SIEMENS

SINAMICS G120P

Training Booklet

Answers for infrastructure and cities.

System configuration required for commissioning STARTER software

- Processor with min. 1 GHz (dual core recommended)
- 1024 MB RAM (2048 MB recommended)
- 3 GB free HDD space
- Graphics card (min. 256 MB memory recommended)
- Screen resolution: 1024 x 768 pixels
- Internet Explorer V6.0 or higher
- Operating systems:
  Microsoft® Windows™ XP (Service Pack 2 or later)
  Microsoft® Windows™ 7

SINAMICS G120P

Training Booklet

The training booklet is a comfortable and easy to understand introduction to the SINAMICS G120P variable speed drive.

Materials and tools

The components listed below are presented in this booklet. To test your knowledge on the actual product, you have the choice between ordering the following alternatives:

Training case	
Product	**Order No.**
• SINAMICS G120P case*	A5E03828108

Single components	
Product	**Order No.**
• SINAMICS G120 PM230 FSA 0.55 kW	6SL3210-1NE11-7UL0
• SINAMICS G120 CU230P-2 HVAC / BT	6SL3243 6BB30 1HA2
• Motor (0.12 kW)	1LA7060-4AB10
• SINAMICS PC Connection Kit-2	6SL3255-0AA00-2CA0
• Basic Operator Panel BOP-2	6SL3255-0AA00-4CA1
• Intelligent Operator Panel IOP-2	6SL3255-0AA00-4JA0
• Screening Kit 2	6SL3264-1EA00-0FA0

Optional components	
Product	**Order No.**
• IOP-2/BOP-2 door mounting kit	6SL3256-0AP00-0JA0

You will also need the following equipment:

- PC / PG with USB interface
- Switches – commercially available*
- Potentiometer – commercially available*
- Various M4 screws and nuts (length depends on installation location) with suitable screwdriver/ wrench – commercially available*

* The training case is a complete demo station including a motor, the power module of the variable speed drive, switches, lights and a 230 V power supply connection.

Safety instructions

Validity

These instructions apply to the following variable speed drive:

Product

SINAMICS G120P

Prerequisites

You are proficient in working with the Microsoft® Windows™ operating system.
You have a good understanding of the principles of electronics and electrical engineering.

Warning

Dangerous currents and voltages!
The equipment contains dangerous voltages and controls potentially dangerous rotating mechanical parts. Non-compliance with the warnings or failure to follow the instructions contained in the documentation can result in loss of life, severe personal injury or serious damage to property.

Take particular notice of the general and regional installation and safety regulations regarding work on dangerous voltage installations (e.g. EN 50178) as well as the relevant regulations regarding the correct use of tools and personal protective equipment (PPE).

Qualified personnel

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

Liability disclaimer

Depending on the firmware and software version of the Control Unit, operator panel and STARTER, the masks, symbols and menus may differ. We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since deviations cannot be entirely ruled out, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Welcome to the SINAMICS G120P Tutorial for First Time Users. This tutorial will help you to simply and quickly get to know the variable speed drive. We'll take you step by step through installation, setting parameters and initial commissioning. We recommend that you work through all of the chapters.

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This chapter introduces the low-voltage SINAMICS G120P variable speed drive. You will learn about the main components, its structure and obtain some practical tips about assembling and wiring of the frequency variable speed drive.

1

Variable speed drive family

SINAMICS G120P

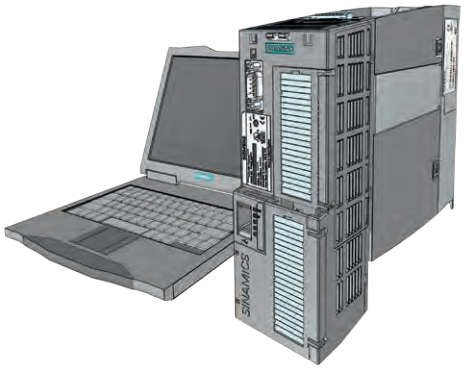
3 AC 400 V 0,37 kW – 90 kW (IP55)
3 AC 400 V 0,37 kW – 75 kW (IP20)

1.1 Components

The SINAMICS G120P variable speed drive has a modular design.
It comprises three basic components:

1 The Power Module supplies power to the motor

2 The Control Unit controls and monitors the Power Module



3

The Basic Operator Panel (BOP-2) or the Intelligent Operator Panel (IOP-2) are used to operate and monitor the variable speed drive

+

With a computer, a USB cable and the STARTER commissioning software you can also set parameters, operate and monitor the variable speed drive

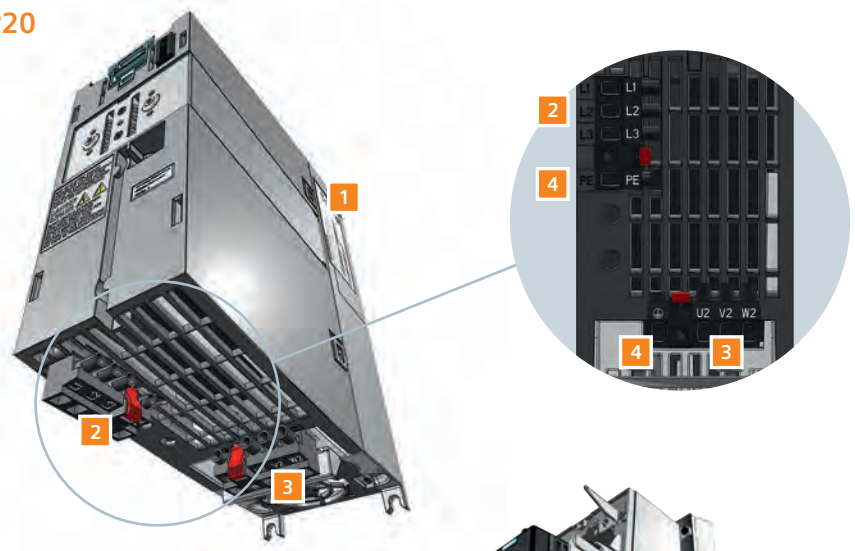
Each Control Unit can be freely combined with each Power Module.

NOTE

Power Module

The device is available in several sizes and degrees of protection. It has a power range extending from 0.37 kW up to 90 kW (75 kW for IP20). The power modules are available in both IP20 and IP55.

IP20



1 Rating plate
2 Power connectors
3 Motor connectors
4 PE terminals
5 Equipotential bonding

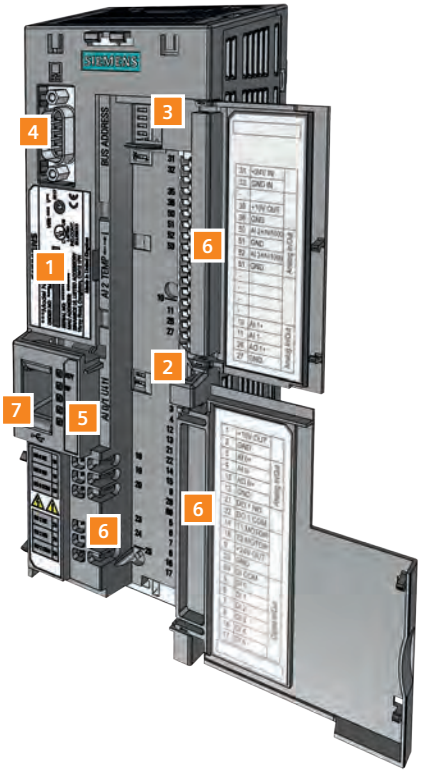
IP55

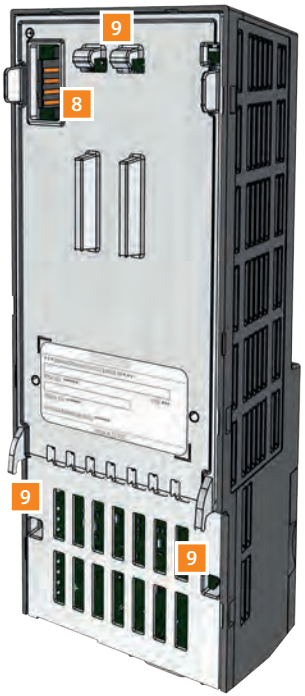
Please check the rating plate to make sure that the power module also meets your requirement specifications.

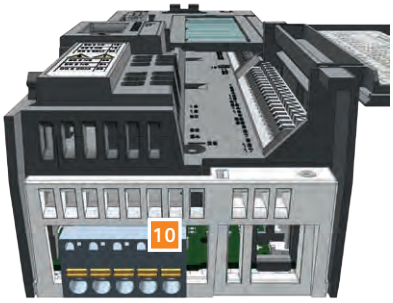
NOTE

Control Unit

There are various designs for the Control Unit. They differ primarily in terms of different fieldbus interfaces. This tutorial will use the example of the CU230P-2 HVAC / BT Control Unit. It offers Modbus RTU, BACnet MS / TP and USS as fieldbus interfaces.







1. Rating plate
2. DIP switch for analog inputs
3. DIP switch for fieldbus address
4. Interface for the Operator Panel (BOP-2 or IOP-2)
5. Status LEDs
6. Terminals for digital and analog inputs and outputs
7. USB interface for STARTER
8. Interface to the Power Module
9. Fastening clips
10. RS485 connector for fieldbus

Always use the CU screening kit in order to ensure optimal potential equalization, fixing and screening of all bus and signal cables.

NOTE

Basic Operator Panel 2 (BOP-2)

The basic input and display device is used to operate and set parameters for the variable speed drive after being connected to the Control Unit. It is operated by pressing the buttons and can be used to simply commission a variable speed drive thanks to the menu prompting and the 2-line display. The BOP-2 can store one set of parameters and can be used to clone.

Intelligent Operator Panel (IOP-2)

The Intelligent Operator Panel manages the same functions as the BOP-2 but adds several more options. The integrated application wizards, full graphical diagnostic overviews and plain text significantly increase the usability. The IOP-2 can store up to 16 parameter settings and is thus very convenient for series commissioning.

BOP-2

1. Seven operating buttons
2. Display
3. Release catch
4. Threaded inserts for door mounting
5. RS232 connector
6. Product rating label

IOP-2

1. Graphic display
2. Navigation wheel
3. Five operating buttons
4. USB connection (for firmware and language pack updates)
5. RS232 connector
6. Product rating label

1.2 Mounting and wiring

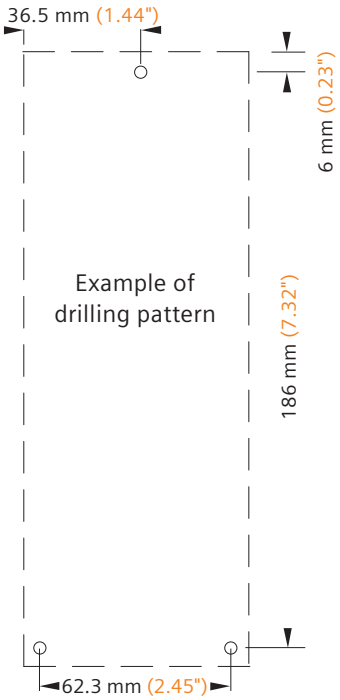
Before starting, check to ensure the following conditions have been met:

- All required components, tools and small parts are available
- All required cables and conductors have been routed / installed in accordance with specifications
- All minimum clearances are complied with

The 5 safety regulations when working on a VSD must be strictly observed

- Disconnect
- Lock out against unintentional restart
- Verify that it really is in a no-voltage condition
- Ground and short circuit
- Cover or partition off any adjacent live parts

Mounting the Power Module in the control cabinet



Please refer to the drilling pattern provided with the Power Module for the correct drilling centers and clearance distances above and below the Power Module. The Power Modules can be mounted side by side. However, a 1 mm gap is recommended to simplify installation.

The motor and variable speed drive must be selected so that they match each other. This is also the case in our example. Further, the data from the rating plate of the motor are important when initially commissioning the variable speed drive.

NOTE

Connecting the Power Module to the motor

Depending on the required EMC class, different cable length limits are applicable for the connection between the Power Module and motor. Always use shielded cables. If longer cables are needed, make sure that a sine-wave filter is used.

Wiring the Power Module (motor cable)

1 • Connect the equipotential bonding conductor to the Power Module (only for IP55. For IP20 ensure that the cabinet is connected to the equipotential bonding conductor and that the metal heatsink is properly connected to the rear of the cabinet)

2 • Connect the phases and the ground conductor to terminals U2, V2, W2 and PE. Make sure that the cable is properly shielded. For IP55 devices use an EMC gland, route the screen through the cable gland and connect it inside the housing

Wiring the motor

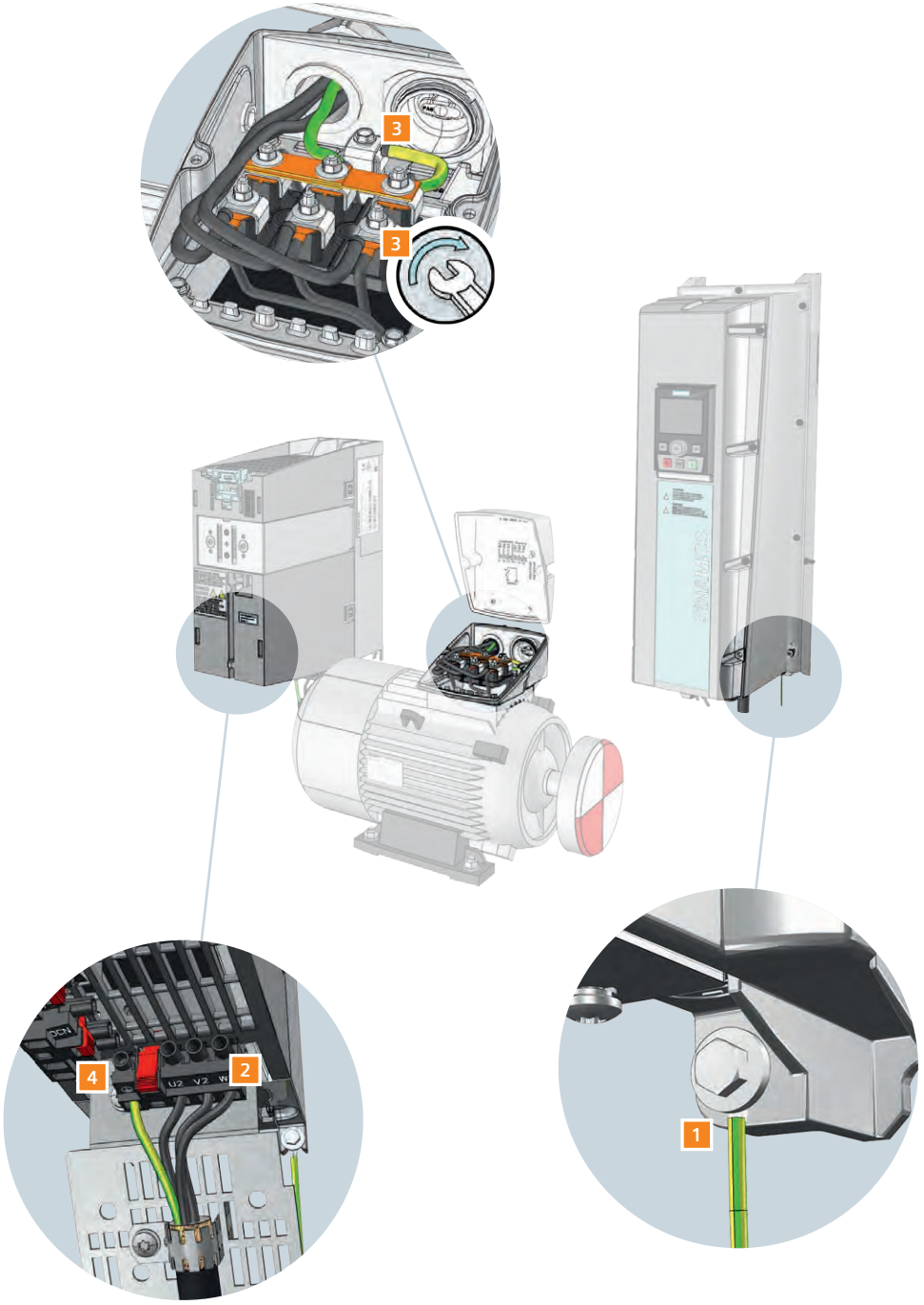
3 • Unscrew the cover of the terminal box on the motor (the inside cover of Siemens' motors illustrates the wiring for star and the delta connections)
• Remove the jumper bars from the connecting block and loosen the screws
• Place the jumper bars on the terminal block and screw them into place (depending on the type of connections required – star or delta – in this example, a star connection is shown)
• Insert the cables from the Power Module through the opening of the terminal box to the motor
• Connect the PE connection first
• Introduce the phase conductors into the connections according to the phase assignment
• Replace the terminal box cover and ensure that it is secured with the four screws, tightened to the required torque
• Use an EMC cable gland on the motor as well and make sure that the cable is properly shielded inside the cable gland

The motor and Power Module are now connected.

Wiring the power supply

4 • Connect the phases and the earth conductor to the terminal clamps L1, L2, L3 and PE

The electrical wiring is now complete.



Motor cables are sources of interference. This means that you must use shielded cables in order to meet the corresponding electromagnetic compatibility specifications. The cable lengths that are actually possible depend on the following:
– Operating environment
– Variable speed drive being used
– Reactors and filters used
– Shielded or unshielded cable

In order to meet Class A / C2 electromagnetic compatibility requirements, you need a power module with integrated filter and a shielded cable (max. length: 25 meters). To meet Class B / C1, a Power Module with Filter B has to be used (IP55 max. 25 m, IP20 max. 50 m).

A star connection is shown in the example. The rating plate provides information about the correct circuit data: e.g. 230/400 V Δ/Y means that you operate the motor in a Y connection with a 400 V line supply.

NOTE

Attaching the Control Unit

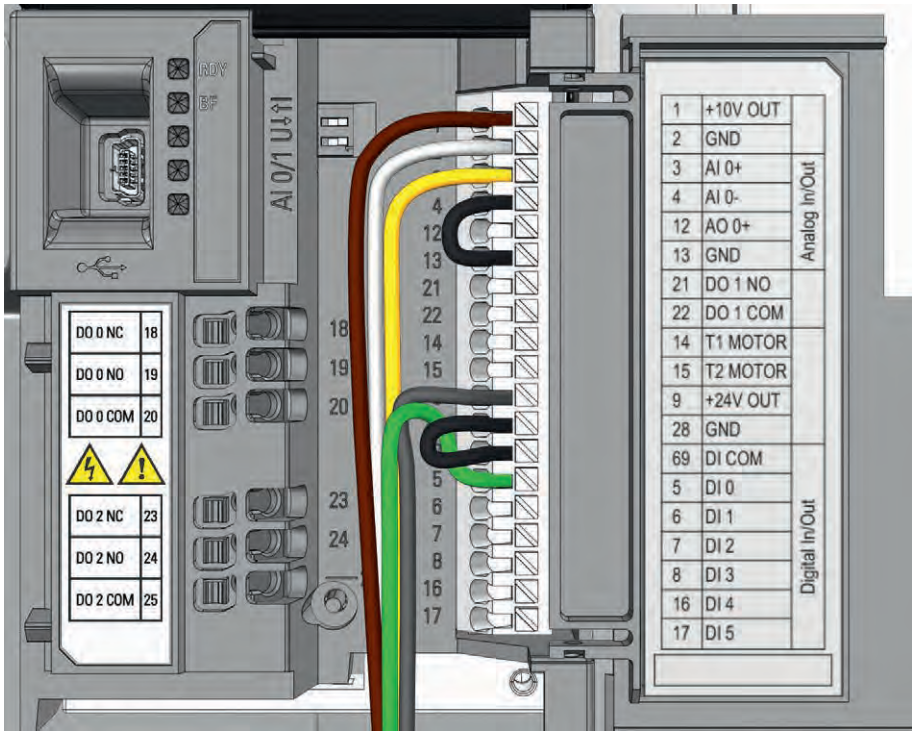
Attach the Control Unit to the bottom of the Power Module using the fastening clips and then press the upper edge of the Control Unit onto the Power Module until the locking device snaps into place. The terminal cover has to be opened before wiring the control terminals.

