Training Booklet
V2.0

SINAMICS G120
Answers for industry.

SIEMENS
The booklet is an easy to understand introduction to the inverter family SINAMICS G120.

09/2010
E80001-Y910-P210-X-7600
**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 the following three order alternatives:

<table>
<thead>
<tr>
<th>Product</th>
<th>Order-no.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Starter Kit</strong></td>
<td></td>
</tr>
<tr>
<td>Starter Kit SINAMICS G120</td>
<td>6SL3200-0AE20-0AA0</td>
</tr>
<tr>
<td>Motor (0.55 kW)</td>
<td>1LA7096-4AA10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Training case</strong></td>
<td></td>
</tr>
<tr>
<td>SINAMICS G120 training case*</td>
<td>6ZB2480-0CJ00</td>
</tr>
<tr>
<td>SINAMICS G120 CU240E-2 Control Unit</td>
<td>6SL3244-0BB12-1BA0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Single components</strong></td>
<td></td>
</tr>
<tr>
<td>SINAMICS G120 PM240-2 FSA 0.55kW</td>
<td>6SL3210-1PE12-3AL0</td>
</tr>
<tr>
<td>SINAMICS G120 CU240E-2</td>
<td>6SL3244-0BB12-1BA0</td>
</tr>
<tr>
<td>Motor (0.55 kW)</td>
<td>1LA7096-4AA10</td>
</tr>
<tr>
<td>SINAMICS PC Connection Kit-2</td>
<td>6SL3255 0AA00 2CA0</td>
</tr>
<tr>
<td>SINAMICS BOP-2</td>
<td>6SL3255 0AA00 4CA1</td>
</tr>
<tr>
<td>Screening kit 2</td>
<td>6SL3264-1EA00-0HA0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product</th>
<th>Order-no.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Optional components</strong></td>
<td></td>
</tr>
<tr>
<td>IOP/BOP-2 door mounting kit</td>
<td>6SL3256-0AP00-0JA0</td>
</tr>
</tbody>
</table>

In addition you will need the following equipment:

- PC 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 converter, switches, lights, and a 230V power supply connection.
**Safety instructions**

**Validity**

These instructions apply to the following inverter:

<table>
<thead>
<tr>
<th>Product</th>
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</tr>
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<tbody>
<tr>
<td>Starter Kit SINAMICS G120</td>
<td>6SL3200-0AE20-0AA0</td>
</tr>
</tbody>
</table>

**Prerequisites**

You are proficient in working with the Microsoft® Windows™ operating system.
You are conversant with 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 (for example, 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. Commissioning and operation of a device/system may only be performed by qualified personnel. 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.

**Disclaimer of Liability**

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.
Welcome to the SINAMIC G120 Training Booklet. This booklet will help acquaint you simply, quickly, and comfortably with the frequency inverter. We’ll take you step by step through installation, setting parameters, and initial start-up. The tutorial is structured so that each section builds on the one before it. As a result, we recommend that you don’t skip any chapters.
# Inverter family SINAMICS G120

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In this section we will introduce the low-voltage SINAMICS G120 inverter. You’ll learn about the main components, its structure, and receive some practice-oriented insight about the assembly and wiring of the frequency inverter.
Inverter family SINAMICS G120
1.1 Components

The SINAMICS G120 frequency inverter is modular. It consists of three basic components:

1. The Power Module supplies voltage to the motor.

2. The Control Unit controls and monitors the Power Module.
Each Control Unit can be freely combined with each IP20 Power Module.

3

The Basic Operator Panel (BOP-2) and the Intelligent Operator Panel (IOP) are used to operate and monitor the inverter.

The optional PC Connection Kit-2 can also be used to operate and monitor the inverter. The kit is required in order to establish communication between the PC and the Control Unit.
**Power Module**

The device is available in several sizes. Its power range is between 0.37 kW and 250 kW. The picture shows the PM240-2.

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**Note**

Please check the rating plate to make sure that the module meets your required specifications.
Control Unit

There are various designs for the Control Unit. They differ primarily in terms of the control terminal assignments as well as in terms of different field bus interfaces. This tutorial will use the example of the CU240E-2 Control Unit. It was developed for stand-alone operation.

1. Rating plate
2. DIP switch, analog inputs, and BUS
3. Interface for the OP or PC Connection Kit
4. Two status LEDs
5. Terminals for digital and analog inputs and outputs
6. USB interface
7. Interface to the Power Module
8. Fastening clips

Please ensure that this is the correct device for your application.

