SIEMENS

SINAMICS

SINAMICS G120 Converters

CU250S-2 Control Units

Getting Started

Edition 10/2013

Answers for industry.

SIEMENS

Safety information 1

Design of the frequency converter 2

Installing 3

Commissioning 4

More information 5

SINAMICS

SINAMICS G120 Converters with CU250S-2 Control Units

Getting Started

Edition 10/2013, Firmware V4.6

10/2013, FW V4.6

A5E32899990B AA

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.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

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

Siemens AG
Industry Sector
Postfach 48 48
90026 NÜRNBERG
GERMANY

A5E32899990B AA
Ⓟ 09/2013 Technical data subject to change

Copyright © Siemens AG 2013.
All rights reserved

Table of contents

1 Safety information 7

1.1 General safety instructions 7

1.2 Safety instructions for electromagnetic fields (EMF) 11

1.3 Handling electrostatic sensitive devices (ESD) 11

1.4 Residual risks of power drive systems 12

2 Design of the frequency converter 15

2.1 Identifying the converter 15

2.2 Overview of Control Units 16

2.3 Power Module 16

2.4 Assembling frequency converter components 18

3 Installing 19

3.1 Installing the Power Module 19
3.1.1 Connecting up the Motor and Power Module 20

3.2 Installing Control Unit 22
3.2.1 Overview of the interfaces 22
3.2.2 Terminal blocks 24
3.2.3 Finding a suitable setting for the interfaces 25
3.2.4 Wiring the terminal strip 29

3.3 Installing encoders 31
3.3.1 Permissible encoders 31
3.3.2 Sensor Module 32

3.4 Description files for fieldbuses 32

4 Commissioning 33

4.1 Tools to commission the converter 33

4.2 Commissioning with STARTER 34
4.2.1 Generating a STARTER project 34
4.2.2 Transfer inverters connected via USB into the project 34
4.2.3 Configuring a drive 36
4.2.4 Adapting the encoder data 39
4.2.5 Loading the configured data into the drive 40
4.2.6 Identifying motor data 40

5 More information 43

5.1 Manuals for your inverter 43

5.2 Product support 44

This manual describes how you install a SINAMICS G120 converter with CU250S-2 Control Unit and commission it.

What is the meaning of the symbols in the manual?

1
2 An operating instruction starts here.

This concludes the operating instruction.

Firmware upgrade and downgrade

Options for upgrading and downgrading the firmware can be found on the Internet at http://support.automation.siemens.com/WW/view/de/67364620 (http://support.automation.siemens.com/WW/news/en/67364620).

Transferring license terms of the OSS code to a PC

The inverter contains open-source software (OSS). The OSS license terms are saved in the inverter.

Procedure

1
2 To transfer the OSS license terms from the inverter to a PC, proceed as follows:

1. Switch off the inverter power supply.
2. Insert an empty memory card into the card slot of the inverter. See also the sections:
   - Tools to commission the converter (Page 33)
   - Overview of the interfaces (Page 22)
3. Switch on the inverter power supply.
4. When you have switched on the power supply, wait 30 seconds.

   During this time, the inverter writes the "Read_OSS.ZIP" file onto the memory card.
5. Switch off the inverter power supply.
6. Remove the card from the inverter.
7. Use a card reader and load the file to a PC.

You have then transferred the OSS license terms from the inverter to a PC.

Safety information 1

Use for the intended purpose

The inverter described in this manual is a device for controlling an induction motor or a synchronous motor. The inverter is designed for installation in electrical installations or machines.

It has been approved for industrial and commercial use on industrial networks. Additional measures have to be taken when connected to public grids.

The technical specifications and information about connection conditions are indicated on the rating plate and in the operating instructions.

1.1 General safety instructions

⚠ DANGER

Danger to life due to live parts and other energy sources

Death or serious injury can result when live parts are touched.

- Only work on electrical devices when you are qualified for this job.
- Always observe the country-specific safety rules.

Generally, six steps apply when establishing safety:

1. Prepare for shutdown and notify all those who will be affected by the procedure.
2. Disconnect the machine from the supply.
   - Switch off the machine.
   - Wait until the discharge time specified on the warning labels has elapsed.
   - Check that it really is in a no-voltage condition, from phase conductor to phase conductor and phase conductor to protective conductor.
   - Check whether the existing auxiliary supply circuits are de-energized.
   - Ensure that the motors cannot move.
3. Identify all other hazardous energy sources, e.g. compressed air, hydraulic systems, water.
4. Isolate or neutralize all hazardous energy sources, e.g. by closing switches, grounding or short-circuiting or closing valves.
5. Secure the energy sources against switching on again.
6. Make sure that the machine is completely locked ... and that you have the right machine.

After you have completed the work, restore the operational readiness in the inverse sequence.

⚠ WARNING

Danger to life through a hazardous voltage when connecting an unsuitable power supply

Death or serious injury can result when live parts are touched in the event of a fault.

- Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV-(Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.

⚠ WARNING

Danger to life when live parts are touched on damaged devices

Improper handling of devices can cause damage.

Hazardous voltages can be present at the housing or exposed components on damaged devices.

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Do not use any damaged devices.

⚠ WARNING

Danger to life through electric shock due to unconnected cable shields

Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.

- Connect cable shields and unused conductors of power cables (e.g., brake conductors) at least on one side to the grounded housing potential.

⚠ WARNING

Danger to life due to electric shock when not grounded

For missing or incorrectly implemented protective conductor connection for devices with protection class I, high voltages can be present at open, exposed parts, which when touched, can result in death or severe injury.

- Ground the device in compliance with the applicable regulations.

WARNING

Danger to life due to electric shock when opening plug connections in operation

When opening plug connections in operation, arcs can result in severe injury or death.

- Only open plug connections when the equipment is in a no-voltage state, unless it has been explicitly stated that they can be opened in operation.

WARNING

Danger to life due to fire spreading if housing is inadequate

Fire and smoke development can cause severe personal injury or material damage.

- Install devices without a protective housing in a metal control cabinet (or protect the device by another equivalent measure) in such a way that contact with fire inside and outside the device is prevented.
- Additionally, select the installation site so that an uncontrolled spreading of smoke can be avoided in the case of a fire.
- Ensure that smoke can escape via designated paths.

WARNING

Danger to life through unexpected movement of machines when using mobile wireless devices or mobile phones

Using mobile wireless devices or mobile phones with a transmitter power > 1 W closer than approx. 2 m to the components may cause the devices to malfunction and influence the functional safety of machines, therefore putting people at risk or causing material damage.

- Switch the wireless devices or mobile phones off in the immediate vicinity of the components.

WARNING

Danger to life due to the motor catching fire in the event of insulation overload

There is a greater load on the motor insulation through a ground fault in an IT system. A possible result is the failure of the insulation with a risk for personnel through smoke development and fire.

- Use a monitoring device that signals an insulation fault.
- Correct the fault as quickly as possible so the motor insulation is not overloaded.

WARNING

Danger to life due to fire if overheating occurs because of insufficient ventilation clearances

Inadequate ventilation clearances can cause overheating with a risk for personnel through smoke development and fire. This can also result in increased downtime and reduced service lives for devices / systems.

- Ensure compliance with the specified minimum clearance as ventilation clearance for the respective component. They can be found in the dimension drawings or in the "Product-specific safety instructions" at the start of the respective section.

WARNING

Danger of an accident occuring due to missing or illegible warning labels

Missing or illegible warning labels can result in death or serious injury.

- Check the warning labels are complete based on the documentation.
- Attach any missing warning labels to the components, in the national language if necessary.
- Replace illegible warning labels.

WARNING

Danger to life when safety functions are inactive

Safety functions that are inactive or that have not been adjusted accordingly can cause operational faults on machines that could lead to serious injury or death.

- Observe the information in the appropriate product documentation before commissioning.
- Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components.
- Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing.
- Run a function test.
- Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.

Note

Important safety notices for safety functions

If you want to use safety functions, you must observe the safety notices in the safety manuals.

1.2 Safety instructions for electromagnetic fields (EMF)

WARNING

Danger to life from electromagnetic fields

Electromagnetic fields (EMF) are generated by the operation of electrical power equipment such as transformers, inverters or motors.

People with pacemakers or implants are at a special risk in the immediate vicinity of these devices/systems.

- Keep a distance of at least 2 m.

1.3 Handling electrostatic sensitive devices (ESD)

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.

NOTICE

Damage through electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g conductive foam rubber of aluminum foil.
- Only touch components, modules and devices when you are grounded by one of the following methods:
  - Wearing an ESD wrist strap
  - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

1.4 Residual risks of power drive systems

The control and drive components of a drive system are approved for industrial and commercial use in industrial line supplies. Their use in public line supplies requires a different configuration and/or additional measures.

These components may only be operated in closed housings or in higher-level control cabinets with protective covers that are closed, and when all of the protective devices are used.

These components may only be handled by qualified and trained technical personnel who are knowledgeable and observe all of the safety instructions on the components and in the associated technical user documentation.

When assessing the machine's risk in accordance with the respective local regulations (e.g., EC Machinery Directive), the machine manufacturer must take into account the following residual risks emanating from the control and drive components of a drive system:

1. Unintentional movements of driven machine components during commissioning, operation, maintenance, and repairs caused by, for example:
   - Hardware defects and/or software errors in the sensors, controllers, actuators, and connection technology
   - Response times of the controller and drive
   - Operating and/or ambient conditions outside of the specification
   - Condensation / conductive contamination
   - Parameterization, programming, cabling, and installation errors
   - Use of radio devices / cellular phones in the immediate vicinity of the controller
   - External influences / damage
2. In the event of a fault, exceptionally high temperatures, including an open fire, as well as emissions of light, noise, particles, gases, etc. can occur inside and outside the inverter, e.g.:
   - Component malfunctions
   - Software errors
   - Operating and/or ambient conditions outside of the specification
   - External influences / damage

   Inverters of the Open Type / IP20 degree of protection must be installed in a metal control cabinet (or protected by another equivalent measure) such that the contact with fire inside and outside the inverter is not possible.