General procedure for wiring using the cage clamp mechanism

- Slide the wire into the terminal opening
- The inner clamp opens slightly and holds the wire tightly into place

The wire is now firmly attached.

- To release the wire gently press a screwdriver onto the lever
- Remove the wire
- Withdraw the screwdriver from the terminal



Wiring example of CU230-P-2

Wiring the control terminals in the CU230P-2

The CU230P-2 comes with an extensive range of I/O. 6 digital inputs, 3 digital outputs, 4 analog inputs – 2 of those for LG-Ni1000 or Pt1000 sensors and 2 analog outputs are standard.

In the factory settings, some of the I/O are preconfigured to address common requirements (see diagramm on the next page).

The CU230P-2 has a macro parameter (p0015), which automatically configures the drive to address common applications. Using this macro, I/O and functions are automatically configured as well as some common parameters in some macros. When carrying out the basic commissioning of the drive with either STARTER, BOP-2 or the IOP-2, you can select the macro most suitable for your particular application. After a drive has been set up you, can select another macro at any time by simply activating the commissioning mode (P0010=1) and then select the required macro in P0015. After commissioning has been completed, you can reset P0010 to 0.

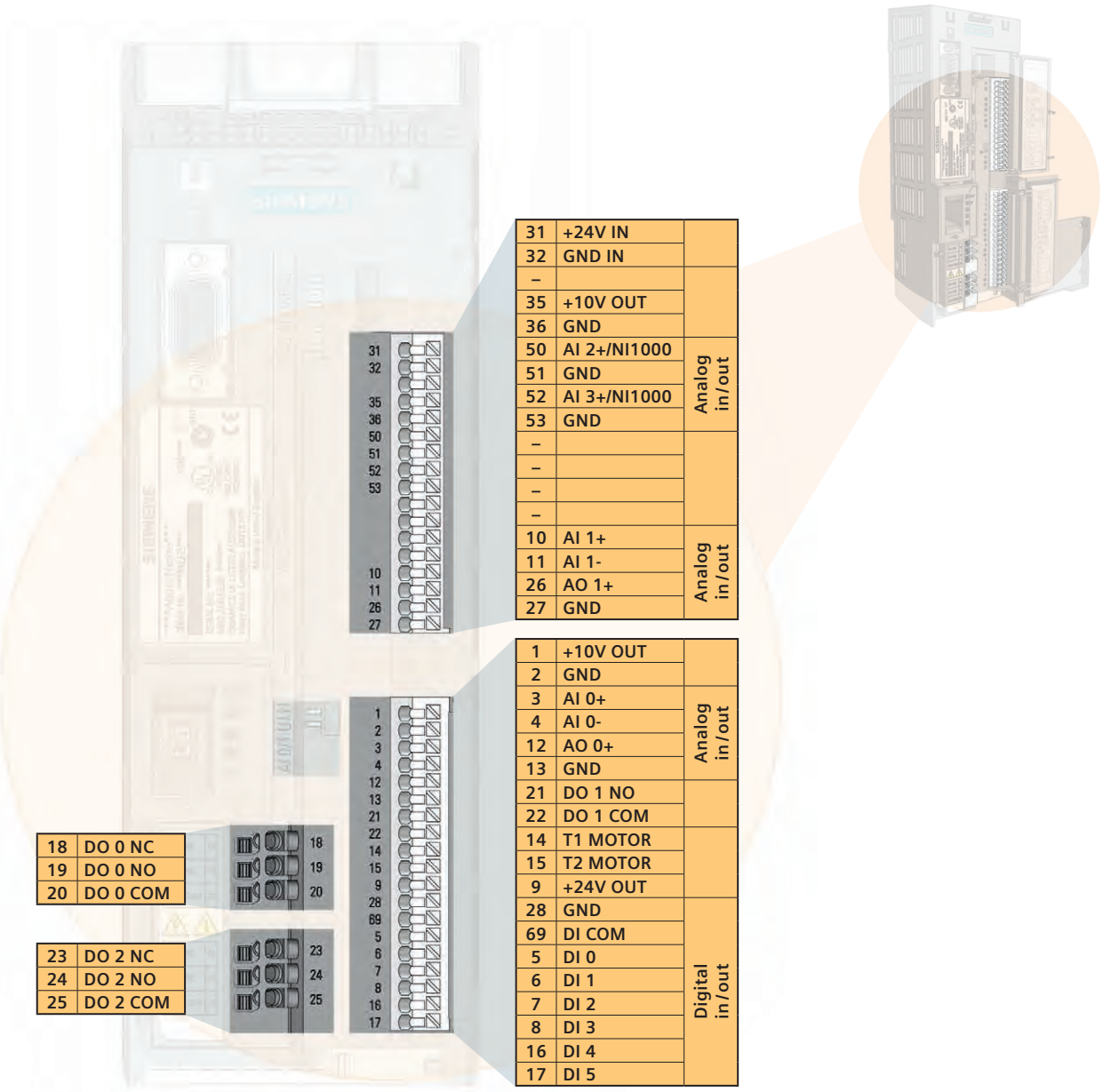
Your G120P with FW 4.6 comes with the following HVAC-specific macros

12: Standard I/O with analog setpoint (factory setting)
101: General purpose application
103: Pump delta P control
104: Stairway pressurization (ESM)
105: Pressure-controlled supply fan
106: Cooling tower fan (active temp. sensor) + hibernation mode
107: Cooling tower fan (LG-Ni1000 temp. sensor) + hibernation mode
108: USS fieldbus
109: Modbus RTU fieldbus
110: BACnet MS/TP fieldbus

Always ensure that all signal and bus cables are shielded at the Control Unit using the shielding kit. Signal and bus cables must be routed the maximum possible distance away from power and motor cables, and cross them only at a 90° angle.

NOTE

Wiring the control terminals in the CU230P-2



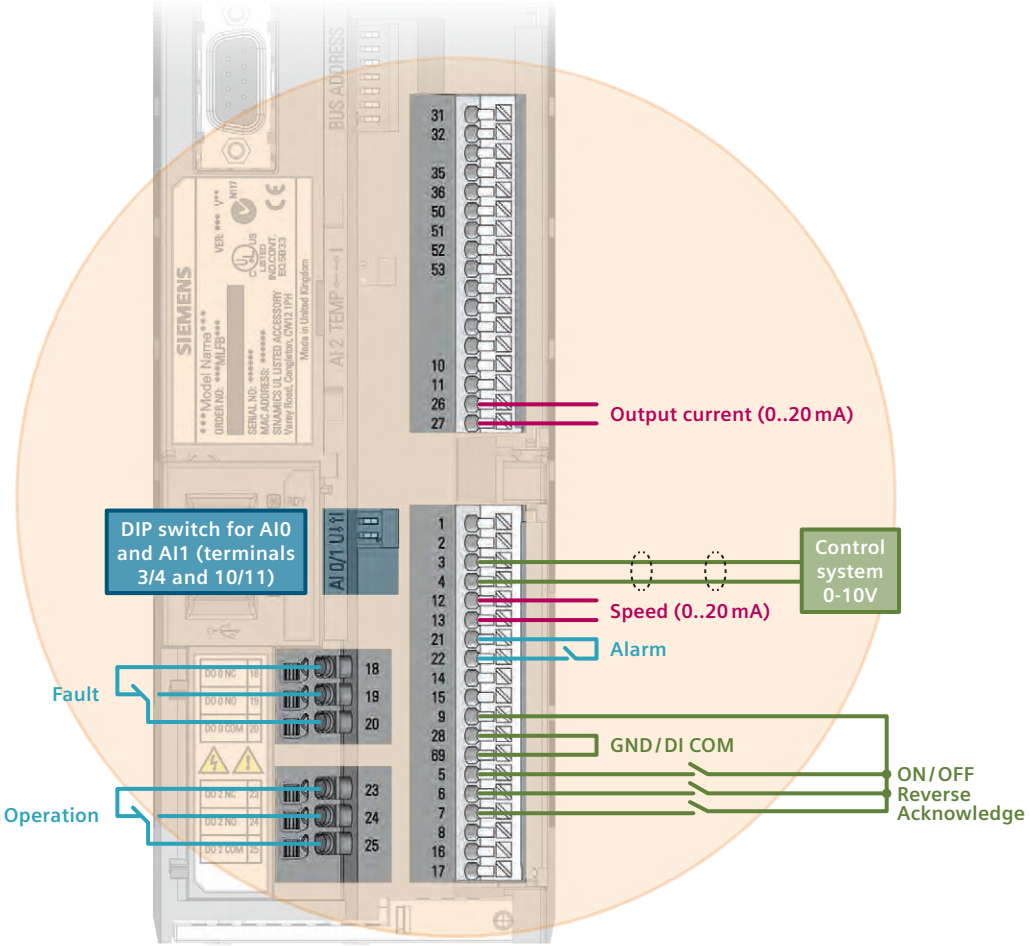
31	+24V IN	
32	GND IN	
–		
35	+10V OUT	
36	GND	
50	AI 2+/NI1000	Analog in/out
51	GND	
52	AI 3+/NI1000	
53	GND	
–		
–		
–		
–		
10	AI 1+	Analog in/out
11	AI 1-	
26	AO 1+	
27	GND	

1	+10V OUT	
2	GND	
3	AI 0+	Analog in/out
4	AI 0-	
12	AO 0+	
13	GND	
21	DO 1 NO	
22	DO 1 COM	
14	T1 MOTOR	
15	T2 MOTOR	
9	+24V OUT	
28	GND	Digital in/out
69	DI COM	
5	DI 0	
6	DI 1	
7	DI 2	
8	DI 3	
16	DI 4	
17	DI 5	

18	DO 0 NC
19	DO 0 NO
20	DO 0 COM

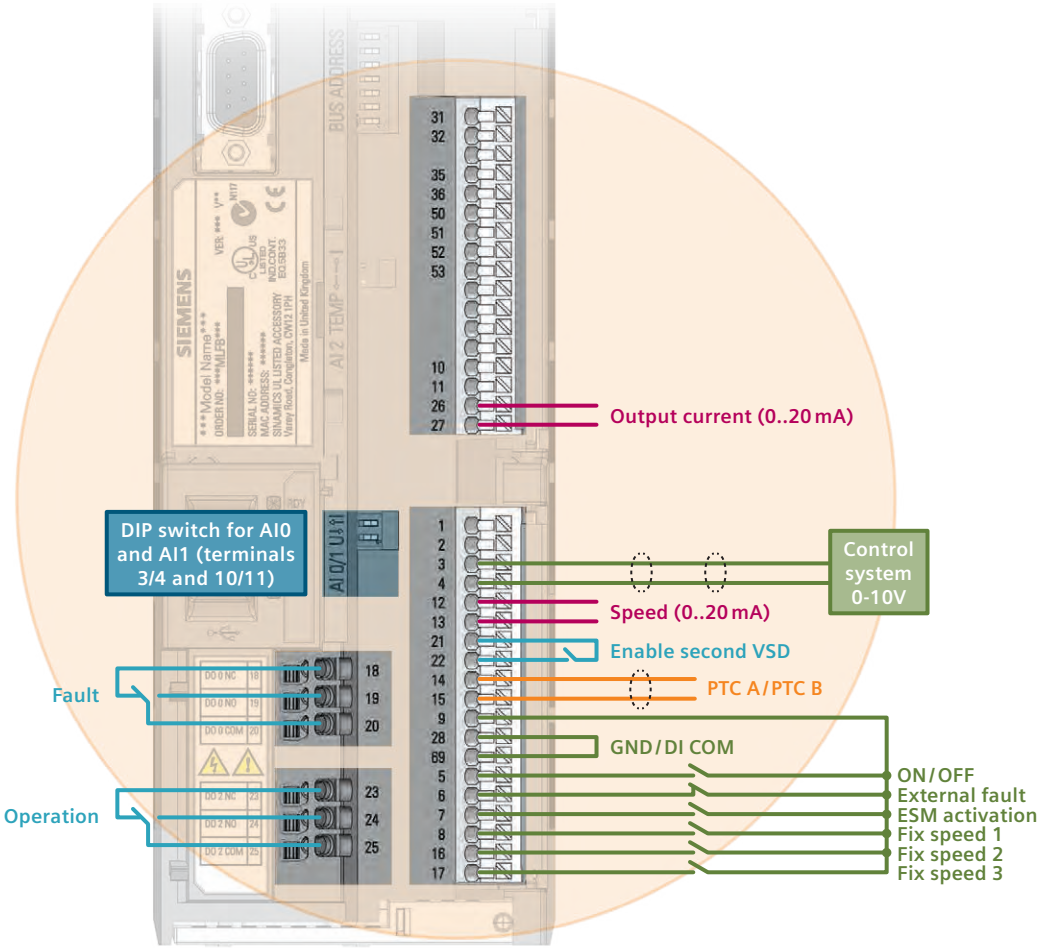
23	DO 2 NC
24	DO 2 NO
25	DO 2 COM

Standard I/O with analog setpoint (factory setting)



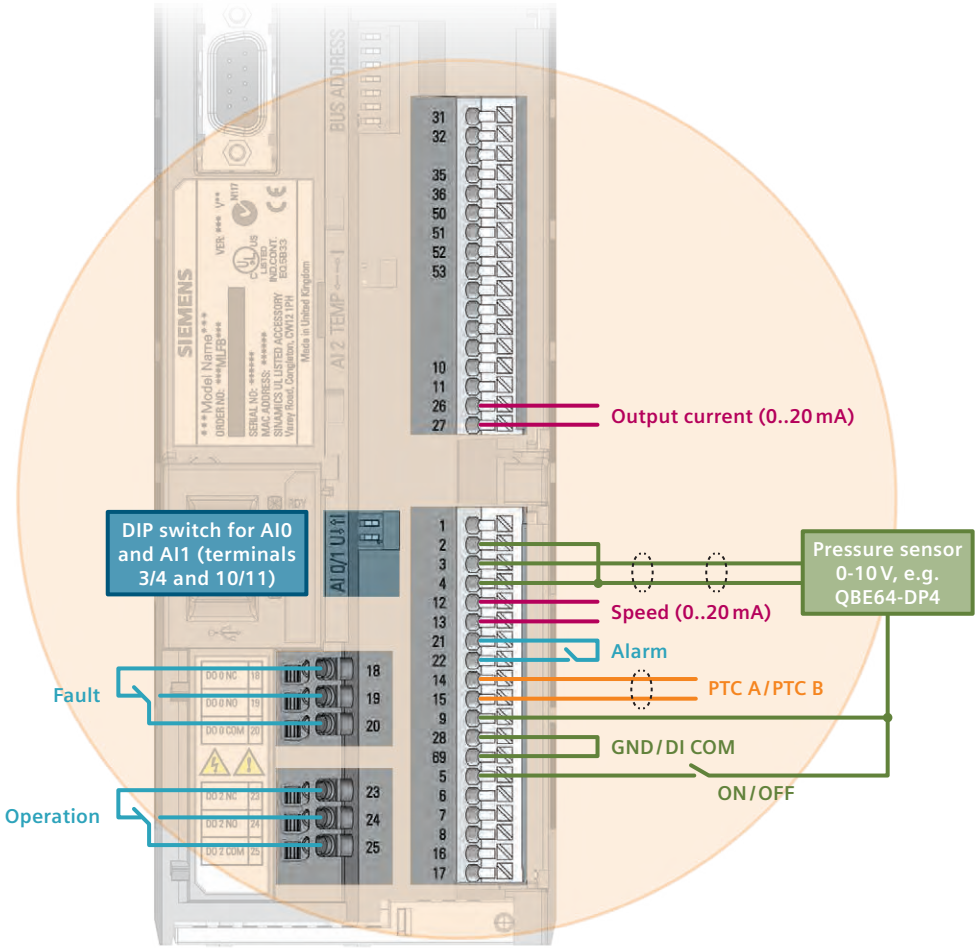
General purpose application

- Macro 101
- Setpoint via a 0...10 V signal
- Analog setpoint can be overridden with 4 fixed speeds
- Flying restart and automatic restart are activated
- Essential service mode (in the event of fire)



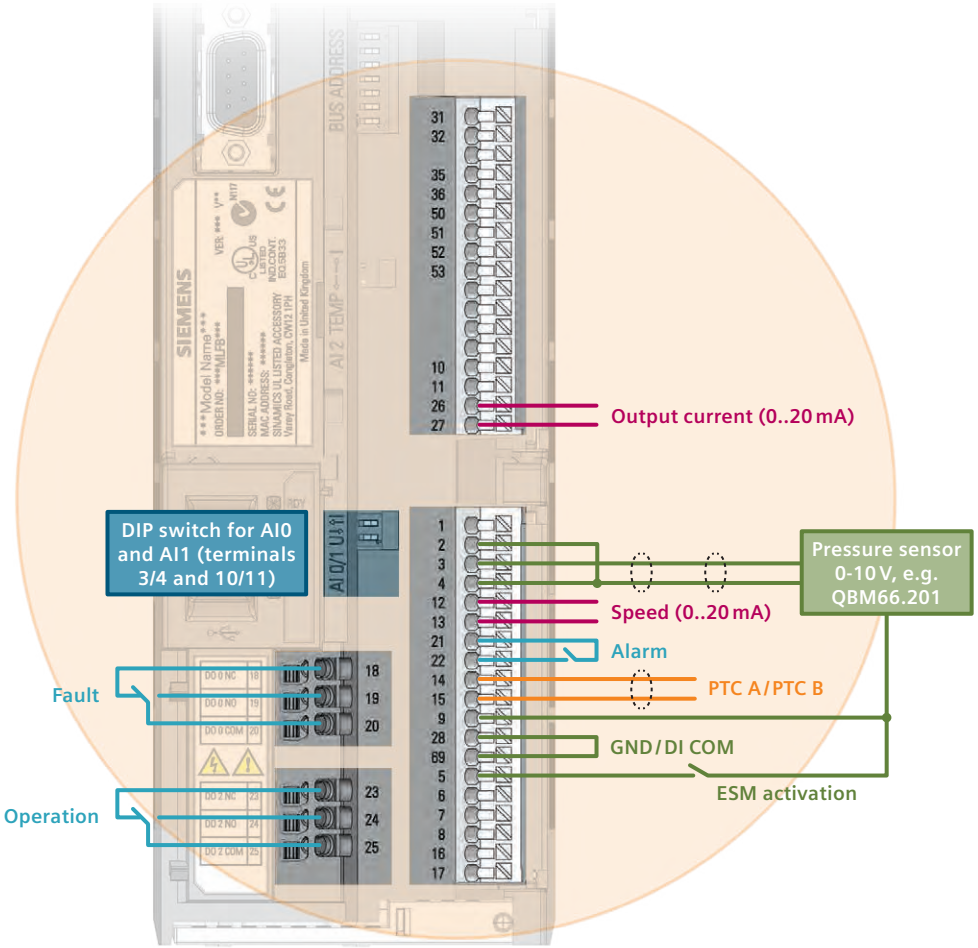
Pump delta P control

- Macro 103
- Differential pressure is controlled by the integrated PID controller
- Flying restart and automatic restart are activated