An overview of the various control unit versions and their differentiation can be found in the official SINAMICS G120 brochure at http://www.siemens.com/sinamics-g120/printmaterial
**Basic Operator Panel 2**

The basic input and display device is used to operate and set parameters for the inverter after being connected to the Control Unit. It is operated by pressing the buttons and features a simple commissioning thanks to the menu prompting and the two-line display (showing parameter and parameter value simultaneously).

**Intelligent Operator Panel**

The advanced input and display device manages the same functions as the BOP-2 and adds several more. Its enhanced features increase usability substantially. They include a large plain text display, integrated application wizards, full graphical diagnostic overviews, rotary knob control, and plain text help information. It is available in various versions and can also be used drive-externally for series commissioning and quick on-site diagnosis.

---

**BOP-2**

1. Seven operating buttons
2. Display
3. Release catch
4. Door mounting screw recess
5. RS232 connector
6. Product rating label

**IOP**

1. Graphical display
2. Navigation wheel
3. Five operating buttons
4. USB connection
1.2 Mounting and wiring

Before starting assembly, check to ensure that the following conditions have been met:
- All required components, tools, and small parts have been gathered.
- All required cables and lines have been laid in accordance with specifications.
- All minimum clearances are being observed.

The Five Safety Regulations must be strictly observed
- Disconnect
- Secure against unintentional restart
- Verify that it is free of voltage
- Ground and bypass
- Cover and shield any adjacent live parts

Mounting the Power Module into the switch cabinet

Please refer to the drilling pattern accompanying the power module for the correct drilling centers and clearance distances above and below the power module.

Note

Normally the motor and inverter are selected in such a way that they match each other. This is also the case in our example. However, the data from the rating plate of the motor is important for the initial start-up of the inverter.
### Connecting the Power Module to the motor

Depending on the operating environment, different cable length limits are required for the connection between the power module and motor. Unshielded cables up to 100 meters in length are possible in industrial electrical networks.

#### Wiring the Power Module

- Connect the phases and the earth conductor to the pluggable terminal clamps U2, V2, W2, and PE.

#### Wiring the motor

- Unscrew the cover to the terminal box on the motor (the inside cover of Siemens motors illustrates the possible wiring for the Star connection and the Delta connection).
- Remove the bridge rails from the connecting block and loosen the screws.
- Place the bridge rails 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).
- Connect the PE connection.
- Insert the cables from the power module through the opening of the terminal box to the motor.
- Slide the phases in accordance with the phase assignment in the connections.
- Screw the cover back onto the motor.

The motor and Power Module are now connected together. Before continuing the commissioning of the motor and inverter, ensure that the motor and the inverter are isolated from the line supply.

#### Wiring the power supply

- Connect the phases and the earth conductor to the pluggable terminal clamps L1, L2, L3, and PE.

The electrical wiring is now complete.
Motor lines represent interfering transmitters. As a result, you should use shielded cable in order to meet the corresponding electromagnetic compatibility requirements.

The cable lengths that can be used depend upon the following:

- Operating environment
- Inverter being used
- Reactors and filters used
- Shielded or unshielded cable

In order to meet Class A electromagnetic compatibility requirements, you need a filter and a shielded cable (max. length: 25 meters).

The depicted example shows a Star connection. The rating plate provides information about the correct circuit data: for example, 230/400V Δ/Y means that you are connecting the motor in Y with a 400V network.

Note
**Attaching the Control Unit**

Connect the Control Unit with the fastening clips on the bottom of the Power Module and then press the upper edge of the Control Unit against the Power Module until the locking device snaps into place. Before wiring the control terminals, the terminal cover has to be opened.

<table>
<thead>
<tr>
<th>General procedure for wiring with spring-type terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Press the screwdriver on the upper release lever.</td>
</tr>
<tr>
<td>• The terminal cover opens.</td>
</tr>
<tr>
<td>• Insert the end of the wire into the terminal opening.</td>
</tr>
<tr>
<td>• Withdraw the screwdriver from the terminal.</td>
</tr>
</tbody>
</table>

The wire is now firmly attached.

