

Simple speed control with SINAMICS G120

SINAMICS G120C

https://support.industry.siemens.com/cs/ww/en/view/109759700

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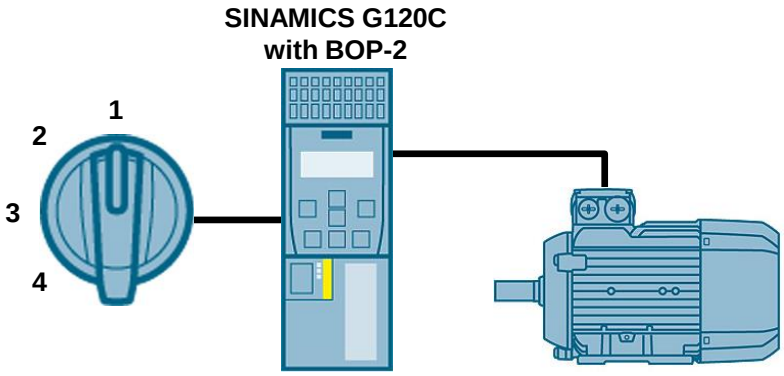
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1 Introduction

1.1 Overview

Speed control is an essential part of many automation tasks. SINAMICS drives can be used to solve a large number of these automation tasks. This application example is intended to enable you to implement simple "standalone" speed control with just one inverter. The main focus of this application example is "ventilation", but under certain circumstances the solutions given here can also be used for pumps and other applications.

Figure 1-1: Automation task



You can use this example for the following tasks, among others:

- Stable / greenhouse ventilation
- Exhaust air from workshops, machine rooms, canteen kitchens, soldering and welding systems.
- Intermittent ventilation of large rooms
- Blower
- Vacuum / overpressure chambers

1.2 Principle of operation

In most cases, the power of a fan is controlled by its speed. The speed of the fan motor is set via an inverter. A toggle switch is used to set the speed in four steps:

1. The motor is switched off.
2. The motor is activated at low speed.
3. The motor is activated at medium speed.
4. The motor is activated at high speed.

The digital inputs of the SINAMICS G120 are addressed via the toggle switch and one of the parameterized speeds and thus the fan power is selected. The SINAMICS inverter then controls the motor at the selected speed.

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1.3 Components used

This application example was created with the following hardware components:

Table 1-1: components used

Components	Quantity	Article number	Note
SINAMICS G120C	1	6SL3210-1KE11-8UB1	Nominal power: 0.55kW Choose a service that meets your requirements.
SINAMICS BOP-2	1	6SL3255-0AA00-4CA1	-
Asynchronous motor	1	1LA7060-4AB10-Z	Alternatively, you can also use another asynchronous motor.
SIRIUS toggle switch			
Rotary knob	1	3SU1000-2AS60-0AA0	Versions also available in metal.
Holder	1	3SU1500-0BA10-0AA0	
Contact module (1 NO contact)	1	3SU1400-1AA10-1BA0	
Contact module (2 NO contacts)	2	3SU1400-1AA10-1DA0	

Note An overview of the SIRIUS control and signaling devices can be found in the catalog IC 10 "SIRIUS Industrial Switchgear":

https://support.industry.siemens.com/cs/ww/en/view/109747945

The following table contains all the files used in this application example.

Table 1-2: Example files and projects

Components	Note
109759700_simple_nReg_with_SINAMICS_G120C_DOCU_v10_en.pdf	This document.