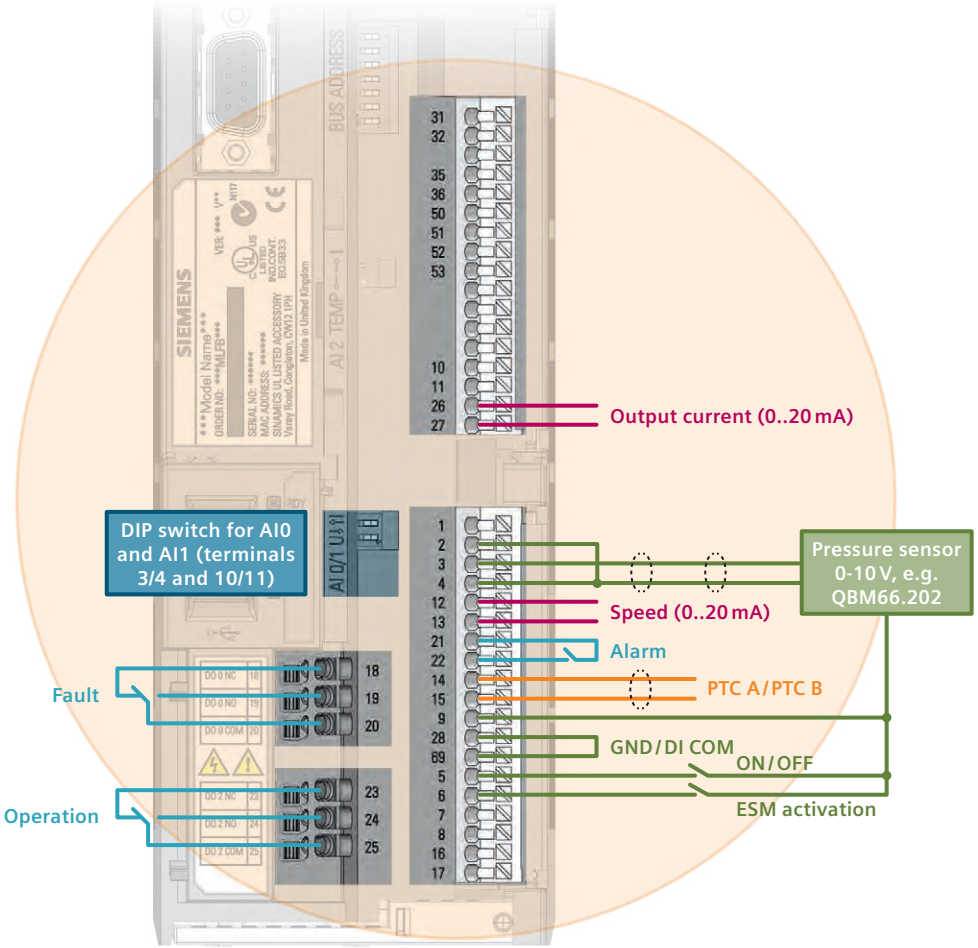
Stairway pressurization (ESM)

- Macro 104
- Central fire alarm system starts the fan
- Pressure control, e.g. in a stairwell, in order to keep escape routes clear
- Flying restart and automatic restart are activated



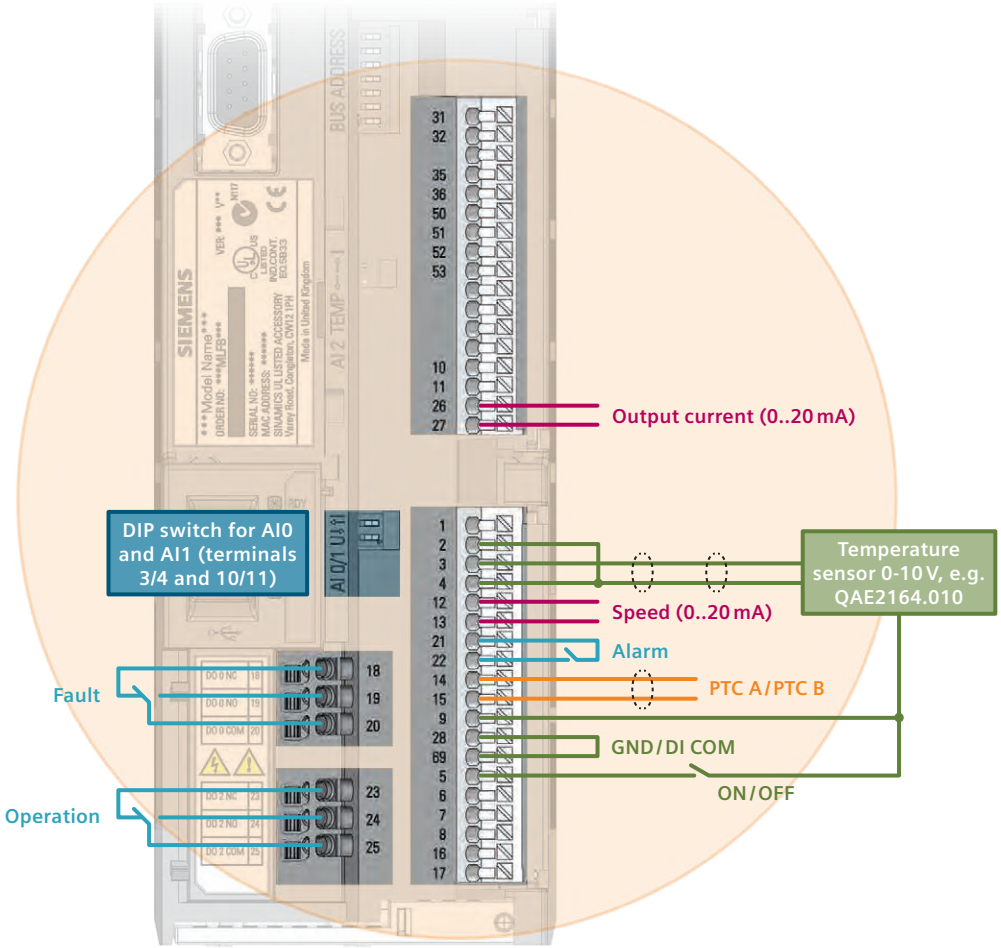
Pressure-controlled supply fan + ESM fixed speed

- Macro 105
- Pressure in the air duct is regulated by the integrated PID controller
- Flying restart and automatic restart are activated
- Essential service mode (in the event of fire) with fixed speed



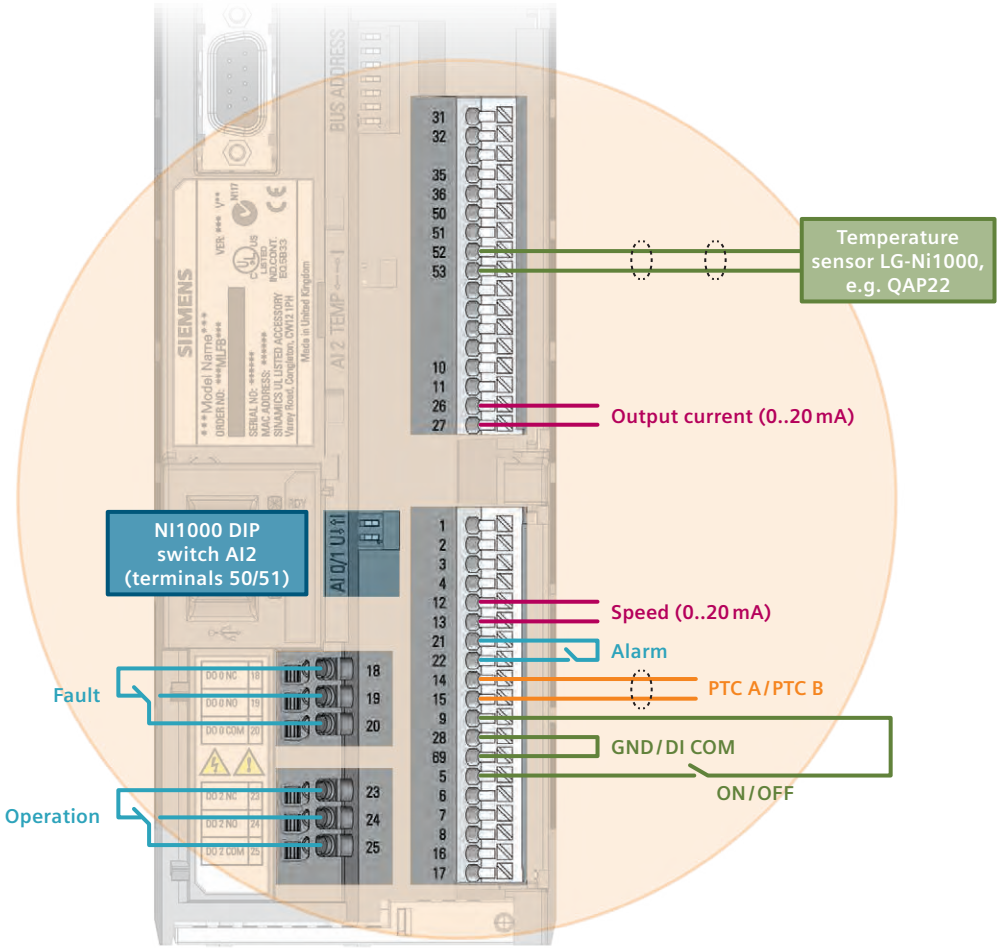
Cooling tower fan (active temp. sensor) + hibernation mode

- Macro 106
- Control of the cooling tower fan based on the temperature of the cooling water
- Hibernation
- Temperature sensor 0 – 10 V at AI0
- Flying restart and automatic restart are activated



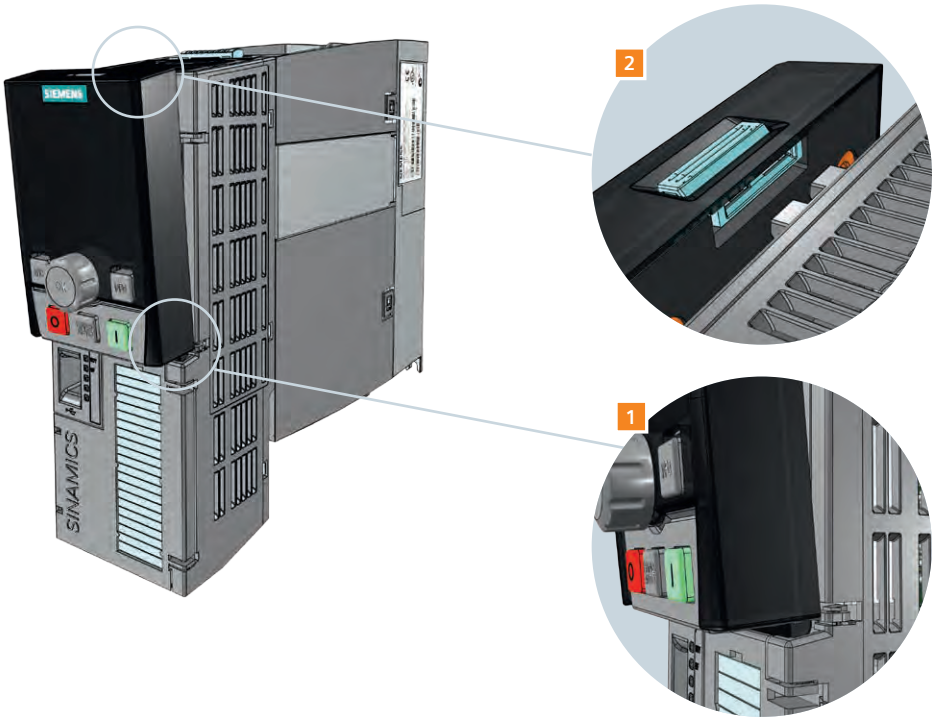
Cooling tower fan (LG-Ni1000 temp. sensor) + hibernation mode

- Macro 107
- Control of the cooling tower fan based on the temperature of the cooling water
- Temperature sensor LG-Ni1000 at AI3
- Hibernation
- Flying restart and automatic restart are activated



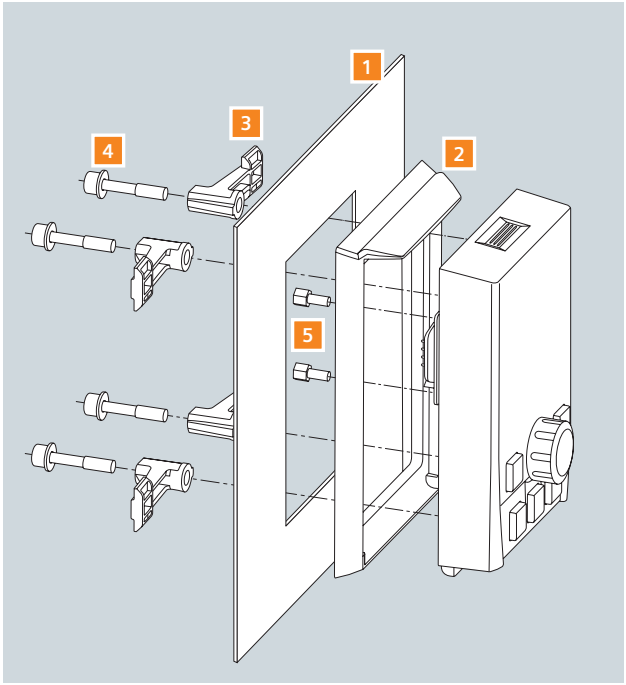
Mounting the operator panels (BOP-2 or IOP-2)

1 • Place the bottom edge of the IOP-2/BOP-2 into the lower recess of the Control Unit housing
2 • Push the IOP-2/BOP-2 toward the Control Unit until the catch clicks into place



Mounting the IOP-2 or BOP-2 in a cabinet door

The operator panel is the input and display instrument for controlling the variable speed drive. It is used in stand-alone operation, i.e., locally, on the device, integrated in the cabinet door or as handheld version for series commissioning (IOP-2).



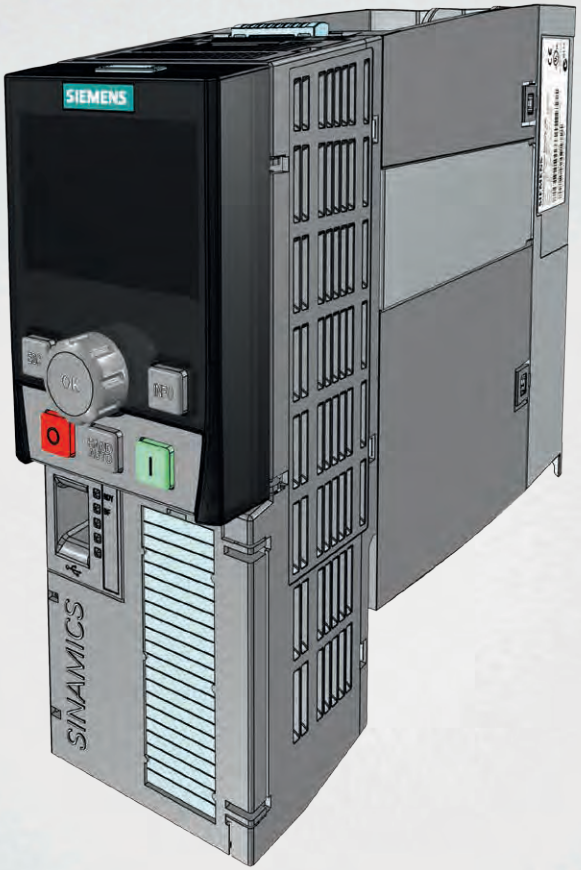
1 Door panel
2 Seal
3 Door mounting bracket
4 Screws
5 D-type retaining screws

Mounting the IOP-2
Identical mounting for the BOP-2

Congratulations! Your variable speed drive is now ready for operation.
After installation has been completed, the variable speed drive parameters must be set, i.e., you must enter the specific characteristics of the connected motor into the variable speed drive.

In this section, you will learn more about how to use the operator panels to locally control the variable speed drive. You will learn how to use the Basic Operator Panel 2 (BOP-2) to set up parameters for the variable speed drive and the connected motor, and how to operate the variable speed drive with the BOP-2. Then, you will learn how to best use the Intelligent Operator Panel (IOP-2).

2



Basic Operator Panel (BOP-2)
Intelligent Operator Panel (IOP-2)

2.1 Basic functions

The operator panel is the input and display instrument for controlling the variable speed drive. It is used in stand-alone operation, i.e., locally, on the device, integrated in the cabinet door or remotely connected with a serial cable (max. 5 m).

The BOP-2 display

The BOP-2 is used to commission, diagnose (troubleshoot) and display the status of the variable speed drive. Up to 2 status values can be simultaneously and continuously monitored. It features simple navigation using a transparent and well-structured menu and clearly assigned operator keys.

1. Menu bar indicates the selected menu function (see page 27)
2. Provides information about the selected functionality or displays the actual value
3. Displays the values

In this tutorial, we introduce an application that is based on “V/f control for a parabolic characteristic”. This control method is typically applied in HVAC applications. We recommend that you work through the example we have presented here in order to familiarize yourself with setting up parameters for a variable speed drive.

NOTE

Menu structure

When moving the menu bar to the following menu function, the following applies:

1 MONITORING

The actual status of the variable speed drive/motor system is displayed

2 CONTROL

Setpoint, jog and reverse mode can be activated

3 DIAGNOSTICS

Faults and alarms can be acknowledged, history and status is displayed

4 PARAMETER

Parameter values can be viewed and changed

5 SETUP

Basic commissioning of the variable speed drive can be performed

6 EXTRAS

Additional functions such as saving and copying data sets into and from the BOP-2 can be performed

2.2 Working with the BOP-2

The BOP-2 is equipped with seven buttons. For setup and parameterization only the UP and DOWN, OK and ESC buttons are relevant. The ON, OFF and HAND/AUTO keys are needed for local operation.

1. ESC key – takes you back to the previous screen
2. Up key – changes selection
3. Down key – changes selection
4. OK key – confirms selection
5. OFF key – stops the motor in the manual mode
6. HAND / AUTO key – switches the command source between HAND and AUTO mode
7. ON / RUN key – starts the motor in the manual mode

Parameter list

To better understand the functionality of the buttons, you should be acquainted with the operating mode: The Basic Operator Panel gives you access to a parameter list. The parameters are assigned stored values that control the operation of the motor. However, not all the numbers are assigned.

