

SINAMICS G120

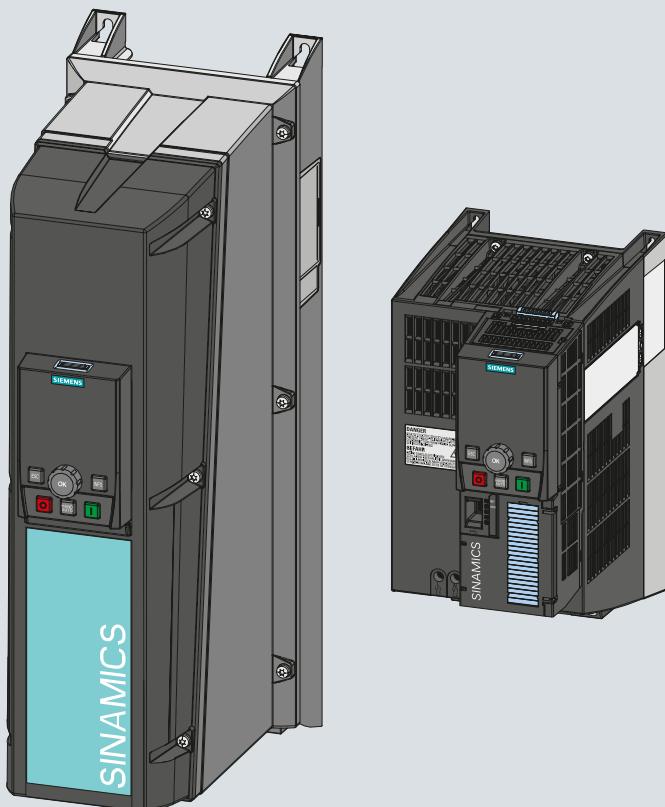
Inverters with the Control Units

CU230P-2

CU240B-2

CU240E-2

Getting Started · 06 2010



SINAMICS

Answers for industry.

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SINAMICS G120

**CU230P-2; CU240B-2; CU240E-2
Control Units**

Getting Started

06/2010 Edition, firmware V4.3.2

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.

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

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CAUTION

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NOTICE

indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

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 for the specific task, 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.

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Design and installation

1.1 Inverter

Components and design of the inverter

SINAMICS G120 inverters comprise a *Power Module (PM)* and *Control Unit (CU)*.

The following tools are available to commission the inverter:

- Intelligent Operator Panel IOP
- Basic Operator Panel BOP 2 (will be available from 05/2010)
- STARTER commissioning tool (PC software)

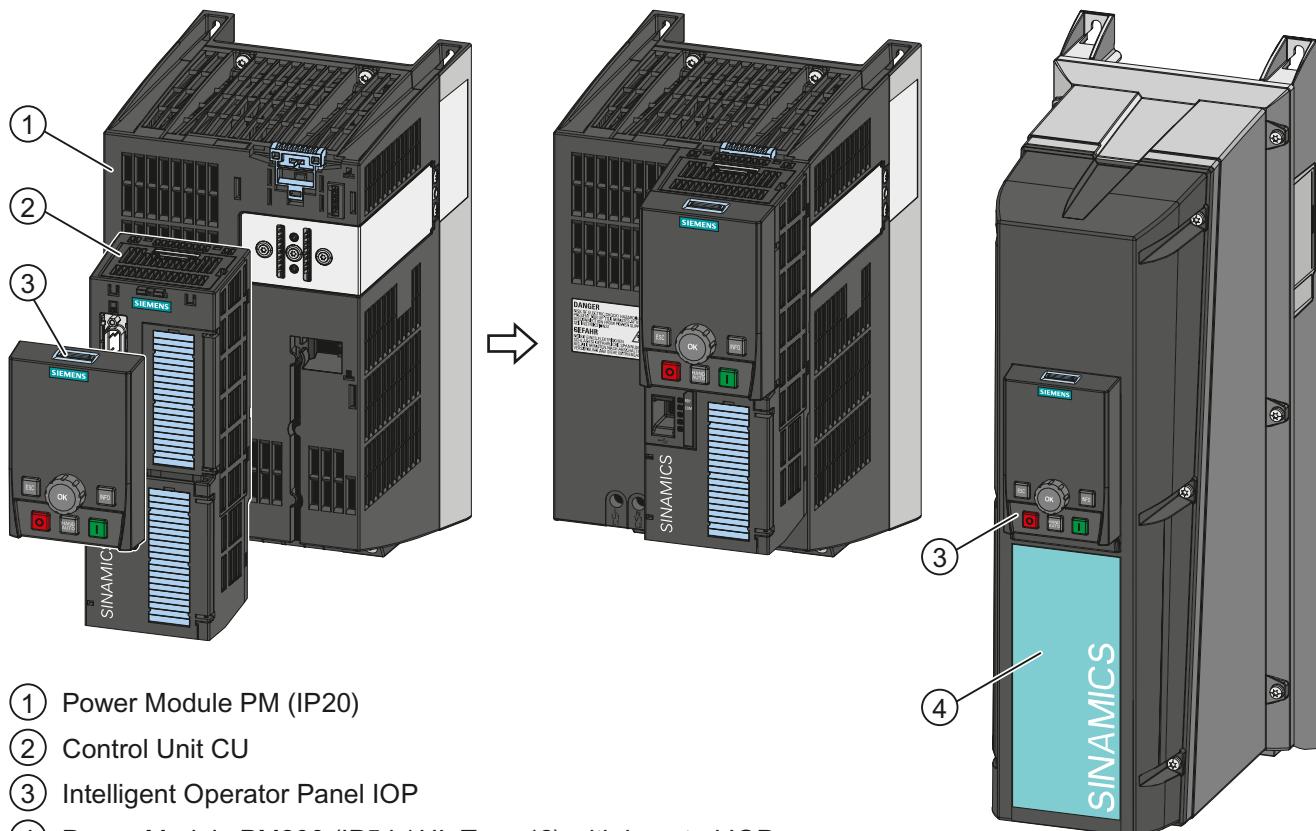
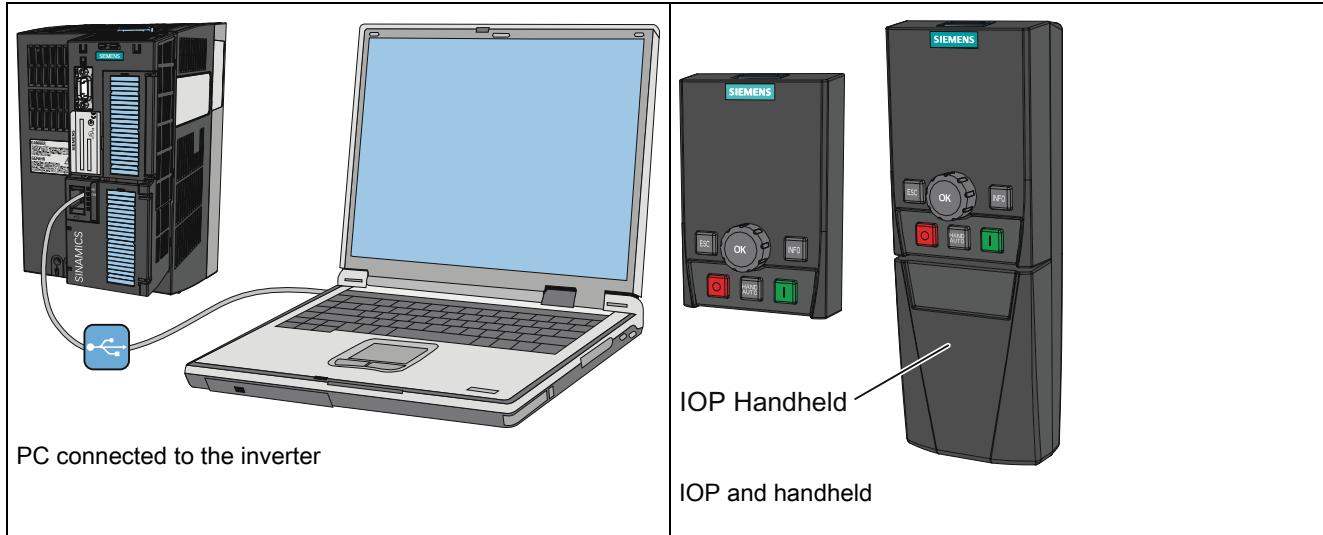


Figure 1-1 Design of the inverter (example)

Table 1- 1 Operator control options



Objective of these operating instructions

This Getting Started describes how you commission and operate a SINAMICS G120 inverter using the Application Wizards of the IOP. For special inverter functions, e.g. the automatic restart or flying restart function, please use the **operating instructions** and the **Parameter Manual** of the corresponding Control Unit.

