

### Overview

#### New system architecture with a central Control Unit

Electronically coordinated single drives work together to perform the drive tasks. Higher-level controls operate the drives to achieve the required coordinated movement. This requires cyclic data exchange between the control and the drives. This exchange usually took place via a fieldbus, which required a great deal of time and effort for installation and configuration. SINAMICS S120 takes a different approach. A central Control Unit controls the drives for all connected axes and also establishes the technological links between the drives and/or axes. Since all the required data is stored in the central Control Unit, it does not need to be transferred. Inter-axis connections can be established within a Control Unit. They can be easily configured in the STARTER drive/commissioning software using a mouse.

- Simple technological tasks can be carried out automatically by the SINAMICS S120 Control Unit
- CU310 DP Control Units are available for single drives
- The CU320 Control Unit is designed for multi-axis applications
- The Control Units in the SINUMERIK solution line CNCs are available in various rating classes for implementing coordinated motion control in a multi-axis interpolation grouping on machine tools.

Each of these Control Units is based on an object-oriented SINAMICS S120 standard firmware which contains all of the most popular control modes and can be scaled to meet even the most advanced performance requirements.

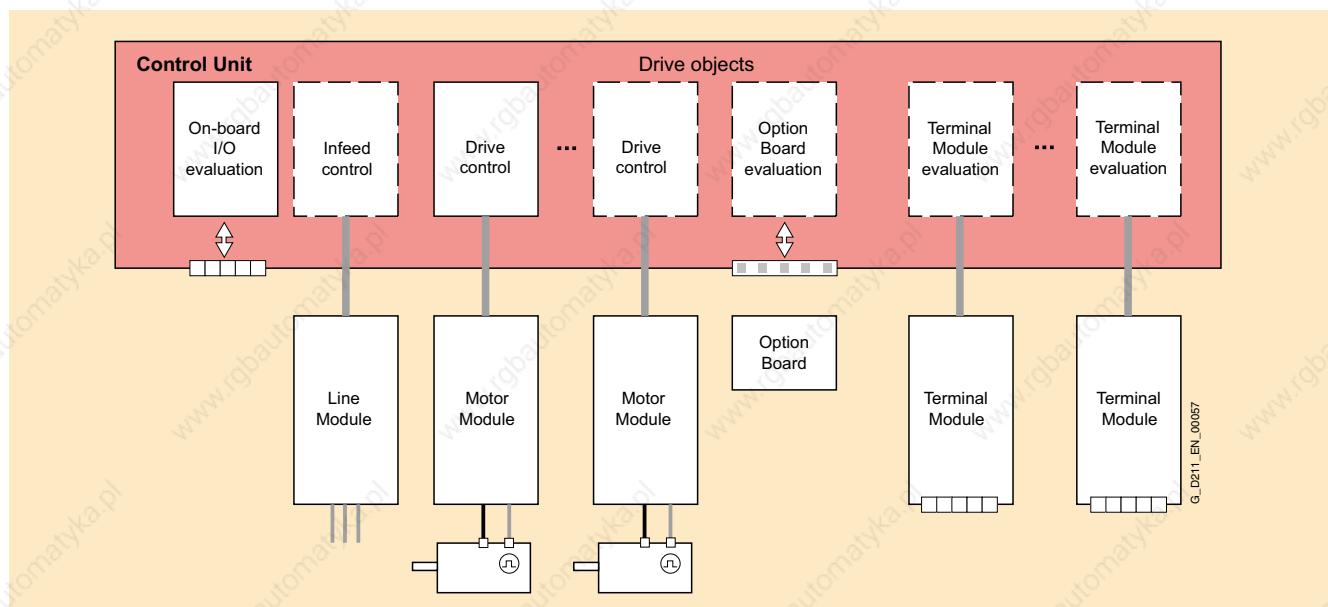
The drive controls are supplied as ready-to-configure drive objects:

- Infeed Control for mains infeed
- Servo Control for permanent-magnet excited synchronous and asynchronous motors with demanding dynamic requirements

All these control variants are based on the principle of field-oriented, closed-loop Vector control.

#### Drive objects

A drive object is a self-contained software function with its own parameters and, if necessary, its own fault messages and alarms.



#### Technology packages

SINUMERIK solution line Control Units support the coordinated motion control of multiple drives.

#### Comprehensive package of open-loop and closed-loop control functions

A wide variety of standard functions such as setpoint input, data set changeover, controller optimization, kinetic buffering, etc. ensure a high degree of operational reliability and excellent flexibility of application.