Operating mode

- Press ESC to enter the menu selection
- Use the UP and DOWN buttons to move the menu bar to PARAMS and press OK
- Press OK to select the standard level

Example

The first parameter number that appears is displayed on the left side of the screen: r2 (r stands for read only and means that you can only read this value but cannot change it). The parameter value of the selected number is shown on the right-hand side.

- Press UP to access the next parameter
- In this case, P3 appears (P means that you can change the value of this parameter)
- Press OK to edit the parameter
- Use the UP and DOWN buttons to adjust the value
- Confirm the value by pressing OK

Example

If you want to change any parameter using the parameter list, you are requested to choose a filter level (Standard or Expert). The standard level limits the available parameters, thus limiting the risk of dangerous parameter settings. The Expert Level allows you to access all parameters.

NOTE

Some parameters have more than one associated value. In this case, pressing OK does not take you directly to the value, but to an index that is displayed in brackets [00] above the actual value.

Example of index parameters

- Pressing OK takes you to [00]
- UP takes you to [01], DOWN back to [00]
- Select an index number of your choice
- Press OK again to edit the index
- The value starts flashing
- Adjust the value by pressing UP or DOWN
- Confirm by pressing OK

Example

A complete list of all parameters can be found in the "Parameter Manual: Control Units – CU230P-2" as a download at: **http://support.automation.siemens.com/WW/view/de/70985339/0/en**

If you want to adjust any blinking/active value digit by digit (using the UP or DOWN button might just take too long), you can always press the OK button for more than two seconds. After releasing the button, you can continuously change any single digit by using the buttons OK (move to next digit), ESC (move to previous digit), UP (increase value), and DOWN (decrease value).

NOTE

Function buttons

You can operate the motor using the function buttons. The HAND/AUTO button changes the command source between the BOP-2 (HAND) and fieldbus or terminal (AUTO). A symbol of a hand appears on the screen to indicate that the HAND mode is active.

- In the HAND mode, the ON and OFF buttons are enabled
- In the AUTO mode, the ON and OFF buttons are disabled
- If the HAND mode is active, pressing the HAND/AUTO button will switch the variable speed drive to the AUTO mode
- If the AUTO mode is active, pressing the HAND/AUTO button will switch the variable speed drive to the HAND mode
- Changing from the HAND to the AUTO mode is possible while the motor is running

Screen icons

The BOP-2 displays a number of icons at the left-hand side of the display to indicate the actual state of the variable speed drive.

- Command source, auto / hand
- Variable speed drive status, operational
- JOG JOG
- Fault / alarms active

A detailed list of the fault and alarm messages can be found in the "Parameter Manual: Control Units – CU230P2" as a download at: **http://support.automation.siemens.com/WW/view/en/49946106**

NOTE

2.3 Quick commissioning

The following descriptions show how to set up the drive using the quick commissioning wizard, which is integrated in the BOP-2.

Starting quick commissioning

- Press ESC to enter the menu selection
- Use UP and DOWN to move the menu bar to SETUP and press OK
- The screen will automatically display the next parameter in the commissioning sequence

Quick commissioning now starts. It will help you to set all of the relevant parameters step by step. Parameters that are not relevant will be skipped automatically. This allows you to adjust the factory settings of your variable speed drive to the requirements of your motor.

Resetting the variable speed drive

- Press OK while the BOP-2 shows RESET
- Press UP or DOWN to change the value to YES
- Press OK and wait until the BUSY symbol disappears
- All values have now been reset to the factory setting

Any step of the commissioning wizard can be skipped by pressing the DOWN button. You can go back one step by pressing the UP button. By confirming one step with OK, the screen will automatically display the next parameter in the commissioning sequence.

NOTE

Setting the control mode (P1300)

In our example it is assumed that your variable speed drive and the motor are new. As a result, a series of preparatory steps are required, e.g. selecting the control mode. This is indicated by the parameter number 1300. 'V/f control with parabolic characteristic curve' is defined by the factory setting.

- Press OK to modify the parameter value CTRL MOD
- The upper line shows the control mode associated with the actual parameter value below
- Choose "V/f control for a parabolic characteristic and ECO" value by pressing UP or DOWN
- Observe how the control mode name in the upper row changes accordingly
- Press OK if the desired control mode is displayed

Selecting the line frequency (P100)

The next parameter sequence sets the line frequency of the region in which the motor is being used. In our example, this is Europe.

- Press OK to modify the parameter value EUR USA
- Set 0 for Europe (50 Hz) (1 represents the US line frequency of 60 Hz)
- Confirm the value by pressing OK
- The screen will automatically display the next parameter in the commissioning sequence

The applicable line frequency can also be found on your motor rating plate (see chapter "Entering motor data").

NOTE

Entering motor data

In the next step, the variable speed drive is adjusted to the motor. The motor data can be found on the motor rating plate. Please set the values according to the rating plate.

- Press OK to edit the motor voltage stored under P304
- The preset motor voltage of 400 volts is displayed
- Keep the value and confirm by pressing OK

OK → 400 → OK

1. P304 = MOT VOLT = motor voltage
2. P100 = EUR USA = standard IEC or NEMA
3. P305 = MOT CURR = motor rated current
4. P307 = MOT POW = motor rated power
5. P311 = MOT RPM = motor rated speed
6. P308 = MOT COS PHI = Rated Motor power factor

The line frequency has been set already in the beginning of quick commissioning (see page 37).

If you want to adjust any flashing value digit by digit (using the UP and DOWN button might take too long) continuously press the OK button for longer than two seconds. After releasing the button, you can change each single digit by using the buttons OK (move to next digit), ESC (move to previous digit), UP (increase value) and DOWN (decrease value).

NOTE

Motor data identification

After entering the motor data, the wizard requests that the motor data identification is activated. This is recommended for a verification and optimization of the data that you have entered. The motor data identification initiates a "measurement" of the connected motor. In the process, the data previously calculated in the variable speed drive are compared to the actual motor data and adapted to one another.

Activating motor data identification (P1900)

- Press OK to confirm MOT ID
- Change the displayed value to 1 by pressing UP

Motor data identification only starts after the basic commissioning sequence has been completed and the motor is switched on the first time!

The motor data identification can take several minutes. Do not interrupt the process.

Specifying application parameters using Macro Parameter

In the next step, pre-defined settings for the variable speed drive interfaces can be activated. This is stored in parameter number 15 and indicated by MAc PAr for macro parameterization. For example, the variable speed drive offers different pre-defined macros for setting the command and setpoint sources (see Page 20/27).

Activating pre-defined settings (P15) e.g. for command and setpoint source

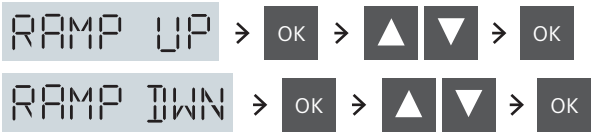
- Press OK to activate macro parameterization MAc PAr
- Macro 12 (Std ASP) is displayed, it determines DI 0 for the command source and the analog input 0 for the setpoint source
- Leave the value and confirm by pressing OK

The variable speed drive can now be switched on using digital input DI 0.
AI0 (0-10 V) is selected as the setpoint source.

Minimum motor speed, ramp-up and ramp-down time (P1080)

- Set the minimum motor speed under parameter MIN RPM
- Press OK (parameter MIN RPM)
- Change the value by pressing UP or DOWN
- Press OK to confirm

- Set the ramp-up time under parameter RAMP UP for the accelerating time to maximum frequency (P1120)
- Set the ramp-down time under parameter RAMP DWN for the time until standstill is reached (P1121)



The values are displayed in seconds. In both cases, the times indicated should not be too short, as this might result in an alarm. The ramp times are only valid in normal operation. If the drive uses PID control, the PID-specific settings have priority. An example for a PID setup is provided in Chapter -> Starter.

Changing the value digit by digit is possible by continuously pressing the OK button for more than 2 seconds. After releasing the button, each single digit can be changed by using the OK (move to next digit), ESC (move to previous digit), UP (increase value) and DOWN (decrease value) buttons.

Refer to the "Parameter Manual: Control Units – CU230P-2" for a description of the control modes and their corresponding parameter settings at: **http://support.automation.siemens.com/WW/view/en/49946106**

G120P requires the minimum speed to be set in rpm and not in Hz. You can use the "SINAMICS Support" app available for iPhone and Android to convert Hz into rpm for your motor. The minimum speed must be entered as a fraction of the synchronous motor speed if V/f control is selected.

NOTE

Completing quick commissioning

- Press OK while the BOP-2 displays FINISH
- Select YES and press OK again

The variable speed drive is now optimally parameterized for your particular application and motor specifications. Motor data identification should now be run to complete commissioning. This can be done by switching on the motor. Presently, the command source is set to digital input DI 0. Start the motor by energizing DI 0.

Motor data identification

- Start the motor manually by using digital input DI 0
- The measuring process is set in motion. This can take several minutes – do not interrupt this process
- The motor is switched off when the process has been completed
- BOP-2 indicates that the measured values are now being converted into data

After the motor data identification has been performed, switch the motor off and on again in order to start normal operation (using DI 0).

NOTE

Saving and restoring data

Saving data in different location is important. The EXTRAS function allows loading parameter data from the variable speed drive memory to the BOP-2 and vice versa.

Saving parameter sets from the variable speed drive to the BOP-2

- Navigate with the menu bar to the function EXTRAS
- Press OK
- Push the DOWN button until TO BOP appears
- Press OK

Copying parameter sets from the BOP-2 to the variable speed drive

- Navigate to the menu EXTRAS
- Press OK
- Push the DOWN button until FROM BOP appears
- Press OK
- Disconnect from the line supply and reconnect, so that the download becomes effective

The Basic Operator Panel 2 can also be used to make a variety of other adjustments to your application. Please note that an overview of the parameter numbers can be found in the Operating Instructions: Control Units CU230P-2.

The BOP-2 can be mounted or removed at any time, even during operation. The device is not necessary for ongoing operation.

NOTE

2.4 Intelligent Operator Panel

With the Intelligent Operator Panel, you can set the variable speed drive parameters, put the variable speed drive into operation, monitor motor operation and get valuable information about faults and alarms. All these functions can be accessed without expert knowledge. The main advantages are as follows:

Fast commissioning without expert knowledge

- Simple commissioning of standard applications using application-specific wizards, knowledge of the parameter structure is not necessary
- User customized parameter lists with reduced parameter sets
- Fast series commissioning of devices using the clone function and the possibility to save up to 16 parameter sets
- Commissioning without documentation by using the integrated help function

Minimized maintenance times

- Diagnostics with plain text display
- Simple update of languages, application wizards and firmware using the integrated USB connection
- Integrated clear plain help function to read fault messages and resolve the causes locally

High usability, intuitive handling

- Direct, manual control of the drive – simple switching from manual to automatic operation
- Intuitive menu navigation using a selection wheel
- Graphical display for e.g. status values in vertical-bar charts (for example pressure or flow rate) or trend graphs
- Status display with freely selectable units – display of real, physical values

Flexible use

- Available for direct mounting on the control unit, door mounting or remote use with a serial cable (max. 5 m)
- Simple and fast mechanical mounting and electrical connection in a door
- The handheld device can be used for a wide variety of variable speed drives
- Multiple languages integrated as standard – more can be downloaded via USB

The device

The IOP-2 is a menu-driven device. It has three main function groups:

1. [Wizards] Assist you in setting up standard applications
2. [Control] Allows you to change the setpoint values, activate the direction of rotation reversal and change to the JOG mode
3. [Menu] Allows you to access all possible functions

The display

All of the necessary information is displayed in plain text or icons in a user-friendly fashion. The icons are displayed at the top right-hand edge of the display. They indicate various variable speed drive states.

- Command source auto / hand
- Variable speed drive status ready / operating
- Fault
- Alarm active
- Indicates all data is currently saved to RAM. If power is terminated all data is lost.

Working with the IOP-2

The IOP-2 is mainly operated using the selection wheel. The five additional buttons make it possible to display certain values or to toggle between the manual and automatic modes. The buttons are as follows: ON, OFF, ESC, INFO and HAND/AUTO.

1. Turning changes the selection
   Pressing confirms the selection
2. Starts the motor in the manual mode
3. Stops the motor in the manual mode
4. Takes you back to the previous screen
5. Displays additional information
6. Switches the command source between the HAND and AUTO modes

The HAND/AUTO function operates in exactly the same way as the one implemented in the BOP-2. After starting the motor with the ON button, you can change the setpoint speed by navigating to CONTROL/SETPOINT and turning the wheel (clockwise to increase speed, counter-clockwise to decrease speed).

NOTE

The wizards

Several wizards are available that allow you to set up various functions and commission the variable speed drive. They navigate you interactively through the parameterization of standard applications. The wizards are accessed from the wizards menu, at the bottom left of the status screen.

- Always use the wheel to select an option and press OK to confirm
- Press ESC to move back one step
- Press INFO to read context-sensitive help information

Basic commissioning

- Select “Wizards” by turning the wheel
- Navigate to “Basic commissioning”
- Confirm by pressing OK

Now the wizard will guide you through several steps by presenting a number of screens where you can choose the necessary options and values. Our example shows a standard configuration.

After selecting Wizards or when advancing with the IOP-2, sometimes a specific loading time is required. If the screen does not immediately change, do not press any additional buttons as this might cause the IOP-2 to advance too far.

At the top of the screen, you can see numbers that indicate the present step of the wizard that you are in. For example, 2/28 means that you are in step 2 of 28.

NOTE

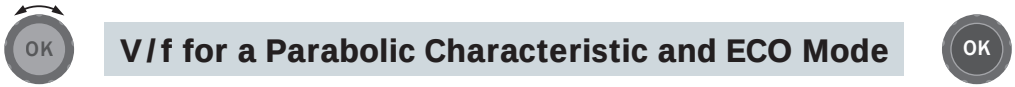
Basic commissioning

Restoring factory settings

- Choose “Yes”
- Confirm by pressing OK

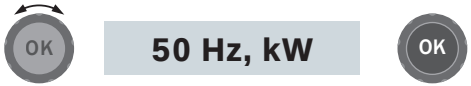
Control mode

- Select the required control mode by turning the wheel
- In our example: “V/f for a Parabolic Characteristic and ECO Mode”
- Press OK



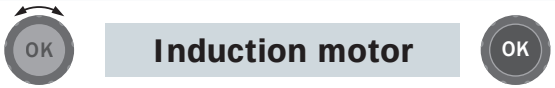
Motor data

- Refer to the rating plate of your motor
- Select “Europe 50 Hz, kW” or “N. America 60 Hz” according your line supply and motor
- Press OK



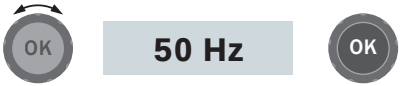
Motor type

- Select the appropriate motor type
- Refer to the rating plate of your motor or consult the motor manual (also see Page 40)
- In our example: “Induction motor”
- Press OK



Motor characteristics

- Choose the appropriate value
- Value depends on the characteristic you want to use. 87 Hz should not be used without first contacting the motor supplier.
- In our example: “50 Hz”
- Press OK



Motor connections

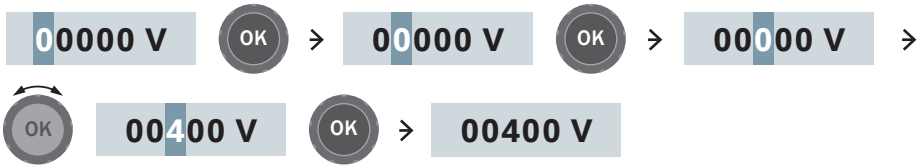
- A note is displayed that prompts you to enter the motor data according to the motor rating plate
- Press OK to continue

Entering detailed motor data

- You are now prompted to enter 50 Hz motor data
- Press OK to continue

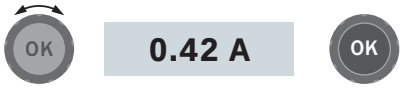
Motor voltage

- Enter the appropriate motor voltage
- In our example: “400 V”
- Turn the wheel to select the appropriate numbers
- Press the OK button to confirm the digit and jump to the next digit
- Please note, that you have to confirm each digit individually



Motor current

- Enter the appropriate motor current
- In our example: “0.42 A”
- Turn the wheel to select the appropriate numbers
- Press OK to confirm the number



Power rating

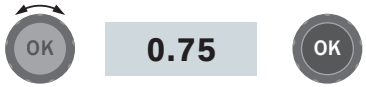
- Enter the appropriate power rating
- In our example: “0.12 kW”
- Turn the wheel to select the appropriate numbers
- Press OK to confirm the number

When editing parameters or search values there is a choice to edit individual digits or an entire value. With a long press of the OK button (>3 sec) it will toggle between the two different value editing modes.

NOTE

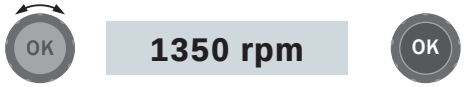
Motor cos phi

- Enter the correct motor cos phi according to the motor rating plate



Rated motor speed

- Enter the appropriate rated motor speed (please see the motor rating plate on page 40)
- In our example: “1350 rpm”
- Turn the wheel to select the appropriate numbers
- Press OK to confirm the number

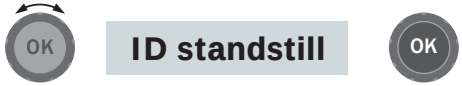


Current limit

- The drive suggests a current limit with factor 1.5 of the rated motor current.
  Adjust this value if needed.

Activating motor data identification

- Motor identification is recommended for verification and optimization of all motor data
- If it is safe choose motor “data identification at standstill”
- Motor data identification will be performed when the motor is switched on
- Press OK to confirm



Encoder type

- In our example: encoder type is not applicable
- Press OK

Encoder parameters

- In our example: all parameters will be set to default
- Press OK to continue

Command and setpoint sources

- Command and setpoint sources are automatically determined using preset macros
- Macro parameters are stored in P015
- Select the appropriate macro according to your wiring
- In our example: “standard macro with analog setpoint and the ON command on the digital input 0”
- Press OK to continue

Standard IO with analog setpoint

Minimum speed

- Enter the appropriate minimum speed
- We recommend that 20 % of the synchronous speed is selected
- In our example: “300 rpm” (rated speed is 1350 rpm, and synchronous speed is 1500 rpm)
- Turn the wheel to select the appropriate numbers
- Press OK to confirm the number

300 rpm

Ramp up

- Enter the appropriate ramp-up time
- Ramp-down time depends on the motor size
- In our example: “30 s”
- Turn the wheel to select the appropriate numbers
- Press OK to confirm the number

Ramp down

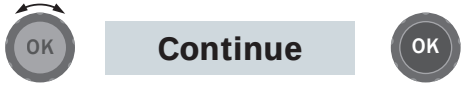
- Enter the appropriate ramp-down time
- Ramp-down time depends on the motor size
- In our example: “30 s”
- Turn the wheel to select the appropriate numbers
- Press OK to confirm the number

Motor temperature sensor

- If there is a motor temperature sensor connected to your device, choose the correct type of sensor.