The functions and properties of the IOP are described in detail in the "SINAMICS IOP" operating instructions and are only explained here to an extent that is necessary to understand the described functions.

Additional information on SINAMICS G120

All manuals for SINAMICS G120 inverters can be downloaded from the Internet:
<http://support.automation.siemens.com/WW/view/en/22339653/133300>

and are additionally available on DVD:

SD Manual Collection - all of the manuals on low-voltage motors, geared motors and low-voltage inverters, 5 languages

Order number: 6SL3298-0CA00-0MG0 (supplied once)

Order number: 6SL3298-0CA10-0MG0 (update service for 1 year; supplied 4 times)

Mistakes, questions and improvements

If you find any mistakes when reading this manual or if you have any suggestions for how it can be improved, please contact us as follows:

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E-mail documentation.standard.drives@siemens.com

1.2 Control Units

Different Control Unit versions

The Control Units differ by the following main factors:

- Fieldbus interface type
- Type and scope of the functions
- e.g. for CU230P-2... through additional specific technology functions for pumps, fans and compressors
- e.g. for CU240E-2... through additional integrated safety functions
- Type and number of available inputs and outputs

This Programming Manual is applicable for the Control Units: CU230P-2..., CU240B-2... and CU240E-2....

CU230P-2... Functions	CU230P-2 HVAC	CU230P-2 CAN	CU230P-2 DP
Fieldbus	USS or Modbus RTU or BACnet MS/TP	CANopen	PROFIBUS DP
Technology functions	For instance: Hibernation, motor staging, emergency operation, multi-zone controller, bypass		
Digital inputs	6		
Analog inputs	AI0 and AI1: Voltage or current; AI2: Current or temperature sensor (Ni1000/PT1000); AI3: Temperature sensor (Ni1000/PT1000);		
Digital outputs	3		
Analog outputs	2		

CU240B/E-2... Functions	CU240B-2	CU240B-2 DP	CU240E-2	CU240E-2 F	CU240E-2 DP	CU240E-2 DP-F
Fieldbus	USS or Modbus RTU	PROFIBUS DP	USS or Modbus RTU	USS or Modbus RTU	PROFIBUS DP	PROFIBUS DP with PROFIsafe
Integrated safety functions	-	-	STO	STO, SS1, SLS	STO	STO, SS1, SLS
Digital inputs	4					
Fail-safe digital inputs*	-	1	3	1	3	3
Analog inputs	1			2		
Digital outputs	1			3		
Analog outputs	1			2		

*) A fail-safe digital input is created by combining two "standard" digital inputs

1.3 Interfaces

Process and user interfaces

You will find the following interfaces and operator controls on the Control Unit:

- Terminals for the digital and analog input and output signals.
- DIP switch to set analog inputs as either current input or voltage input.
- Fieldbus interface for signal exchange, e.g. with a higher-level control. (The type of fieldbus interface depends on the specific CU.)
- DIP switch to connect a bus terminating resistor.
- DIP switch to set the fieldbus address.
- Memory card slot to save and transfer inverter settings.
- Interface, to insert the operator device (e.g. IOP or BOP-2).
- USB interface, to connect the inverter with PC / STARTER.
- LED for diagnostics and to display operating states.

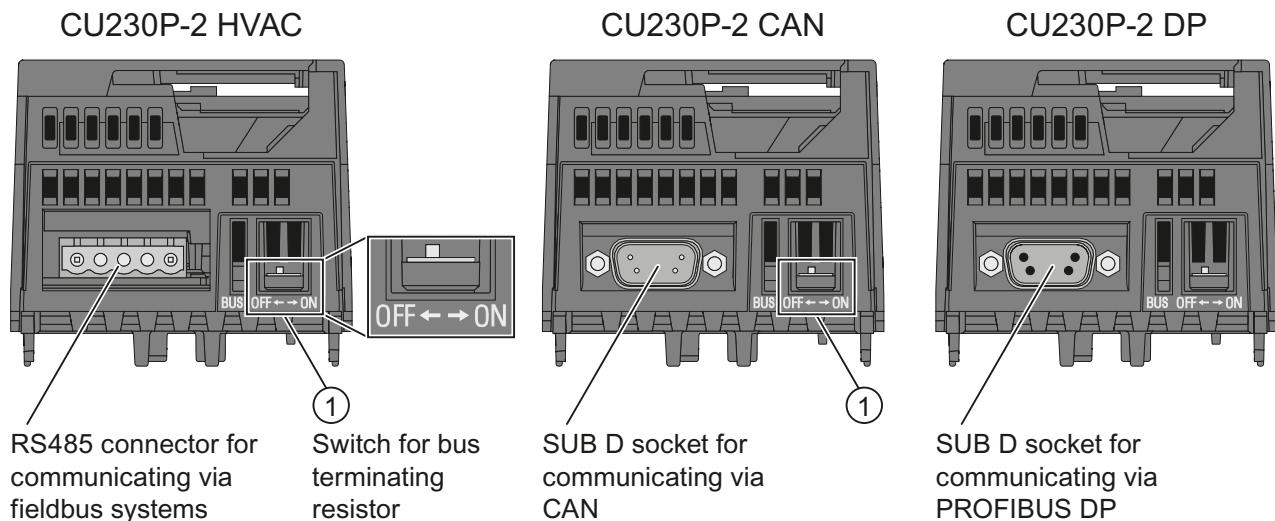


Figure 1-2 Communication interfaces, CU230P-2

Table 1- 2 Assignment of the RS-485 connector

Contact	Designation	Description
Pin 1	0 V	Reference potential
Pin 2	RS485P	Receive and send signal (+)
Pin 3	RS485N	Receive and send signal (-)
Pin 4	Shield	Cable shield
Pin 5	---	---