3. Hazardous shock voltages caused by, for example:
   - Component malfunctions
   - Influence of electrostatic charging
   - Induction of voltages in moving motors
   - Operating and/or ambient conditions outside of the specification
   - Condensation / conductive contamination
   - External influences / damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc. if they are too close.
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly.

Note

The components must be protected against conductive contamination (e.g. by installing them in a control cabinet with degree of protection IP54 according to IEC 60529 or NEMA 12).

Assuming that conductive contamination at the installation site can definitely be excluded, a lower degree of cabinet protection may be permitted.

For more information about residual risks of the components in a drive system, see the relevant sections in the technical user documentation.

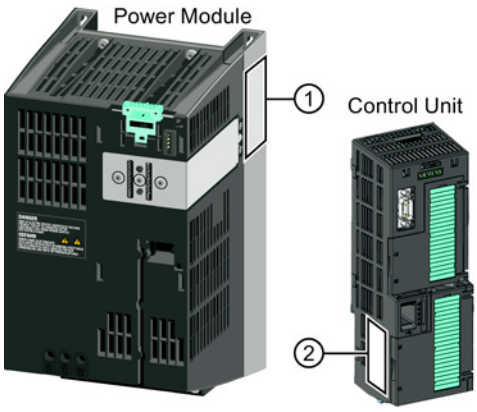
Design of the frequency converter 2

2.1 Identifying the converter

Main components of the converter

Each SINAMICS G120 converter comprises a Control Unit and Power Module.

- The Control Unit controls and monitors the Power Module and the connected motor.
- The Power Modules are available for motors with a power range of between 0.37 kW and 250 kW.



The following data is provided on the Power Module type plate (①):

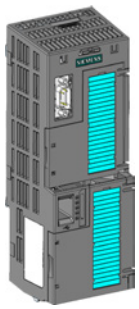
- Designation: e.g. Power Module 240
- Technical data: Voltage, current and power
- Order number: e.g. 6SL3224-0BE13-7UA0
- Version: e.g. A02

The following data can be found on the Control Unit type plate (②):

- Designation: e.g. CU250S-2 DP Control Unit
- Order number: e.g. 6SL3246-0BA22-1PA0
- Version: e.g. 02 (hardware) 4.6 (firmware)

2.2 Overview of Control Units

The Control Units CU250S-2 differ with regard to the type of fieldbus.

	Designation	Order number	Fieldbus
	CU250S-2	6SL3246-0BA22-1BA0	USS, Modbus RTU
	CU250S-2 DP	6SL3246-0BA22-1PA0	PROFIBUS DP
	CU250S-2 PN	6SL3246-0BA22-1FA0	PROFINET IO, EtherNet/IP
	CU250S-2 CAN	6SL3246-0BA22-1CA0	CANopen

2.3 Power Module

You may operate the Control Unit with the following Power Modules:

- PM240 (3 AC 400 V for standard applications with dynamic braking)
- PM240-2 (3 AC 400 V for standard applications with dynamic braking, 2nd generation)

  in degree of protection IP20 and Push Through (PT)
- PM340 (1 AC 200 V with dynamic braking)
- PM250 (3 AC 400 V with energy recovery)
- PM260 (3 AC 690 V with energy recovery),

PM340, 1 AC 200 V - Standard areas of application

The PM340 Power Module is available without a filter or with an integrated class A line filter with degree of protection IP20. The PM340 allows dynamic braking via an external braking resistor.

Order number range: 6SL3210-1SB1…

Frame size	FSA	FSB	FSC	FSD	FSE	FSF	FSGX
Power range (kW)	0.12 … 0.75	--	--	--	--	--	---

PM240, 3 AC 400 V - Standard areas of application

The PM240 Power Module is available without a filter or with an integrated class A line filter with degree of protection IP20. The PM240 allows dynamic braking via an external braking resistor.

Order number range: 6SL3224-0BE… and 6SL3224-0XE…

Frame size	FSA	FSB	FSC	FSD	FSE	FSF	FSGX
Power range (kW)	0.37 … 1.5	2.2 … 4	7.5 … 15	18.5 … 30	37 … 45	55 … 132	160 … 250

PM240-2, 3 AC 400 V - standard areas of application, 2nd generation

The PM240-2 Power Module is available without a filter or with an integrated class A line filter. The PM240-2 permits dynamic braking via an external braking resistor.

Range of order numbers:
- IP20: 6SL3210-1PE…
- Push-through 6SL3211-1PE…

Frame size	FSA						
Power range (kW), IP20	0.55 … 3						
Power range (kW), PT	2.2 … 3						

PM250, 3 AC 400 V - Application areas with line regeneration

The PM250 Power Module is available without a filter or with an integrated class A line filter with degree of protection IP20. The PM250 permits dynamic braking with energy feedback into the line supply.

Order number range, IP20: 6SL3225-0BE …

Frame size	FSC	FSD	FSE	FSF			
Power range (kW)	7.5 … 15	18.5 … 30	37 … 45	55 … 90			

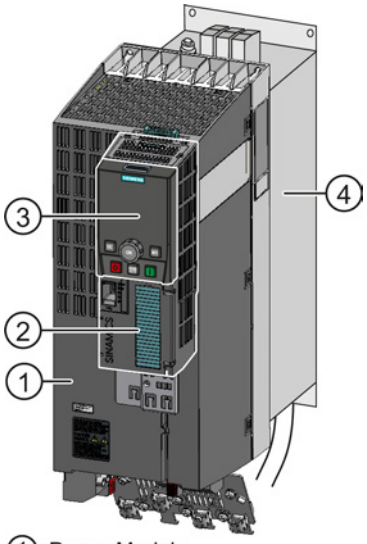
PM260, 3 AC 690 V - Application areas with line regeneration

The PM260 Power Module is available without a filter or with an integrated class A line filter with degree of protection IP20. A sine-wave filter is fitted to the motor. The PM260 permits dynamic braking with energy feedback into the line supply.

Order number range, IP20: 6SL3225-0BH…

Frame size	FSD	FSF					
Power range (kW)	11 … 18.5	30 … 55					

Inverter accessories



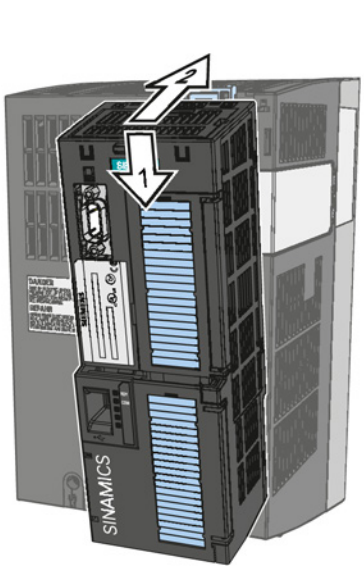
① Power Module
② Control Unit
③ Intelligent Operator Panel IOP
④ Base components: Filters, reactors or braking resistors

Inverter with accessories (example)

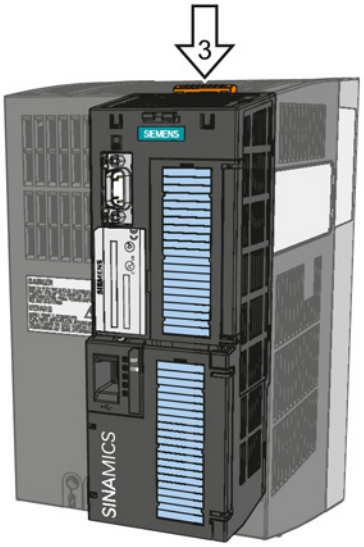
The following accessories are available for the inverter:

- Operator Panel for commissioning and diagnostics (Basic Operator Panel BOP-2 or Intelligent Operator Panel IOP).
- Memory cards for the following tasks:
  - Back up the inverter settings on an interchangeable data storage device.
  - Licensing of the "Extended safety functions" and "Basic positioner" functions.
- Shield connection kit for optimum shield support of the connected cables.
- Line filter for achieving a higher radio interference suppression class.
- Line reactor for protecting the inverter in harsh industrial networks.
- Output reactor for protecting the inverter when motor cables > 50 m (shielded) or > 100 m (unshielded) are used.
- Sine-wave filter for protecting motors which are not suitable for inverter operation and for motor cables up to 300 m.
- Braking resistor for dynamic braking of the motor.
- Brake Relay for controlling a motor holding brake.

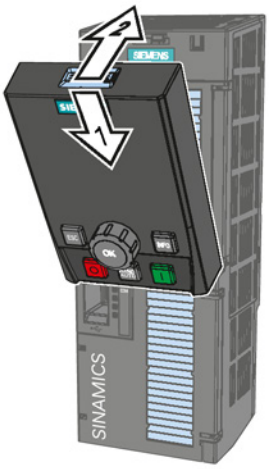
2.4 Assembling frequency converter components



Attaching the CU



Removing the CU



Attaching the Operator Panel

Installing 3

3.1 Installing the Power Module

⚠ WARNING

Danger of death caused by high leakage currents when the external protective conductor is interrupted

The inverter conducts high leakage currents > 3.5 mA via the protective conductor. When the protective conductor is interrupted, touching live components can result in electric shock, which can lead to death or serious injuries.

- Connect a protective conductor, which satisfies at least one of the following conditions, to the inverter:
  - The protective conductor is routed so that it is protected against mechanical damage.