Summary of settings

- Review all settings by scrolling through the list
- Each setting can still be changed by selecting and pressing OK
- Press “Esc” if you want to go back
- Select “Continue” and press OK to confirm all settings



Saving settings

- Select “Save” and press OK

Saving

- The settings are saved to the EEPROM memory of the variable speed drive
- Please wait until the process has been completed
- Press OK to continue

Completing basic commissioning

- The display reminds you that you have selected motor data identification
- Press OK to complete basic commissioning
- The status screen is displayed
- At the top right a small warning symbol still reminds you that you have selected motor data identification
- Switch on the motor
- Motor data identification is performed

During the motor data identification you will hear a peeping sound. The identification process can take up to five minutes. After the motor data identification has been completed your motor and variable speed drive are configured.

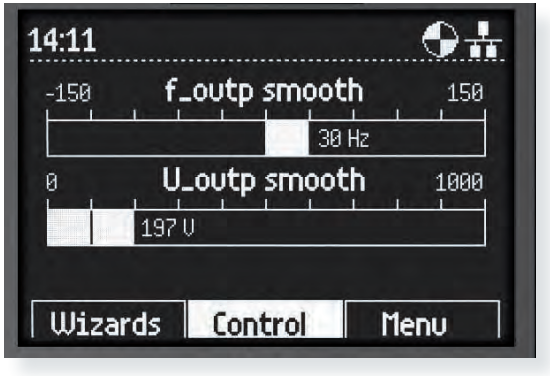
If “Cancel Wizard” is selected, all changes will be cancelled and the status screen will return to the last set status screen settings.

After the motor data identification has been performed, switch the motor off and on again in order to start normal operation (using DI 0).

NOTE

Output settings

Two bar graphs with two different values can be displayed on the status screen. Both graphs can be changed so that other physical values are displayed. An easy-to-use wizard guides you through the relevant steps.



Navigating to the status screen wizard

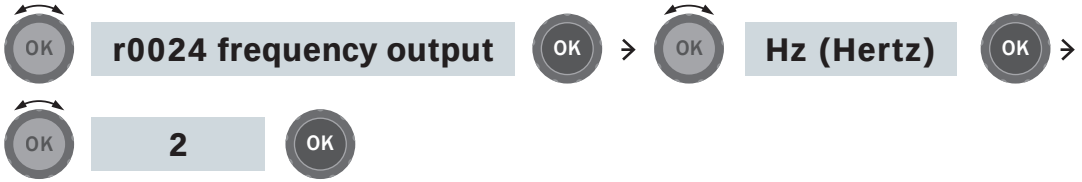
- Go to “Menu” and press OK
- Select “Extras” and confirm with OK
- Select “Status screen wizard”

Changing the top or bottom bar that is displayed

- Select “Bar graph” to change its values
- Press OK
- Select the screen position
- In our example: Select the top bar and press OK

Selecting new values

- Choose the required parameter
- In our example: “r0024 frequency output”
- Press OK
- Select the appropriate unit
- In our example: “Hz (Hertz)”
- Press OK
- Select the number of digits to be displayed
- In our example: “2”
- Press OK



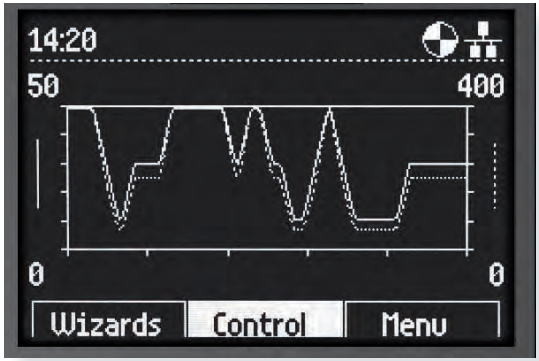
Summary of the setting

- A list of all changes is displayed
- Review the setting changes
- Select “Continue” and press OK
- Save the settings

After saving has been completed the status screen opens and the changes are displayed immediately. In our example you can now monitor the motor speed, in Hertz (and not in rpm).

Trend View

The Trend View is a powerful feature for diagnostics and optimization. The Trend View allows selected parameters to be graphically displayed with respect to time, for example, motor frequency and output current. This means that the selected parameters can be graphically monitored over a certain time period. The graph can be configured according to your needs.



Navigating to the status screen wizard

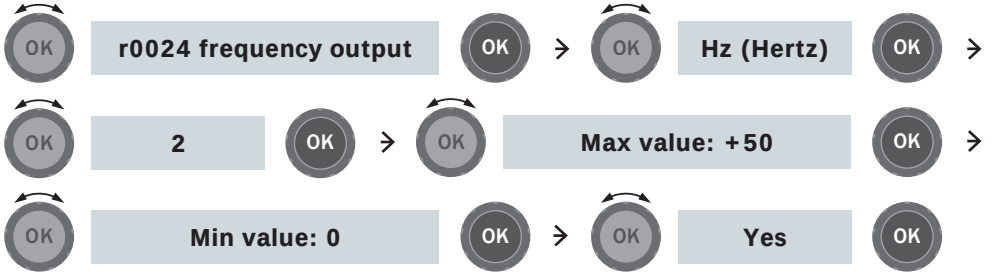
- Go to “Menu” and press OK
- Select “Extras” and confirm with OK
- Select “Status screen wizard”

Configuring the Trend View

- Choose “Trend View” to present data
- Press OK
- First choose “Y-axis left”
- Press OK to change the setting to Y-axis left

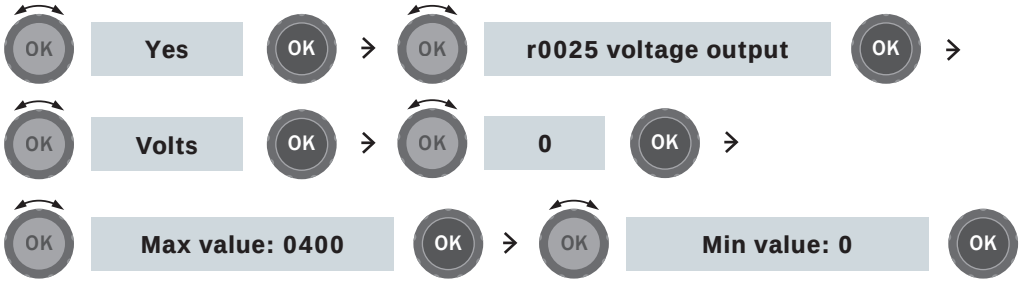
Changing the Y-axis left

- Select the required parameter values
- In our example: “r0024 frequency output”
- Press OK
- Select the required unit
- In our example: “Hz (Hertz)”
- Select the required number of unit digits
- In our example: “2”
- Determine maximum value
- Determine minimum value
- In our example: ranging from “0 to 50 Hz”
- Press OK to continue



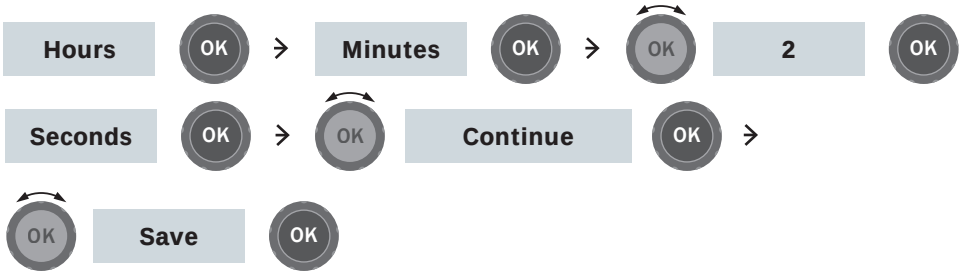
Changing the Y-axis right

- If required the Y-axis right can also be configured
- Select “Yes” and press OK
- Choose the required output parameter
- In our example: “r0025 voltage output”
- Press OK
- Select the required unit
- In our example: “Volts”
- Press OK
- Select the required number of unit digits
- In our example: “0”
- Determine maximum value
- Determine minimum value
- In our example: ranging from “0 to 400 V”
- Press OK



Defining the displayed time period and completing the configuration

- Set the required time period for the Trend View
- “Hours”, “minutes” and “seconds” are individually selected
- Press OK to jump from hours to minutes/seconds
- Turn the wheel to change the number of hours/minutes/seconds
- In our example: “2 minutes”
- Press OK to continue
- A summary of settings is displayed
- Review off all settings
- Select “Continue” and press OK
- Select “Save” to complete the configuration



The configuration process is completed by saving all of the settings. The screen will automatically return to the status screen. The configured graph is immediately displayed. Now switch on the motor to see how the graph displays selected motor parameters (e.g. motor current, motor frequency). You will see how the motor accelerates according to the ramp-up time that you configured. Change the motor speed to see how the graph changes.

2 minutes is a good time period for a quick analysis. 24 hours is recommended for long-term monitoring.

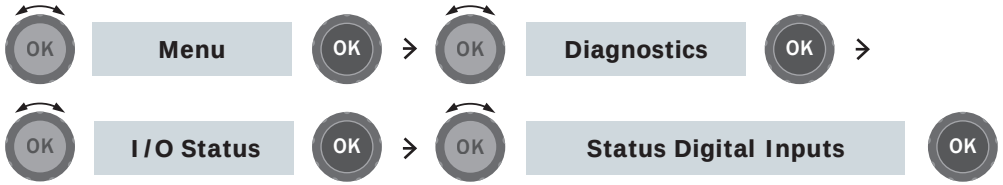
NOTE

Accessing the diagnostics

If you want to find out which input and output devices are connected to the variable speed drive, simply navigate to the diagnostics menu and select the I/O status. This option displays a list of the digital and analog inputs and outputs of the variable speed drive. In addition, you can monitor their current status. This is an information screen only and cannot be changed.

Reading the I/O status

- Use the wheel to select “Menu”
- Confirm by pressing OK
- Select “Diagnostics”
- Confirm by pressing OK
- Choose “I/O Status”
- Confirm by pressing OK
- Choose “Status Digital Inputs”
- Confirm by pressing OK



You can now see a clearly arranged overview of all of the connected I/O including their status.

The INFO button – always provides you with more in-depth information about the presently highlighted selected step or feature.

NOTE

Obtaining information on active faults

- Use the wheel to select “Menu”
- Confirm by pressing OK
- Choose “Diagnostics”
- Confirm by pressing OK
- Select “Active Faults/Alarms”

All active fault messages that have not yet been acknowledged are now displayed.
You can select each one, and press INFO to obtain more information.

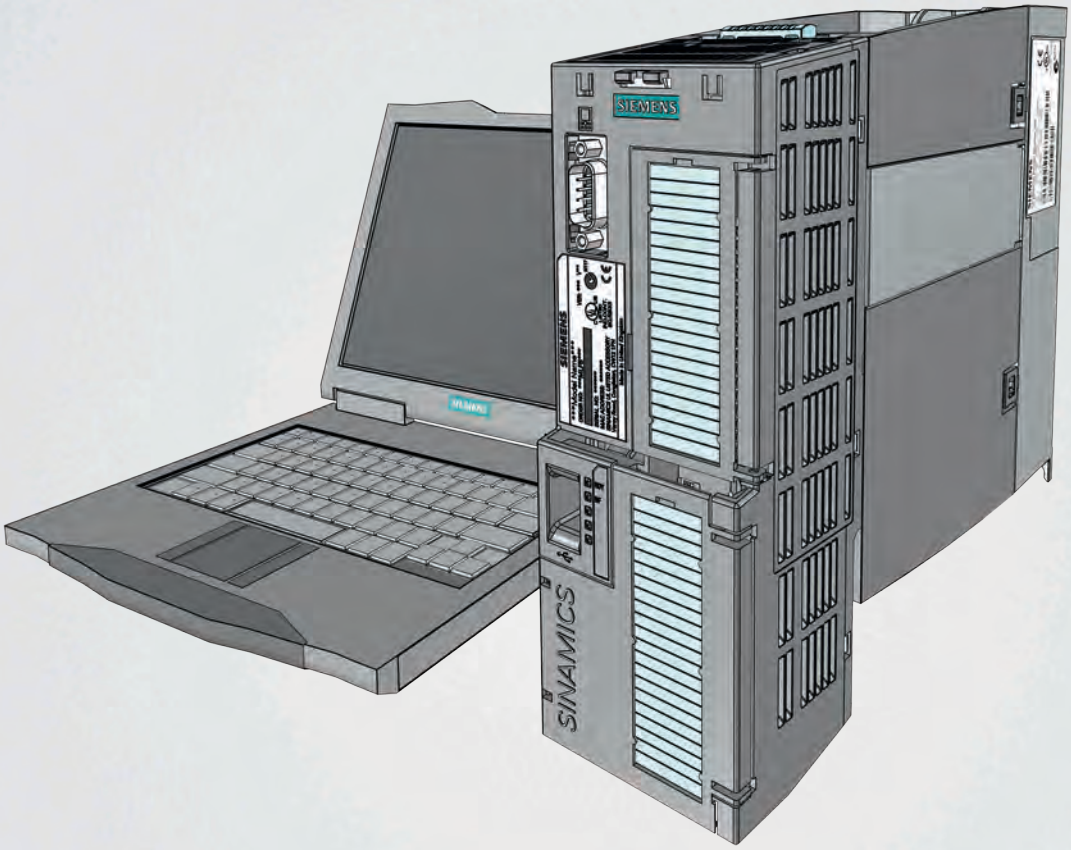
You now know how to use the operator panels to set the parameters on your variable speed drive and commission it. Another option for setting the parameters is to use your PC or a SIMATIC programming device. This method is clearer and more convenient, but requires somewhat more preparation time.

If you want to find out about previous faults and alarms, please navigate back one level and select “History”. This will display a list of all previous faults and alarms including the time that they occurred.

NOTE

In the next step, you will learn how to connect your PC or PG to the variable speed drive and how to set parameters using the STARTER software.

3



STARTER software and PC

3.1 Mounting and preparation

The optional PC Connection Kit 2 is required to set up the parameters using a PC.
The kit consists of two components.

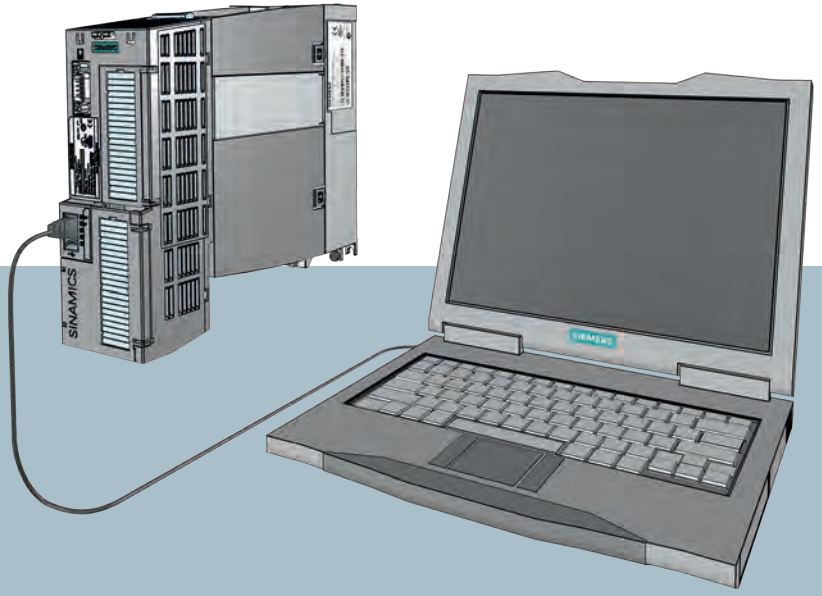
1 Connecting cable

2 STARTER software on DVD

Hardware preparation

- Insert the STARTER DVD into your DVD drive
- Install the STARTER software by following the setup wizard
- Connect the USB cable to the Control Unit
- Connect the other end to the USB port of your PC

You must install the USB driver if you are connecting the variable speed drive and PC together for the first time. Windows 7 automatically installs the driver; for older Windows versions, you must confirm the automatic installation.



The latest version of STARTER can also be downloaded at: **http://support.automation.siemens.com/WW/view/en/26233208**

NOTE

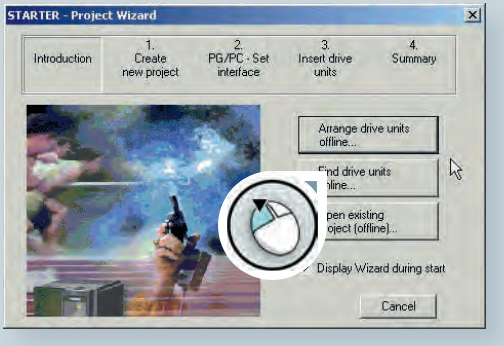
Creating a STARTER project

After the installation has been completed, switch on the variable speed drive power supply and start the program. The project wizard opens automatically. The wizard will help you create your first project in four steps.

1 Introduction: Select “Find drive units online”

STARTER software reading step-by-step instructions are provided on the following pages.