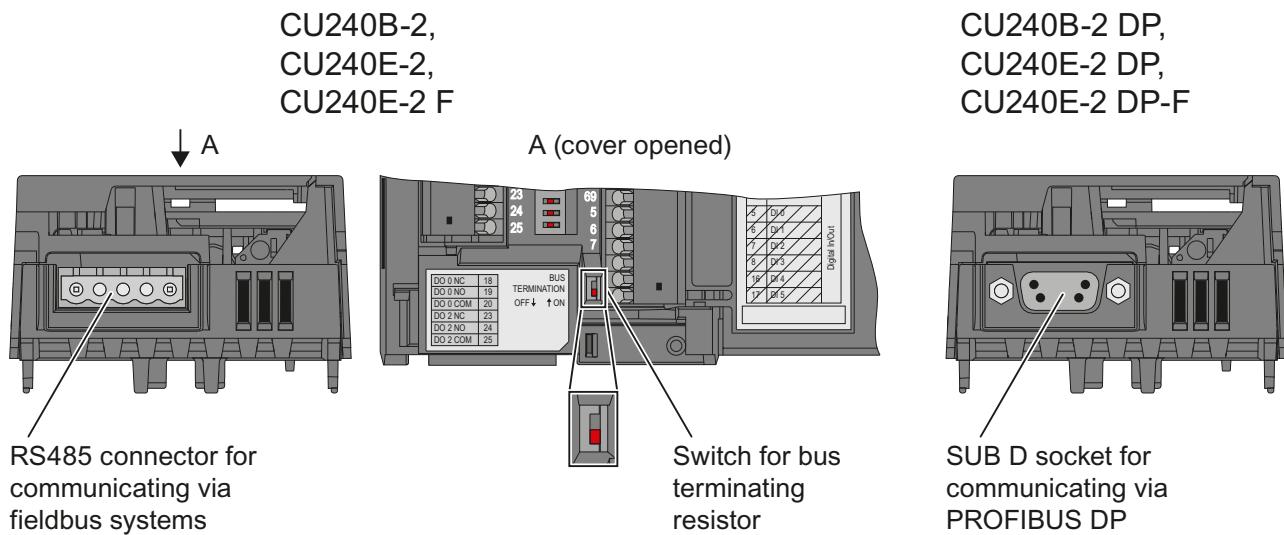


Figure 1-3 Communication interfaces, CU240B-/E-2

1.3 Interfaces

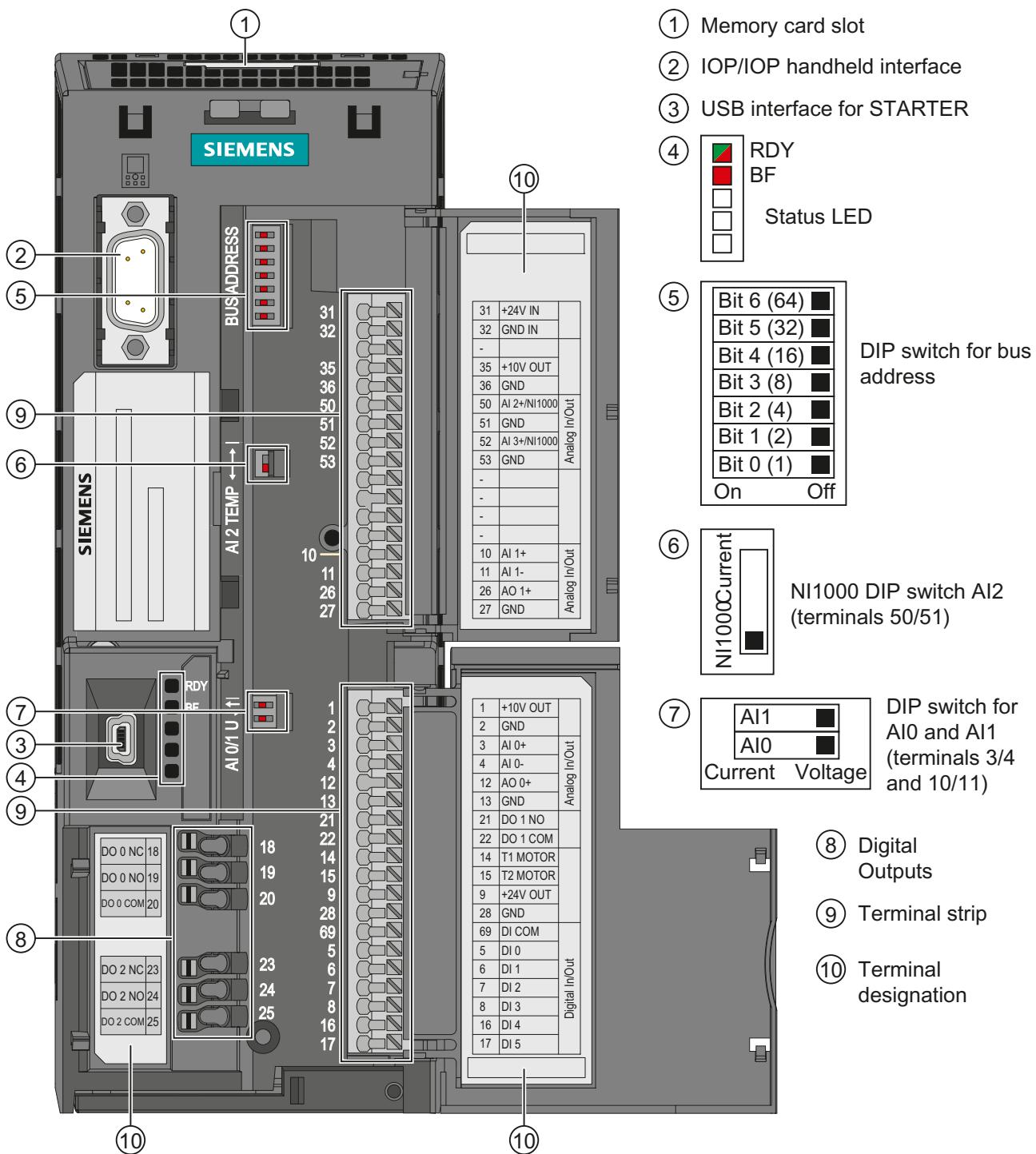


Figure 1-4 Process and user interfaces CU230P-2

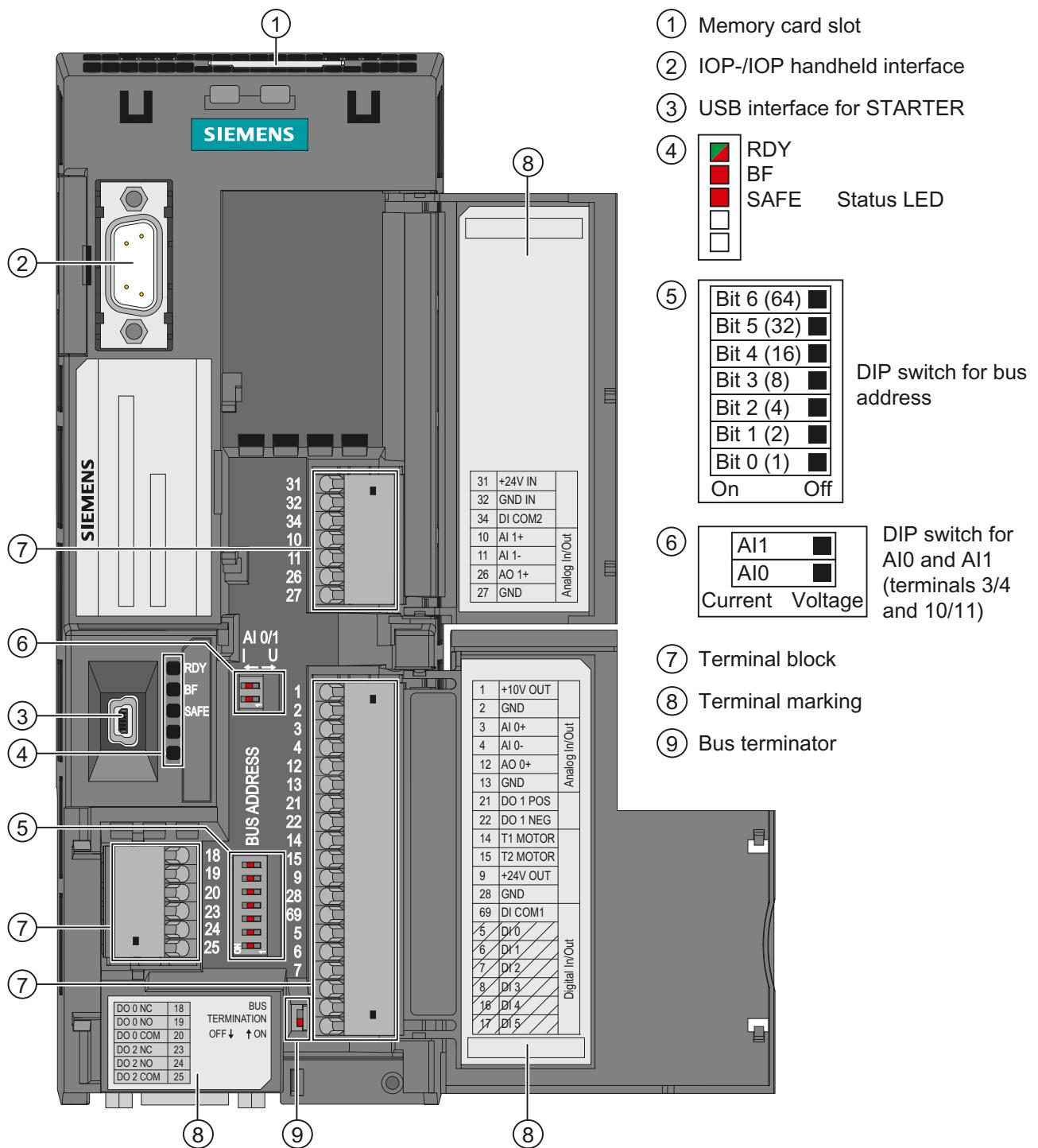


Figure 1-5 Process and user interfaces, CU240B-/E-2

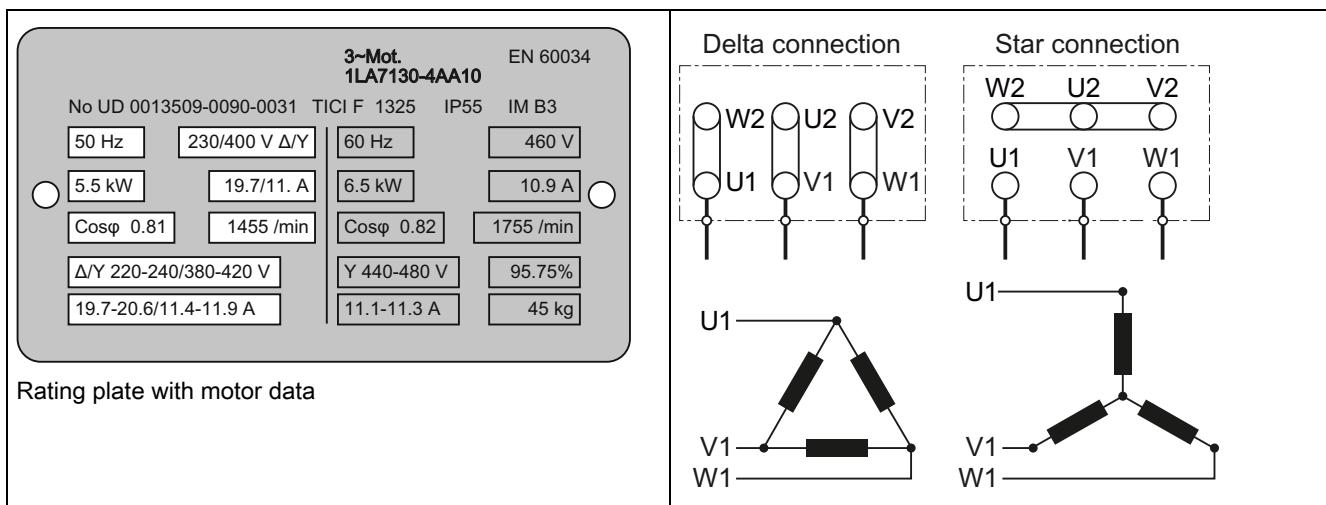
1.4 Installation

Procedure to install the inverter

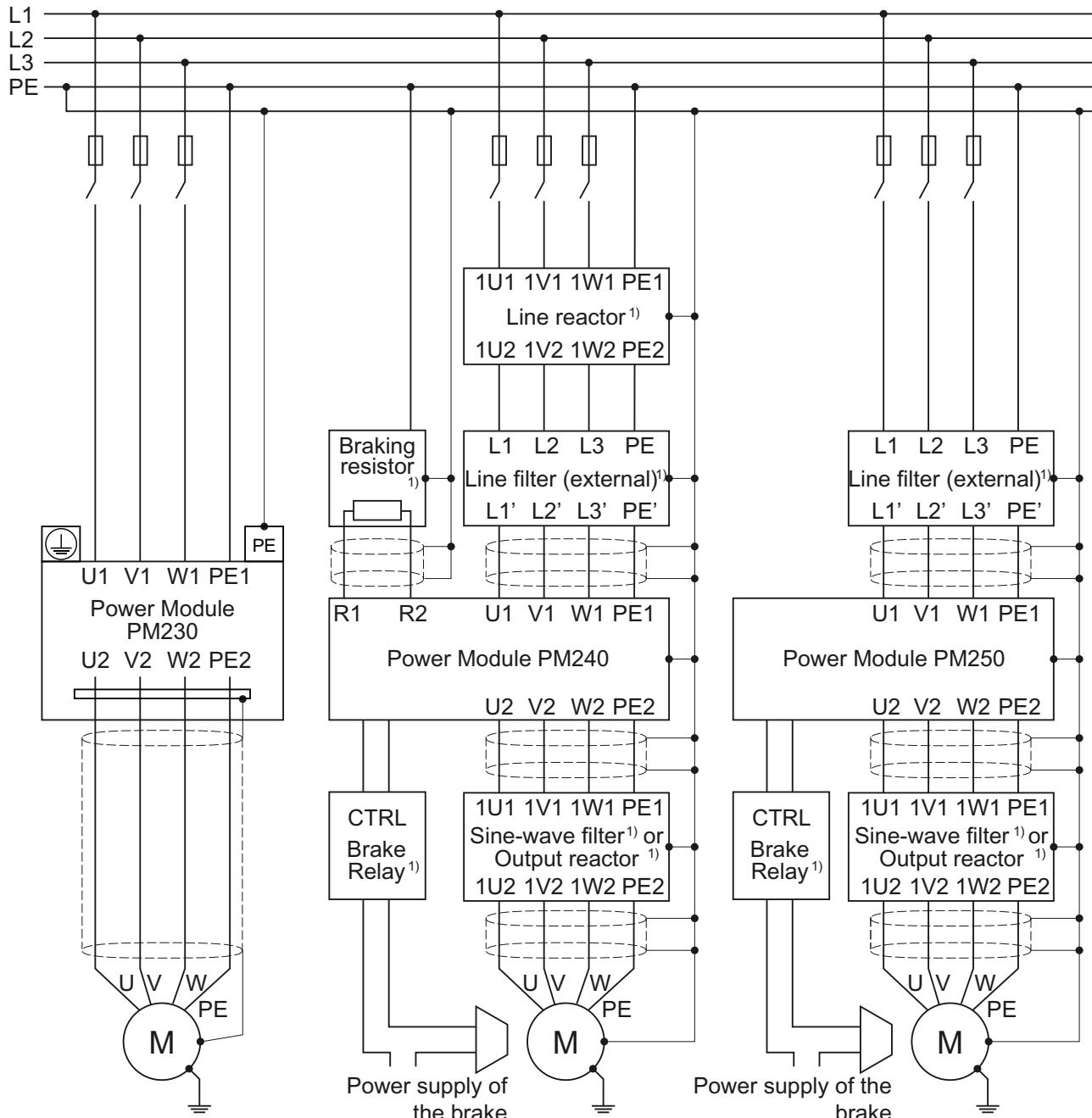
1. Mount the Power Module according to the mounting regulations.
2. Connect the motor in either the star or delta circuit configuration (observe the data on the motor rating plate).
3. Connect the Power Module to the motor and power supply.
4. Plug the Control Unit onto the Power Module.
5. Connect the terminals of the CU according to the connection diagram for open-loop controlled or closed-loop controlled applications.
6. Plug the IOP onto the Control Unit.
7. Switch on the inverter power supply.
8. Start the basic commissioning using an Application Wizard.

Motor connection type (star or delta)

A delta connection is required if you wish to operate your application with an 87 Hz characteristic (instead of 50 Hz).