    Cables routed in control cabinets or enclosed machine enclosures are considered to be adequately protected.
  - The protective conductor routed as an individual conductor has a cross-section of ≥ 10 mm² Cu.
  - In a multi-core cable the protective conductor has a cross-section of ≥ 2.5 mm² Cu.
  - Two parallel protective conductors with the same cross-section are installed.
  - The protective conductor corresponds to the local regulations for equipment with increased leakage current.

3.1.1 Connecting up the Motor and Power Module

Connecting the Power Module to the motor and power supply

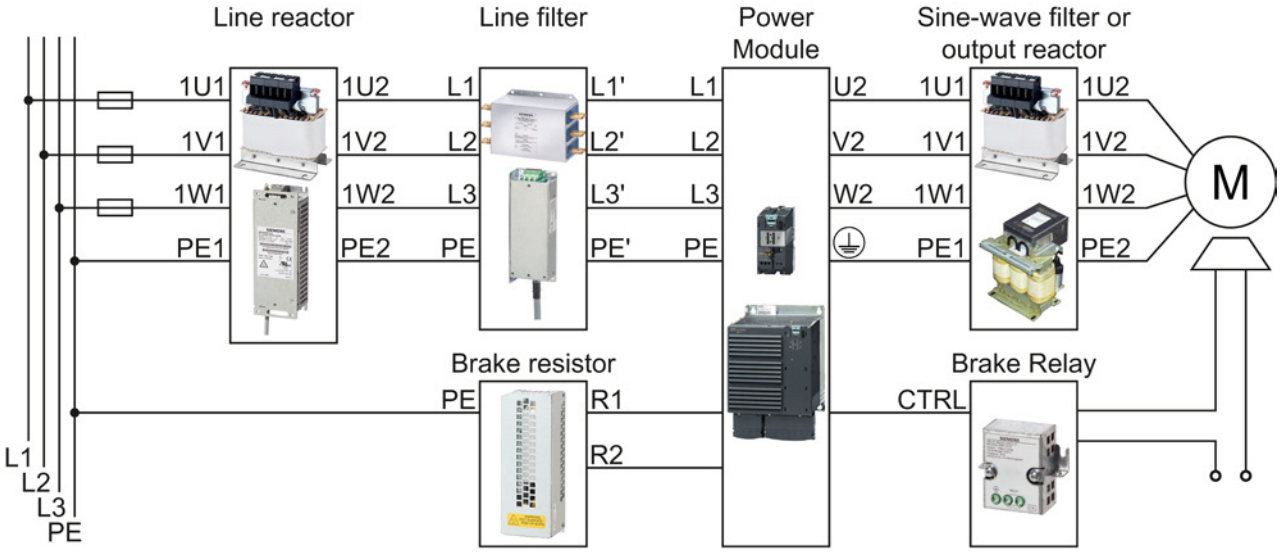


Figure 3-1 Connecting the PM240 and PM240-2 3AC Power Modules

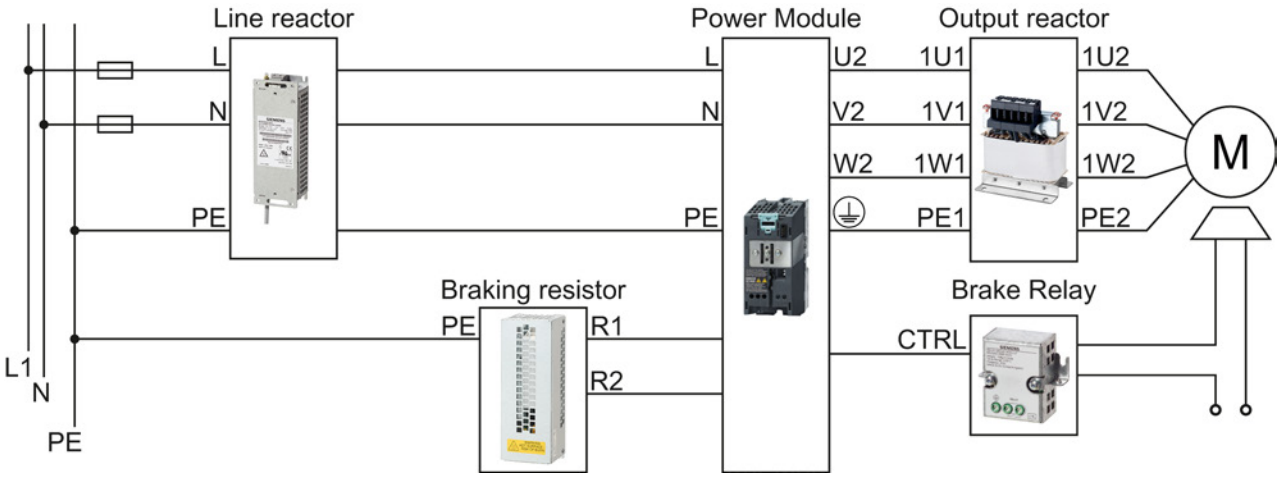


Figure 3-2 Connecting the PM340 1AC Power Module

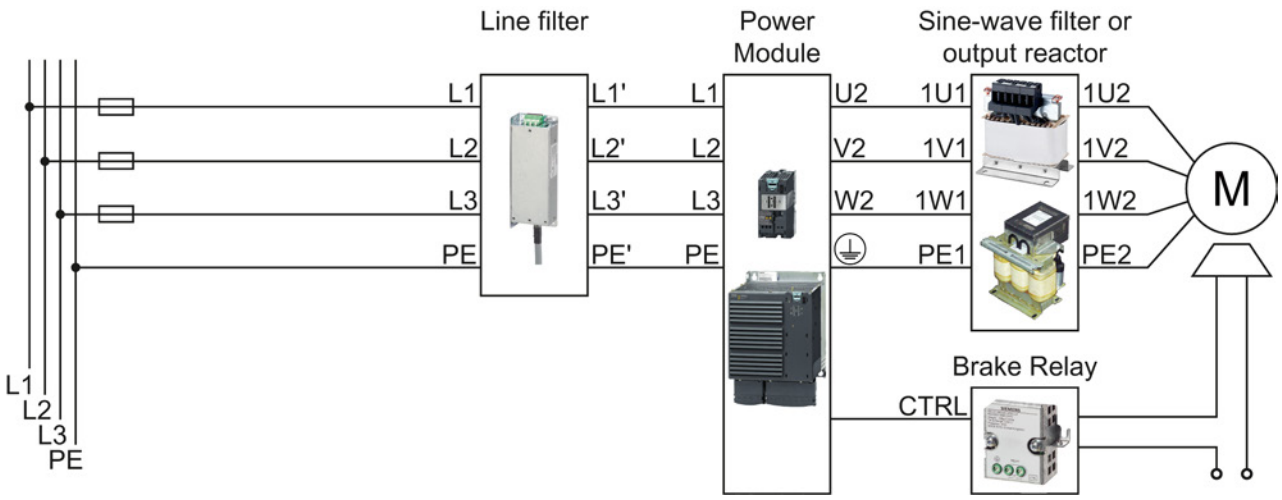


Figure 3-3 Connecting the PM250 Power Module

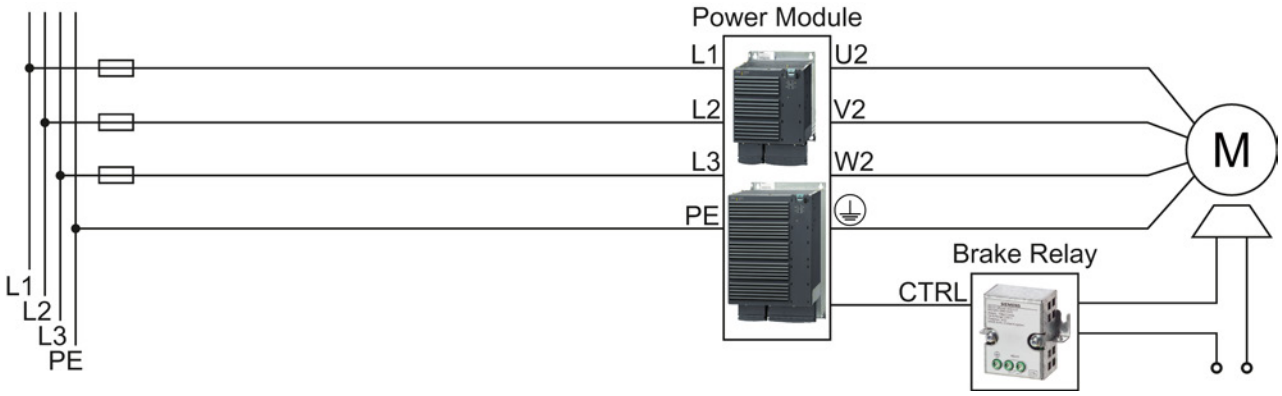


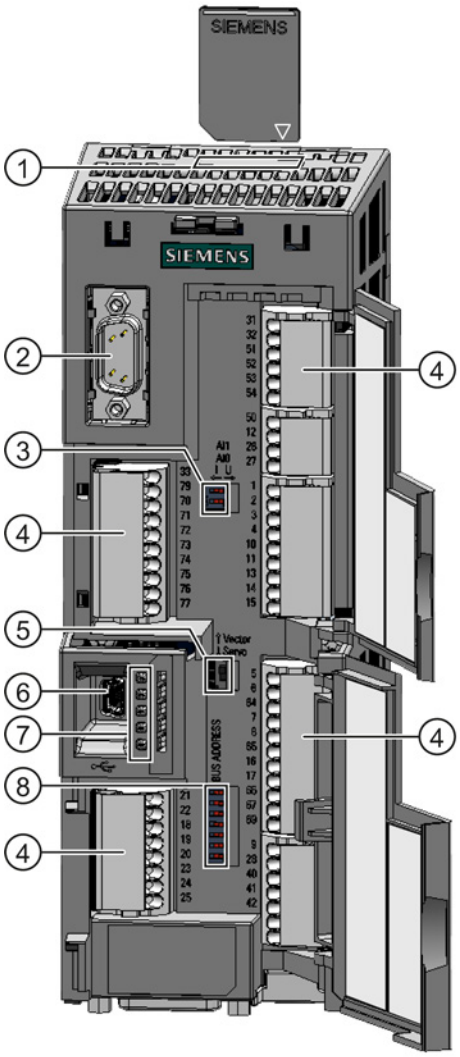
Figure 3-4 Connecting the PM260 Power Module

3.2 Installing Control Unit

3.2.1 Overview of the interfaces

Interfaces at the front of the Control Unit

To access the interfaces at the front of the Control Unit, you must unplug the Operator Panel (if one is being used) and open the front doors.