<table>
<thead>
<tr>
<th>Wiring the control terminals in the CU240E-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 The potentiometer:</td>
</tr>
<tr>
<td>• Attach the positive pole of the potentiometer to terminal 1.</td>
</tr>
<tr>
<td>• Attach the negative pole to 2.</td>
</tr>
<tr>
<td>• Wire the output of the potentiometer arm to 3.</td>
</tr>
<tr>
<td>• Close the circuit by connecting 4 to terminal 2.</td>
</tr>
<tr>
<td>2 On/Off, Reverse, and Reset buttons:</td>
</tr>
<tr>
<td>• Wire their power supply to 9.</td>
</tr>
<tr>
<td>• Attach the associated digital inputs to terminals 5, 6, and 7.</td>
</tr>
<tr>
<td>• To close the circuit, connect 9 with 20 and 22.</td>
</tr>
<tr>
<td>3 Indicator lights:</td>
</tr>
<tr>
<td>• Attach the power supply for the LEDs to 9.</td>
</tr>
<tr>
<td>• To close the circuit, connect 9 with 20 and 22.</td>
</tr>
<tr>
<td>• Wire the “Faults” and “Warning” LEDs to digital outputs 19 and 21.</td>
</tr>
<tr>
<td>• Connect the negative pole to terminal 28.</td>
</tr>
<tr>
<td>4 Display for frequency output:</td>
</tr>
<tr>
<td>• Connect the positive pole to 12.</td>
</tr>
<tr>
<td>• Connect the negative pole to 13.</td>
</tr>
</tbody>
</table>

The wiring is now complete.
Mounting the Operator Panels (BOP-2 or IOP) on the CU

1. Remove the cover of the RS232 connection by lifting it up and sliding it to the side.
2. Place the bottom edge of the IOP/BOP-2 casing into the lower recess of the Control Unit housing.
3. Push the IOP/BOP-2 toward the Control Unit until the release-catch clicks into place.
Mounting the IOP or BOP-2 in a cabinet door

The operator panels can easily be mounted in a control cabinet door with just a few manual operations using the optionally available door mounting kit. Degree of protection IP55 / UL type 12 is achieved when mounting them in the control cabinet door.

Congratulations! Your inverter is now ready for operation.

After assembly is completed, the inverter’s parameters must be set up, in other words, you must give the inverter the specific characteristics of the attached motor.
In this section you will learn more about the use of operator panels to control the inverter locally on site. First, you’ll learn how to use the Basic Operator Panel 2 (BOP-2) to set up parameters for the inverter and the attached motor and how to operate the inverter with the BOP-2. Next, you'll learn how to use the Intelligent Operator Panel (IOP) to your advantage.
Basic Operator Panel (BOP-2)
Intelligent Operator Panel (IOP)
2.1 Basic functions
The Operator Panel is the input and display instrument for controlling the inverter. It is used in stand-alone operation, in other words, locally, on the device, integrated in the cabinet door, or as handheld version for series setup (IOP).

The BOP-2 display
The BOP-2 is used to commission, diagnose (troubleshoot), and display the status of the inverter. It allows for manual control of drives locally at the drive. Up to two status values can be simultaneously and continuously monitored. It features a simple navigation using a transparent and well structured menu and clearly assigned operator keys.

Note
In this tutorial we introduce an application that is based on “V/f control with linear characteristic curve.” This control method is typically applied for pumps, ventilators and conveyer belt applications. We recommend that you work through the example we have presented here in order to familiarize yourself with setting up parameters for an inverter.
2.2  Working with BOP-2

Seven buttons make up the operator panel. For setup and parameterization, only the Up and Down, OK and ESC buttons are relevant. For local operation the ON, OFF, and HAND / AUTO keys are needed.
Operating pattern

To better understand the functionality of the buttons, you should be acquainted with the operating pattern: the Basic Operator Panel gives you access to a parameter list, which ranges from 0 to 9,899. Stored behind the parameters are parameter values that control the operation of the motor. However, not all the parameters are assigned.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value/Index</th>
<th>Index value</th>
</tr>
</thead>
<tbody>
<tr>
<td>r0000</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>r0002</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>P0003</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>P0004</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>P0005</td>
<td>in000</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>in001</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>in002</td>
<td>0</td>
</tr>
<tr>
<td>P9899</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

General procedure for accessing parameters with the BOP-2

• Press ESC to enter the menu selection.
• Use the UP and DOWN buttons to move the menu bar to the word “Parameter” and press OK.
• Press OK to select the standard user parameters.
• The first number in the list appears 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).
• On the right side of the screen the value of the selected parameter is shown.
• Press the UP button to access the next parameter.
• For example, P3 appears (P means that you can change the value of this parameter).
• Adjust the value by pressing OK and using the UP and DOWN buttons.
• Confirm the adjusted 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 in order to increase the speed while browsing through the parameters with the BOP-2. This also limits the chance of changing any possibly dangerous parameters. The expert level gives access to all parameters.
Some parameters store more than one value. In this case, pressing P does not take you directly to the value, but to an index that is displayed in brackets [00] above the actual value.