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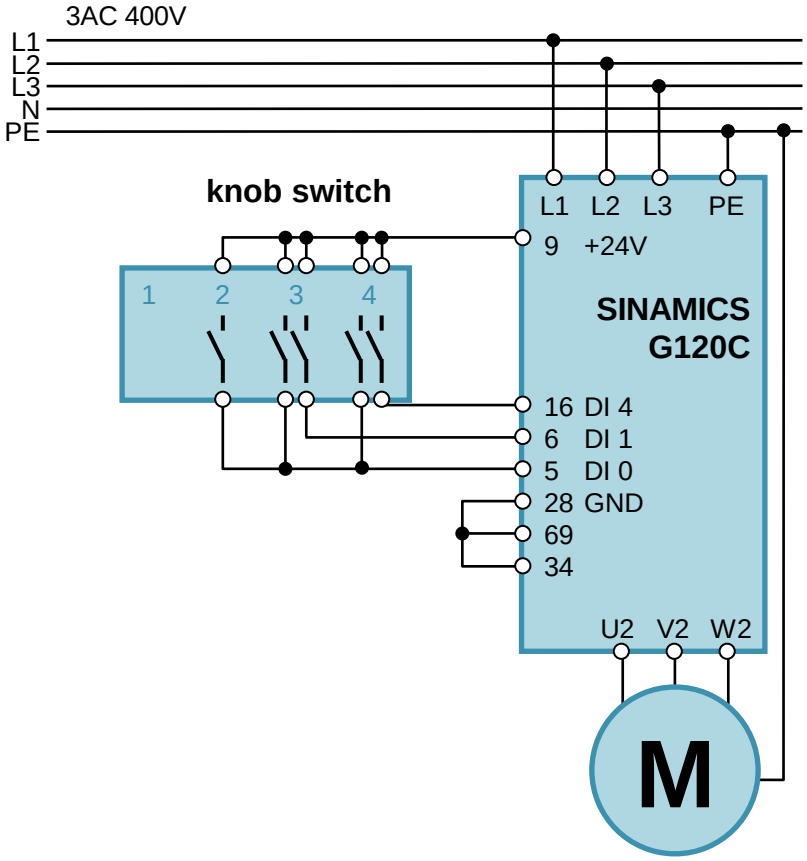
2 Engineering

2.1 Hardware setup

2.1.1 Wiring the SINAMICS

The following figure shows the structure of the SINAMICS G120C and the connection of the SIRIUS toggle switch.

Figure 2-1: Hardware structure of the SINAMICS G120C



Note Guidelines for the assembly and installation of the SINAMICS G120C drive can be found in the operating instructions:

https://support.industry.siemens.com/cs/ww/en/view/109757226

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2.1.2 Basic Operator Panel

The SINAMICS frequency inverter is parameterized using the "SINAMICS G120 Basic Operator Panel 2" (BOP-2). With this panel you parameterize the drive and acknowledge fault messages.

Note A detailed description of the "SINAMICS Basic Operator Panel" (BOP-2) can be found in the operating instructions:

https://support.industry.siemens.com/cs/ww/en/view/109483379

Figure 2-2: Basic Operator Panel

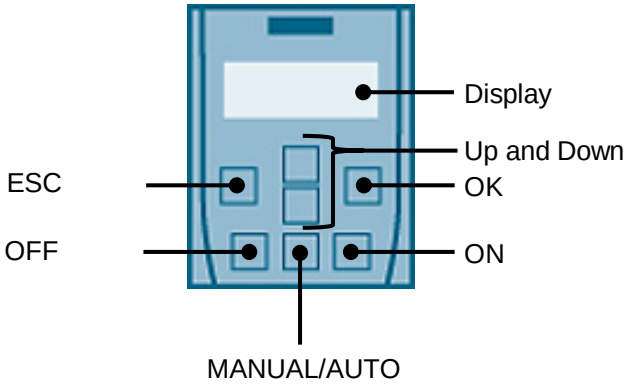


Table 2-1: Function of the keys

Key	Function
ESC	If the button is pressed for less than 2 seconds, the BOP-2 will return to the previous screen or, if a value has been changed, the new value will not be saved. If the button is pressed for more than 3 seconds, the BOP-2 returns to the status screen.
OPEN	When navigating through a menu, the available screens are scrolled by pressing the up key. When changing a parameter value, the displayed value is increased by pressing the key.
QB	When navigating through a menu, the available screens are scrolled by pressing the down key. When changing a parameter value, the displayed value is reduced by pressing the key.
OK	When navigating through the menus, pressing the OK button confirms the selection of a menu command. When working with parameters, pressing the OK key allows the parameter to be changed. Pressing the OK button again confirms the entered value and the previous screen is displayed again. In the error screen, the key is used to clear errors.
OFF	In AUTO mode, pressing the OFF button has no effect and is ignored. If the key is pressed for more than 2 seconds, the inverter will execute the OFF2 command and the motor will coast to a standstill.