# SINAMICS S120 drive system

## Control Units

### Function

#### Overview of key open-loop and closed-loop control functions:

	Closed-loop control types S120	Open-loop control types S120	Main functions S120 for booksize/chassis	Comment, note
<b>Infeed control</b>	<ul style="list-style-type: none"> <li>• Booksize               <ul style="list-style-type: none"> <li>- Current control without/with mains sensor</li> <li>- <math>V_{DC}</math> control without/with mains sensor</li> </ul> </li> <li>• Chassis               <ul style="list-style-type: none"> <li>- Current control with mains sensor</li> <li>- <math>V_{DC}</math> control with mains sensor</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Booksize               <ul style="list-style-type: none"> <li>- Smart Line Modules can be selected</li> </ul> </li> <li>• Chassis               <ul style="list-style-type: none"> <li>- None</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Mains identification</li> <li>• Controller optimization</li> <li>• Harmonics filter</li> <li>• Automatic restart</li> </ul>	The mains sensor is the VSM10 Voltage Sensing Module; "current" is the line current; 3-phase with line frequency
<b>Servo control</b>	<ul style="list-style-type: none"> <li>• Asynchronous motor               <ul style="list-style-type: none"> <li>- Torque control with encoder</li> <li>- Speed control with/without encoder</li> </ul> </li> <li>• Synchronous motor, linear motor and torque motor               <ul style="list-style-type: none"> <li>- Torque control with encoder</li> <li>- Speed control with encoder</li> </ul> </li> <li>• For all motor types               <ul style="list-style-type: none"> <li>- Position control with encoder</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Linear/parabolic characteristic</li> <li>• Fixed-frequency characteristic (textiles)</li> <li>• Independent voltage setpoint input</li> </ul>	<ul style="list-style-type: none"> <li>• Data set changeover</li> <li>• Setpoint input</li> <li>• Motor identification</li> <li>• Damping application</li> <li>• Technology controller</li> <li>• Basic positioner</li> </ul>	The position control can be selected as a function module

#### Function modules

The basic positioner is used for the absolute/relative positioning of linear and rotary axes (modulo) with motor encoders (indirect measuring system) or machine encoders (direct measuring system).

#### Integrated safety functions

The Control Units support drive-autonomous safety functions such as "Safe standstill" (STO = Safe Torque Off).

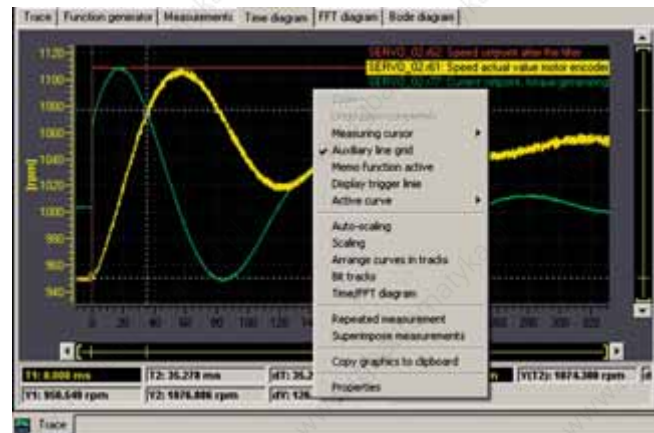
#### CompactFlash card

The functions of the SINAMICS S120 drives are stored on a CompactFlash card. This card contains the firmware and parameter settings for all drives in the form of a project. The CompactFlash card can also hold additional projects, which means that the correct project can be accessed immediately when series machines of different types are commissioned. When the Control Unit has booted, the data on the CompactFlash card are read and loaded to the RAM.

The firmware is organized in objects. Drive objects are used to implement open-loop and closed-loop control functions for Line Modules, Motor Modules, Power Modules and other system components connected by DRIVE-CLiQ.

#### Diagnostics optimally supported by trace function

The time characteristics of input and output variables associated with drive objects can be measured by the integrated trace function and displayed using the STARTER drive/commissioning software or via SINUMERIK solution line. The trace can record up to 4 signals simultaneously. A recording can be triggered as a function of freely selectable boundary conditions, e.g. the value of an input or output variable.



# SINAMICS S120 drive system

## Control Units

### CU310 DP Control Unit

#### Overview



The CU310 DP Control Unit is designed for the communication and open-loop/closed-loop control functions of a Power Module and combines with the Power Module to create a powerful single drive.