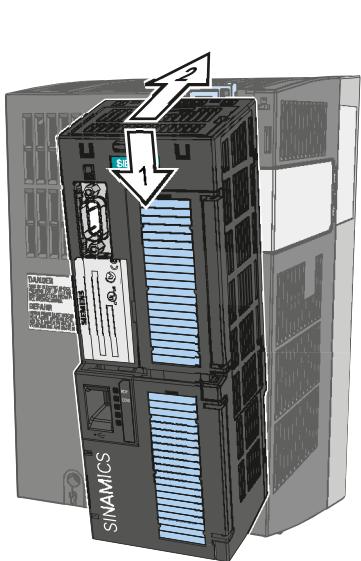
Connecting the Power Module to the motor and power supply.



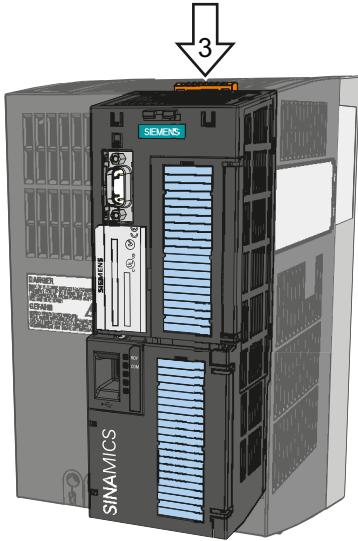
1) Accessories

Figure 1-6 Connection diagrams for PM230, PM240, PM250 - line filter and sine-wave filter are already integrated in the PM260 Power Module. Otherwise, the wiring of the PM260 corresponds to that of the PM250.

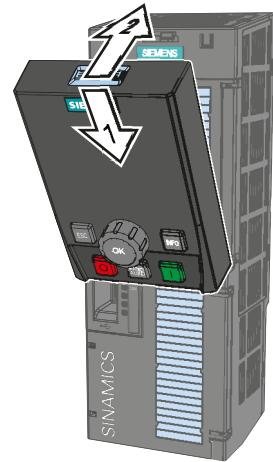
Plug the Control Unit onto the Power Module and the operator device onto the Control Unit



Insert CU



Remove CU



Insert IOP

1.5 Connection diagram

Connection diagram to use Application Wizards

Commissioning using Application Wizards is the simplest way of commissioning pump, fan and compressor applications as well as conveyor systems. Application Wizards guide you step-by-step, in the form of questions, through the commissioning of various standard applications. To do this, your application must be connected up as shown on the following connection diagram.

"Controlled" operation: Application using a technology controller

"Open-loop controlled" operation - i.e. application *without* technology controller- differs in so much that the second analog input (AI1 = gray background) is not used.

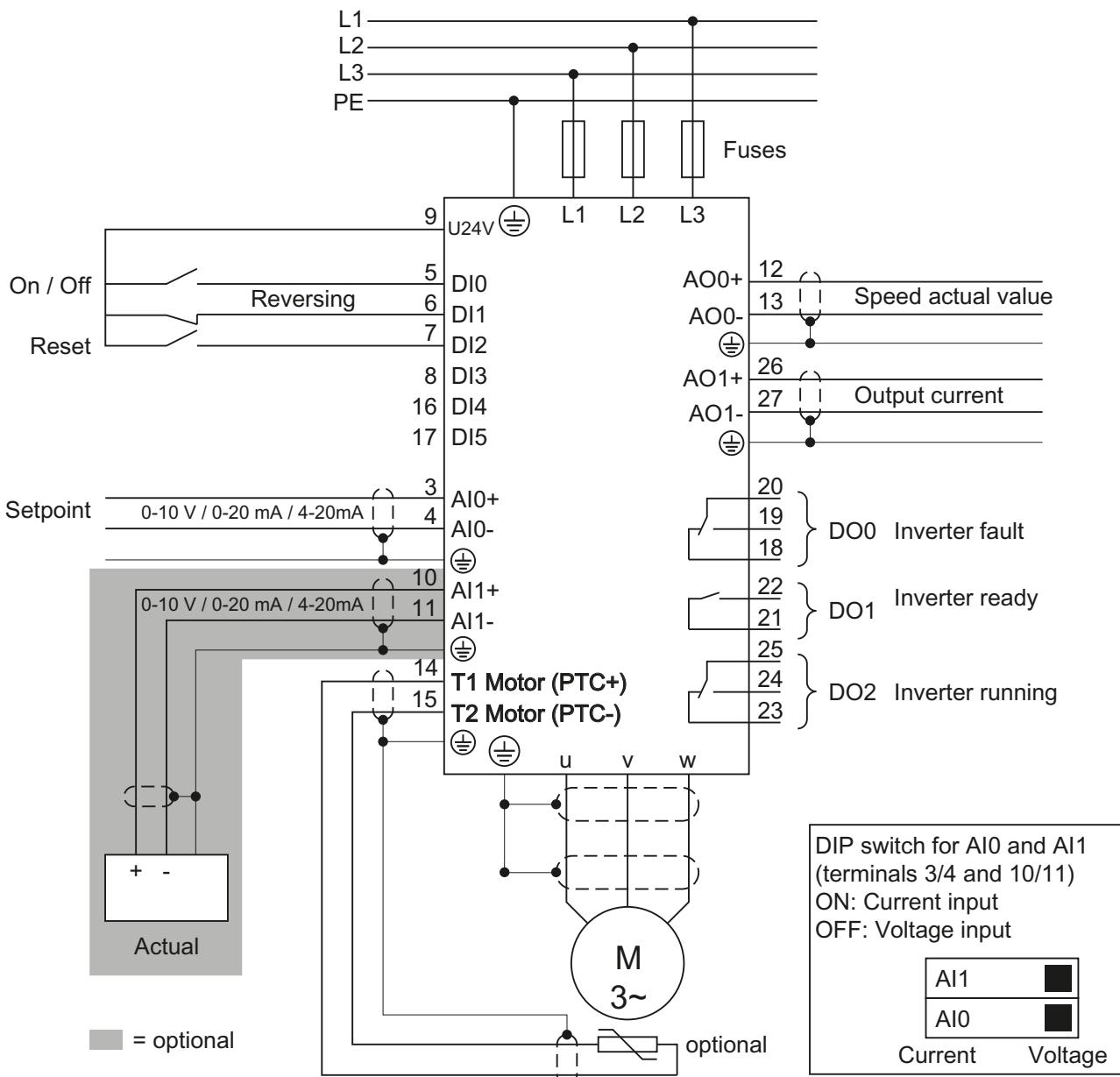


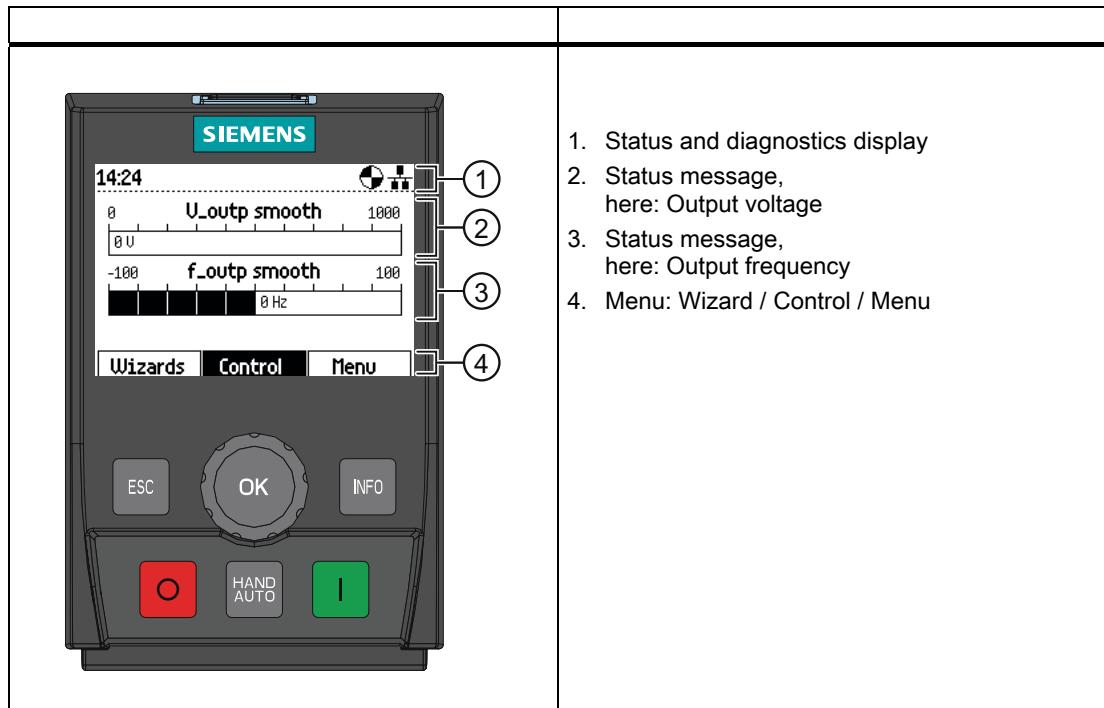
Figure 1-7 Application with technology controller

1.6 IOP Intelligent Operator Panel

The IOP

The IOP is an operator device with which you can commission the inverter locally, enter parameters and monitor operation.