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Key	Function
MANUAL/ AUTO	Pressing the MANUAL/AUTO key while MANUAL mode is active switches the inverter to AUTO mode and disables the ON and OFF keys. Pressing the MANUAL/AUTO key while the AUTO mode is active switches the inverter to MANUAL mode and the ON and OFF keys are activated.
ON	The ON key is not active in the AUTO operating mode. Pressing this key is ignored. The inverter is started in MANUAL mode. The symbol for the running drive is displayed on the inverter.

Plug the Basic Operator Panel BOP-2 into the inverter.

To connect the Basic Operator Panel BOP-2 to the inverter, proceed as follows:

Table 2-2: Plug BOP-2 into inverter

Step	Description
1.	Remove the inverter dummy cover.
2.	Insert the bottom edge of the BOP-2 enclosure into the appropriate recess in the inverter enclosure.
3.	Press the BOP-2 on the inverter until the BOP-2 clicks audibly into place on the inverter housing.

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2.2 Commissioning the drive

The parameterization of the SINAMICS G120C is done with the SINAMICS G120 Basic Operator Panel 2 (BOP-2). With the BOP you can access all relevant parameters of the actuator and make settings. The parameterization in this application example is divided into the following steps:

- Step 1: Carry out quick commissioning of the drive
- Step 2: Parameterization of the drive's mode of operation

Note A detailed description of the commissioning of the SINAMICS G120C drive can be found in the operating instructions:

https://support.industry.siemens.com/cs/ww/en/view/109757226

2.2.1 Step 1: Quick commissioning

A quick commissioning must be carried out before parameterizing the drive. Selected parameters of the drive are set to defined values.

Requirements:

- The supply voltage is switched on.
- The BOP-2 displays setpoints and actual values (after switching on the actuator).

Make the factory settings for the drive

Table 2-3: Start of commissioning

Step	Description
1.	Press the ESC key on the BOP-2.
2.	Press one of the arrow keys until the BOP-2 displays the SETUP menu.
3.	To start the quick commissioning, press the OK key in the "SETUP" menu.
4.	"RESET" appears on the display. Press the OK button.
5.	Use an arrow key to change the display: NO → YES
6.	Press the OK button. (The drive carries out a factory setting)

Enter motor data

The inverter is factory-set to an asynchronous motor suitable for the rated power of the SINAMICS G120C used. Check and, if necessary, change the motor data parameters.

The data of the motor you are using can be found on the nameplate.

Figure 2-3 : Nameplate of a standard asynchronous motor

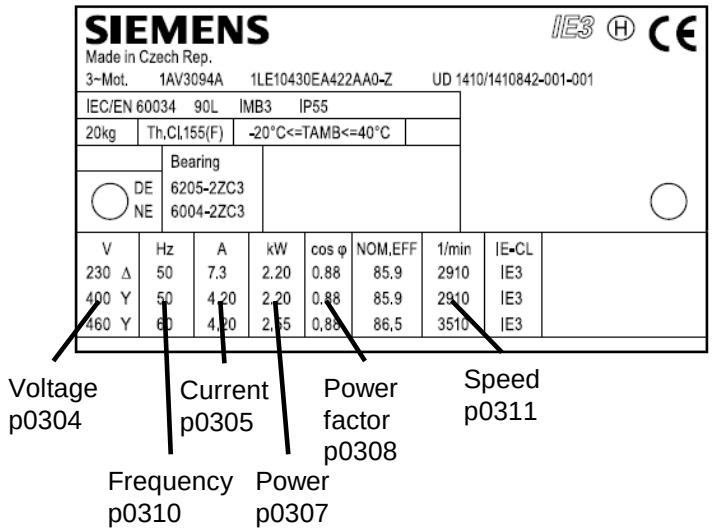


Table 2-4: Parameters for entering motor data

Step	Parameters	Description
1.	p0096	Enter the value 1 for "Standard Drive Control" in parameter p0096 (application classes).
2.	p0100	Parameter p0100 defines the motor standard. 0: IEC motor (50 Hz) 1: NEMA-Motor (60 Hz)
3.	p0210	Enter the device connection voltage in parameter p0210.
4.	p0300	In parameter p0300 you select the type of motor: 1: asynchronous motor
5.	p0304	Entry of the rated voltage from the motor nameplate.
6.	p0305	Entry of the rated current from the motor nameplate.

