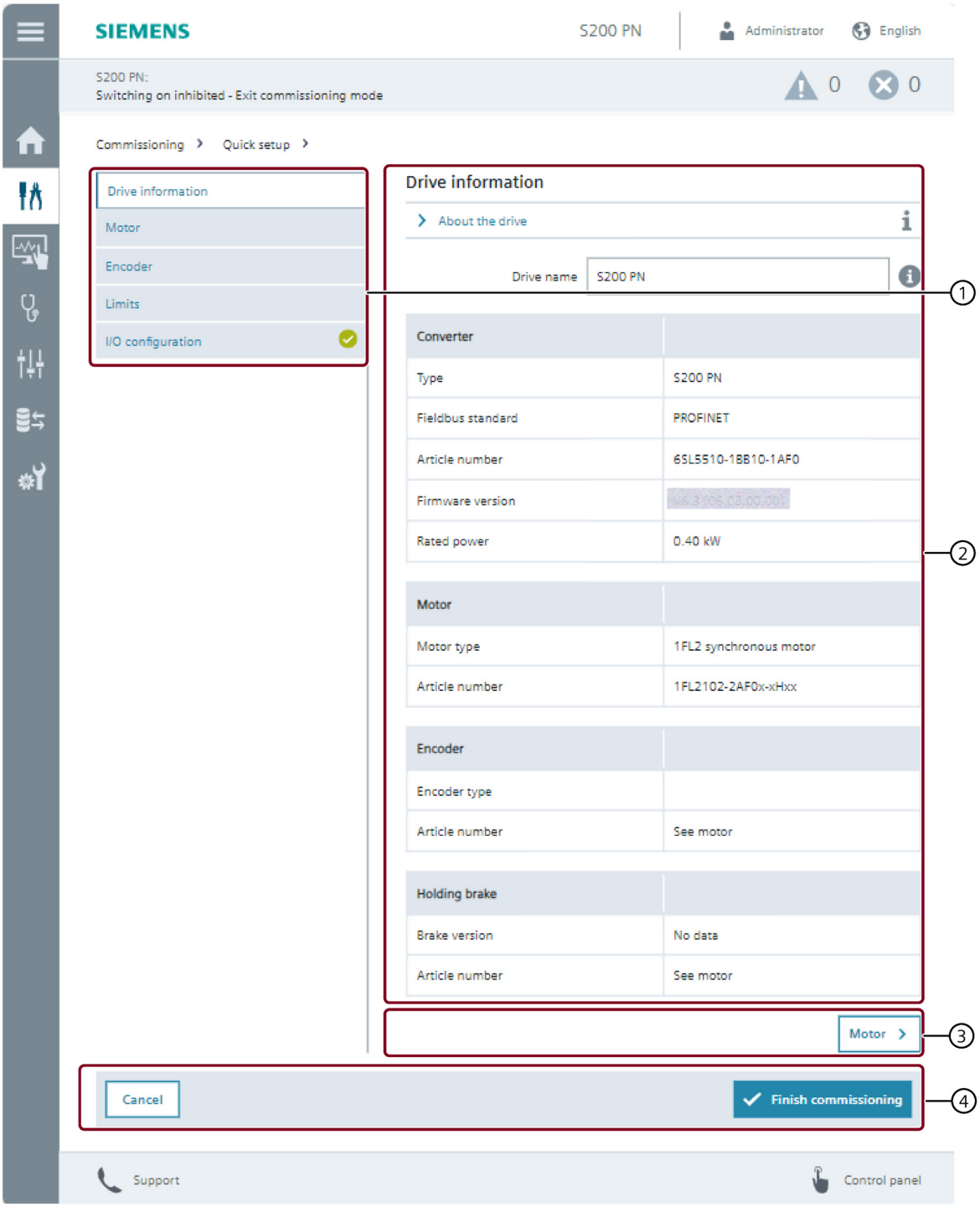


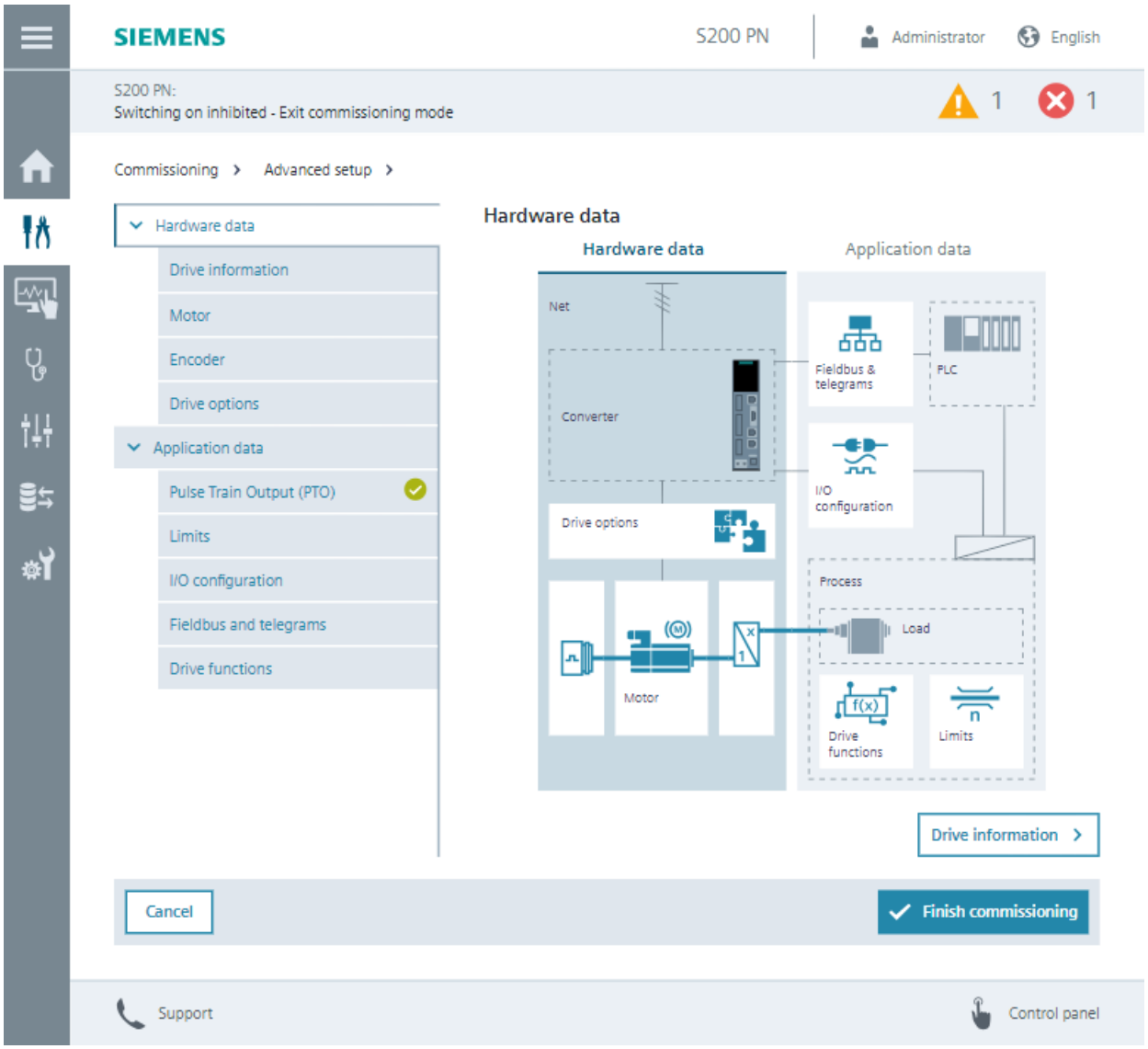
Figure 5-3 Quick setup (example)

The converter can generally be operated without making additional settings using quick setup. Siemens recommends that quick setup is performed to set the limit values and the I/O configuration to optimally address the target application. Only the most important properties of the converter are configured in the quick setup.