#### Design

CU310 DP Control Units feature the following interfaces as standard:

- 1 DRIVE-CLiQ socket for communication with other DRIVE-CLiQ devices, e.g. Sensor Modules or Terminal Modules
- 1 PM-IF interface for communication with Power Modules in blocksize format
- 1 interface to the BOP20 Basic Operator Panel<sup>1)</sup>
- 1 PROFIBUS interface with PROFIdrive V4 profile
- 1 HTL/TTL encoder evaluation circuit
- 4 parameterizable digital inputs (floating)
- 4 parameterizable bidirectional digital inputs/digital outputs (non-floating)
- 1 serial RS 232 interface
- 1 slot for the CompactFlash Card on which firmware and parameters are stored
- 3 test sockets and one reference ground for commissioning support
- 1 connection for the electronics power supply via the 24 V DC power supply connector
- 1 safe standstill input (enable pulses) for controlling the connected PM340 Power Module
- 1 temperature sensor input (KTY84-130 or PTC)
- 1 PE (protective earth) connection

The status of the CU310 DP Control Unit is indicated via multi-color LEDs.

As the firmware and parameter settings are stored on a plug-in CompactFlash card, the Control Unit can be changed without the need for software tools.

<sup>1)</sup> BOP20 is not used on machine tools.

#### Integration

The CU310 DP Control Unit drives PM340 Power Modules in blocksize format via the PM-IF interface. In this case, other DRIVE-CLiQ components such as Sensor or Terminal Modules can be connected to the DRIVE-CLiQ socket on the CU310 DP Control Unit.

The CU310 DP Control Unit and other connected components are commissioned and diagnosed with the STARTER drive/commissioning software or with the HMI-based tool integrated in the SINUMERIK solution line. The CU310 DP Control Unit requires a CompactFlash card with firmware version 2.4 or higher.

A CU310 DP Control Unit communicates with the higher-level control system using PROFIBUS and the PROFIdrive V4 profile.

# SINAMICS S120 drive system

## Control Units

### CU310 DP Control Unit

#### Technical specifications

<b>Order No.</b>	<b>6SL3040-0LA00-0AA1</b>
<b>Product name</b>	CU310 DP Control Unit
<b>Current requirement at 24 V DC, max.</b> excluding digital outputs and DRIVE-CLiQ supply	0.35 A for CU310 DP + 0.5 A for PM340 Power Module
<b>Conductor cross-section, max.</b>	2.5 mm <sup>2</sup>
<b>Fuse protection, max.</b>	20 A
<b>Digital inputs</b>	4 floating digital inputs 4 bidirectional non-floating digital inputs/digital outputs
• Voltage	-3 ... +30 V
• Low level (an open digital input is interpreted as low)	-3 ... +5 V
• High Level	15 ... 30 V
• Current consumption at 24 V DC, typ.	10 mA
• Delay time of digital inputs, approx. <sup>1)</sup>	
- L → H	50 μs
- H → L	100 μs
• Delay time of high-speed digital inputs, approx. <sup>1)</sup> (high-speed digital inputs can be used for position detection)	
- L → H	5 μs
- H → L	50 μs
• Conductor cross-section, max.	0.5 mm <sup>2</sup>
<b>Digital outputs</b> (continued-short-circuit-proof)	4 bidirectional non-floating digital inputs/digital outputs
• Voltage	24 V DC
• Load current per digital output, max. <sup>2)</sup>	500 mA
• Delay time, approx. <sup>1)</sup>	150 μs
• Conductor cross-section, max.	0.5 mm <sup>2</sup>
<b>Encoder evaluation</b>	TTL or HTL incremental encoders (with adjustable parameters)
• Cut-off frequency	500 kHz
• Cable length with TTL incremental encoder, max.	100 m (328 ft) (only bipolar signals permitted)
• Cable length with HTL incremental encoder, max.	100 m (328 ft) for unipolar signals 300 m (984 ft) for bipolar signals
<b>Power loss</b>	< 20 W
<b>PE connection</b>	On housing with M5 screw
<b>Dimensions</b>	
• Width	73 mm (2.87 in)
• Height	183.2 mm (7.21 in)
• Depth	89.6 mm (3.53 in)
<b>Weight, approx.</b>	0.95 kg (2.09 lb)
<b>Approvals</b>	cULus (File No.: E164110)

#### Selection and Ordering Data

Designation	Order No.
<b>CU310 DP Control Unit</b> Without CompactFlash card	<b>6SL3040-0LA00-0AA1</b>

#### Accessories

Designation	Order No.
<b>PROFIBUS connector</b>	
• Without programming device/ PC connection	<b>6ES7972-0BA41-0XA0</b>
• With programming device/ PC connection	<b>6ES7972-0BB41-0XA0</b>
<b>STARTER drive/commissioning tool</b>	<b>6SL3072-0AA00-0AG0</b>

<sup>1)</sup> The specified delay times refer to the hardware. The actual reaction time depends on the time slot in which the digital input or output is processed.