1



2 Creating a new project (Step 1): Give the project a name and click “Next” to access

3 PG/PC Set interface (Step 2): Check that “DEVICE” is set as access point.
If not, click “Access point” and set “DEVICE” in the dialog box

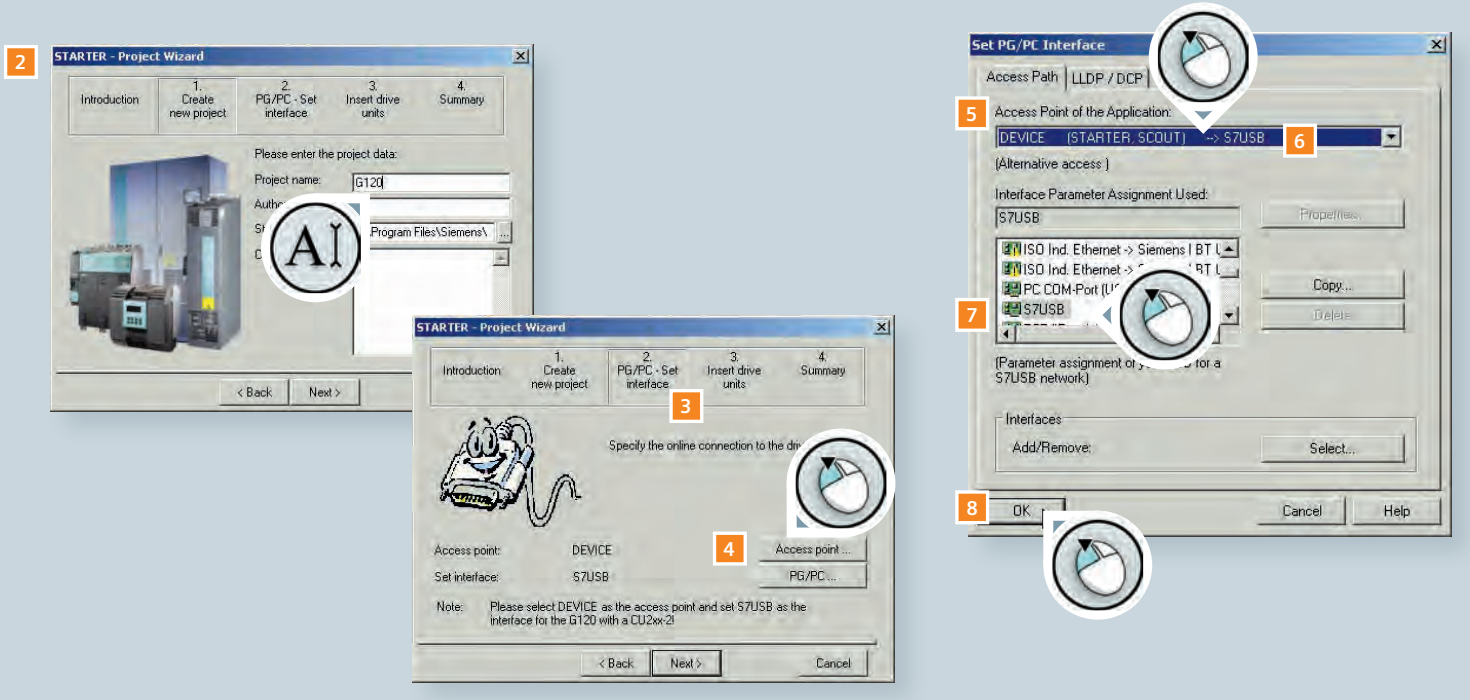
4 Check that “S7USB” is set as interface. If not, click “PG/PC”

5 Open the dropdown menu and select “Access point of the Application”

6 Choose the command “Device (STARTER, SCOUT) --> to S7USB”

7 In the lower section called “Interface Parameter Assigned Used” select “S7USB”

8 Close with OK and click “Next”

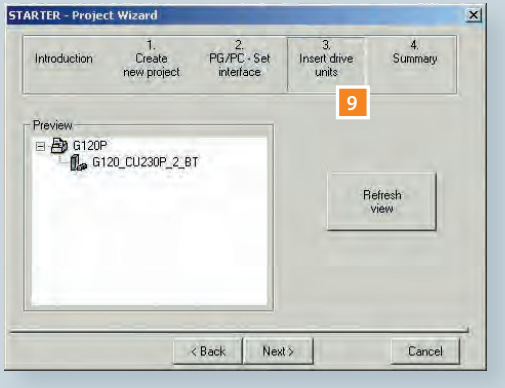


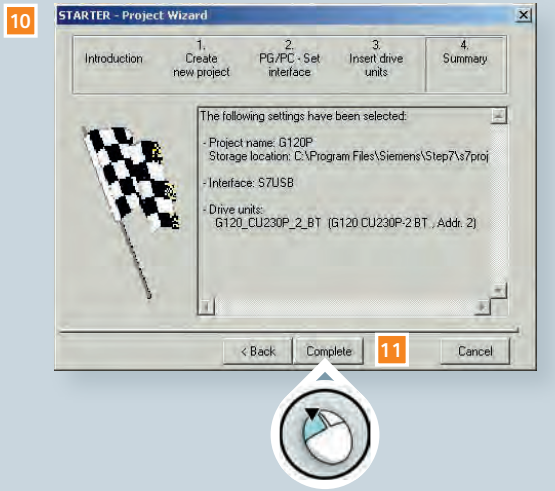
9 Insert drive units (Step 3): The identified variable speed drive is displayed, click “Next”

10 Summary (Step 4): Check the summary

11 Close the project wizard by clicking “Complete”

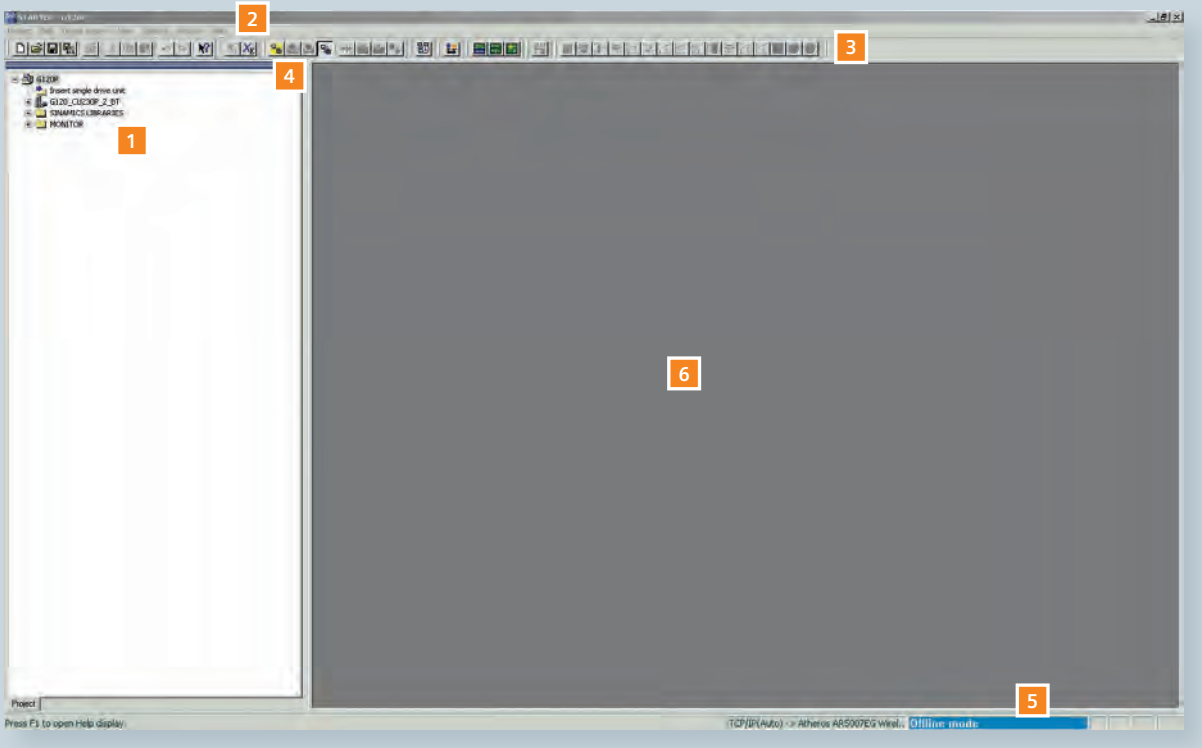
The variable speed drive is now integrated into the project tree and the parameters can be set using the STARTER software.





STARTER user interface

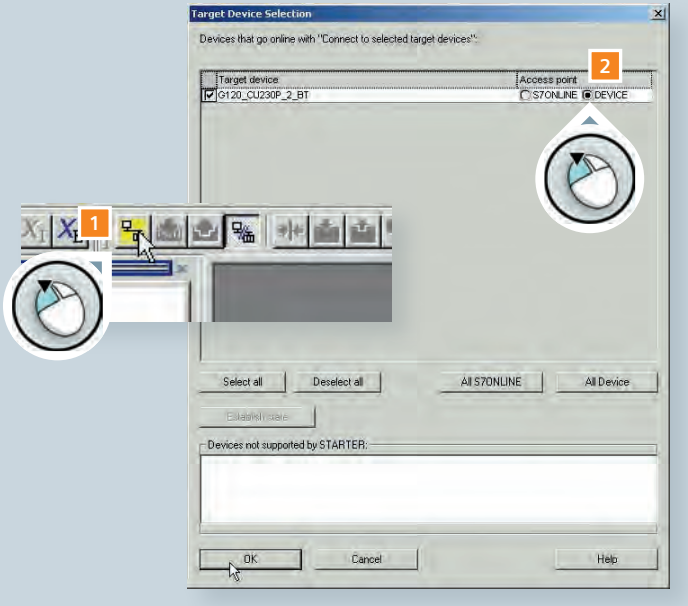
1. Project tree
2. Program menu
3. Toolbar with special features
4. Icon “Connect to selected target devices”
5. Connection mode
6. Work area

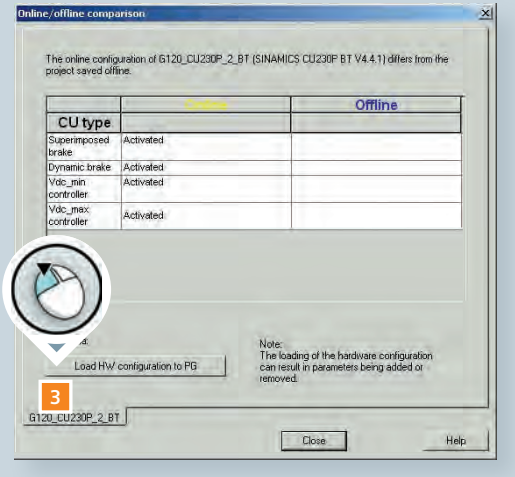


Loading variable speed drive data

Before you can load the actual variable speed drive's data into your project, an online connection between the PC and the variable speed drive has to be established.

1. Click the icon "Connect to selected target devices" in the tool bar and a window appears
2. Set the access point to "DEVICE" and place a checkmark next to the variable speed drive name and click OK
   A connection is now established
3. An online/offline comparison is displayed, click "Load HW configuration to PG" and close the window





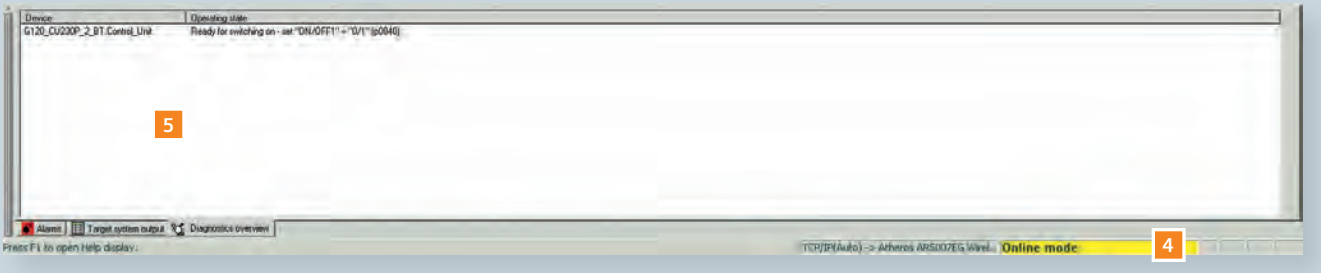
The variable speed drive data is now loaded into the project and an online connection between PC and variable speed drive is established.

4 The blue highlighted “Offline mode” changes to the yellow highlighted “Online mode”

5 The workbench area opens

Workbench area

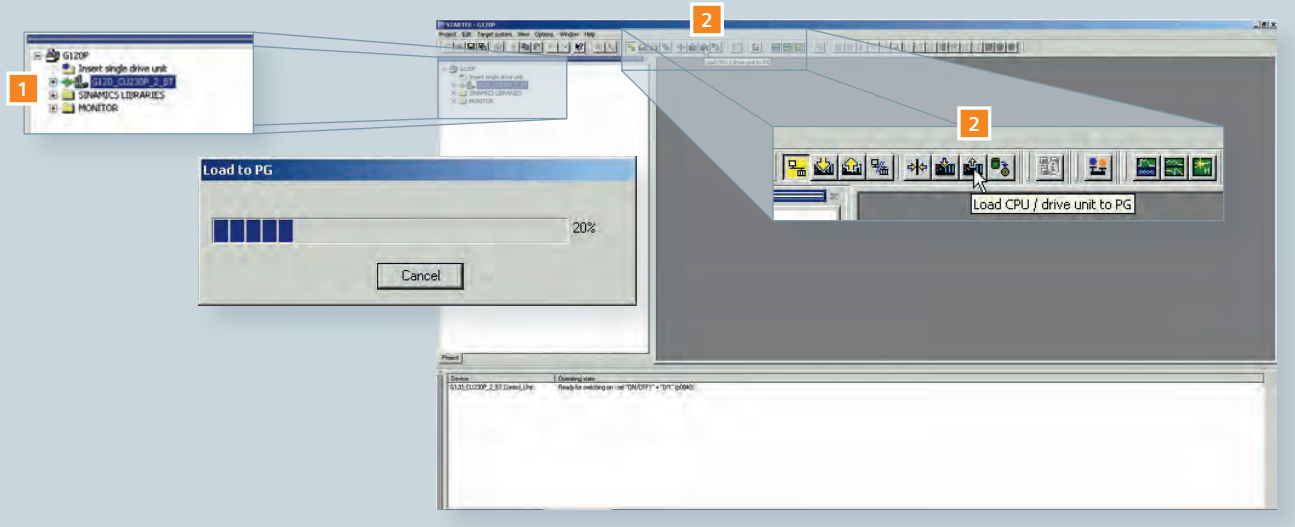
The area provides additional information such as alarms, the target system output and the diagnostics overview. It also stores additional operating features.



3.2 Parameterization

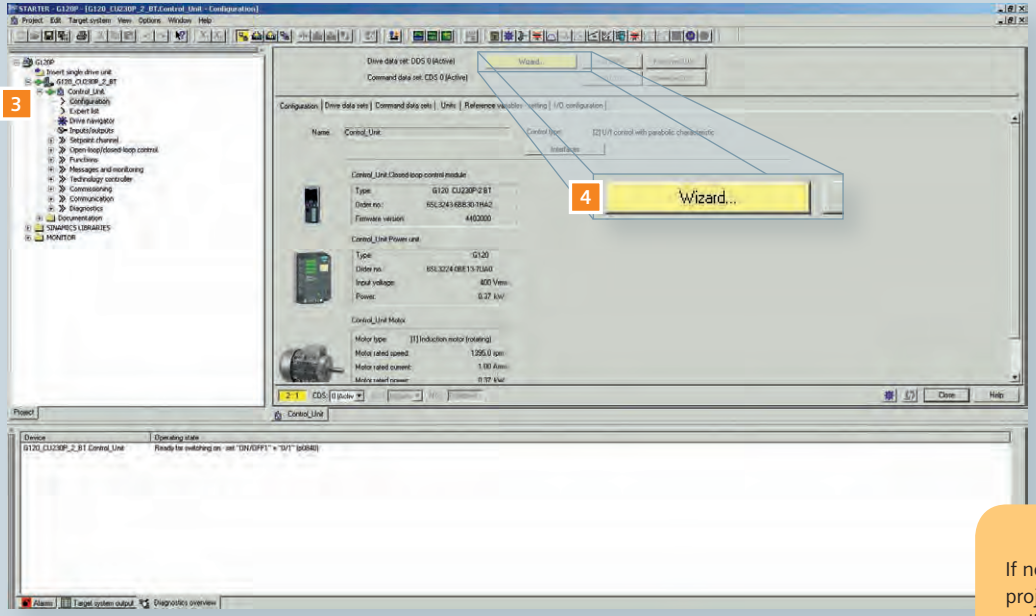
You can now begin to parameterize your variable speed drive.

1. Double-click on the variable speed drive icon in the project tree
2. Click on “Load CPU/drive Unit to PG” in the toolbar and confirm the loading process
   The data set is loaded



3 Open the project tree and double-click “Configuration” under “Control Unit”

4 Click “Wizard ...” in the work area and follow the wizard’s instructions



If no Control Unit appears in the project tree, just go offline and go online again. In most cases this resolves the problem.

We recommend that our example is parameterized in the online mode.

NOTE

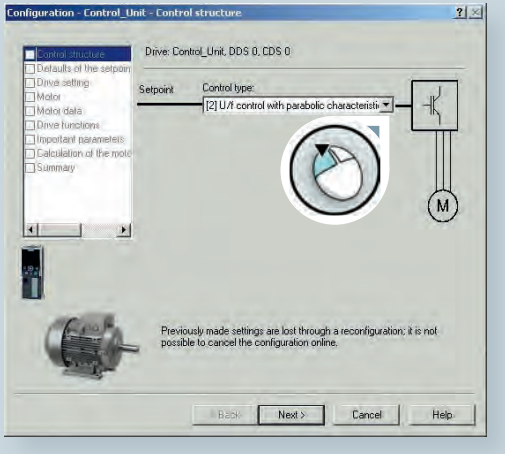
Configuration wizard

The configuration wizard guides you step by step through the following parameters:

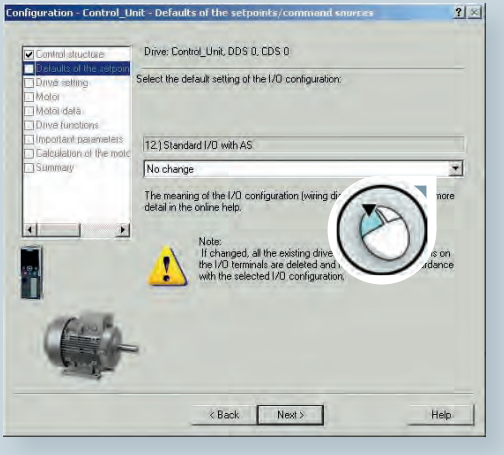
- Control structure
- Defaults of the setpoint and command sources
- Drive setting
- Motor
- Motor data
- Drive functions
- Important parameters
- Calculation of the motor data
- Summary

You move to the next configuration step by pressing “Next”.

1

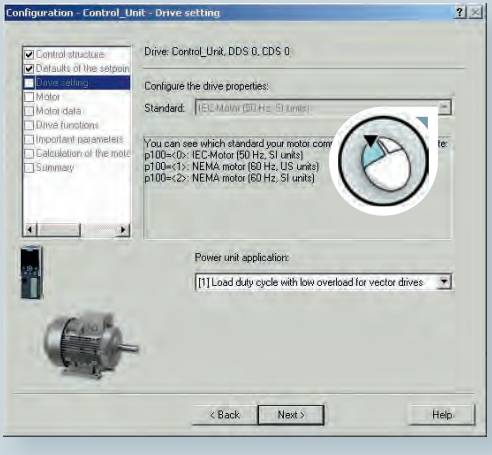


2

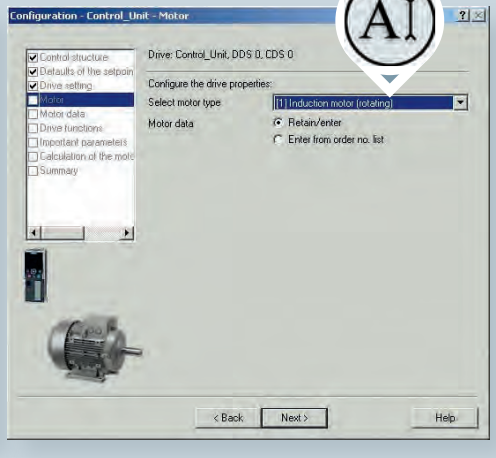


1. Start by setting the control structure: V/f with parabolic characteristic
2. Define the command and setpoint source: Keep the default settings
3. Select the drive settings: Keep the identified drive properties and click “Next”
4. Select the motor type: Induction motor
5. Enter the motor rating plate data

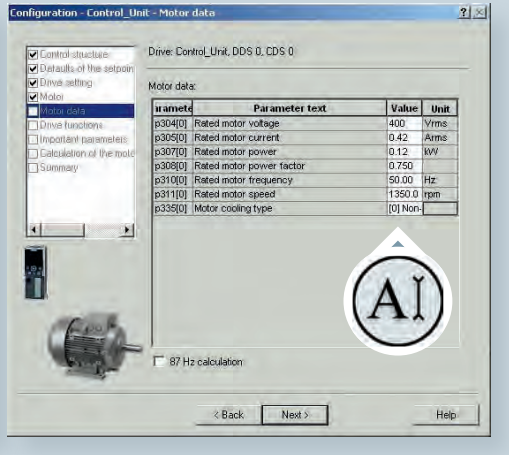
3



4



5



For non-Siemens motors, please enter the motor rating plate data.