The Commissioning Wizard of the web server guides users through the following quick setup steps.

Setting	Description
Drive information	The step provides information about the converter, motor, encoder and motor holding brake being used. A specific drive name can be assigned.
Motor	The data of the motor being used are displayed. It is not possible to configure another motor. The direction of rotation of the motor can be selected.
Encoder	The data of the encoder being used are displayed. Configuration is not possible.
Limits	The converter limit values are shown graphically and in a tabular form. The following data can be configured: • Limit values • Device supply voltage (only available for 400 V variants)
I/O configuration	The configuration of the converter inputs and outputs is shown in a tabular form. In the table, a function can be assigned to an input or output of the terminal. Specified functions can be selected. Do not assign a function to more than one input or output.

5.6 Performing advanced setup



With the advanced setup, you define drive options and functions to suit your application. In addition to the settings of the quick setup (Page 27), the advanced setup provides the following function views. Clicking on the tool icon will open up further configuration options.

Setting	Description
Drive options	If you use an external braking resistor with thermal model monitoring, manually enter the technical data of the braking resistor.
Pulse Train Output (PTO)	The pulse train output and electronic gear ratio can be configured. • The following settings can be configured through "Output configuration" for PTO position control: – PTO direction change Select the PTO direction for an application of fully closed-loop position control using PTI and PTO. The direction output defines the traversing direction. – PTO output frequency limit Set the maximum output frequency of the pulse train output. – PTO zero mark offset Set the zero mark offset to shift the zero mark within one mechanical revolution. • The following settings can be configured through "Electronic gear ratio" for PTO position control: – Gear ratio configuration Set the number of PTO pulses per motor revolution to transfer the distance of mechanical movement to a controller.
Fieldbus and telegrams	Configure the PROFINET interface X150 and select a PROFIdrive telegram.
Drive functions	The "Setup_functions" parameter list is intended for parameters that are configurable only in the commissioning mode, but not accessible via the advanced setup menu. The suggested values for these parameters are preassigned in the factory settings. The "Setup-functions" list is created and managed under "Parameters" > "Parameter List". You can add parameters to the list. This allows uniform access to the parameters of a drive function, for example.