Selection menus and status displays are shown on the text and graphics display. The central panel is structured in three display areas:



The IOP Intelligent Operator Panel

1.7 Operation

Operation with the IOP

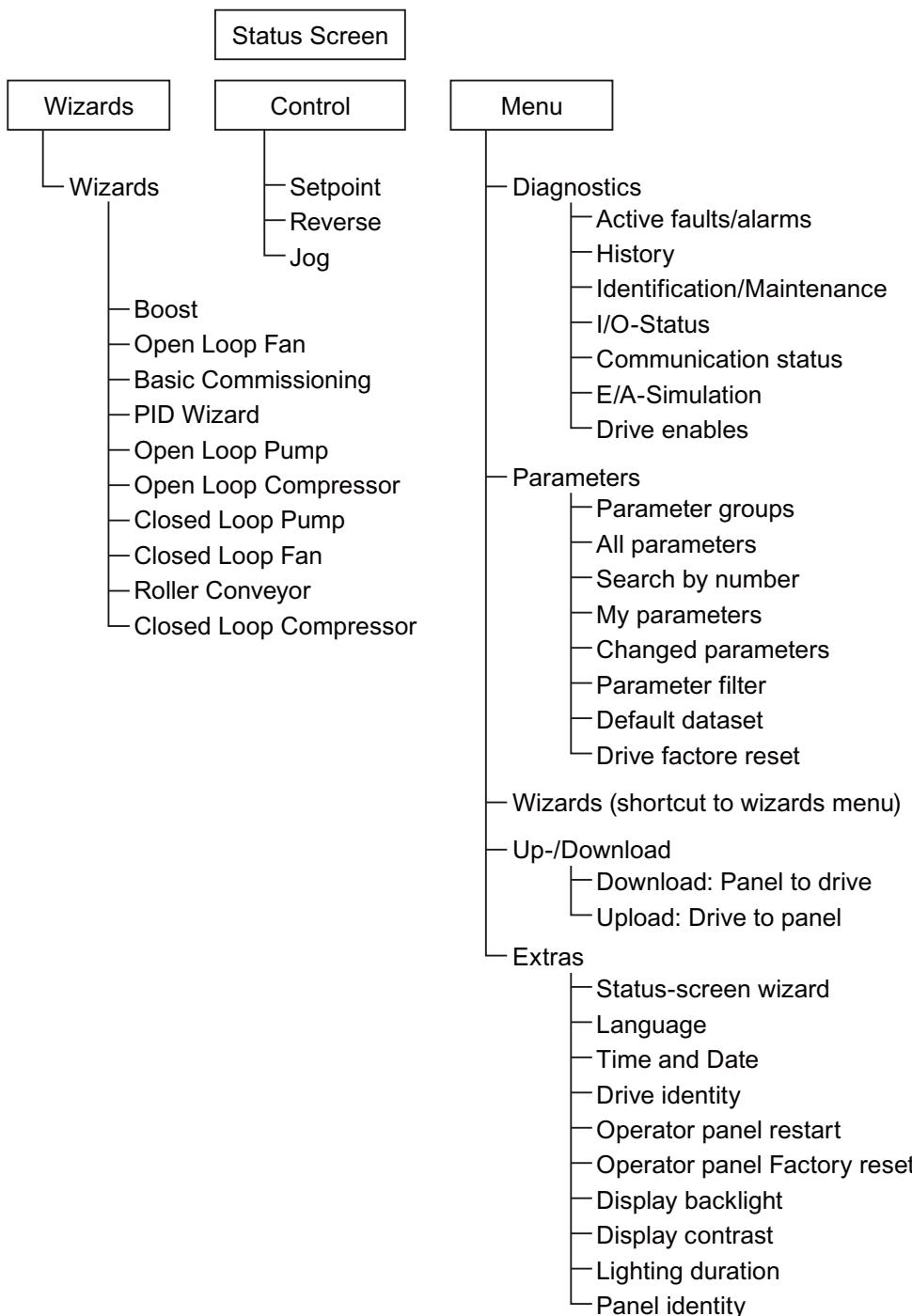
Table 1- 3 The IOP is operated using the 5 buttons and a navigation wheel.

	<ul style="list-style-type: none"> • You can select the required menu by turning the navigation wheel, e.g. WIZARD • You confirm your selection by pressing on the navigation wheel (OK).
	<p>By pressing, you can toggle between external command sources and the IOP as command source.</p> <ul style="list-style-type: none"> • MANUAL means: Manual control using the IOP buttons • AUTO means: The inverter responds to the external control commands (e.g. fieldbus or terminals)
	<ul style="list-style-type: none"> • In the AUTO mode: without function • In the MANUAL mode: Pressing starts the inverter
	<ul style="list-style-type: none"> • In the AUTO mode: without function • In the MANUAL mode: <ul style="list-style-type: none"> – Press briefly: OFF1 - the motor comes to a standstill with the selected down ramp (P1121) – Pressing longer than 3 seconds: OFF2 - the motor coasts down to standstill
	<ul style="list-style-type: none"> • Pressing supplies information about the actual display • You return to the display by pressing again
	<ul style="list-style-type: none"> • Press briefly: Return to the previous display • Pressing longer than 3 seconds: The IOP returns to the status screen

1.8 Menu structure

Menu structure

The menu structure shows you where you can find the application Wizards and additional setting functions. Instead of using the application Wizards, you can also use individual parameters to change all of the settings.



Commissioning

2

2.1 Commissioning procedure

General commissioning procedure using the menu-assisted IOP Wizards

The BASIC COMMISSIONING Wizard has been developed so that either the terminals or the fieldbus are used as command source. You can select the IOP as command source using the MANUAL / AUTO button.

- You generally start with the BASIC COMMISSIONING or an Application Wizard, e.g. CONTROLLED PUMP.
 - You will find an example for the basic commissioning on the following page.
 - In order to optionally commission e.g. using the Application Wizard CONTROLLED PUMP, your application must be connected up as shown in the connection diagram for 'Application with technology controller'.
 - The first step in each Wizard is to RESTORE FACTORY SETTINGS. This ensures that the inverter is in a defined basic setting.
 - As you proceed, among other things, enter the motor data: To do this, read off the data from the motor rating plate.

- You must check and confirm your commissioning data before it is accepted in the inverter. You do this using the last but one menu item OVERVIEW OF THE SETTINGS. In this screen, scroll down to CONTINUE and acknowledge it with OK.

2.2 Basic commissioning

- The last step is the prompt SAVE or INTERRUPT WIZARD? Select SAVE! Your commissioning data are then loaded into the inverter. Commissioning has now been completed.
- You can then make additional settings if required: e.g. a voltage boost to optimize starting behavior using the BOOST Wizard.