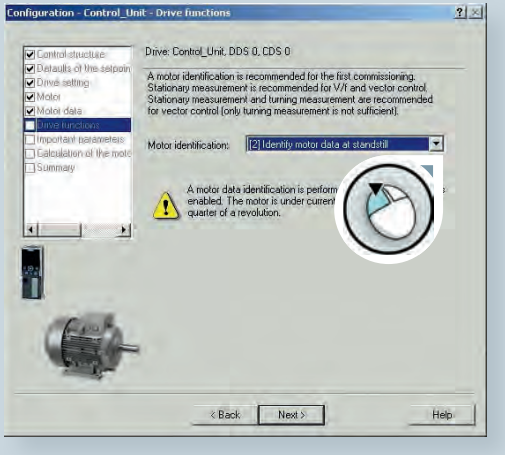
NOTE

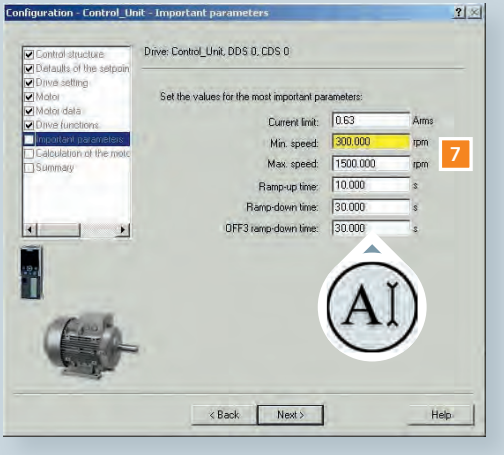
6 Define drive functions: Select “Identify motor data at standstill” for motor data identification

7 Enter important parameters
- Minimum speed: 300 rpm
- Maximum speed: 1500 rpm
- Ramp-up time: 10 s
- Ramp-down time: 30 s
- OFF3-ramp-down time emergency shutdown: 30 s

8 Choose “Calculate motor data only” in the next step

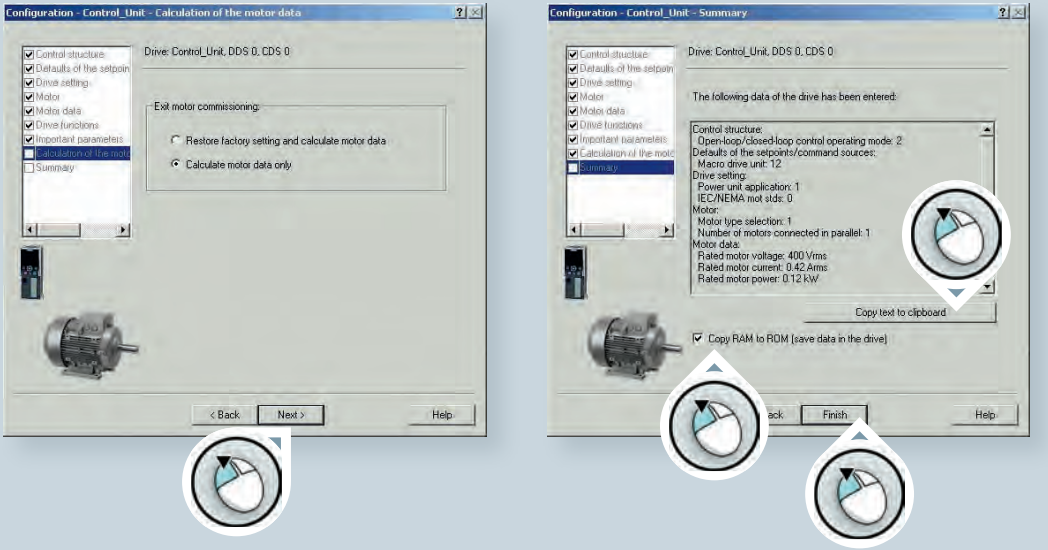
6





After clicking “Next”, you will receive a summary of all the parameter values that have been entered. The summary can be inserted into a text file by pressing the “Copy text to clipboard” button. Finally select “Copy RAM to ROM” to save the parameterization in the variable speed drives EEPROM memory and close the window by clicking finish.

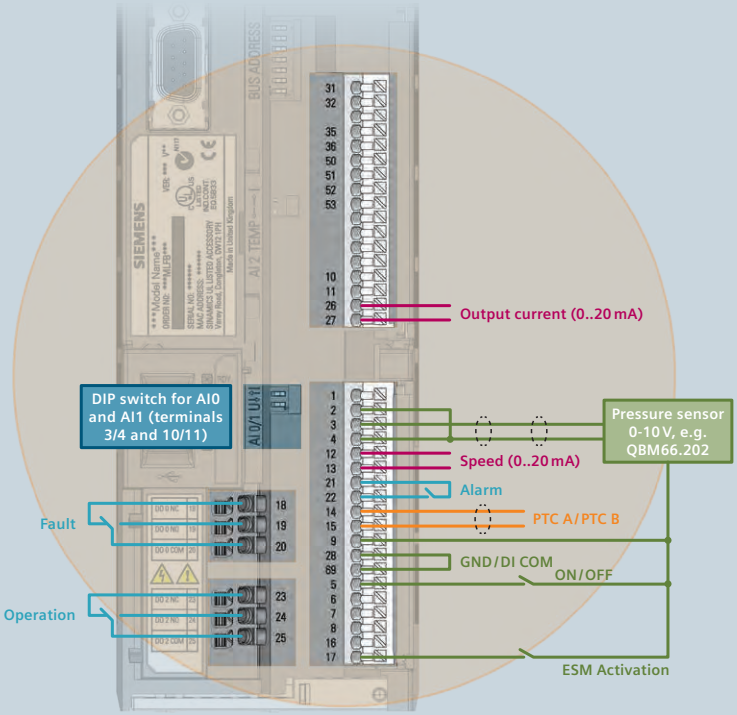
8



3.3 Application cases

In the event of a fire, the G120P can automatically switch over to the essential service mode (ESM), ensuring that the system ignores all external faults and alarms. The goal is to maintain an overpressure condition through ventilation as long as possible so that escape routes are kept free of smoke and doors can still be easily opened. This example shows you how to parameterize a pressure-controlled ventilation combined with ESM operation using the STARTER software.

Wiring example

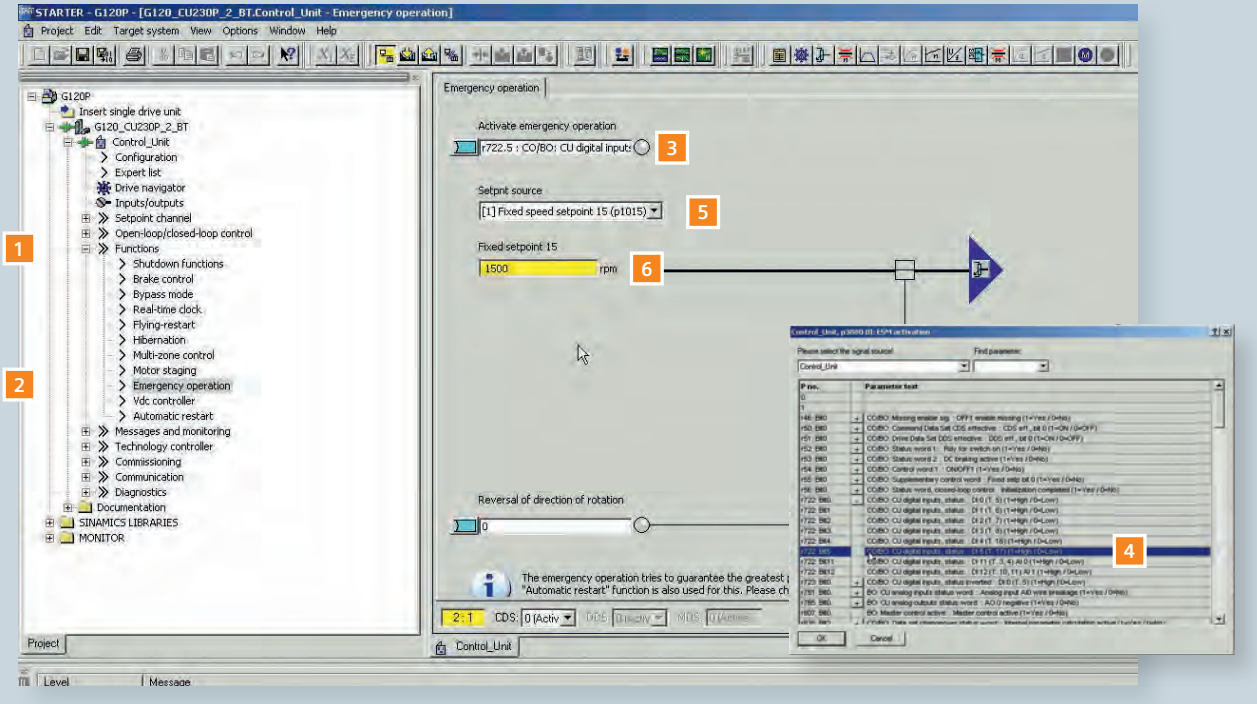


In our example, the ventilation is operated by a proportional-integral-derivative controller (PID).

NOTE

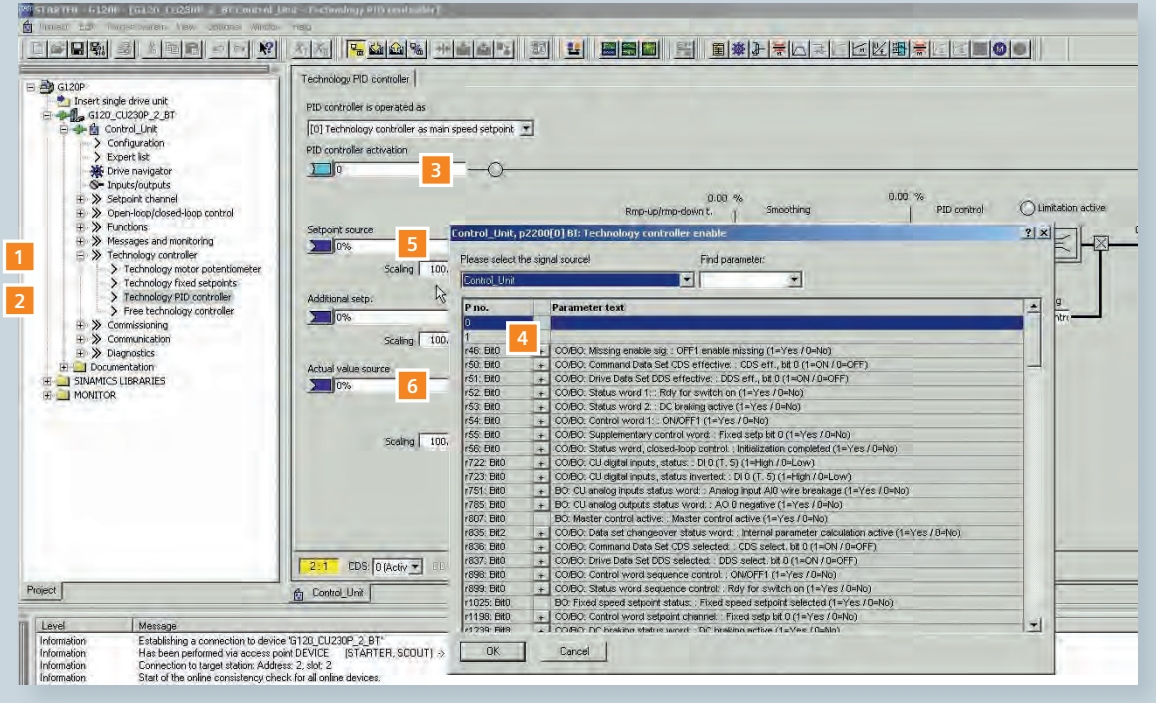
Activating emergency operation

1. Choose “Functions” in the project tree
2. Double-click “Emergency operation”
   Emergency operation opens in the work area
3. Start the parameterization by clicking on the blue binector button next to “Activate emergency operation”
   A list of relevant parameters opens
4. Select parameter r722 for DI 5 corresponding to the wiring example (see wiring example)
   Close the window with OK
5. Define the setpoint source by opening the drop-down menu
   Select “Fixed speed setpoint (p1015)”
6. Enter fixed setpoint: 1500 rpm



Parameterizing the PID characteristic

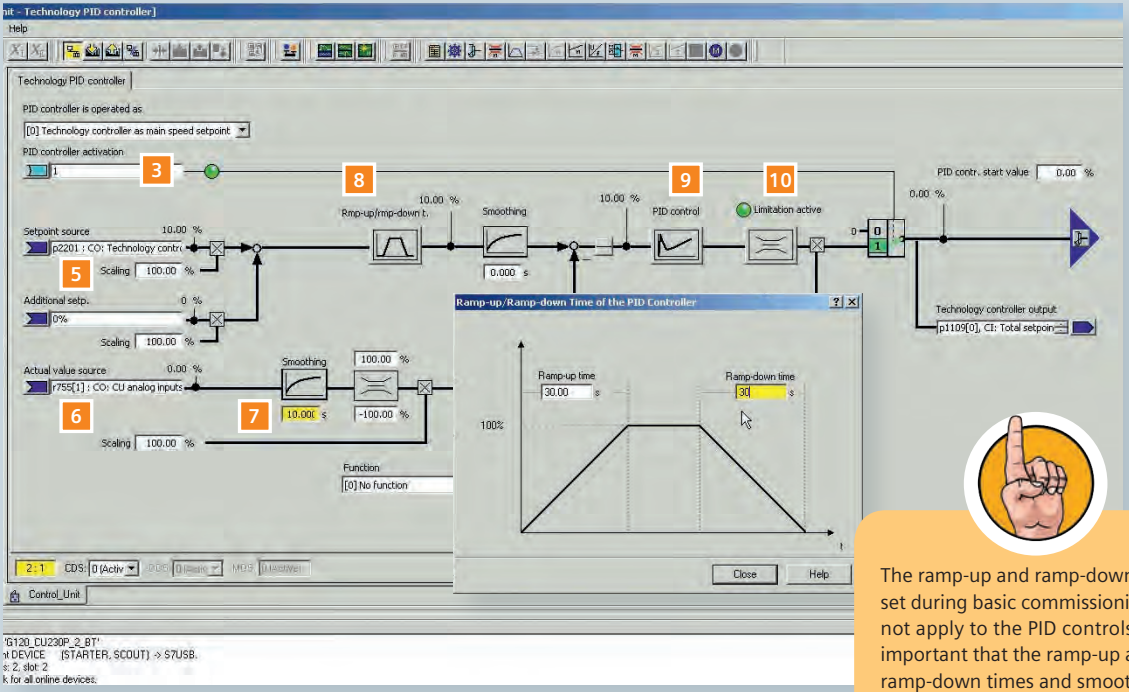
1. Access “Technology controller” in the project tree
2. Select “Technology PID controller”
   The PID controller opens in the work area
3. Start the parameterization by clicking on the blue binector button next to “PID controller activation”
   A window with relevant parameter opens
4. Select 1 for activation and click OK
5. Define the setpoint source by clicking in the appropriate field
   A window with relevant parameters opens
   Choose P2201 for fixed value 1 and click OK



6 Define the actual value source by clicking in the appropriate field
A window with the relevant parameters opens
Select analog input 1 which is saved in r755[1] and click OK

7 Set the smoothing time for the actual value (P2265) by clicking the appropriate field
Enter 10 s

8 Define ramp-up/ramp-down time by clicking in the appropriate field
A window opens
Enter 30 s for both values and close the window



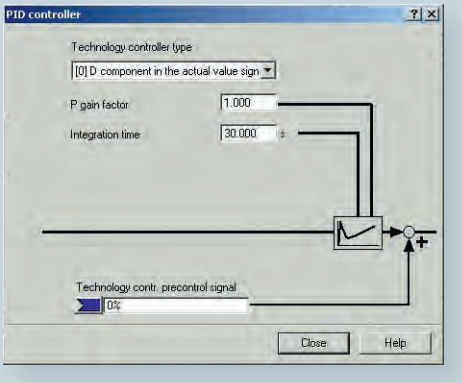
The ramp-up and ramp-down times set during basic commissioning do not apply to the PID controls. It is important that the ramp-up and ramp-down times and smoothing times are set in the PID window.