5.7 Performing One Button Tuning

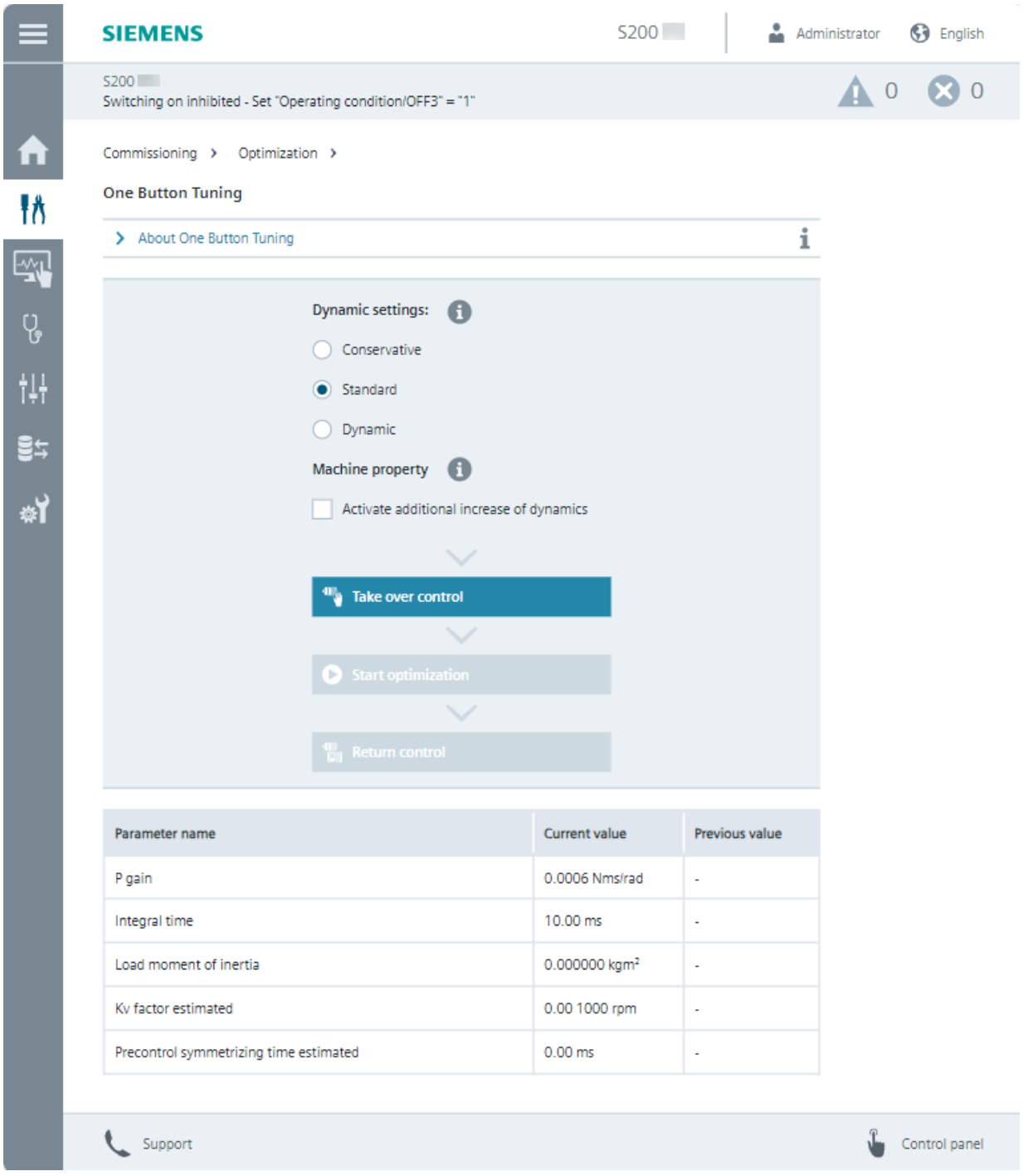


Figure 5-4 One Button Tuning (example)

Proceed as follows to perform One Button Tuning:

1. Select "Commissioning > Optimization" in the navigation bar.
2. Select a dynamic setting according to the mechanical capabilities of your machine.
3. Activate additional increase of dynamics if the machine fulfills the displayed conditions.
4. Click "Take over control".
5. Click "Start optimization".

6. Enter the angle of rotation through which the motor and the connected machine are permitted to turn for the required measurements (e.g. 360°) without the mechanical system being damaged.
   The table shows how the settings have been changed by the One Button Tuning. If One Button Tuning was not successful, then optimization must be repeated with other settings.
7. Click "Return control" once the controller has been optimized.

6 Diagnostics and monitoring

6.1 Diagnostics and monitoring with SINAMICS SDI Status

The converter is designed with a SINAMICS SDI (Smart Drive Interface) Status panel on the front of the converter.

① Cover*
② 6-digit 7-segment display
③ LED display
④ Function buttons

* Open the cover gently from the lower right corner.

You can use the SDI Status panel for the following operations:

- Monitoring
  The SINAMICS SDI Status enters the monitoring mode when the servo state changes from OFF to ON. In this mode, it displays the actual speed, actual torque, actual position, actual DC link voltage, and position following error. You can press the DOWN button for navigating to the next item.
- Diagnosis
  The SINAMICS SDI Status enters the diagnosis mode when a new fault, alarm, or safety message appears. You can press the OK button to acknowledge the faults after eliminating the causes. You can press the M button to switch between the monitoring mode and the diagnosis mode.

  Note
  If you failed to configure UMAC as required, A01637 will be triggered. In this case, the monitoring mode does not switch to the diagnosis mode automatically unless you press the M button. To exit the diagnosis mode, press the M button again.