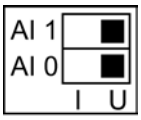


① Memory card slot

② Connection to the Operator Panel

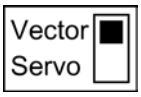
③ Switch for analog inputs

I 0/4 mA … 20 mA
U -10/0 V … 10 V



④ Terminal blocks

⑤ Selecting the control mode



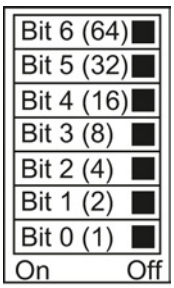
⑥ USB interface for connection to a PC

⑦ Status LED

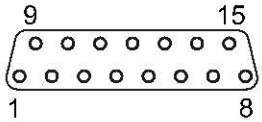
RDY
BF
SAFE
LNK1, only for PROFINET
LNK2, only for PROFINET

⑧ Selecting the fieldbus address:

- PROFIBUS
- USS
- Modbus RTU
- CanOpen



Interfaces at the lower side of the Control Unit

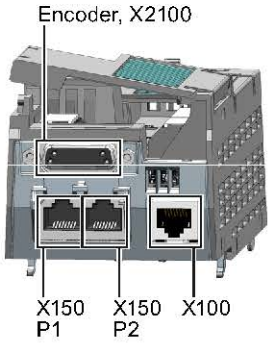


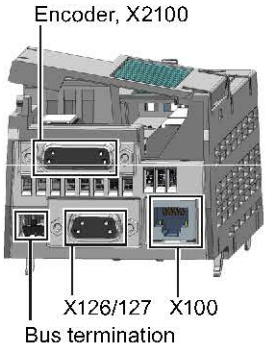
X2100 Encoder

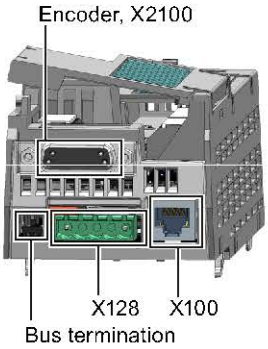
		Motor temperature, KTY84 or PTC	HTL	TTL	SSI (RS422 standard)
1	Positive	X	---	---	---
2	Clock +	---	---	---	X
3	Clock -	---	---	---	X
4	Power supply, referred to pin 7	---	X	X	X
5	Power supply, referred to pin 7	---	X	X	X
6	P_Sense, sense input for the power supply	---	---	X	---
7	GND, reference potential for pins 4 and 5	---	X	X	X
8	Negative	X	---	---	---
9	M_Sense, sense input, GND	---	---	X	---
10	Z +	---	X	X	---
11	Z -	---	X	X	---
12	B -	---	X	X	---
13	B +	---	X	X	---
14	A - / Data -	---	A -	A -	Data -
15	A + / Data +	---	A +	A +	Data +

X100 DRIVE-CLiQ

1 Transmit data +
2 Transmit data -
3 Receive data +
4 ---
5 ---
6 Receive data -
7 ---
8 ---
A + 24 V power supply, max. 450 mA
B M, reference potential for power supply



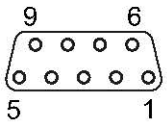




Bus termination

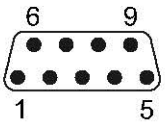
X150 P1
X150 P2
PROFINET

1 RX+ Receive data +
2 RX- Receive data -
3 TX+ Transmit data +
4 ---
5 ---
6 TX- Transmit data -
7 ---
8 ---



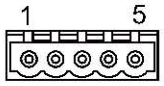
X126
CAN

1 ---
2 CAN_L
CAN signal (dominant low)
3 CAN_GND, CAN ground
4 ---
5 (CAN _SHLD),
optional shield
6 (GND), optional ground
7 CAN_H,
CAN signal (dominant high)
8 ---
9 ---



X127
PROFIBUS

1 ---
2 M Reference potential for P24_Serv
3 RxD/TxD-N
receive and transmit (B/B')
4 CNTR-P control signal
5 GND
reference potential for data (C/C')
6 + 5 V power supply
7 P24_Serv
8 RxD/TxD-N
receive and transmit (A/A')
9 ---

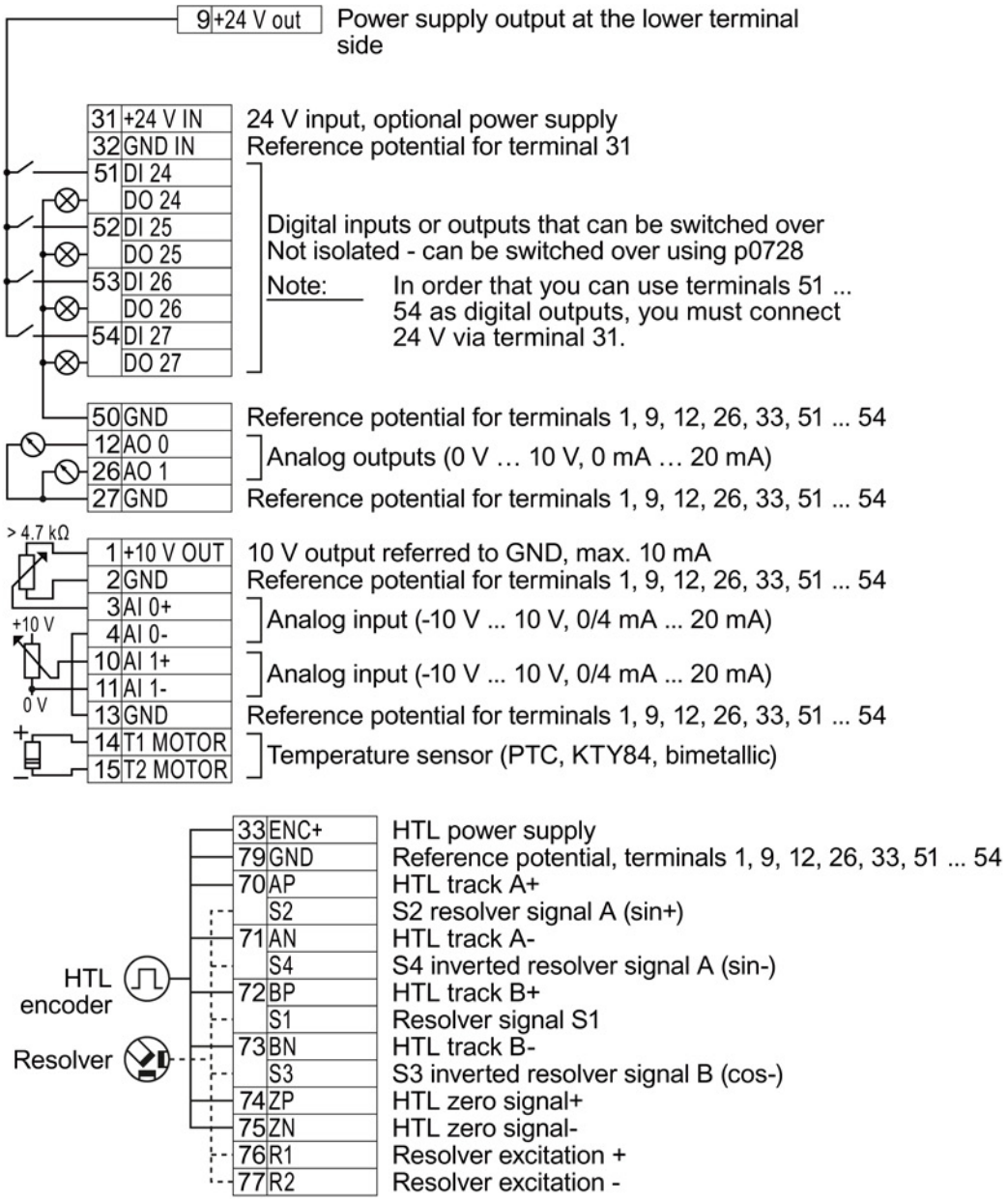


X128
RS485

1 0 V, reference potential
2 RS485P, receive and transmit (+)
3 RS485N, receive and transmit (-)
4 Cable shield
5 ---