**Example for index parameter**

- Pressing OK takes you to [00].
- UP takes you to [01], DOWN back to [00].
- Decide on an index number of your choice.
- Press OK again to activate the index and move to the actual value.
- Adjust the value by pressing UP and DOWN.
- Confirm by pressing OK.

---

Example

```
P 1000  OK [00]  ▲ 01  OK  ▲  3  OK
```

---

If you want to adjust any blinking/active value digit by digit (using the UP and DOWN button might just take too long), you can always press the OK button longer than two seconds. After releasing the button, you can 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**

**HAND/AUTO and ON/OFF buttons**

The HAND/AUTO button switches the command source between the BOP-2 (HAND) and field bus (AUTO). A hand icon appears on the screen to indicate HAND mode is active.

- If HAND mode is active, pressing the HAND/AUTO button will switch the inverter to AUTO mode and disable the ON and OFF buttons.
- If AUTO mode is active, pressing the HAND/AUTO button will switch the inverter to HAND mode and enable the ON and OFF buttons.
- Changing between HAND mode and AUTO mode is possible while the motor is still running.

**Screen Icons**

The BOP-2 displays a number of icons on the left-hand side of the display to indicate the actual state of the inverter.

- Command source
- Inverter status
- Jog
- Fault/alarm

*Note*

Menu structure

Monitor
The Monitor menu allows the user to easily access a variety of screens that display the actual status of the inverter/motor system.

Control
The Control menu allows the user to access the following functions of the inverter:
• Setpoint
• Jog
• Reverse

Diagnostics
The Diagnostics menu allows the user to access the following function:
• Acknowledge all faults
• Faults
• History
• Status

Parameters
The Parameter menu allows access to view and change the parameters of the inverter.

Setup
The Setup menu is a fixed sequence of screens that allow the user to perform the basic commissioning of the inverter.

Extras
The Extras menu allows the user to perform additional functions such as saving and copying data sets into and from the BOP-2.
2.3 Quick commissioning

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

Starting quick commissioning

- Press ESC to enter the menu selection.
- Use the UP and DOWN buttons to move the menu cursor to the word “Setup” and press OK.
- The screen will automatically display the next parameter in the commissioning sequence.

Quick commissioning begins now. It leads you step by step from parameter to parameter. Parameters that are not relevant will be skipped automatically. Essentially, you are adjusting the factory settings of your inverter to the requirements of your motor.

Reset inverter

- Reset the inverter to factory state by first pressing OK while the BOP-2 shows RESET.
- Press UP or DOWN to change the value to YES.
- Press OK and wait until BUSY sign disappears (approx. five seconds).

Don’t forget: switch on the power supply before initial start-up.
Control mode (P1300)

- Press OK to modify the parameter value CTRL MOD.
- The upper row shows the control mode associated with the actual parameter value below.
- Choose control mode value by pressing UP or DOWN.
- See how the control mode name in the upper row changes accordingly.
- Press OK if the desired control mode is displayed.

| CTRL MOD | OK | ▲ | ▼ | NF LIN | OK |

Selecting line frequency (P100)

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

| EUR USA | OK | 0 | OK |

Note

Any step of the commissioning wizard can be skipped by pressing the DOWN button. Going back one step can be done by pressing the UP button. By confirming any step with OK, the screen will automatically display the next parameter in the commissioning sequence.
Entering motor data
The values for the next parameter settings can be found on the rating plate of your motor. Please set the motor data parameters according to the picture below.

![Motor Data Table]

Once the motor rated speed has been adjusted, you have completed adjusting your inverter to your motor.

**Note**
If you want to adjust any blinking/active value digit by digit (using the UP and DOWN button might just take too long) you can always press the OK button longer than two seconds. After releasing the button you can 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).