2.2 Basic commissioning

Start the menu: WIZARD / BASIC COMMISSIONING

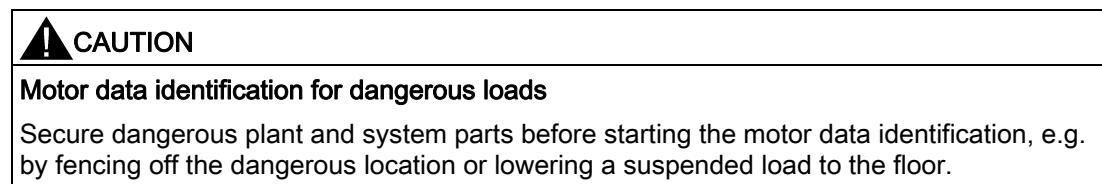
No.	Input screen of the IOP	Selected setting on the IOP	Parameter	Value
01/23	Restore factory settings	[1] yes	P0970 = ...	1
02/23	Control mode	[0] V/f with linear characteristic	P1300 = ...	0
03/23	Encoder type	[0] Not activated	P0400 = ...	0
04/23	Encoder pulses	Encoder type not activated P0408 is set as default	Confirm with OK	
05/23	Motor data	[0] Europe 50 Hz, kW	P0100 = ...	0
06/23	Characteristic	50 Hz / 87 Hz	Select characteristic	
07/23	Motor connections	Observe the motor connection (star / delta)!	Confirm with OK	
08/23	Motor data	Enter motor data for 50 Hz (refer to 06/23)	Confirm with OK	
09/23	Rated power	Enter [kW] (or [hp]) according to the motor rating plate	P0307 =	0.37
10/23	Motor speed	Enter [rpm] according to the motor rating plate	P0311 =	1395
11/23	Motor current	Enter [A] according to the motor rating plate	P0305 =	1.00
12/23	Motor voltage	Enter [V] according to the motor rating plate	P0304 =	400
13/23	Motor data ID	[1] Stationary and rotating measurement ¹⁾ If the motor cannot freely rotate, e.g. if travel is mechanically limited, select the setting [2] "MotID only stationary".	P1900 = ...	1
14/23	Command source	[2] Connecting terminal / [6] fieldbus	P0700 = ...	2 / 6
15/23	Main setpoint source	[2] Connecting terminal / [6] fieldbus	P1000 = ...	2 / 6
16/23	Additional setpoint source	No additional setpoint	P1075 = ...	0
17/23	Minimum speed	Enter the minimum speed [rpm] down to which the motor should operate.	P1080 = ...	0.00
18/23	Ramp-up	Time [s] in which the motor should accelerated from standstill up to the maximum speed (P1082).	P1120 = ...	50.00
19/23	Ramp-down	Time [s] in which the motor should be decelerated from the maximum speed (P1082) down to standstill.	P1121 = ...	10.00
20/23	Overview of the settings	Check list + Select < Continue> + OK	P3900 = ...	3
21/23	Save settings	Save	Confirm with OK	

No.	Input screen of the IOP	Selected setting on the IOP	Parameter	Value
22/23	Saving, please wait	...	Confirm with OK	
23/23	Motor data ID	A motor data ID is started at the next ON command.	Confirm with OK	

- 1) If the IOP Assistant does not offer this setting, after completing the basic commissioning, set parameter p1900 to a value of 1 using the parameter menu.

Identifying motor data

Alarm A07791 is output for as long as the inverter has still not identified the motor data. You must switch on the motor (e.g. from the IOP) to identify the motor data. The inverter switches-off the motor after the motor data identification has been completed.

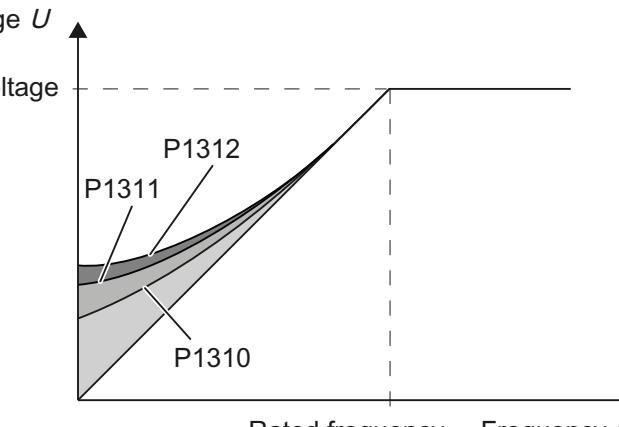


2.3 Voltage boost

Voltage boost for a high breakaway torque or overload

Using the voltage boost, you can optimize the starting behavior of the V/f control for a high breakaway torque and overload.

- Start the menu: WIZARD / BOOST

No.	Input screen of the IOP	Selected setting on the IOP	Parameter	Value
1/6	Continuous boost	Input in [V]	P1311 = ...	
2/6	Acceleration voltage boost	Voltage U	P1310 = ...	
3/6	Starting boost	Rated voltage  P1312 P1311 P1310 Rated frequency Frequency f	P1312 = ...	

No.	Input screen of the IOP	Selected setting on the IOP	Parameter	Value
4/6	Overview of the settings	Check list + Select < Continue> + OK	Confirm with OK	
5/6	Save settings	Save	Confirm with OK	
6/6	Save, please wait until the following is displayed: <i>Settings successfully saved</i>	Confirm with OK	

2.4 Inputs and outputs

Adaptation of the inputs and outputs for special applications

The inverter inputs and outputs are pre-assigned certain functions with the factory default settings or those functions pre-assigned during commissioning with the Application Wizards. However, these can be changed.

Assigning specific control commands to digital inputs

You can precisely assign one control command from a list of selectable control commands (functions) to each digital input. The following control commands are pre-selected in the factory for digital inputs DI0, DI1 and DI2:

- DI0 = ON / OFF1
- DI1 = reversing
- DI2 = fault acknowledgement

Changing the pre-assignment

To change the pre-assignment, assign the required function to the input from a list of control commands.

- Start the menu: MENU / PARAMETERS / PARAMETER GROUPS/ INPUTS-OUTPUTS / DIGITAL INPUTS
- FUNCTION of DIx (*select the required digital input, e.g. DI1*)
- *acknowledgewith <OK>*
- *select the required function from the list, e.g. 'JOG right'*
- *acknowledgewith <OK>*

Evaluating various inverter operating states via digital outputs

Using the digital outputs, you can display the various inverter states, e.g. inverter alarms or faults. The following messages are pre-selected in the factory for the digital outputs DO0 and DO1:

- DO0 = signal for drive **fault** (inverter fault)
- DO1 = signal for drive **alarm** (inverter ready)

Changing the pre-assignment

In order to change the pre-assignment, assign the required status message to the output from a list of messages.

- Start the menu: MENU / PARAMETERS / PARAMETER GROUPS/ INPUTS-OUTPUTS / DIGITAL OUTPUTS
- BI: FUNCTION of DOx (*select the required digital output, e.g. DO1*)
- *acknowledgewith <OK>*
- *select the required function (e.g. function 'in operation')*
 - 52: Act. STATUS WORD 1 + <OK>
 - *select IN OPERATION + <OK>*
- *Acknowledgewith <OK>*
- Press <ESC> for longer than 3 seconds to return to the standard screen.

Defining analog inputs for setpoints

Analog setpoints are read-in via the analog inputs. The analog inputs are pre-selected in the factory as bipolar voltage inputs (-10 V ... +10 V)
(-10V corresponds to -100% of 1500 [rpm]; +10 V corresponds to +100 % of 1500 [rpm])

Changing the default setting

To change the default setting, proceed as follows:

- Set the DIP switch (e.g. AI0 to ON for a unipolar current input 0 mA ...20 mA)
- Start the menu: MENU / PARAMETERS / PARAMETER GROUPS/ INPUTS-OUTPUTS / ANALOG INPUTS
 - TYPE of the Alx (*select the required analog input, e.g. AI0*) + <OK>
 - INDEX 0 = analog input 0 + <OK>
- *Acknowledgewith <OK>*
- *Select the required analog input type, e.g.. 'Unipolar current input' (0 mA ...20 mA)*
- *acknowledgewith <OK>*

Output of various inverter signals via the analog outputs

Using the analog outputs, you can output a wide range of variables; e.g. the actual speed, the actual output voltage or the actual output current. The analog outputs are locked when supplied from the factory.