<sup>2)</sup> In order to use the digital outputs, an external 24 V power supply must be connected to terminal X124.

# SINAMICS S120 drive system

## Control Units

### CU320 Control Unit

#### Overview



The communication, open-loop and closed-loop control functions for one or more Motor Modules and Active Line Modules run in a CU320 Control Unit. The CU320 Control Unit is designed fundamentally for multi-axis operation.

#### Design



CU320 Control Unit, without protective cover

CU320 Control Units feature the following interfaces as standard:

- 4 DRIVE-CLiQ sockets for communication with other DRIVE-CLiQ devices, e.g. Motor Modules, Active Line Modules, Sensor Modules
- 1 PROFIBUS interface
- 8 parameterizable digital inputs (floating)
- 8 parameterizable bidirectional digital inputs/digital outputs (non-floating), of which 6 are high-speed digital inputs

<sup>1)</sup> BOP20 is not used on machine tools.

#### Design (continued)

- 1 serial RS 232 interface
- 1 interface for the BOP20 Basic Operator Panel<sup>1)</sup>
- 1 slot for the CompactFlash Card on which firmware and parameters are stored
- 1 slot for mounting an option module (e.g. TB30 Terminal Board)
- 3 test sockets and one reference ground for commissioning support
- 1 connection for the electronics power supply via the 24 V DC power supply connector
- 1 PE (protective earth) connection
- 1 ground connection

A shield connection for the signal cable shield on the option module is located on the CU320 Control Unit.

The available option slot is used to expand the interfaces, for example, to include additional terminals or for communication purposes.

The status of the CU320 Control Unit is indicated via multi-color LEDs.

As the firmware and parameter settings are stored on a plug-in CompactFlash card, the Control Unit can be changed without the need for software tools.

The CU320 Control Unit can be mounted on the side of the Line Module in booksized format via brackets integrated in a Line Module. The CU320 Control Unit can also be fixed to the wall of the control cabinet using the integrated fixing lugs. As the CU320 Control Unit is not as deep as the Line Modules, suitable spacers are available to increase the depth of the CU320 Control Unit to 270 mm (10.63 in).

#### Integration

DRIVE-CLiQ components, for example, Motor Modules and Active Line Modules, can be connected to a CU320 Control Unit. The number of modules depends on the performance required, including duty type and additional functions.

Communication between a CU320 Control Unit and the connected components takes place via DRIVE-CLiQ.

If an application requires more than one Control Unit, the number can be increased accordingly. The Control Units are then interconnected on a higher-level control via PROFIBUS with the PROFIdrive V4 profile.

The integrated safety functions such as "Safe brake control" must be selected in two channels. Two digital inputs are required for this purpose.

# SINAMICS S120 drive system

## Control Units

### CU320 Control Unit

#### Technical specifications

<b>Order No.</b>	<b>6SL3040-0MA00-0AA1</b>
<b>Product name</b>	CU320 Control Unit
<b>Current requirement at 24 V DC, max.</b> excluding the digital outputs, expansion option slot	0.8 A
<b>Conductor cross-section, max.</b>	2.5 mm <sup>2</sup>
<b>Fuse protection, max.</b>	20 A
<b>Digital inputs</b>	8 floating digital inputs 8 bidirectional non-floating digital inputs/digital outputs
• Voltage	-3 ... +30 V
• Low level (an open digital input is interpreted as low)	-3 ... +5 V
• High level	15 ... 30 V
• Current consumption at 24 V DC, typ.	10 mA
• Delay times of digital inputs, approx. <sup>1)</sup>	
- L → H	50 μs
- H → L	100 μs
• Delay times of high-speed digital inputs, approx. <sup>1)</sup> (high-speed digital inputs can be used for position detection)	
- L → H	5 μs
- H → L	50 μs
• Conductor cross-section, max.	0.5 mm <sup>2</sup>
<b>Digital outputs</b> (continued-short-circuit-proof)	8 bidirectional non-floating digital inputs/digital outputs
• Voltage	24 V DC
• Load current per digital output, max.	500 mA
• Delay time, approx. <sup>1)</sup>	150 μs
• Conductor cross-section, max.	0.5 mm <sup>2</sup>
<b>Power loss</b>	20 W
<b>PE connection</b>	On housing with M5 screw
<b>Ground connection</b>	On housing with M5 screw
<b>Dimensions</b>	
• Width	50 mm (1.97 in)
• Height	270 mm (10.63 in)
• Depth	226 mm (8.90 in)
<b>Weight, approx.</b>	1.5 kg (3.31 lb)
<b>Approvals</b>	cULus (File No.: E164110)