Operator Panels BOP-2 and IOP: Quick commisioning
Motor data identification

After entering the motor data, the wizards asks you to activate the motor data identification. Motor ID is recommended for a live 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 inverter is compared to the actual motor data and they are adapted to one another.

Starting motor data identification (P1900)

- Press OK to modify the displayed parameter value.
- Change the displayed value to 1 by pressing UP.
- The display will automatically display the next parameter in the commissioning sequence.

Motor identification will not start until the basic commissioning sequence has been completed.
- Start the motor manually (by using digital input DI 0 or by activating the HAND mode and starting the drive using the ON button).
- The measuring process is set in motion.
- When finished, the motor switches off.
- BOP-2 indicates that the measured values are now being converted into data.

The inverter can now be turned on using digital input DI 0. The setpoint source is specified as the potentiometer.
Command source, setpoint source, and application parameters

With the next step, you can select whether the Basic Operator Panel or the terminal should be the command source (parameter P700). In the case of the CU240E-2 being used here, the terminals are set as the default for the command source.

Selecting command source (P700)

- Press OK to modify the parameter value CMD SRC.
- Check to see if it shows TERMINAL and the value 2.
- Confirm by pressing OK.

![CMD SRC OK TERMINAL OK]

The next step is checking the setpoint source. This is stored with P1000.

Checking the setpoint source (P1000)

- Press OK to modify the parameter value MAIN SP.
- Check if it shows ANALOG and the value 2.
- The 2 indicates that the potentiometer on the terminal is currently set as the setpoint source.
- Confirm by pressing OK.

![MAIN SP OK ANALOG OK]

Now you should adjust the operating behavior of the motor to your application.

Additional setpoint source (P1000)

- Press OK to modify the parameter value ADD SP.
- This parameter gives you the possibility to add a second setpoint source by pressing UP or DOWN.
- Leave the value at NONE (0) and confirm by pressing OK.

![ADD SP OK D D NONE OK]
The values are displayed in seconds. In both cases, the times indicated should not be too short, because this might result in an alarm.

### Finishing
- Press OK when the BOP-2 shows FINISH.
- Confirm by using the UP or DOWN button to select YES and press OK again.

You have now reached the end of the quick commissioning. The inverter can now be turned on using digital input DI 0. The setpoint source is specified as the potentiometer.

Changing the value digit by digit is possible by pressing the OK button longer than 2 seconds. After releasing the button, you can 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).

2.4 Application case

You’ll now see how you can use the Basic Operator Panel 2 to make additional adjustments. In specific applications, it is meaningful, for example, to control the motor using fixed frequencies. Fixed frequencies are preset at digital inputs DI 3, DI 4, and DI 5. Therefore, the setpoint source must be switched from the potentiometer to the digital inputs on the terminals. This can be accomplished quickly and simply using the Basic Operator Panel 2. As previously mentioned, you define the setpoint source using parameter P1000.

Using fixed frequencies

Changing setpoint source

- Navigate with the menu bar to menu function PARAMETER.
- Select the STANDARD filter.
- Navigate to parameter P1000 and access index [00].
- Change value 2 to 3.

The setpoint source has been transferred from the potentiometer to fixed frequencies at digital inputs DI 3, DI 4 and DI 5. If you now attempt to control the motor using the potentiometer, you will see that the motor does not react. The next step is to determine the revolution speed associated with the digital inputs: 300, 600, 900 1/min.

Setting fixed numbers of revolutions

- The digital inputs of switches DI 3, DI 4, and DI 5 are assigned the revolution speed of 0 1/min by default.
- You can see this by consulting P1001, P1002, and P1003.
- Change these values by pressing OK, UP, and DOWN to P1001=300, P1002=600, P1003=900.
Testing the application

Now check to see how the motor reacts to the digital inputs being actuated. To do so, flip switch DI 0 (start the motor) and DI 3 (activate the first fixed frequency). The motor starts. Now use the Basic Operator Panel 2 to enter the menu function MONITORING by pressing OK. You’ll see that the motor setpoint has been set to 300 1/min and that the motor is accelerating/running at the speed of 300 1/min. Now also flip switch DI 5. You’ll see that the speed of 300 1/min and 600 1/min are added. The motor runs at a speed of 900 1/min now.