NOTE

9 PID control parameters can also be adjusted, if required, by clicking the appropriate button
A window with detailed parameters open
No changes are necessary in our example
Close the window by clicking CLOSE

10 Check the output limits by clicking on “Limitation active” and
define a ramp-up / ramp-down time of 30 s.
Close the window by clicking CLOSE

9



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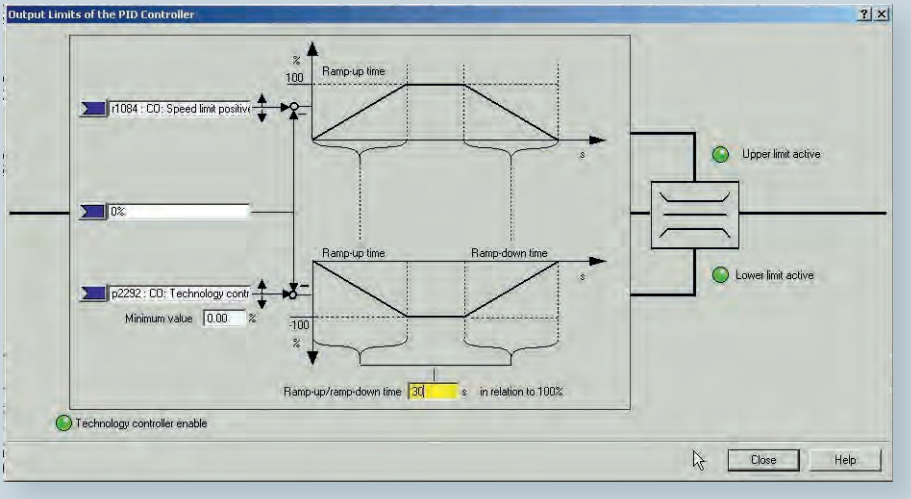
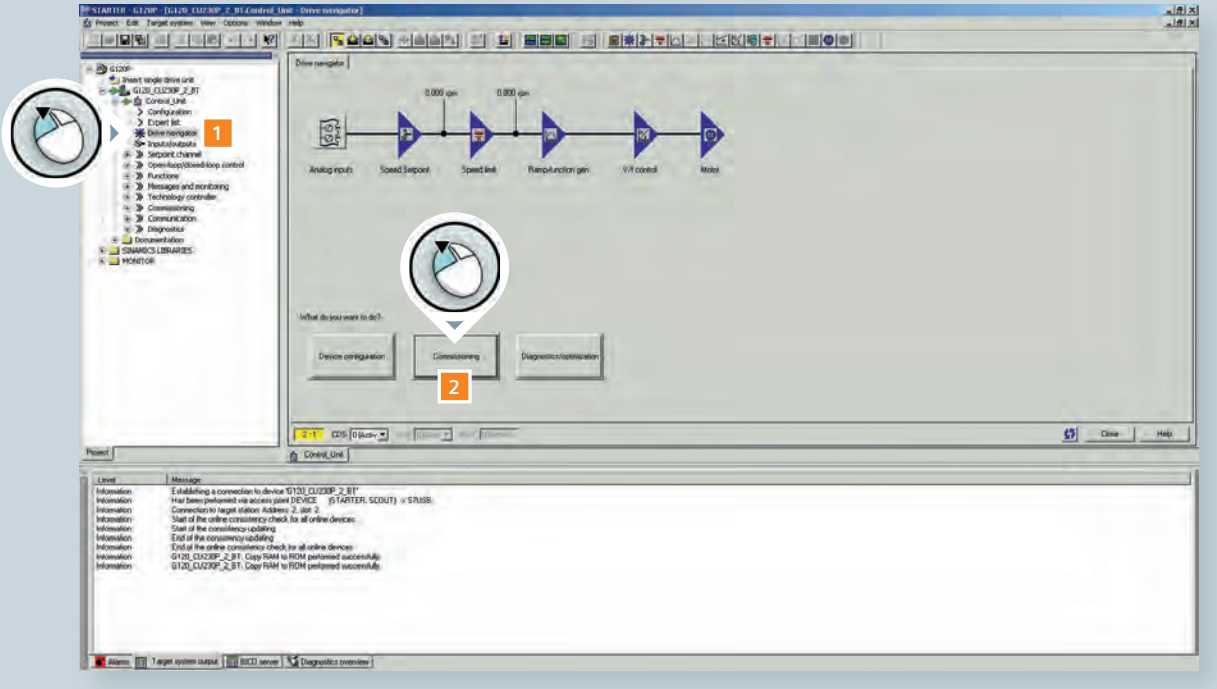


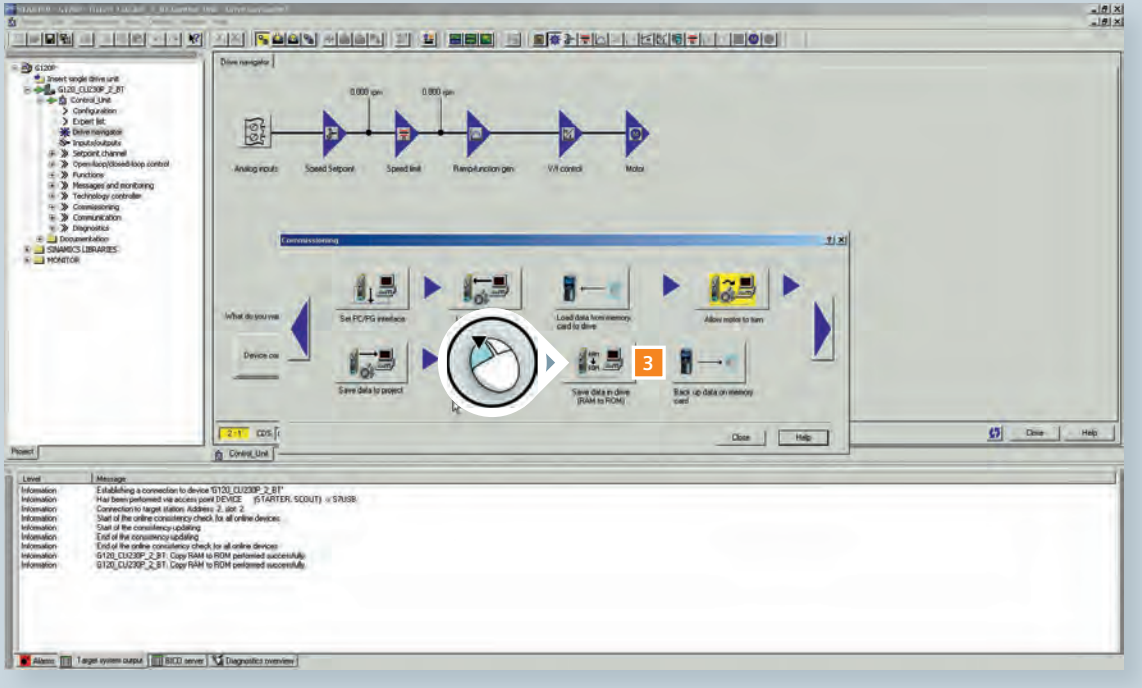
Saving data

A power failure may mean that parameter settings are lost. STARTER offers various possibilities for backing up your parameter settings.

1. Double click the “Drive navigator” in the project tree
2. Select “Commissioning” in the work area



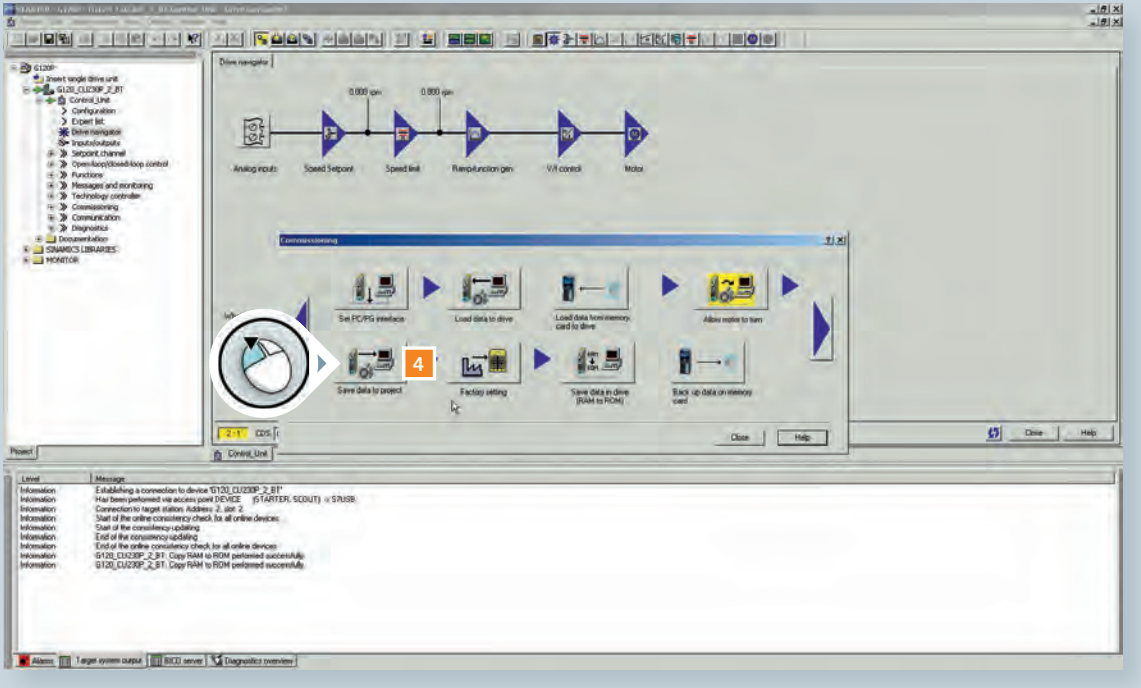
3 Select “Save data in drive (RAM to ROM)” to store the parameter settings in the variable speed drive EEPROM memory



Because you have worked in the online mode, no data whatsoever has been stored in your project on the computer.

4 Click “Save data to project” to save the parameter setting in your project

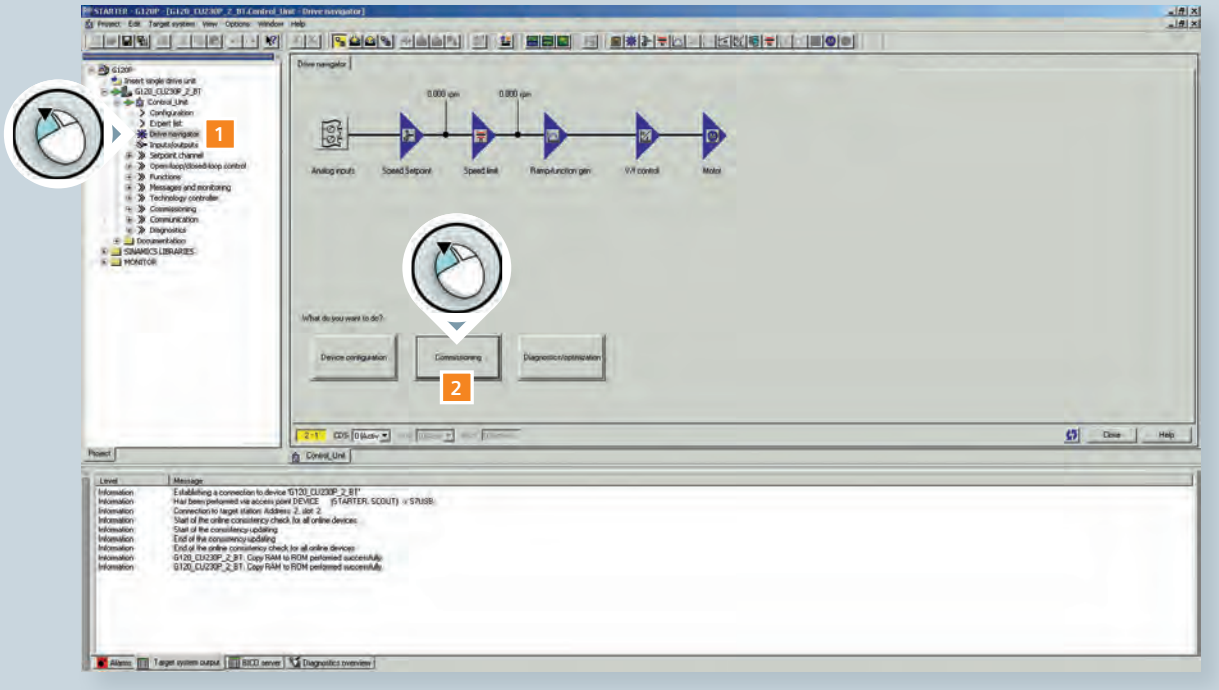
You could now disconnect the online connection to the variable speed drive by clicking the “Disconnect from target system” icon. In our example, please stay online to restore the variable speed drive to its factory settings.



Restoring factory settings

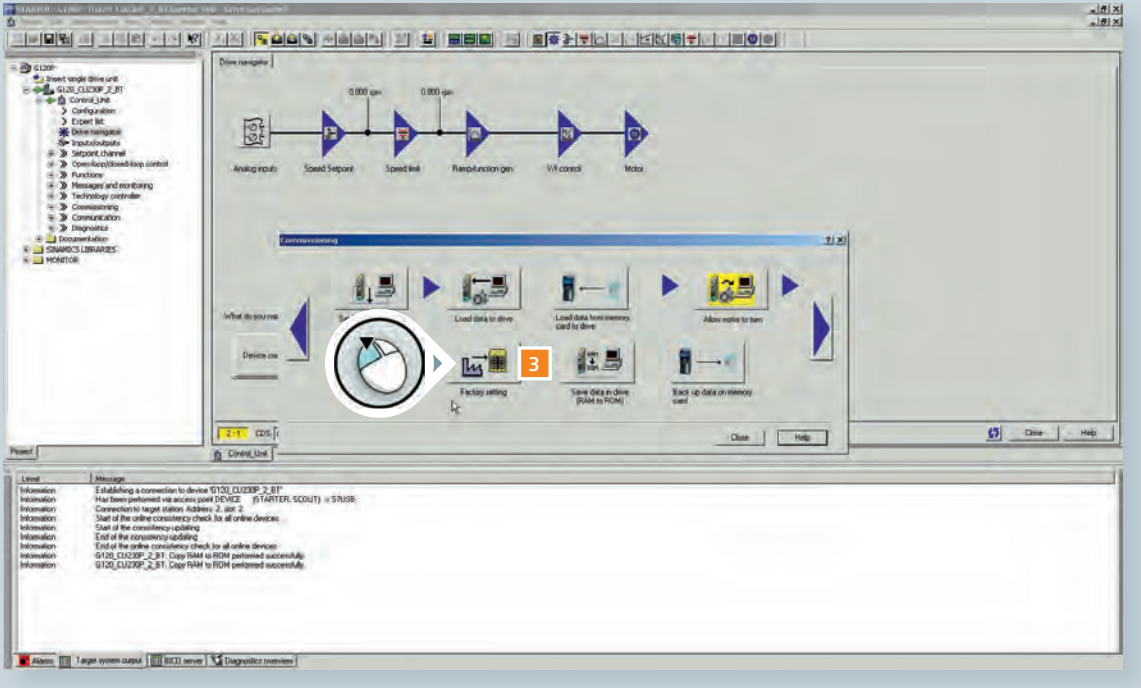
Resetting your variable speed drive to factory settings might be helpful if you have experienced any problems during parameterization.

1. Double-click the “Drive navigator”
2. Select “Commissioning”

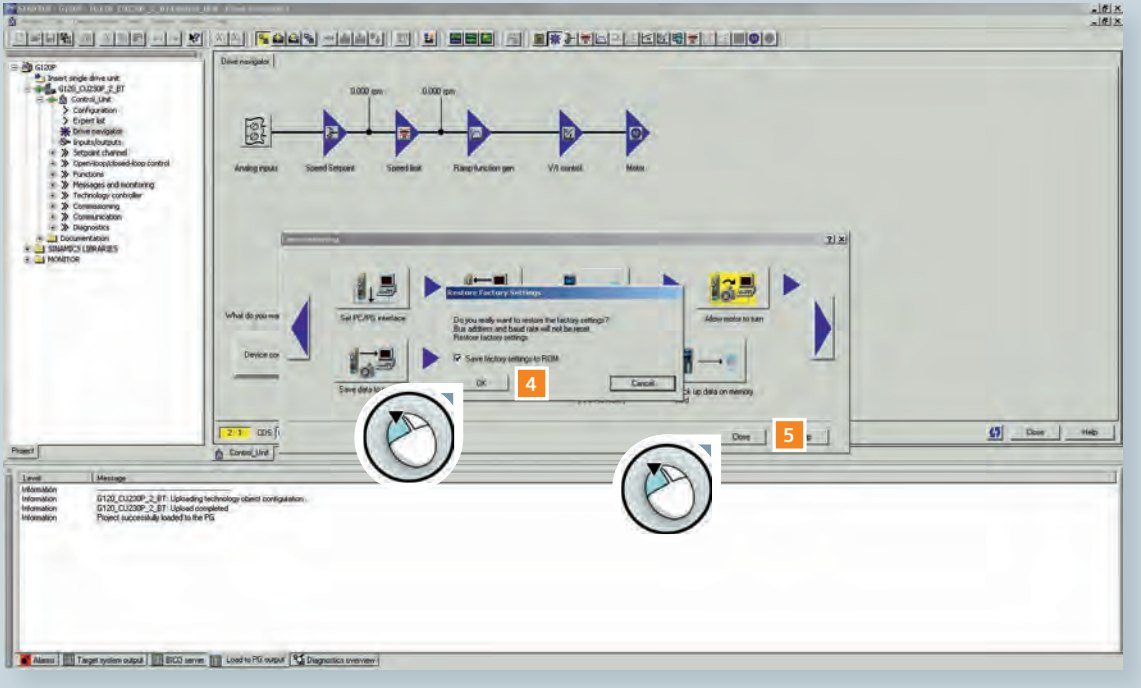


3 Select “Factory settings”

The security prompt that is now displayed lets you know that all settings you have made will be reset. Using the checkbox (“Save factory settings to ROM”) query, you will overwrite the current settings also in the non-volatile EEPROM of the variable speed drive.



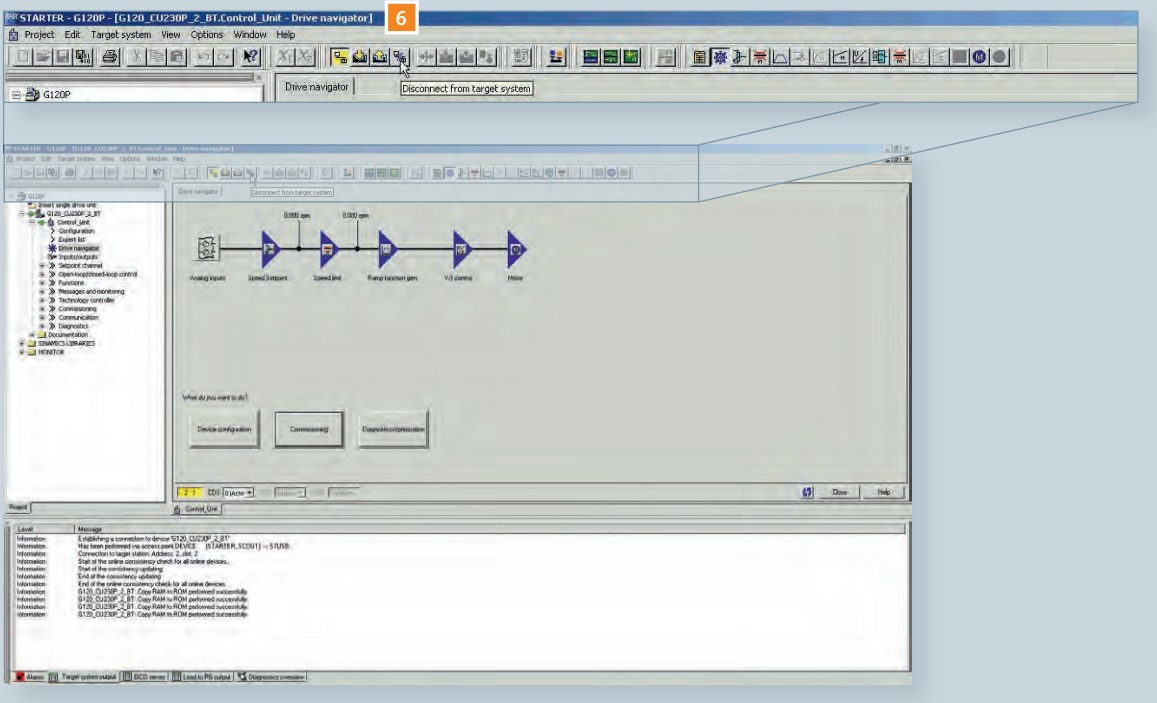
4 Click “OK” to restore all variable speed drive settings to the factory setting
The factory settings are restored



5 Click “Close” to complete the process

6 Click “Disconnect from target system” to finally complete the process

You now know how to use STARTER to easily and clearly insert your variable speed drive into a project, set its parameters, and commission it. Please make sure that you always remember to save the parameter data to the variable speed drive and in the software before exiting a project.



Congratulations!
You have mastered the SINAMICS G120P Training Booklet. Thank you for your time and efforts. We hope that this tutorial addressed all of your questions and was useful to you. More detailed information can be found online at www.siemens.com/G120P.

Notes

Notes

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The information in this document contains general descriptions of technical options available, which do not always have to be present in individual cases. The required features should therefore be specified in each individual case at the time of closing the contract.

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www.siemens.com/G120P