#### Selection and Ordering Data

Designation	Order No.
<b>CU320 Control Unit</b> Without CompactFlash card	<b>6SL3040-0MA00-0AA1</b>

#### Accessories

Designation	Order No.
<b>PROFIBUS connector</b>	
• Without programming device/ PC connection	<b>6ES7972-0BA41-0XA0</b>
• With programming device/ PC connection	<b>6ES7972-0BB41-0XA0</b>
<b>Spacers</b> (2 units) For increasing the depth of the CU320 Control Unit to 270 mm (10.63 in) if the brackets on the side are not to be used, but the depth still has to be 270 mm (10.63 in).	<b>6SL3064-1BB00-0AA0</b>
<b>STARTER drive/commissioning tool</b>	<b>6SL3072-0AA00-0AG0</b>

<sup>1)</sup> The specified delay times refer to the hardware. The actual reaction time depends on the time slot in which the digital input or output is processed.

# SINAMICS S120 drive system

## Control Units

### CompactFlash card

#### Overview



The CompactFlash card contains the firmware and parameter settings. It is inserted into the appropriate slot on the CU310 DP or CU320 Control Unit.

#### Design

A CU320 Control Unit can perform the communication, open-loop and closed-loop control functions for several Motor Modules. The computing capacity requirement increases in proportion to the number of connected Motor Modules and system components and in relation to the dynamic response required. The full computing capacity of the CU320 Control Unit is only available on systems with performance expansion 1.

The CU310 DP Control Unit has been designed to control only single axes. Performance expansion 1 is not required in this case.

In addition to the firmware, the CompactFlash card also contains licensing codes which are required to enable firmware options (performance expansion 1 in the current version).

The computing capacity requirement and utilization of the CU320 Control Unit can be calculated with the SIZER configuration tool.

The firmware options can also be enabled on-site, for example, if the performance expansions required are not known at the time of placing the order. You will need the serial number of the CompactFlash card and the order number of the firmware option to be enabled. With this information, you can purchase the associated license code from a license database and enable the firmware option. The license code is only valid for the CompactFlash card declared and cannot be transferred to other CompactFlash cards.

#### Selection and Ordering Data

Designation	Order No.
<b>CompactFlash card</b>	
For CU310 DP and CU320 Control Units with current firmware version including certificate of license	
• Without performance expansion	<b>6SL3054-0AA00-1AA0</b>
• With performance expansion 1 firmware option	<b>6SL3054-0AA01-1AA0</b>
<b>Firmware license</b>	
Performance expansion 1 option including certificate of license for upgrading the license of a CompactFlash card	<b>6SL3074-0AA01-0AA0</b>

#### More information

##### Firmware version

The firmware version is encoded in the order number of the CompactFlash card supplied. If the CompactFlash card with Order No. 6SL3054-0AA0.-1AA0 is ordered for the current firmware version, its order number is different to the order number of the CompactFlash card supplied.

The firmware version is encoded as follows in the order number printed on the CompactFlash card:

Order No.:	6SL3054-0 ■ ■ 0 ■ -1AA0	
Firmware version	1	<b>B</b>
	2	<b>C</b>
	3	<b>D</b>
	4	<b>E</b>
Version	.1	<b>B</b>
	.2	<b>C</b>
	.3	<b>D</b>
	.4	<b>E</b>
	.5	<b>F</b>
	.6	<b>G</b>
Without performance expansion		<b>0</b>
With performance expansion 1		<b>1</b>

##### Example:

A CompactFlash card with order number 6SL3054-0AA00-1AA0 is ordered (current firmware version as specified in the catalog).

The CompactFlash card with the most recent firmware version is confirmed and shipped, e.g. Order No. 6SL3054-0CE00-1AA0 for firmware version 2.4. In this way, it is possible to specify a specific firmware version in a replacement part order, e.g.: 6SL3054-0CD00-1AA0 for firmware version 2.3.