Monitoring the fixed frequencies

- Press ESC.
- Navigate with the menu bar to the menu function MONITORING.
- Press OK.

| ESC | ← | MONITOR | → | OK |

The Basic Operator Panel 2 can also be used to make a variety of other adjustments to your application. An overview of the parameters can be found in the “Operating Instructions: Control Units CU240E”.

Saving and restoring a parameter set

Saving parameter set from inverter in the BOP-2

- Navigate to the menu function EXTRAS and press OK.
- Push the DOWN button until TO BOP appears and press OK.

| EXTRAS | → | OK | ← | TO BOP | → | OK |

Copying parameter set from BOP-2 in the inverter

- Navigate to the menu EXTRAS and press OK.
- Push the DOWN button until FROM BOP appears and press OK.

| EXTRAS | → | OK | ← | FROM BOP | → | OK |

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

Note
2.5 **Intelligent Operator Panel**

With the Intelligent Operation Panel, you can set the inverter parameters, put the inverter into operation, monitor the ongoing operation of the motor, 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 assistants, no knowledge of parameter structure necessary.
- User-customized parameter lists with reduced parameter sets.
- Simple local commissioning using the handheld version.
- Fast multiple commissioning with clone function.
- Commissioning without documentation by using the integrated help function.

### Minimization of maintenance time

- Diagnosis with clear text display, without documentation available on site.
- Simple update of languages, application assistants, and firmware using the integrated USB connection.
- Integrated clear text help function to read and resolve fault messages and reasons locally.

### High usability, intuitive handling

- Direct, manual control of the drive – simple switching from local to remote operation.
- Intuitive menu navigation using wheel-click interface.
- Graphical display, for example, status values in vertical-bar charts (for example, pressure or flow rate).
- Status display with freely selectable units – display of real, physical values.

### Flexible usage

- Available for direct control unit mounting, for door mounting, or as handheld version (depending on frequency inverter type).
- Simple and fast mechanical and electrical door mounting.
- Handheld usable for a large variety of frequency inverters.
- Five integrated languages.
The device

The IOP is a menu-driven device. Its functionality is structured by three options:

1. [Wizards] Assists you to set up standard applications
2. [Control] Allows you to change setpoint value, turning direction, or to activate the real-time jog function
3. [Menu] Gives you access to all possible functionalities

The display

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

- Command source auto/hand
- Inverter status ready/running
- Fault
- Alarm pending
- Battery condition Fully Charged/Discharged
Working with IOP
The IOP is operated mainly by using the push-wheel. The five additional buttons make it possible to display certain values or to switch between manual and auto mode. The buttons are called: ON key, OFF key, ESC key, Info key, and HAND/AUTO key.

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

The HAND/AUTO function works the same 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 (right to increase speed, left to decrease speed).
The wizards

There are several wizards that allow you to set up various functions and commission the inverter. 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.

Example: Basic commissioning

- Use the wheel to highlight the word WIZARDS.
- Confirm by pressing OK.
- Navigate to BASIC COMMISSIONING by turning the wheel.
- Confirm by pressing OK.

Now the wizards will guide you step by step through the basic commissioning process by presenting a number of screens where you can choose the necessary options and values. At the conclusion of the basic commissioning process, the data can be saved to the inverter's memory, and calculation of motor and control data is started.

- 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.
Accessing diagnostics

If you want to find out which input and output devices are connected to the inverter, 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 inverter. In addition, you can monitor their current status. This is an information screen and cannot be changed.

Reading the I/O status

- Use the wheel to highlight the word 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 connected I/O including their status.

Using the button INFO always gives you more in-depth information on the currently highlighted parameter, step, or feature.
Getting information on active faults

- Use the wheel to highlight the word MENU.
- Confirm by pressing OK.
- Choose DIAGNOSTICS.
- Confirm by pressing OK.
- Select ACTIVE FAULTS / ALARMS.

Now all active fault messages that have not yet been acknowledged are displayed. To get further information you can highlight each one and press INFO.

You now know how to use the Operator Panels to set the parameters on your inverter and start it up. A further possibility is setting up the parameters using your PC or a SIMATIC programming device. This method is clearer and more convenient, but requires somewhat more preparation time.

Note

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 they occurred.
This section will show you how to connect your PC or PG to the inverter and acquaint you with the STARTER software. You will then set the parameters of the SINAMICS G120 inverter with the software and start it up. In the following chapter, you will see how to do this with a PC. Additionally, with the STARTER software you can easily activate the Safety Integrated functions of the drive.
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. A connecting cable
2. The STARTER software on DVD
In addition to the hardware, you’ll also need the STARTER software, which is included on a DVD in the PC Connection Kit 2. Install the STARTER software on your PC following the explanations of the setup wizard.