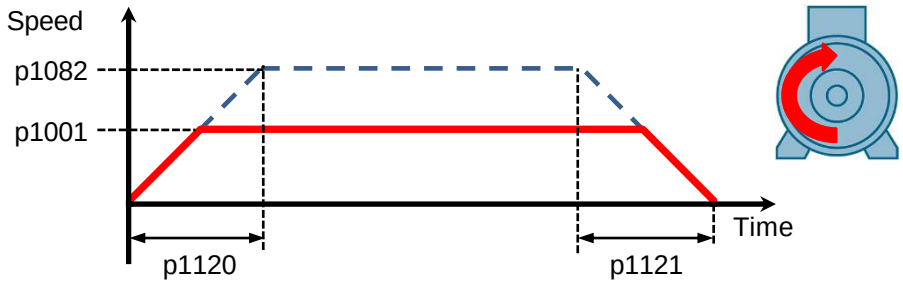
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Step	Parameters	Description
7.	p0307	Entry of the rated power from the motor nameplate.
8.	p0308	Entry of the power factor (cos φ) from the motor nameplate.
9.	p0310	Entry of the rated frequency (in Hz) from the motor nameplate.
10.	p0311	Entry of the rated speed from the motor nameplate.
11.	p0335	Entry of the engine cooling type: 0: self-cooling 1: forced cooling 2: liquid cooling 128: no fans
12.	p0501	Leave the parameter p0501 (Technological application) at the value 0.
13.	p0015	Set parameter p0015 (macro drive unit) to value 3 (see Table 2-6).
14.	p1080	Leave the parameter p1080 (minimum speed) at the value 0 1/min.
15.	p1082	If you require a speed >1500 1/min, increase the parameter p1082 (maximum speed) accordingly.
16.	p1120 p1121	Parameters p1120 (acceleration time) and p1121 (deceleration time) allow you to influence the acceleration and deceleration behavior of the drive.
17.	p1135	Leave parameter p1135 (OFF3 return time) at the value 0.
18.	p1900	The default setting for motor data identification is p1900 = 2. If drive releases are present, motor data identification is carried out at standstill with the next switch-on command. The motor carries current and can align up to a quarter turn. The setting p1900 = 0 locks the motor data identification.

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The acceleration and deceleration time is entered in seconds and refers to the maximum speed of the motor (p1082). The extended acceleration and deceleration behavior of the drive protects the mechanics.

Figure 2-4: Ramp-up and ramp-down time



After setting parameter p1900, the display of the BOP-2 shows "FINISH". Now complete the quick commissioning.

Table 2-5: End of commissioning

Step	Description
1.	Use an arrow key to change the display: NO → YES
2.	Press the OK button.

Macro settings

The drive is parameterized by selecting a macro in parameter p0015. By selecting a macro, the functions of the digital and analog inputs and outputs are defined in the SINAMICS drive.

In this application example, the default setting 3 of the macro was selected.

Table 2-6: Settings by selecting Macro 3

Terminal	Function	Description
5	Digital input DI 0	ON/OFF with fixed speed reference 1
6	Digital input DI 1	Fixed speed setpoint 2
7	Digital input DI 2	Acknowledge fault
16	Digital input DI 4	Fixed speed setpoint 3
17	Digital input DI 5	Fixed speed setpoint 4
18	Digital output DO 0	Fault
21	Digital output DO 1	Warning
12	Analog output AO 0	Actual speed value

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2.2.2 Step 2: Parameterization of the mode of operation

To enter the parameter settings, switch to the "Parameters" menu. Press the arrow keys until the term "PARAMS" appears in the BOP-2 display.

Then leave the filtering of the parameters at "Expert". Now you can switch between the parameters of the drive with the arrow keys.

The speed reference values are specified in the drive parameterization.

Table 2-7: Configuration

Step	Parameters	Description
1.	p1001	With the parameters p1001 to p1003 (fixed speed setpoint 1 to 3) you define the speed of the drive in revolutions per minute (1/min). (see section 2.3)
2.	p1002	
3.	p1003	

Save to EEPROM

By storing the parameterization in the non-volatile memory (EEPROM) of the frequency inverter, the settings are retained even after a power failure.