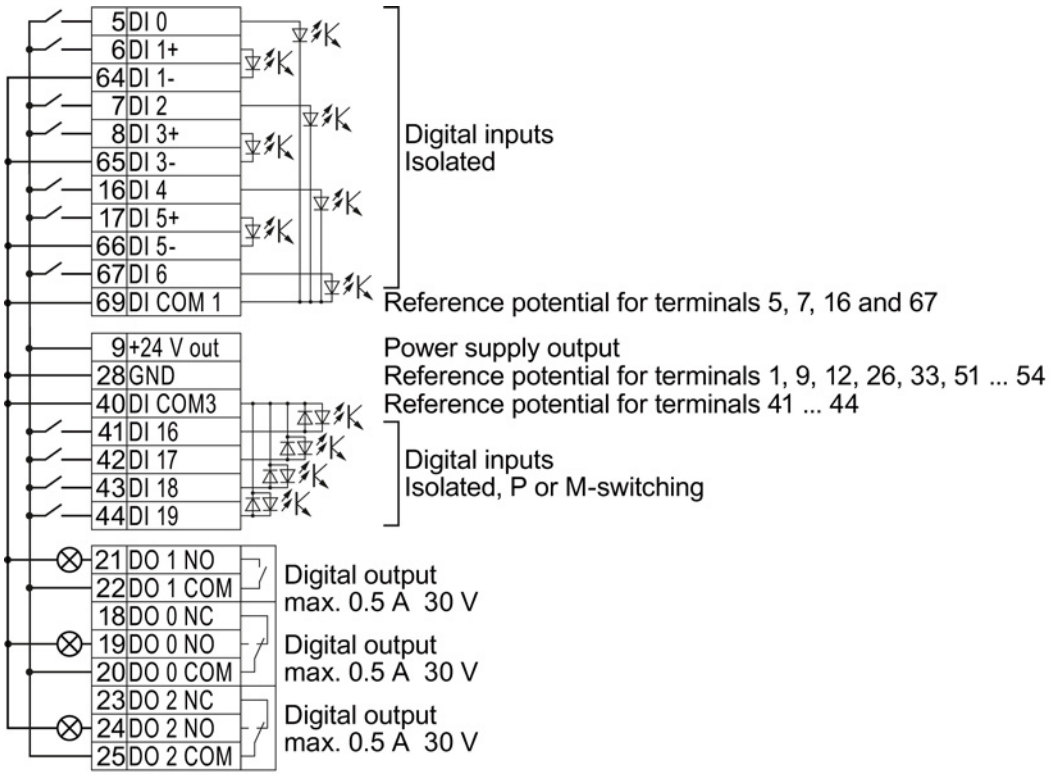
3.2.2 Terminal blocks

Terminal strips behind the upper front door



For the analog inputs, you may use the internal 10 V power supply (example: terminals 1 … 4, 13) or an external power source (example: terminals 10, 11).

Terminal strips behind the lower front door



Note

Short-circuit at the Control Unit output terminals at full load

If a short circuit occurs at the output terminals when the CU is fully loaded, then the Power Module switches off the internal power supply for the Control Unit.

3.2.3 Finding a suitable setting for the interfaces

The inputs and outputs of the frequency inverter and the fieldbus interface have specific functions when set to the factory settings.

When you put the frequency inverter into operation, you can change the function of each of its inputs and outputs and the setting of the fieldbus interface.

To make the setting process easier, the inverter has various predefined assignments (macros).

Only the inputs and outputs whose functions change by selecting a specific assignment, are shown on the following pages.

Procedure

To select one of the inverter's pre-assigned settings, proceed as follows:

1. Think about which of the input and output functions you are using in the application.
2. Find the I/O configuration (macro) that best suits your application.
3. Note the macro number of the corresponding default setting.

   You must set this macro number when putting the frequency inverter into operation.

You have found the appropriate inverter pre-assignment.

Macro 1: Two fixed speeds	Macro 2: Two fixed speeds with safety function	Macro 3: Four fixed speeds
5 DI 0 ON/OFF1 right 6 DI 1 ON/OFF1 left 7 DI 2 Acknowledge 8 DI 3 --- 16 DI 4 Fixed speed 3 17 DI 5 Fixed speed 4 3 AI 0 --- 4 18 DO 0 Fault 19 20 21 DO 1 Alarm 22 12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V DI 4 and DI 5 = high: The inverter adds both fixed speeds.	5 DI 0 ON/OFF1 Fixed speed 1 6 DI 1 Fixed speed 2 7 DI 2 Acknowledge 8 DI 3 --- 16 DI 4] Reserved for 17 DI 5] safety function 3 AI 0 --- 4 18 DO 0 Fault 19 20 21 DO 1 Alarm 22 12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V	5 DI 0 ON/OFF1 Fixed speed 1 6 DI 1 Fixed speed 2 7 DI 2 Acknowledge 8 DI 3 --- 16 DI 4 Fixed speed 3 17 DI 5 Fixed speed 4 3 AI 0 --- 4 18 DO 0 Fault 19 20 21 DO 1 Alarm 22 12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V Multiple DIs = high: The inverter adds the corresponding fixed speeds.

Macro 4: PROFIBUS or PROFINET	Macro 5: PROFIBUS or PROFINET with safety function	
PROFIdrive telegram 352 5 DI 0 --- 6 DI 1 --- 7 DI 2 Acknowledge 8 DI 3 --- 16 DI 4 --- 17 DI 5 --- 3 AI 0 --- 4 18 DO 0 Fault 19 20 21 DO 1 Alarm 22 12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V	PROFIdrive telegram 1 5 DI 0 --- 6 DI 1 --- 7 DI 2 Acknowledge 8 DI 3 --- 16 DI 4] Reserved for 17 DI 5] safety function 3 AI 0 --- 4 18 DO 0 Fault 19 20 21 DO 1 Alarm 22 12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V	

Macro 7: Switch over between fieldbus and jogging via DI 3 Factory setting for inverters with PROFIBUS or PROFINET interface		Macro 8: Motorized potentiometer (MOP) with safety function
PROFIdrive telegram 1 5 DI 0 --- 6 DI 1 --- 7 DI 2 Acknowledge 8 DI 3 LOW 16 DI 4 --- 17 DI 5 --- 3 AI 0 --- 4 18 DO 0 Fault 19 20 21 DO 1 Alarm 22 12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V	5 DI 0 Jog 1 6 DI 1 Jog 2 7 DI 2 Acknowledge 8 DI 3 HIGH 16 DI 4 --- 17 DI 5 --- 3 AI 0 --- 4 18 DO 0 Fault 19 20 21 DO 1 Alarm 22 12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V	5 DI 0 ON/OFF1 6 DI 1 MOP raise 7 DI 2 MOP lower 8 DI 3 Acknowledge 16 DI 4] Reserved for 17 DI 5] safety function 3 AI 0 --- 4 18 DO 0 Fault 19 20 21 DO 1 Alarm 22 12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V

Macro 9: Motorized potentiometer (MOP)	Macro 12: Two-wire control with method 1 Factory setting for inverters without PROFIBUS or PROFINET interface.	Macro 13: Setpoint via analog input with safety function
5 DI 0 ON/OFF1 6 DI 1 MOP raise 7 DI 2 MOP lower 8 DI 3 Acknowledge 16 DI 4 --- 17 DI 5 --- 3 AI 0 --- 4 18 DO 0 Fault 19 20 21 DO 1 Alarm 22 12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V	5 DI 0 ON/OFF1 6 DI 1 Reversing 7 DI 2 Acknowledge 8 DI 3 --- 16 DI 4 --- 17 DI 5 --- 3 AI 0 Setpoint 4 I U -10 V ... 10 V 18 DO 0 Fault 19 20 21 DO 1 Alarm 22 12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V	5 DI 0 ON/OFF1 6 DI 1 Reversing 7 DI 2 Acknowledge 8 DI 3 --- 16 DI 4] Reserved for 17 DI 5] safety function 3 AI 0 Setpoint 4 I U -10 V ... 10 V 18 DO 0 Fault 19 20 21 DO 1 Alarm 22 12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V

Macro 14: Switch over between fieldbus and motorized potentiometer (MOP) via DI 3		
PROFIdrive telegram 1		
5 DI 0 --- 6 DI 1 External fault 7 DI 2 Acknowledge 8 DI 3 LOW 16 DI 4 --- 17 DI 5 ---	5 DI 0 ON/OFF1 6 DI 1 External fault 7 DI 2 Acknowledge 8 DI 3 HIGH 16 DI 4 MOP raise 17 DI 5 MOP lower	
3 AI 0 --- 4	3 AI 0 --- 4	
18 DO 0 Fault 19 20 21 DO 1 Alarm 22	18 DO 0 Fault 19 20 21 DO 1 Alarm 22	
12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V	12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V	

Macro 15: Switch over between analog setpoint and motorized potentiometer (MOP) via DI 3		Macro 17: Two-wire control with method 2 Macro 18: Two-wire control with method 3
5 DI 0 ON/OFF1 6 DI 1 External fault 7 DI 2 Acknowledge 8 DI 3 LOW 16 DI 4 --- 17 DI 5 ---	5 DI 0 ON/OFF1 6 DI 1 External fault 7 DI 2 Acknowledge 8 DI 3 HIGH 16 DI 4 MOP raise 17 DI 5 MOP lower	5 DI 0 ON/OFF1 right 6 DI 1 ON/OFF1 left 7 DI 2 Acknowledge 8 DI 3 --- 16 DI 4 --- 17 DI 5 ---
3 AI 0 Setpoint 4 I U -10 V ... 10 V	3 AI 0 --- 4	3 AI 0 Setpoint 4 I U -10 V ... 10 V
18 DO 0 Fault 19 20 21 DO 1 Alarm 22	18 DO 0 Fault 19 20 21 DO 1 Alarm 22	18 DO 0 Fault 19 20 21 DO 1 Alarm 22
12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V	12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V	12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V

Macro 19: Three-wire control with method 1	Macro 20: Three-wire control with method 2	Macro 21: Fieldbus USS Macro 22: Fieldbus CANopen
5 DI 0 Enable/OFF1 6 DI 1 ON right 7 DI 2 ON left 8 DI 3 Acknowledge 16 DI 4 --- 17 DI 5 --- 3 AI 0 Setpoint 4 I U -10 V ... 10 V 18 DO 0 Fault 19 20 21 DO 1 Alarm 22 12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V	5 DI 0 Enable/OFF1 6 DI 1 ON 7 DI 2 Reversing 8 DI 3 Acknowledge 16 DI 4 --- 17 DI 5 --- 3 AI 0 Setpoint 4 I U -10 V ... 10 V 18 DO 0 Fault 19 20 21 DO 1 Alarm 22 12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V	USS setting: 38400 baud, 2 PZD, PKW variable CANopen setting: 20 kBaud 5 DI 0 --- 6 DI 1 --- 7 DI 2 Acknowledge 8 DI 3 --- 16 DI 4 --- 17 DI 5 --- 3 AI 0 --- 4 18 DO 0 Fault 19 20 21 DO 1 Alarm 22 12 AO 0 Speed 13 0 V ... 10 V 26 AO 1 Current 27 0 V ... 10 V

3.2.4 Wiring the terminal strip

NOTICE

Damage to the inverter when using long signal cables

Using long cables at the inverter's digital inputs and 24 V power supply can lead to overvoltage during switching operations. Overvoltages can damage the inverter.