- Converter restart
  You can press the key combination of the M button and the OK button for four seconds to restart the converter.

6.2 Fault causes and remedial measures for the motor

Possible faults

Fault	Fault cause (see the table "Fault causes and remedial measures")														
Motor does not start	A	B													
Motor starts slowly	A		C		F										
Humming sound when starting			C		F										
Humming sound in operation	A		C		F										
High temperature rise under no-load operation				D		I									
High temperature rise under load	A		C			I									
High temperature rise of individual winding sections					F										
Uneven running							J	K							
Grinding sound, running noise									L						
Radial vibrations										M	N	O	P		R
Axial vibrations												O		Q	R

Fault causes and remedial measures

No.	Fault cause	Remedial measures
A	Overload	Reduce load
B	Interrupted phase in the converter line supply cable or motor winding	Check the converter and converter line supply cable, measure the winding resistance and insulation resistance, repair after consultation with manufacturer
C	Interrupted phase in the converter line supply cable after switching on	Check the converter, converter line supply cable, and the winding resistance
D	Converter output voltage too high, frequency too low	Check the settings on the converter, perform automatic motor identification
F	Winding short-circuit or phase short-circuit in stator winding	Measure the winding resistance and insulation resistance, repair after consultation with the manufacturer, replace the motor if required
I	Heat dissipation impeded by deposits	Clean the surface of the servo drive system and ensure that the cooling air can flow in and out unimpeded
	Cooling air inlet or outlet is blocked by foreign bodies	Remove the things that block the inlet or outlet and ensure that the cooling air can flow in and out unimpeded
J	Insufficient shielding for motor and/or encoder cable	Check the shielding and grounding
K	Excessive drive controller gain	Adjust the controller
L	Rotating parts are grinding	Determine cause and adjust parts
	Foreign bodies inside the motor	Replace the motor
	Bearing damage	For low or medium inertia motors, replace the motor; for high inertia motors, replace the bearings
M	Rotor not balanced	Replace the motor
N	Rotor out of true, shaft bent	Consult the manufacturer
O	Poor alignment	Align motor set, check coupling
P	Coupled machine not balanced	Re-balance coupled machine
Q	Shocks from coupled machine	Check coupled machine
R	Fault originating from the gearbox	Adjust or repair the gearbox

If the fault still cannot be resolved after taking the measures stated above, please contact the manufacturer or the Siemens Service Center.

7 Additional information

Operating Instructions

For more information about the drive system, see the Operating Instructions (https://support.industry.siemens.com/cs/ww/en/ps/29596/man)

Technical support

You can find additional information about the product:

- via ID link (ID link is a globally unique identifier according to IEC 61406-1)
- using the Siemens Industry Online Support
  - Website: SIOS (https://support.industry.siemens.com/cs/ww/en/)
  - App Industry Online Support (for Apple iOS and Android)

Contents of Siemens Online Support include

- Product support
- Global forum for information and best practice sharing between users and specialists
- Local contact persons via the contact person database (→ Contact)
- Product information
- FAQs (frequently asked questions)
- Application examples
- Manuals
- Downloads
- Compatibility tool
- Newsletter with product selection
- Catalogs/brochures
- Certificates

The online spare part service "Spares on Web" offers certain spare parts for the product:

- Website: SOW address (https://www.sow.siemens.com)

Getting information about the product

You can use the ID link to access product data, manuals, Declarations of Conformity, certificates and other information about your product.

Figure 7-1 QR code with ID link included

Siemens Aktiengesellschaft
Digital Industries
Postfach 48 48
90026 NÜRNBERG
GERMANY

SINAMICS S200 PROFINET servo drive system with SIMOTICS S-1FL2
A5E52388930A AD, 11/2024, FW V6.4

Get more information

SINAMICS:
www.siemens.com/sinamics

SIMOTICS:
www.siemens.com/simotics

Industry Mall:
www.siemens.com/industrymall

Industry Online Support:
www.siemens.com/online-support