Hardware preparation

- Connect the USB cable to the USB connection at the Control Unit.
- Connect the other end to the USB interface of your PC.

The STARTER is also available as a download at: http://support.automation.siemens.com/WW/view/en/10804985/133100
PC preparation

To connect the STARTER tool to the inverter you need to make sure that the USB-COM emulation connects to a COM port smaller than eight (COM1 ... COM7). You need to remember that number for later use with the STARTER.

1. Browse to your computer’s control panel.
2. Select “Hardware.”
3. Click on “Device Manager.”
4. Check if “Sinamics G120 USB COM Emulation” has an address higher than COM7.
5 In case it is higher than eight, double-click the connection.
6 Enter the "Advanced" section.
7 Change the COM address by choosing any free small COM address.
8 Confirm your selection with OK.
Creating a STARTER project with the Project Wizard

After installation is complete, switch on the inverter’s power supply and start the program. The Project Wizard opens automatically. The wizard will help you create your first project.

1. Select the “Find drive units online” button.
2. Give the project a name and click “Continue.”
3. Click the “Change and test” button to set up the PC interface.
4. Select “PC COM-Port (USS)” and click “Properties.”
Installing the PC COM-Port (USS)

In some cases, you might have to add the PC COM-Port (USS) to your list. To do this, click “Select,” highlight the port in the appearing list, and add it with a mouse click on “Install.” Close the window. Back in the interface list, select PC COM-Port (USS) as described before and click “Properties.”
5 Specify the interface and enter the baud rate 115,200 in the “Interface” tab.

6 Select “Automatic mode” in the “RS485” tab and close the properties dialog field by clicking “OK.”
Click “Continue” to start the search for online units: a preview of the project tree will appear in the summary.

Close the Project Wizard by selecting “Complete.”
STARTER user interface
The inverter is now integrated into the project tree and the parameters can be set up using the STARTER software.

1. Project tree  
2. Program menu  
3. Toolbar with special features  
4. Icon "Connect to target system"  
5. Connection mode  
6. Work area
Uploading inverter data

By clicking the “Connect to target system” button, you establish an online connection between the PC and the inverter.

1. Click icon “Connect to target system.” A dialog window opens and the current inverter data is displayed.
2. Click the “Load HW configuration to PG” button.
3. In addition, the blue highlighted “Offline mode” changes to the yellow highlighted “Online mode”; the workbench area opens.

Workbench area

This area provides additional information like alarms, the target system output, and the diagnostics overview. It also stores additional operating features.

We recommend setting up parameters using the online mode.
3.2 Parameterization

The STARTER software and the inverter are now connected to each other. You can now begin to parameterize your inverter.

1. Double-click on the inverter icon in the project tree: a directory folder opens.
2. Double-click on the first icon: the configuration window in the work area opens.
3. Click “Wizard” and let the wizard guide you.
Configuration Wizard

The Configuration Wizard guides you step by step through the following parameters:

- Control structure
- Defaults of the setpoint source and the command source
- Motor
- Motor data
- Drive functions
- Important parameters
- Calculation of the motor data
- Summary
By clicking “Continue” you get to the next configuration step.

1. Start by setting the control method.
2. Define the command and setpoint source.
3. Select the motor type.
Input motor data from the rating plate.

Select “Identification of all parameters in standstill” for motor data identification.

**Alarm message**

The warning message “warning 541” appears. The message indicates that the motor might turn when motor data identification is performed.
Enter maximum current – normally 200%, minimum and maximum frequency, ramp-up and ramp-down time, and OFF ramp-down time (the time the motor needs to stop in the case of an emergency shut-off).

After clicking “Next,” the calculating of the motor data starts. This concludes the parameterization with the Configuration Wizard. You will now receive a summary of all parameter values input. The summary can be inserted into a text file by pressing the “Copy text to clipboard” button. Finally, close the window by clicking “Finish.”
Motor data identification
Before the inverter can be operated, you must start the motor from the PC. Performing this action will activate the parameters. The first step is to assume control priority.