- If you use cables of more than 30 m at the digital inputs and 24 V power supply, connect an overvoltage protection element between the terminal and the associated reference potential.
  We recommend using the Weidmüller overvoltage protection terminal with designation MCZ OVP TAZ DIODE 24VDC.

⚠ WARNING

Danger to life as a result of hazardous voltages when connecting an unsuitable power supply

Death or serious injury can result when live parts are touched in the event of a fault.

- For all connections and terminals of the electronic modules, only use power supplies with protective extra low voltage (PELV), Class 2.

Requirements

- Use suitable cables:
  - Solid or flexible cables.
  - Suitable cable cross-section: 0.5 mm² (21 AWG) to 1.5 mm² (16 AWG).

    When completely connecting up the unit, we recommend cables with a cross-section of 1 mm² (18 AWG).
- Do not use end sleeves.
- You have found an appropriate pre-assignment for the terminal strips, which you can now use to wire the inverter.

  See also Section Finding a suitable setting for the interfaces (Page 25).
- You have the appropriate tools:
  - Small screwdriver to open the spring-loaded terminals
  - Tool for stripping the cables

Procedure

To connect up the inverter's terminal strip, proceed as follows:

1. Remove the last 10 mm (approx.) of the cable insulation.
2. Using the screwdriver, press on the orange operator control of the spring-loaded terminal hard enough to open the terminal.
3. Insert the cable into the terminal as far as it will go and remove the screwdriver.
4. Ensure that the cable is securely connected by pulling on it lightly.
5. Connect up all of the required terminals on the terminal strip in this way.
6. Route the signal cables in such a way that you can completely close the front doors after wiring the terminal strip.
7. If you use shielded cables, then you must connect the shield to the mounting plate of the control cabinet or with the shield support of the inverter through a good electrical connection and a large surface area.
   See also: EMC installation guideline
   (http://support.automation.siemens.com/WW/view/en/60612658)
8. Use strain relief.

You have now connected up the inverter's terminal strips.

3.3 Installing encoders

3.3.1 Permissible encoders

Encoders for speed control

The encoder must be mounted on the motor shaft.

Table 3- 1 Permissible encoders

Encoder type	Terminal block	SUB-D connector	DRIVE-CLiQ interface	
			Connection via SMC or SME	Connection via DRIVE-CLiQ
Resolver	✓		✓	
HTL encoder	✓	✓	✓	
TTL encoder		✓	✓	
Endat 2.1			✓	
sin/cos encoder			✓	
DRIVE-CLiQ encoder				✓
	For the connection, refer to Terminal blocks (Page 24)	For the connection, refer to Overview of the interfaces (Page 22)		

Encoders for position control

Permissible encoders for position control and the permissible combination of encoders for speed and position control are listed in the "Basic positioner" Function Manual, also see Section: Manuals for your inverter (Page 43).

3.3.2 Sensor Module

Table 3- 2 Permissible SMC/SME Sensor Modules and encoders that can be connected

	SMC10	SMC20	SMC30	SME20	SME25
Two-pole resolver	✓				
Multi-pole resolver	✓				
sin/cos encoder 1 V_{pp}		✓			
sin/cos encoder 1 V_{pp} without rotor position track (C and D tracks)				✓	
SSI encoders with incremental signals sin/cos 1 V_{pp}		✓			✓
SSI encoders with TTL/HTL incremental signals			✓		
SSI encoder without incremental signals			✓		
HTL or TTL encoder			✓		
Absolute encoders Endat 2.1		✓			✓

Information about installing and connecting the Sensor Modules is provided in the "SINAMICS S120 Control Units and additional system components" manual, also see Section: Manuals for your inverter (Page 43).

3.4 Description files for fieldbuses

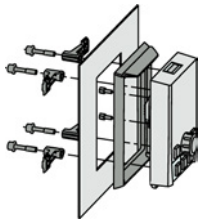
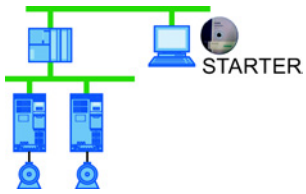
The description files contain the information required to configure and operate the converter on a fieldbus under a higher-level control.

Description file	Download	Alternative to download
GSD for PROFIBUS	Internet: (http://support.automation.siemens.com/WW/view/en/23450835)	GSD and GSDML are saved in the converter. The converter writes its GSD or GSDML to the memory card once you insert this card in the converter and set p0804 to 12. You can then transfer the file to your programming device or PC using the memory card.
GSDML for PROFINET	Internet: (http://support.automation.siemens.com/WW/view/en/26641490)	
EDS for CANopen	Internet: (http://support.automation.siemens.com/WW/view/en/48351511)	---
EDS for Ethernet/IP	---	Further information can be found in the operating instructions

Commissioning

4

4.1 Tools to commission the converter

Operator panels for commissioning, diagnostics and controlling inverters		Order number
	BOP-2 (Basic Operator Panel) - for snapping onto the inverter • Two-line display • Guided basic commissioning • Backing up and transferring the inverter settings	6SL3255-0AA00-4CA1
	IOP (Intelligent Operator Panel) - for snapping onto the inverter • Plain text display • Menu-based operation and application wizards • Backing up and transferring the inverter settings	6SL3255-0AA00-4JA0
	Door mounting kit for IOP/BOP-2 • For installation of the BOP-2 or IOP in a control cabinet door. • Degree of protection with IOP: IP54 or UL Type 12 • Degree of protection with BOP-2: IP55	6SL3256-0AP00-0JA0
	For mobile use of the IOP: IOP handheld with IOP housing, power supply unit and rechargeable batteries as well as RS232 connecting cable If you are using your own connecting cable, carefully note the maximum permissible length of 5 m.	6SL3255-0AA00-4HA0
PC tools for commissioning, diagnostics and controlling the converter		
	PC Connection Kit Includes a STARTER DVD and USB port.	6SL3255-0AA00-2CA0
	STARTER Commissioning tool (PC software) Connection to the inverter via USB port, PROFIBUS or PROFINET Downloading: STARTER (http://support.automation.siemens.com/WW/view/en/10804985/133200)	STARTER on DVD: 6SL3072-0AA00-0AG0
	Drive ES Basic As an option to STEP 7 with routing function via network limits for PROFIBUS and PROFINET	6SW1700-5JA00-5AA0

4.2 Commissioning with STARTER

STARTER and STARTER screen forms

STARTER is a PC-based tool to commission Siemens inverters. The graphic user interface of STARTER supports you when commissioning your inverter. Most inverter functions are integrated in STARTER in screen forms.

The STARTER screen forms that are shown in this manual show general examples. You may therefore find that a screen contains more or fewer setting options than are shown in these instructions. A commissioning step may also be shown using an inverter other than the one you are using.

Preconditions for commissioning

You require the following to commission the inverter using STARTER:

- An installed drive (motor and inverter)
- A computer with Windows XP or Windows 7
- Installed STARTER V4.3 SP2 or higher.

4.2.1 Generating a STARTER project

Procedure

In order to create a new project, proceed as follows:

1. In the STARTER menu, select "Project" → "New…".
2. Specify a name of your choice for the project.

You have created a new STARTER project.

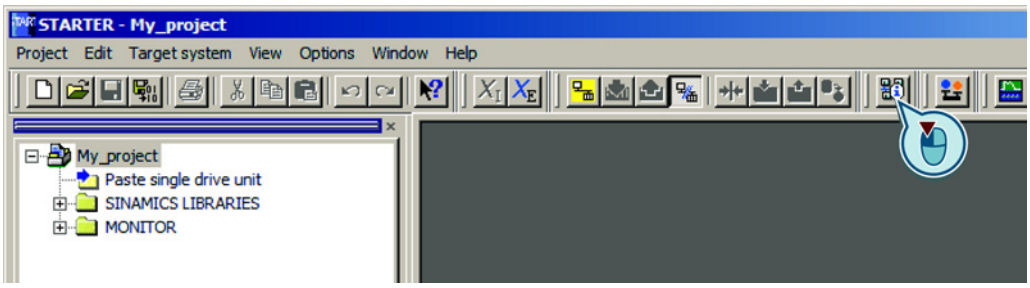
4.2.2 Transfer inverters connected via USB into the project

Procedure

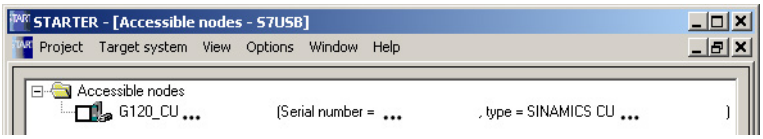
Proceed as follows to transfer an inverter connected via USB into your project:

1. Switch on the inverter power supply.
2. First insert a USB cable into your PC and then into the inverter.
3. The PC operating system installs the USB driver when you are connecting the inverter and PC together for the first time.
   - Windows 7 installs the driver automatically.
   - For Windows XP you must acknowledge several system messages.
4. Start the STARTER commissioning software.