Table 2-8: save to EEPROM

Step	Parameters	Description
1.	p0971	Set the value of parameter p0971 (Save parameter) to 1.
2.	-	Wait until parameter p0971 displays the value 0 again.

Note A list of all parameters of the SINAMICS G120C drive can be found in the list manual:

https://support.industry.siemens.com/cs/ww/en/view/109751318

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2.3 Operation



WARNING

Make sure that the moving drive does not pose a danger to persons or system sections.

Take appropriate measures to prevent the drive from going beyond technically or mechanically specified limits.

After the drive has been parameterized, operation takes place via the toggle switch. This has four switch positions in this application example.

Table 2-9: Switch positions of the toggle switch

Switch position of the toggle switch	Meaning
1	The motor is switched off.
2	The motor is switched on and moves with the fixed speed setpoint 1 (p1001).
3	The motor is switched on and moves with the sum of the fixed speed reference 1 (p1001) and the fixed speed reference 2 (p1002).
4	The motor is switched on and moves with the sum of the fixed speed reference 1 (p1001) and the fixed speed reference 3 (p1003).

Note that the motor data is determined after the SINAMICS G120C drive is switched on for the first time. (with setting p1900 = 2)

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2.4 Error handling

2.4.1 LED display

The operating status of the SINAMICS drive is indicated by the RDY indicator (LED).

Table 2-10: LED display of operating states

RDY-LED	Meaning
yellow	Temporary state after switching on the supply voltage.
green	The inverter is trouble-free.
green (flashing)	Commissioning or resetting to factory settings.
red	Firmware update is active.
red (flashing)	A fault is active.

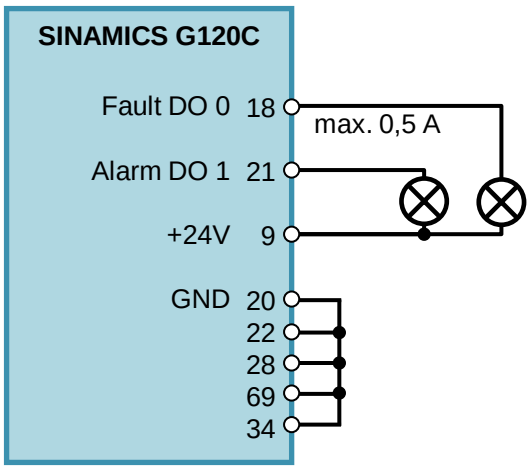
The drive indicates an error by signaling the corresponding fault or warning. This message appears on the BOP display. The warning or fault value describes the cause of the fault.

Note A list of the error and warning messages of the SINAMICS G120C drive can be found in the list manual:

https://support.industry.siemens.com/cs/ww/en/view/109751318

An existing fault or warning is also indicated by the activation of the corresponding digital output.

Figure 2-5: Use of the digital outputs



2.4.2 Warnings

Warnings have the following properties:

- Incoming warnings have no direct effect on the inverter.
- Warnings go away again when the cause has been eliminated.
- Warnings do not have to be acknowledged.
- Warnings are displayed on the BOP-2 with Axxxxx.

2.4.3 Faults

Faults have the following characteristics:

- In general, a fault will cause the motor to shut down.
- A fault must be acknowledged.
- Faults are indicated on the BOP-2 with Fxxxxx.

Confirm a repaired fault with the following measures:

- Press the OK key on the Basic Operator Panel 2 (BOP-2).
- Activation of the digital input DI 2 of the SINAMICS drive.

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3 Appendix

3.1 Service and support

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3.2 Links and literature

Table 3-1

Nr.	Thema
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to this entry page of this application example https://support.industry.siemens.com/cs/ww/en/view/109759700
\3\	Operating Instructions SINAMICS G120C https://support.industry.siemens.com/cs/ww/en/view/109757226
\4\	List Manual SINAMICS G120C https://support.industry.siemens.com/cs/ww/en/view/109751318
\5\	Operating Instructions Basic Operator Panel 2 https://support.industry.siemens.com/cs/ww/en/view/109483379

3.3 Change documentation

Table 3-2

Version	Date	Modifications
V1.0	09/2019	First version

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