Changing the default setting

To change the default setting, proceed as follows:

- Start the menu: MENU / PARAMETERS / PARAMETER GROUPS/ INPUTS-OUTPUTS / ANALOG OUTPUTS
- AOx (*select the required analog output, e.g. A00*)
- *Acknowledgewith <OK>*
- Select what is required (e.g. *unipolar current output 0 mA ...20 mA*)
- *acknowledgewith <OK>*

2.5 Data backup on the memory card

Memory card for data backup and data transfer

You can save a parameter set on the memory card and transfer it to other inverters, e.g. to transfer settings after a device has been replaced.

Order No. of the memory card: 6SL3254-0AM00-0AA0

Backup the parameters on the memory card (upload)

Proceed as follows to save the inverter data.

- Insert the memory card into the card slot in the Control Unit
- Start the menu: MENU / PARAMETERS / SEARCH FOR NUMBERS
- *Enter the parameter number, here: 00971*
- '*p0971SAVE PAR*' *acknowledgewith <OK>*
- *select a function from the list, here: 'SAVE DRV_OBJ'*
- *Acknowledgewith <OK>*
- Display: '*P0971 Save Par (1 Save drv_obj.)*'
- *Wait until the save operation has been completed*
- Display: '*P0971 Save Par (0 inactive)*'
- Save operation successfully completed

2.6 Important parameters

The most important parameters at a glance

Table 2- 1 Command and setpoint sources

Parameter	Possible settings
P0700	<p>Select the command source</p> <p>2: Digital inputs / terminals: Factory setting for inverters without PROFIBUS interface CU230P-2: P0701 ... P0706 CU240B-2: P0701 ... P0704 CU240E-2: P0701 ... P0706</p> <p>6: Fieldbus (P2050 ... P2091) Factory setting for inverters with PROFIBUS interface.</p>
P1000	<p>Select the setpoint source</p> <p>0: No master setpoint</p> <p>1: MOP setpoint / motorized potentiometer (P1031 ... P1040)</p> <p>2: Analog setpoint (P0756 ... P0762): Factory setting for inverters without PROFIBUS interface</p> <p>3: Fixed setpoint (P1001 ... P1023)</p> <p>6: Fieldbus (P2050 ... P2091): Factory setting for inverters with PROFIBUS interface</p> <p>7: Analog setpoint 2</p>

Table 2- 2 Select the fieldbus protocol

Parameter	Possible settings (selection options, depend on the CU type)
P2030	0: No protocol (this means: Control via digital inputs / connecting terminals) 1: USS 2: Modbus 3: PROFIBUS DP 4: CAN 5: BACnet

Table 2- 3 Ramp settings

Parameter	Meaning
P1080	Minimum speed in [rpm]
P1082	Maximum speed in [rpm]
P1120	Ramp-up time in [s]
P1121	Ramp-down time in [s]

Commissioning

2.6 Important parameters

Table 2- 4 Control types

Parameter	Possible settings
P1300	Setting the open-loop and closed-loop control mode of a drive 0: V/f control with linear characteristic 1: Linear V/f characteristic with Flux Current Control (FCC) 2: V/f control with square-law characteristic 3: Freely selectable V/f characteristic 4: Linear V/f characteristic ECO 5: Linear V/f characteristic for applications requiring a precise frequency in textile systems 6: Linear V/f characteristic with FCC for applications requiring a precise frequency in textile systems 7: Square-law V/f characteristic with ECO 19: V/f control without characteristic 20: Vector control without speed encoder 22: Torque control without speed encoder

Table 2- 5 Motor data according to the rating plate

Parameter	Possible settings
P0100	Motor standard IEC / NEMA 0: Europe 50 [Hz]
P0300	Motor type selection 0: No motor 1: Induction motor 2: Synchronous motor
P0304	Motor voltage in [V]
P0305	Motor current in [A]
P0307	Motor frequency in [kW] or [hp]
P0310	Motor frequency in [Hz]
P0311	Motor speed in [rpm]
P0625	Ambient temperature of the motor in [°C]
P0640	Current limit of the motor in [A]

Table 2- 6 Digital inputs

Parameter	Terminal	Signal	Factory setting	Possible settings
P0701	5	DI0	1	Possible settings of the digital inputs: 0: 0: No control command 1: ON/OFF1 3: 2. OFF2 4: 2 OFF3 9: 2. Acknowledge faults 10: Jog mode bit 0 11: Jog mode bit 1 12: Direction reversal 13: Motorized potentiometer setpoint higher 14: Motorized potentiometer setpoint lower 15: Fixed speed setpoint selection, bit 0 16: Fixed speed setpoint selection, bit 1 17: Fixed speed setpoint selection, bit 2 18: Fixed speed setpoint selection, bit 3 25: Activate DC braking 26: Activate emergency operation 27: Release technology controller 29: External fault 1 35: Command data set selection CDS bit 0 50: Load monitoring failure detection
P0702	6	DI1	12	
P0703	7	DI2	9	
P0704	8	DI3	15	
P0705	16	DI4	16	
P0706	17	DI5	17	

Table 2- 7 Digital outputs (relay outputs)

Parameter	Terminal	Signal	Factory setting	Meaning
P0730	18/19/20	DO0	52.3	Drive fault active (inverter fault)
P0731	21/22	DO1	52.7	Drive warning active (inverter ready for operation)
P0732	23/24/25	DO2	52.2	Operation enabled (inverter running)

Table 2- 8 Analog inputs and temperature sensors

Parameter	Terminal	Signal	Factory setting	Possible settings
CU230P-2; CU240E-2; CU240B-2				
P0756 [0]	3 / 4	AI0	4: Voltage input, bipolar: Can be switched between current and voltage	Possible settings of the analog inputs 0: Unipolar voltage input (0 V ...+10 V) 1: Unipolar voltage input monitored (+2 V... +10 V) 2: Unipolar current input (0 mA ...+20 mA) 3: Unipolar current input monitored (+4 mA ...+20 mA) 4: Bipolar voltage input (-10 V ...+10 V) 6: Ni1000 temperature sensor (-50 ... +150°C) 7: PT1000 temperature sensor (-50 ...+250°C) 8: No sensor connected
CU230P-2; CU240E-2				
P0756 [1]	10 / 11	AI1	4: Voltage input bipolar: Can be switched between current and voltage	
CU230P-2				With each switchover between current and voltage, the DIP switch on the housing of the CU must also be set accordingly.
P0756 [2]	50 / 51	AI2	Input can be switched between current and temperature sensor	
P0756 [3]	52 / 53	AI3	Input for temperature sensor	

Commissioning

2.6 Important parameters

Table 2- 9 **Analog outputs**

Analog outputs				
Parameter	Terminal	Signal	Factory setting	Possible settings
P0771[0]	12 / 13	AO0	0: Analog output locked Analog output 0 switchable between current and voltage through P0776	0: Analog output locked 21: Speed actual value 24: Output frequency smoothed 25: Output voltage smoothed 26: DC link voltage smoothed 27: Actual current value (smoothed absolute value)
P0771[1]	26 / 27	AO1	0: Analog output locked Analog output 1 is only the current output	

Table 2- 10 **Motor temperature sensor interface**

PTC/KTY84 ThermoClick interface				
Parameter	Terminal	Abbreviation	Factory setting	Possible setting
P0601	14	T1 motor (+)	0: Evaluation of the motor temperature sensor is disabled	0: No sensor (factory setting) 1: PTC thermistor (→ P0604) 2: KTY84 (→ P0604) 4: ThermoClick sensor
	15	T2 motor (-)		

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