5. In STARTER, press the (("Accessible nodes") button.



6. When the USB interface is appropriately set, then the "Accessible nodes" screen form shows the inverters that can be accessed.



If you have not correctly set the USB interface, then the following "No additional nodes found" message is displayed. In this case, follow the description below.

7. Select the inverter ☑.
8. Press the "Accept" button.

You have transferred an inverter accessible via the USB interface into your project.

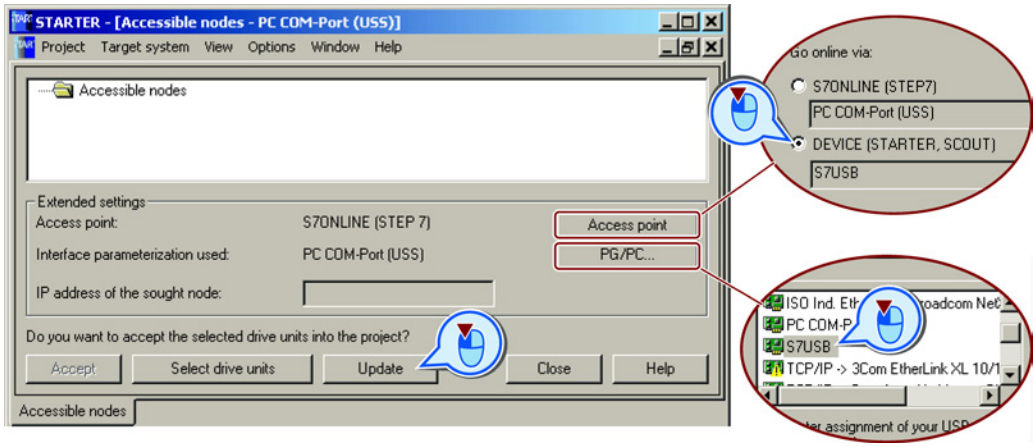
Setting the USB interface

Procedure

1
2

Proceed as follows to set the USB interface in STARTER:

1. In this case set the "Access point" to "DEVICE (STARTER, Scout)" and the "PG/PC interface" to "S7USB".
2. Press the "Update" button.



You have set the USB interface.

STARTER now shows the inverters connected via USB.

4.2.3 Configuring a drive

The basic commissioning of the inverter comprises the following steps:

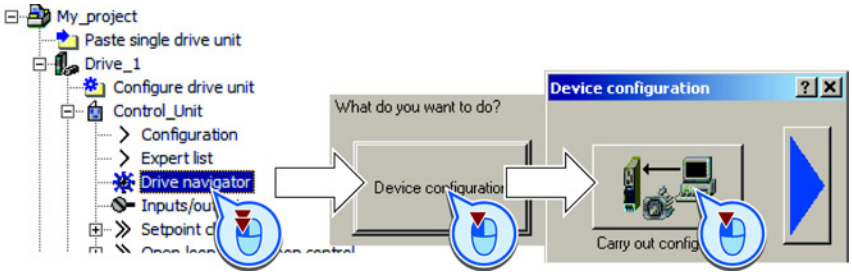
1. Starting basic commissioning
2. Configuring a drive
3. Loading the configured data into the drive

Starting basic commissioning

Procedure

To start the basic commissioning, proceed as follows:

1. In STARTER select the drive you wish to commission.
2. Start the wizard for the device configuration:



You have started the basic commissioning.

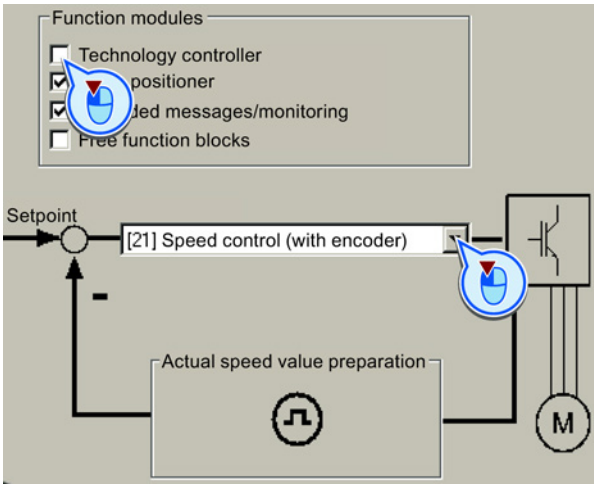
Configuring a drive

Procedure

To configure the drive, proceed as follows:

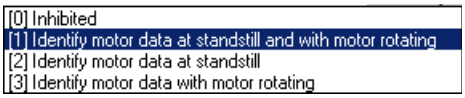
1. Control structure — Select the required function modules for your application.

   Select the control mode.

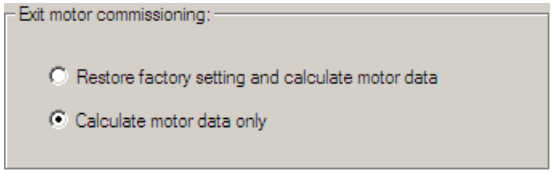


2. ☑ Defaults of the setpoin — Select the default setting of the inverter interfaces.
   See also Section: Finding a suitable setting for the interfaces (Page 25).
3. ☑ Drive setting — Select the application for the inverter:
   Low overload for applications that only require a low dynamic performance, e.g. pumps or fans.
   High overload for applications requiring a high dynamic performance, e.g. conveyor systems.
4. ☑ Motor — Select your motor.
5. ☑ Motor data — Enter the motor data according to the rating plate of your motor.
   If you have selected a motor based on its order number, the data has already been entered.
6. ☑ Drive functions — If you have set the "Speed control" control mode, then we recommend setting "[1] Identify motor data at standstill and with motor rotating".

   With this setting, the inverter optimizes its speed controller.

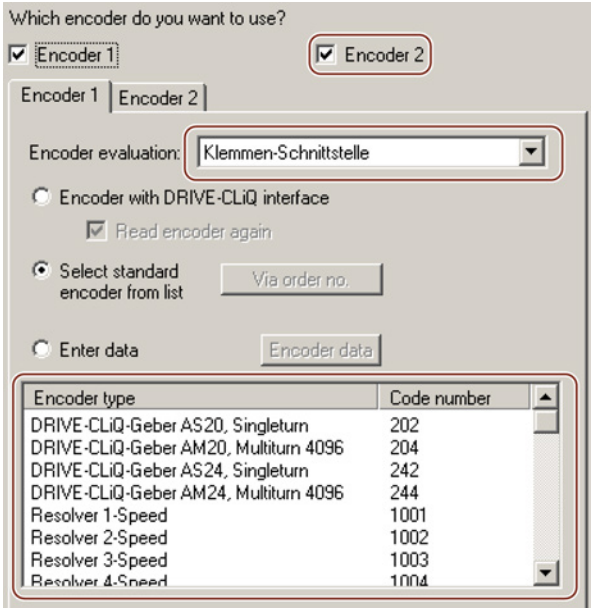
   If one of the following cases is applicable, select the setting "[2] Identify motor data at standstill":
   - You have selected "Speed control" as control mode, however the motor cannot freely rotate, e.g. for mechanically limited traversing sections.
   - You have set "V/f control" as control mode.
7. ☑ Important parameters — Set the most important parameters to suit your application.
8. ☑ Calculation of the motc — We recommend the setting "Calculate motor data only".

9. ☑ Encoder — Select whether the inverter evaluates one or two encoders.
   Select the interface to which the encoder is connected.

Select a standard encoder from the list of encoder types.

- Code number < 1000: Encoders with integrated DRIVE-CLiQ
- 100x: Resolvers with different pole pair numbers
- 2xxx: sin/cos encoder
- 3xxx: HTL/TTL encoders and SSI encoders

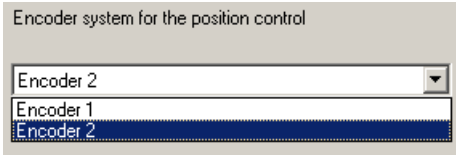


If you cannot find your encoder in the list, then initially select the closest possible encoder type. Continue the configuration, and then adapt the encoder data. See also Section: Adapting the encoder data (Page 39).

10. ☑ Measurement system

This step is only visible if you have configured the basic positioner.

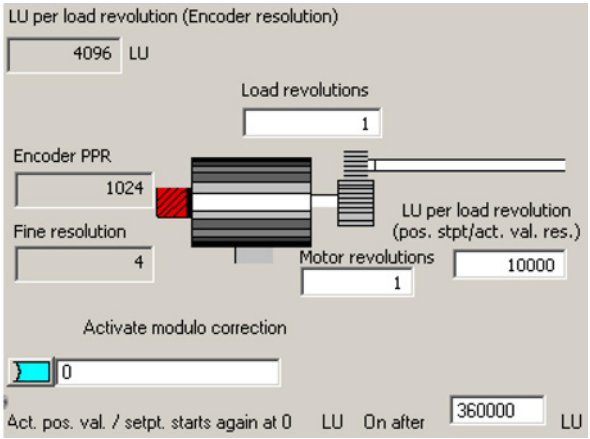
Select the encoder that you use for position sensing.



11. ☑ Mechanics

This step is only visible if you have configured the basic positioner.

You may skip this screen form initially. The settings are explained in the context of commissioning the basic positioner in the function manual "Basic positioner".