1. Open the "Commissioning" entry in the project tree.
2. Double-click "Control panel" to open the control panel in the workbench area.
3. In the workbench area, click on "Assume control priority."

Note

The pending motor data identification is indicated by the message "warning 541" in the workbench. You can find the message in the alarm tab. It tells you that motor data identification will be performed after switching the motor on.
4 A setup window for command transfer opens: accept the displayed values and safety instructions.
5 In the workbench area, place a checkmark next to “Enables.”

Now the STARTER software has control authority for the attached motor.

6 Click the green button to start the motor.

Motor data identification is processed. The motor will stop running automatically after the process has been completed. Your inverter is now ready for operation.
3.3 **Safety Integrated**

All control units CU240E-2 come with the Safety Integrated function STO (Safe Torque Off). Activating the STO function immediately ensures that the motor cannot supply any further torque-generating energy.

Advantages for the user:
- No wearing parts, thanks to electronic shutdown
- Inverter remains connected to the supply, and always supports full diagnostics capability
- Password protected, no manipulation of the function possible

We strongly recommend that Safety Integrated engineering only be performed using the STARTER tool. In so doing, you are guided by graphical explanations and the risk of wrong inputs is reduced to a minimum.

STO can be used in cases where motor can decelerate to a standstill by itself within a sufficiently short period of time on account of the load torque or friction, or in situations where safety issues do not arise as a result of the motor “coasting down.”
Activating Safety Integrated

1. Browse to functions in the project tree and click on “Safety Integrated.”
2. Select “Change settings.”
3. Choose the applicable Safety function from the drop-down menu.
4. If you require the status signal “STO active” in your higher-level controller, link it up accordingly.
5. Click on “Extended settings” for further adjustments.
6. Follow the STARTER tool instructions.

Did you know that the extended SINAMICS Safety Integrated functions can be used without the need of an encoder at the motor? This worldwide unique feature saves installation and engineering time, reduces system costs and saves space.

For further instructions consult the Safety functions manual SINAMICS G120 using the Siemens Product Information System (Prodis) at http://support.automation.siemens.com/WW/view/en/22339653/130000
3.4 Application cases

Before returning control authority from the STARTER software to the terminal, you should try controlling the motor from the PC.

Setting setpoint specifications

1. Input 1,500 1/min in the "Setpoint specifications" box.
2. Start the motor: the motor runs at 1,500 1/min.
3. Adjust the frequency with the slider.
4. Conclude the process by pressing the "Give up control priority" button.

All functions from the displayed control area in the STARTER will be deactivated. The control authority has been returned to the terminal.
Closing a project and saving data

Unintentional disruption of the online connection between the inverter and the PC due to a power outage, for example, leads to the loss of the parameter settings. As a result, STARTER offers various possibilities for protecting your parameter settings.

1. Double-click the “Drive Navigator” in the project tree.
2. Select “Commissioning” in the workbench area.
3. Save the parameter settings in the inverter’s EEPROM memory by selecting “Save data in drive (RAM to ROM).”
4. AND save the parameter setting in your project by clicking “Save data to project.”

Note

Now you can disconnect the online connection to the inverter by clicking the “Disconnect from target system” icon. In our example, please continue to remain online to restore the inverter to its factory settings.
Restoring factory settings
Before you can start setup for your specific application, you should reset your inverter to factory settings.

1. Double-click the “Drive navigator” in the project tree.
2. Select “Commissioning” in the work area.
3. Click “Restore factory settings.”
The security query that is now displayed lets you know that all settings you have made will be reset. Using the checkbox query, you will have the opportunity beforehand to save your settings to the inverter’s ROM memory.

4 Click “OK” to reset all inverter settings to the factory setting.
5 Click “Disconnect from target system” to conclude the process.

You now know how to use STARTER to quickly and clearly insert your inverter into a project, set up its parameters, and put it into operation. Please make sure that you always remember to save the parameter data to the inverter and in the software before exiting a project.
Congratulations!

You have mastered the SINAMICS G120 Training Booklet V2.0. Thank you for your time and efforts. We hope that this tutorial has addressed all the questions you had and was useful to you. More detailed information can be found online.
Download overview

Additional information on parameters

“Parameter Manual: Control Units – CU240B/E-2”
available on the Internet as a download at


Detailed information about SINAMICS G120

“Operating Instructions: Control Unit CU240E”
available on the Internet as a download at


STARTER Software

STARTER is available as a download at

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