12. ☐ Summary

Exit basic commissioning by means of Finish.

Back up your project .

You have entered all of the data that is necessary for the basic commissioning of your inverter.

4.2.4 Adapting the encoder data

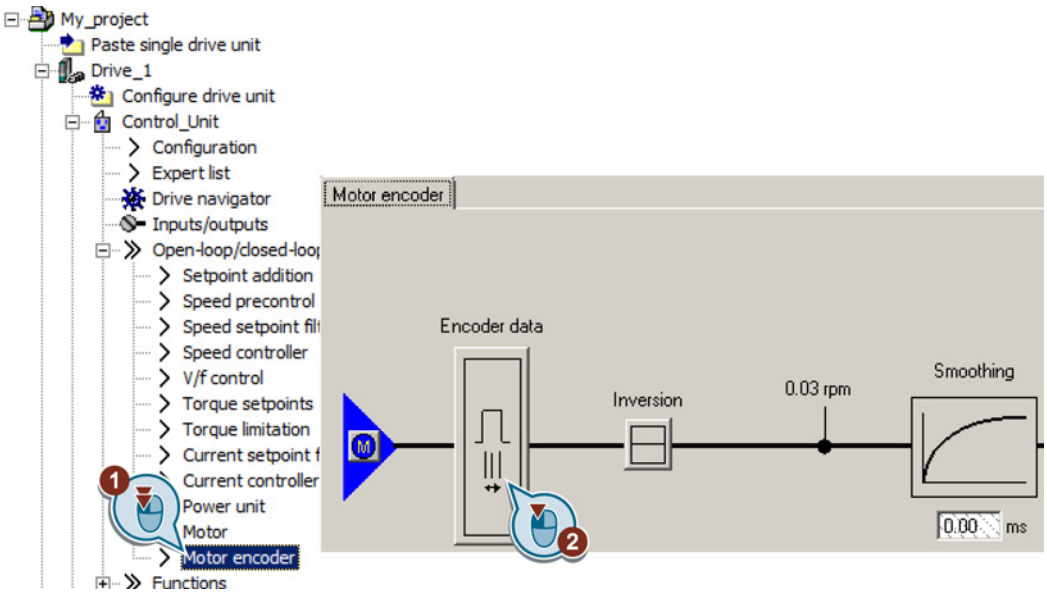
Preconditions

- You have selected an encoder type that does not precisely match your encoder, because it is not included in the list of default encoder types.
- You have completely configured the drive.

Procedure

Proceed as follows to adapt the encoder data:

1. Select the "Motor encoder" screen form.
2. Select the "Encoder data" button.



3. You have access to the following settings in the "Encoder data" screen form:
   - You can change all of the encoder data.
   - You can select another encoder. In this screen form, STARTER only lists the encoder types, which are permitted for the configured interface.

     If you wish to set another encoder interface, then you must reconfigure the inverter.

You have adapted the encoder data.

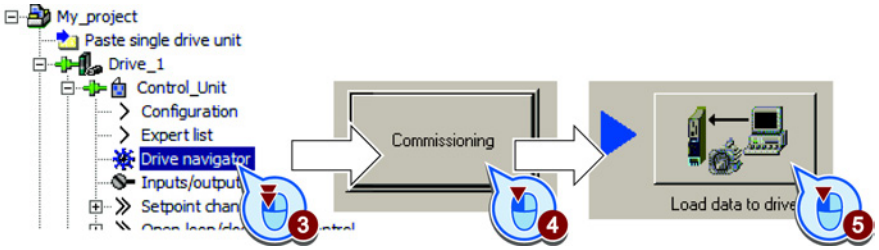
4.2.5 Loading the configured data into the drive

Procedure

Proceed as follows to load the configured data into the drive:

1. Select your project and go online: .
2. STARTER compares your configuration with the real inverter. STARTER signals any differences in the "Online/offline comparison".

   Acknowledge the message by pressing the "Load HW configuration to PG" button.
3. Open "Drive Navigator".
4. Select the "Commissioning" button.
5. Click on "Load data to the drive".



6. ☑ In the screen form, select "After loading copy RAM to ROM".
7. Load your configuration into the inverter.
8. Close the "Commissioning" screen form.

You have loaded your configuration into the drive and therefore performed the basic commissioning.

4.2.6 Identifying motor data

Preconditions

- In the basic commissioning, you have selected the motor identification (MOT ID). In this case, after the basic commissioning has been completed, the converter issues the alarm A07991.
- The motor has cooled down to the ambient temperature.

  If the motor is too hot, the motor data identification will provide incorrect values and the closed-loop speed control will become unstable.

DANGER

Risk of injury or material damage as a result of machine movements when switching on the motor

Switching on the motor for identification purposes may result in hazardous machine movements.

Secure dangerous machine parts before starting motor data identification:

- Before switching on, check that no parts are loose on the machine or can be spun out.
- Before switching on, ensure that nobody is working on the machine or located within its working area.
- Secure the machine's work area against unintended access.
- Lower hanging/suspended loads to the floor.

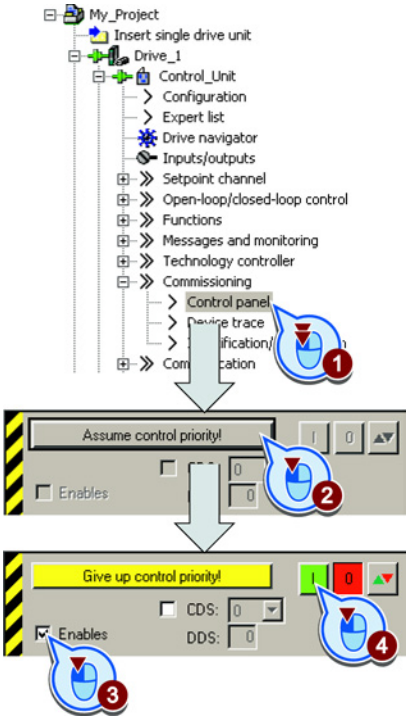
Procedure

1
2

To initiate motor data identification and optimization of the motor control, proceed as follows:

1. Open by double-clicking on the control panel in STARTER.
2. Assume master control for the converter.
3. Set the "Enable signals"
4. Switch on the motor.

   The converter starts the motor data identification. This measurement can take several minutes. After the measurement, the converter switches off the motor.
5. Relinquish the master control after the motor data identification.
6. Click the Save (RAM to ROM) button.



You have now completed motor data identification.

Self-optimization of the closed-loop control

If you have also selected a rotating measurement with self-optimization of the speed control in addition to the motor data identification, then you must switch on the motor again as described above and wait for the optimization run to be completed.

More information

5

5.1 Manuals for your inverter

Table 5- 1 Manuals for your inverter

Information depth	Manual	Contents	Available languages	Download or order number
++	**Getting Started Guide**	(This manual)	English, German, Italian, French, Spanish, Chinese	Download manuals (http://support.automation.siemens.com/WW/view/en/22339653/133300) **SINAMICS Manual Collection** Documentation on DVD, order number 6SL3097-4CA00-0YG0
+++	**Operating instructions** for the SINAMICS G120 inverter with a CU250S-2 Control Unit in the vector control mode	Installing, commissioning and operating the inverter. Setting the inverter functions. Technical data.		
+++	**Function Manual, Basic Positioner**	Commissioning the basic positioner.	English, German, Chinese	
+++	**Function Manual for Safety Integrated** for the SINAMICS G120, G120C and G120D inverters	Configuring PROFIsafe. Installing, commissioning and operating fail-safe functions of the inverter.	English, German, Chinese	
+++	**List Manual**	Complete list of all parameters, alarms and faults. Graphic function diagrams.	English, German, Chinese	
+	**Getting Started Guide** for the following SINAMICS G120 Power Modules: • PM240, PM250 and PM260 • PM240-2	Installing the Power Module.	English	
+	**Installation Instructions** for reactors, filters and braking resistors	Installing components.		
+++	**Hardware Installation Manual** for the following SINAMICS G120 Power Modules: • PM240 • PM240-2 • PM250 • PM260	Installing power modules, reactors and filters. Technical data Maintenance	English, German	

Information depth	Manual	Contents	Available languages	Download or order number
+++	**Operating Instructions** for the following Operator Panels: • BOP-2 • IOP	Operating operator panels, installing door assembly kit for IOP.		
+++	**Configuration Manual** EMC installation guideline	EMC-compliant control cabinet design, potential equalization and cable routing	English, German, Italian, French, Spanish, Chinese	
+++	**Manual** SINAMICS S110 Manual PM340 Power Module	Installing the PM340 Power Module. Technical data Maintenance	English, German, Italian, French, Spanish	S110 Manual (http://support.automation.siemens.com/WW/view/en/49086218)
+++	**SINAMICS S120 Control Units and Additional System Components**	Including: SMC and SME Sensor Modules	English, German, Italian, French, Spanish, Chinese, Russian	S120 system components (http://support.automation.siemens.com/WW/view/en/68040800)

5.2 Product support

Table 5- 2 Technical support

France	Germany	Italy	Spain	Great Britain
+33 (0) 821 801 122	+49 (0)911 895 7222	+39 (02) 24362000	+34 902 237 238	+44 161 446 5545
Other service telephone numbers: Product support (http://support.automation.siemens.com/WW/view/en/4000024)				

Further information

SINAMICS inverters:
www.siemens.com/sinamics

Safety Integrated:
www.siemens.com/safety-integrated

PROFINET:
www.siemens.com/profinet

Siemens AG
Industry Sector
Drive Technologies
Motion Control Systems
P.O. Box 3180
91050 ERLANGEN
GERMANY

Subject to change without prior notice
© Siemens AG 2013

Scan the QR code for further information on SINAMICS G120.

www.siemens.com/drives